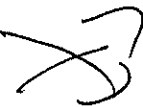



MEMORANDUM

TO: President Edward T. Foote II

FROM:  George C. Alexandrakis 
Chairman, Faculty Senate

DATE: June 21, 1991

SUBJECT: Faculty Senate Legislation #90008(B) -
New Double Major in Meteorology and Mathematics

The Faculty Senate Council, acting on behalf of the Faculty Senate, at its meeting of June 10, 1991, voted to approve Faculty Senate Legislation #90008(B) - New Double Major in Meteorology and Mathematics. The text of the legislation is attached.

This legislation is forwarded to you for your action.

7/2



GCA/b

Attachment

cc: Provost Glaser







CAPSULE:

Faculty Senate Legislation #90008(B) - New Double Major in Meteorology and Mathematics

RESPONSE BY THE PRESIDENT:

DATE: 2/8/97

APPROVED: [Signature]

OFFICE OR INDIVIDUAL TO IMPLEMENT OR PUBLISH: [Signature]

EFFECTIVE DATE OF LEGISLATION: _____

NOT APPROVED AND REFERRED TO: _____

REMARKS (IF NOT APPROVED): _____



COLLEGE OF ARTS AND SCIENCES

Office of the Dean

M E M O R A N D U M

April 16, 1991

TO: Faculty Senate

FROM: David Wilson, Dean
College of Arts and Sciences

A handwritten signature in black ink, appearing to read "David Wilson", with a long horizontal flourish extending to the right.

The attached proposal for a new double major in meteorology/mathematics has been proposed by the faculty at RSMAS and approved by the faculty of the College of Arts and Sciences as a B.S. degree program.

DW:ek

Enclosure

Proposal for an Undergraduate Major in Meteorology at the University of Miami

Division of Meteorology and Physical Oceanography (MPO)
Rosenstiel School of Marine and Atmospheric Science

April 15, 1991

1 Introduction

There has been active debate within the MPO division for more than two years on the feasibility of an undergraduate meteorology program at UM. Planning for such a program has proceeded to the point where the curriculum for a double-major baccalaureate degree in Meteorology and Applied Mathematics has been approved by MPO, the Mathematics department and the Arts and Sciences Curriculum Committee. New faculty hires by MPO have enhanced the division's ability to provide teachers for the meteorology curriculum.

Here we present MPO's arguments in favour of the proposed undergraduate program, and we outline how the program can be feasible, given the present and anticipated future resources of the division.

We consider first the rationale for the proposed program, then we compare our program with those that already exist at other universities. In section 4 we discuss the physical resources which will be required by the program, and in section 5 we discuss the proposed curriculum. In section 6 we attempt to predict as realistically as possible the level of student enrollment. In section 7 we discuss the faculty required by (and available to) the program. Next, we discuss logistical problems caused by the location of the RSMAS and Main campuses, and finally we outline how the program will be administered.

2 Rationale for the Undergraduate Program

In the next decade the U.S. is forecast to experience a severe shortage of scientists and engineers (cf. *Science*, 27 April, 1990). Meteorology is unlikely to be an exception to this trend. Consequently, there will be unprecedented employment opportunities opening up for professionally trained meteorologists. The opportunities will be enhanced by an expansion of both operational and research meteorology which will reflect growing national awareness of the importance of meteorological, climatological and related environmental issues. The National Weather Service is in

the middle of a major upgrade of its observing network. The gradual phase-in of two separate networks of ground-based remote sensing stations in the 90's will create a significant need for additional baccalaureate-trained personnel; corresponding developments can be foreseen in the private sector. Many working meteorologists are nearing retirement age and will need to be replaced by well-educated personnel who can function in a highly technical working environment involving super-computers, doppler radar and a growing suite of remote sensing products.

In this context, the role of the undergraduate meteorology program at UM will be to attract students into the discipline, and to provide them with the background to enable them to exploit the myriad future opportunities.

The Division has managed to maintain a stable graduate student population in the past five years largely because of its ability to attract qualified students from abroad. To broaden the domestic student pool RSMAS has entered into a cooperative agreement with the College of Arts and Sciences which pre-admits qualified undergraduate honors students in Physics and Mathematics to our graduate program. Early indications are that this program is a success even though the number of students is small. A logical extension of this program is to establish a full B.S. degree program in meteorology, which could generate a significant new pool of potential MPO graduate students.

While we have designed the double-major curriculum as a solid background for students wishing to advance to graduate school or research careers, we realize that operating the undergraduate program solely as a "nursery" for graduate school is unlikely to attract a viable number of students. We envisage, therefore, offering a two-track undergraduate meteorology program: an "honor" track leading to the double-major degree (with mathematics), and a general track consisting of a minor in meteorology combined with a major in an alternative subject. The most obvious choice of major would be mathematics, but other majors such as media/communications, geography/remote sensing and marine science could be considered. The general track would provide a terminal degree for students wishing to work as weather broadcasters or as operational forecasters for the National Weather Service. Furthermore, we expect to attract a large number of non-science majors into the meteorology service course (MET 118) which will discuss such hot-button topics as Global Climate Change.

Capitation support from the state of Florida is somewhat limited by the number of Florida residents in our graduate program. Students entering the undergraduate program from Florida would enhance the ability of the program to attract increased state matching funds. MPO currently offers the only academic meteorology program in South Florida. A long-term goal of the undergraduate program should be to win recognition for itself as the state-sanctioned meteorology program in South Florida.

3 Comparison with other Undergraduate Institutions

Undergraduate programs in meteorology tend to be available either from small private universities which have no corresponding graduate programs, or from large state universities which have both undergraduate and graduate programs. At present, the University of Miami is typical of large private institutions in offering only graduate degrees in meteorology. However, a good model for the type of program which we envisage is provided by McGill University in Montreal, where there is a robust undergraduate program (awarding 10 degrees a year, on average) co-existing with a graduate program similar to MPO's, and faculty who are active in funded research.

McGill offers eight undergraduate meteorology courses; the proposed program at the University of Miami has ten courses for a total of 26 credits. We propose that senior undergraduate

students should also have the option to take some of the graduate-level courses currently offered by MPO. The approved curriculum is well balanced between general introductory courses and the three sub-disciplines of synoptic, physical and dynamic meteorology. In some smaller institutions, a similar or weaker *curriculum* to that devised by us may be spread over more *courses*. Large state universities tend to offer more genuine variety in their curricula than small colleges do.

MPO currently has five faculty to share the teaching load of the undergraduate meteorology program. Of these, two are tenured professors and three are recently hired (within the past two years) assistant professors. A few of the physical oceanographers in MPO are also qualified and willing to teach undergraduate meteorology courses. Institutions which offer primarily or solely undergraduate meteorology degrees tend to have three or four instructional faculty. More diversified departments, of course, have more.

The library and laboratory resources for the undergraduate meteorology program at the University of Miami compare favourably, in general, with those available at other similar institutions. This is largely because the resources built up for the graduate meteorology program in MPO will also be available to undergraduates.

4 Physical Resources

The library resources and weather map-room facilities which are currently in place for the graduate program in MPO will also be available to undergraduates. On balance, these resources will provide an "infrastructure" for the undergraduate program which will compare favourably with that available in other institutions.

The RSMAS library currently holds all the standard meteorological texts, as well as a large collection of up-to-date volumes on ancillary subjects such as mathematics and computer science. The library subscribes to all the major meteorological journals. It will be an invaluable resource for the undergraduate program. As a specific service for undergraduates the library will need to acquire multiple (e.g., four or five) copies of some undergraduate textbooks, at a cost of approx. \ \$40 per copy.

In addition to classroom and office space, minimum facilities for an undergraduate meteorology program must consist of a system for acquiring and displaying current data on the state of the atmosphere, such as a facsimile recorder for reproducing weather maps produced at the National Meteorological Center in D.C., and a satellite receiving station. A system for receiving, storing and processing of digital information, such as individual weather station reports, is also needed. Such facilities currently exist for the graduate program at RSMAS/MPO, but a problem arises because of the physical location of these facilities, as discussed below. We should stress that we are talking about minimal facilities for undergraduate meteorology; an increasing number of schools around the country are acquiring more elaborate and impressive systems, such as color graphics workstations, real-time weather radar displays, hard-copy glossy satellite imagery, etc.

As the number of undergraduate meteorology students increases over the next few years, we expect that classroom, office and other space will be provided on Main Campus as a permanent home for the program. MPO faculty will apply to NSF for funding for weather map-room equipment under the "Instrumentation and Laboratory Improvement" program of the division of undergraduate science, engineering and mathematics education (USEME). If the application is successful (which is far from certain) matching funds will be required from the University in order for the NSF money to be made available. A preliminary estimate of the cost of some essential equipment is as follows:

\$6,000	Satellite dish/receiver/demultiplexer
\$3,500	Weather-map plotter (Alden Electronics, Inc.)
\$9,000	PC-McIdas (video display unit for weather data)
<u>\$4,000</u>	Meteorological Instrumentation (rain gauge, thermometers, etc.)
\$22,500	

Operating costs for this equipment would be minimal, the only ongoing expense being for computer paper.

The Marine Science Program currently runs a shuttle between Main Campus and RSMAS twice a week, on Tuesdays and Thursdays. This shuttle will be available to undergraduate meteorology students coming to RSMAS for classes and to make use of the library and weather-room facilities.

The proximity of the National Hurricane Center (located on South Dixie Highway across from the University of Miami's main campus), and the close ties between scientists there and the MPO faculty, will provide excellent opportunities for undergraduate students to become familiar with the work of this unique facility at first hand. Preliminary enquiries indicate that the Center is eager to play a role in the undergraduate meteorology program. Their involvement may take the form of lectures, tours, and/or summer internships for honor students before their senior year.

5 Curriculum

Historically, MPO has concentrated on graduate education with good success. In general, the students who do well at the graduate level are those with a well-rounded background in physics and math; it is from this pool that we recruit most of our students. Therefore, in order to equip B.S. degree graduates in meteorology for productive research careers it is essential that the students' training at the undergraduate level be sufficiently rigorous, in terms of emphasizing quantitative and analytic aspects of atmospheric science.

This is one reason for offering the double-major track degree option, with mathematics as the second major. A further reason is to provide graduates with a unique (so far as we are aware) and versatile qualification. The double-major aspect of the program distinguishes it from other undergraduate meteorology programs (e.g., the program at FSU). The mathematical content of the program is important from the meteorological point of view, but it should also prove to be an asset to students wishing to keep open a broad range of career options, since the double-major provides formal recognition of a broad scientific education.

For the general degree track, we foresee the minor in meteorology being combined with a major in an alternative, possibly non-scientific, subject. For this track, some of the mathematical requirements for meteorology students (e.g., the 500-level math courses) would be relaxed.

In selecting the meteorological content of the curriculum, we are guided by a policy statement recently adopted by the American Meteorological Society, which gives the minimum requirements for a "sound undergraduate meteorology program." This statement (Attachment A) requires at least 20 semester hours of course credit in meteorology leading to the B.S. degree. The program proposed by us (Attachment B) consists of 25 semester hours which is the norm in other meteorology programs across the country. This curriculum balances needs for strong undergraduate mathematics and physics exposure with introductory and intermediate atmospheric science courses.

7 Faculty requirements

A minimum of three full-time faculty members, each teaching at least one 3-credit course per semester, are needed to teach the courses in the undergraduate meteorology program (see Attachment B). The fields of specialization of these individuals must be such that all three sub-disciplines of meteorology, viz. dynamic, physical and synoptic, can be adequately taught. Between incumbent faculty and new hires, all three of these areas are presently represented in MPO, so it may be argued that the undergraduate program could be launched without hiring more new faculty whatsoever. While this may be true, such reasoning defeats one of the purposes of the whole exercise, which is to bring our graduate faculty up to proper strength. In particular there is no real expertise among the present faculty for teaching MET 303 --- the course on Meteorological Instrumentation. One more faculty member with specialization in physical meteorology/instrumentation is required --- not merely to teach this course, but to bring necessary breadth and diversity to the undergraduate degree program and to the division at large. This individual could be either an Atmospheric Radiation Transfer/Satellite Meteorology specialist, or a Marine Boundary Layer specialist; new faculty in both these disciplines are envisaged in the current MPO 5-year plan.

In selecting teachers for the undergraduate courses, the Division must guard against the emergence of a "class" hierarchy among the faculty, with the "second-class" members spending most of their time teaching the introductory courses. All faculty should continue to engage in research; however, time and effort spent teaching should receive increased recognition in the tenure review process.

8 Logistics

A potentially major problem is presented by the geographical distance between the Main Campus and RSMAS. None of the alternatives for dealing with this problem are ideal, but we believe that the two optimal ones are as follows.

(1) In the absence of adequate classroom, office and especially weather situation-room facilities at Main Campus, all meteorology courses (other than the 1-credit MET 118 course on "Current Weather Topics") should be taught at RSMAS. Students would typically visit RSMAS once or twice a week to attend classes and, occasionally, the daily MPO weather map discussions. An advantage of this arrangement would be that students become familiar with the research environment in their chosen field. Disadvantages are that a relatively large number of students will have to spend a lot of time commuting between campuses, and they would not have the opportunity to maintain day-to-day contact with weather charts. (We consider such daily exposure a vital element of undergraduate meteorology training.)

(2) With the provision of adequate facilities at Main Campus, meteorology faculty would retain their offices at RSMAS and pay short visits to Main Campus to teach undergraduate courses. This would involve more than occasional visits but trips on a daily basis for some faculty members to maintain the weather situation room and to conduct map discussions of the type currently held at RSMAS. Clearly there would be a duplication of effort and a greater demand on faculty time. This could be justified by a sufficiently large number of undergraduate students.

Given the current state of development of the program, we foresee that in the near- to medium-term future option (1) above will be easily the most viable alternative.

9 Administration

The undergraduate meteorology program will be administered, at least during its initial phase, by the Undergraduate Marine Science Program, whose name should be changed accordingly to "Marine and Atmospheric ...". In the long run we envision the incorporation of the undergraduate meteorology program into a main campus department of "Earth, Marine and Atmospheric Science".

We expect that the administration of the new undergraduate meteorology program will be a relatively minor burden. Current secretarial support should suffice to keep the program running smoothly. More demands will undoubtedly be made on photocopying facilities, causing these to depreciate faster than they otherwise would. Some funding for teaching aids will be required: e.g., the set of overhead transparencies published by the AMS cost \$100 per set.

10 Conclusion

We in MPO believe that sufficient planning has already been done to get the undergraduate meteorology program off the ground, and we are scheduled to start teaching undergraduate courses in the spring, 1991, semester. For the present, we expect students to commute to RSMAS for lectures and practical training, as outlined above.

Having considered all the aspects to the undertaking that we can think of, we feel that an undergraduate meteorology degree program is feasible at UM and we are enthusiastic about starting it and building it up. If the university administration is willing to support such an undertaking, then we can undoubtedly find a way to make it succeed.

(Written by Enda O'Brien, Naomi Surgi and Rainer Bleck)

The Bachelor's Degree in Meteorology or Atmospheric Science

Statement of the American Meteorological Society
as adopted by the Council on October 2, 1987

1. Introduction

This Statement elucidates the curricular, faculty, and facility requirements for a minimally sound undergraduate program.¹

2. Attributes of Bachelor's Degree Programs

a. General objectives

The objectives of a Bachelor's Degree Program in meteorology or atmospheric science include one or more of the following:

- 1) In-depth study of meteorology to serve as a culmination to a liberal arts education.
- 2) Preparation for graduate education.
- 3) Preparation for professional employment in meteorology or a closely related field.

b. Course offerings

A curriculum leading to the degree Bachelor of Science (or Bachelor of Arts) in Meteorology or Atmospheric Science as a minimum should contain:

- 1) At least 20 semester hours (or 30 quarter hours) of credit in meteorology, including at least six semester hours of atmospheric dynamics and thermodynamics with calculus as a prerequisite or corequisite, at least three semester hours of physical meteorology, at least six semester hours of analysis and prediction of weather systems, and at least two semester hours of atmospheric measurements and instrumentation.
- 2) Calculus through ordinary differential equations in courses

designed for majors in either mathematics, physical science, or engineering.

- 3) A one-year sequence in physics, with laboratory, with calculus as a prerequisite or corequisite.
- 4) A course in chemistry designed for physical-science majors.
- 5) A course in computer science designed for physical-science majors.

As in any science curriculum, students should have the opportunity to supplement these minimum requirements with additional course work in the major or any of the supporting areas. Students should be strongly urged to give considerable attention to course work and other activity to develop effective articulation skills, both written and oral.

c. Faculty attributes

There should be a minimum of three full-time regular faculty members teaching meteorology courses and having expertise in the areas listed in 2b above: namely, atmospheric dynamics and thermodynamics, physical meteorology, analysis and prediction of weather systems, atmospheric measurements and observations. The faculty composition should give some basis for quality and diversity of instruction as well as to the general ambiance of the degree program in meteorology or atmospheric science.

d. Facilities

There should be coherent space for the meteorology program and its students. There should be access to current weather information through equipment such as a weather-map facsimile machine and/or a minimal computer-based weather information receiving system. There should be equipment or facilities for studying atmospheric observation and measurement techniques.

¹ At the request of the chairpersons of United States departments of meteorology and atmospheric science, the Executive Committee of the Society established an ad hoc Committee on Undergraduate Accreditation to (a) consider the matter of accreditation or certification of undergraduate degree programs and (b) determine the minimum requirements and features of such a degree program. The ad hoc committee reported findings at the Fifth Meeting of Heads and Chairmen of Departments of Atmospheric Science held in Boulder, Colorado, in October 1986. Dis-

ussion there led to a recommendation that, while a formal accreditation program is not appropriate at this time, the Society should prepare and publish a Statement declaring the curricular, faculty, and facility requirements for a minimally sound undergraduate program. The Executive Committee accepted this recommendation and charged the ad hoc committee with preparation of the Statement in coordination with the Society's Commission on Education and Manpower. This Statement is the result. It should be readopted, revised, or eliminated by the end of 1992.

CURRICULUM FOR METEOROLOGY STUDENTS

April 1991

Credits

Freshman Year

MSC 118	Current Weather Topics	1
English 105	Freshman Composition	3
Math 111	Calculus I	4
Humanities Elective		3
Social Science Elective		<u>3</u>
		14

MSC 240	Introduction to Meteorology	3
English 106	Freshman Composition	3
Math 112	Calculus II	4
Social Sciences Elective		3
IEN 124 or Math 120	Computer Programming	<u>3-4</u>
		16-17

Sophomore Year

Geography 202	Physical Geography: Climatology	3
Math 210	Vectors and Matrices	3
Physics 211, 222	University Physics and Lab	5
Language		<u>3</u>
		14

MSC 243	Weather Forecasting	3
Math 310	Vectors	3
Physics 212, 236	University Physics II and Lab	5
Language		<u>3</u>
		14

Junior Year

MSC 303	Meteorological Instruments	3
MSC 305	Atmospheric Thermodynamics	2
Math 230	Introduction to Abstract Math	3
Physics 360	Modern Physics	3
Language		3
Humanities Elective		<u>3</u>
		17

MSC 405	Atmospheric Dynamics I	3
Math 311	Ordinary Differential Equations	3
Math 512	Complex Variables	3
Social Science Elective		3
Humanities Elective		<u>3</u>
		15

Senior Year

MSC 406	Atmospheric Dynamics II	3
MSC 407	Weather Analysis	3
Math 520 or 524		3
Math 533	Advanced Calculus	3
Humanities Elective		<u>3</u>
		15

MSC 408	Tropical Meteorology	3
MSC 409	Physical Meteorology	3
Math 513	Partial Differential Equations	3
Math 508	Modern Algebra	3
Social Science Elective		<u>3</u>
		15

Summary

Meteorology	27 Credits (+ 3 cr. Climatology)
Math	35
Physics	13
Comp.Prog.	3-4
Social Science	12
Humanities	12
Language	9
English Composition	6
	Total 117-118 cr.

University of Miami Undergraduate Meteorology Program

COURSE DESCRIPTION

- Current Weather Topics (1 cr.):** Discussion of weather- and Climate related phenomena such as hurricanes, severe storms, global warming, acid rain, etc. (Notes and analysis materials provided)
- Introduction to Meteorology (3 cr.):** Fundamentals of atmospheric motion and thermodynamics; basic laws of radiation; structure of tropical and extratropical cyclones, anticyclones, thunderstorms and local circulations; seasonal weather patterns. (Textbook: Anthes, Cahir, Fraser, Pansoky, *The Atmosphere*, 3rd Edition)
- Weather Forecasting (3 cr.):** Application of physical principles to weather forecasting. Use and interpretation of computer-generated forecast guidance products of the U.S. Weather Service (No text, synoptic products provided by instructor)
- Meteorological Instrumentation (2 Cr.):** Techniques for measuring meteorological variables at the ground and in the free atmosphere. (Selected readings)
- Atmospheric Thermodynamics (2 Cr.):** Equation of State; water vapor and moist air thermodynamics; phase changes and latent heat; buoyancy and atmospheric convection; thermodynamic diagrams. (Textbook: Wallace & Hobbs, *Atmospheric Science an Introductory Survey*)
- Weather Analysis (3 Cr.):** Three-dimensional analysis of synoptic-scale weather systems; application of the fundamental laws of atmospheric dynamics to observed weather patterns; practical questions of worldwide data exchange and display. (Textbook: Saucier, *Principles of Meteorological Analysis*)
- Tropical Meteorology (3 Cr.):** Structure and Behavior of the tropical atmosphere; wave perturbations of the Trades and the Inter-Tropical Convergence Zone; structure and dynamics of tropical cyclones; interaction between cloud- and synoptic-scale motions. (Textbook: Krishnamurti, *Compendium of Tropical Meteorology*, WMO)
- Physical Meteorology (3 Cr.):** Atmospheric radiation; absorption and scattering in different wavelength bands, principles of remote sensing of the atmosphere; cloud microphysics: nucleation, ice crystal formation, coalescence, maintenance of the earth's electric field. (Textbook: Fleagle-Businger, *An Introduction to Atmospheric Physics*)
- Atmospheric Dynamics I (3 Cr.):** Derivation and scaling of the equations of atmospheric motion; hydrostatic and geostrophic balance; circulation and vorticity. (Textbook: Holton, *An Introduction to Dynamic Meteorology*)
- Atmospheric Dynamics II (3 Cr.):** Baroclinic and brotropic instability; boundary layer dynamics; mathematical principles of numerical weather prediction; maintenance of the general circulation. (Textbook: Holton, *An Introduction to Dynamic Meteorology*)

Student Government Representatives

Ms. Esther Feuer, Student Government Speaker of the Senate, spoke to the Senate about her involvement in the activities of the University. She mentioned that Student Government is interested in expanding the student forgiveness policy and expanding the Afro-American Studies Program. She extended an invitation to the Senate to attend the Student Government meetings. The Senate Speaker Series, hosted by Ms. Feuer, will feature administrators and faculty and she invited the Senate's participation.

Mr. Ernie Varela, Graduate Student Association Vice President, also issued an open invitation to the Senate to attend the Graduate Student General Council meetings. He said that the organization had met with Interim Dean Sugrue regarding the future of the Graduate School. They will be conducting a "quality of life" survey among the graduate students. Mr. Varela mentioned that he has been investigating possibilities for health care insurance for graduate students. Specific proposals will be presented to the Board of Trustees at a later date.

Approval of the Minutes

The minutes of April 15 and April 29 were approved as submitted. Excused absences were approved for Professors Allegro, Baden, Brass, Litosch, Malinin, Raffini, Seiler and Victoria.

Matters Deriving from the Minutes

The Chair announced that the Senate Council has acted on behalf of the Senate in approving the Program in Meteorology and Math and the Program in Environmental Science. The Administration has agreed that in future no new proposals shall be presented after the March 1 deadline in order to give the Council and Senate time to work on the proposals during the academic year. Professor Green inquired about whether the oversight committee for the Environmental Science program had met and whether a director has been appointed. Because of delays, it is apparent that the program will be not be able to run this year. The Provost responded to a query about the Program in International Studies by stating that it was flourishing with approximately 97 students.

Cornerstone Campaign

The President introduced Mr. Roy Nirschel, Vice President for University Advancement, who presented slides and outlined plans for the Cornerstone Campaign for the College of Arts and Sciences and the Richter Library. The Campaign will be announced officially on

Professor Knoblock reminded the Council that a letter of financial commitment from the Provost is required for the approval of any new program. The matter of the Deans having veto power on the Steering Committee was also discussed. Professor Knoblock requested that the newly approved majors be listed by degrees, by schools and by existing major with the tracks to be offered.

Bachelor's Degree in Meteorology - (First Reading)

Professor Alexandrakis introduced Professors Enda O'Brien and Dean Churchill from the Department of Meteorology and Physical Oceanography at RSMAS to answer any queries on the proposed Bachelor's degree in Meteorology. Professor Eckstein, Chairman of the review sub-committee, presented the committee's report. He indicated that the financial issue regarding salaries for participating faculty has been handled by the Provost and Deans. Dr. Farmer has indicated that she will handle day-to-day issues from the existing budget for the office of Marine Science. Capital equipment will be funded at a later date from proposals written to the National Science Foundation for matching funds from the University. The sub-committee has recommended that a single major in Meteorology, without meeting the full Mathematics major requirements, be offered in the future. Professor Eckstein stressed the need for transportation to RSMAS. It was *moved*, and seconded, to accept this discussion as the first reading of the proposal. The *motion carried*. It was *moved*, and seconded, to waive the second reading. The *motion carried with two opposed*.

Committee on Committees

Professor Whelan, Senate Chair-elect, presented the recommendations of the Committee on Committees for committee appointments for 1991-1992. Each committee was reviewed by the Council and some suggestions were made for strengthening or balancing the representation on some of the committees. The Committee was granted the authority to refine several committees. It was suggested that the Committee on Women and Minority Rights investigate the recent history and associated issues of paid maternity leave for female faculty members.

Matters from the Floor

Professor Brass brought to the Council the matter of a change in tuition remission benefits. It indicates a violation of the Faculty Charter by the administration. He said it is also a misrepresentation of the discussion between the administration and Senate and Budget

SENATE COUNCIL MEETING

May 6, 1991

- PRESENT: Professors Alexandrakis, Allegro, Awad, Boardman, Brass, Clasby, DeSantis, Eckstein, Heuson, Lorton, Seiler, Swan, Victoria, Warren and Whelan.
- ABSENT: Professor Baden.
- GUESTS: President Foote, Provost Glaser, Dean Wilson and Professors Bleck and Farmer.

Call to Order

The first meeting of the 1991-92 Senate Council was called to order at 2:05 p.m. by Chairman Alexandrakis. The minutes of April 1 were approved as submitted.

Bachelor's Degree in Meteorology

Professor Eckstein, Chairman of the sub-committee to review the proposal for a Bachelor's degree in Meteorology, summarized the proposal and previous discussion for a double-major baccalaureate degree in meteorology and applied mathematics for undergraduate students. In addition, there would be a possibility of a minor in Communication for students interested in working for the National Weather Service. It has been suggested that students be allowed the option of a single major that would include such courses as chemistry. Professor Rainer Bleck, Chairman of the Department of Meteorology and Physical Oceanography, informed the Council that the faculty in his department, who are heavily involved in research and supervision of graduate students, wished to offer their expertise to undergraduates. He mentioned that there is a great demand for Bachelor's degree candidates in the vast network of people needed to forecast weather worldwide. He indicated that an additional person would need to be hired. A discussion followed on the arrangement of revenues derived from the program. It was *moved*, and seconded, to refer the proposal back to the review committee for a written report, including any understandings which have been made. The *motion carried*.

Program in Environmental Science

Professor Awad, Chairman of the sub-committee to review the proposal for the Program in Environmental Science, summarized the proposal and his committee's discussion. He informed the Council that the following colleges and schools would be involved in the program: Arts and Sciences, Engineering, Medicine, Business and RSMAS. He indicated

FILE COPY

MEMORANDUM

TO: Provost Luis Glaser
FROM: George C. Alexandrakis
Chairman, Faculty Senate
DATE: April 25, 1991
SUBJECT: Your Memorandum Dated April 24, 1991

I believe that for as long as there is a Faculty Senate there is no need to worry that Stanford, or Duke, or Columbia, is going to beat the University of Miami in the establishment of an important program.

GCA/b

cc: President Edward T. Foote II

Proposal for Bachelor's Degree in Meteorology

Dean Wilson from the College of Arts and Sciences introduced the proposal for a Bachelor's Degree in Meteorology. He explained that this program will have heavy input from the Faculty of RSMAS. The program will allow the students to satisfy a double major in Meteorology as well as in Mathematics. Professor Farmer, from the Department of Biology, summarized the proposal. Discussion about curriculum, budget and facilities followed. It was agreed to appoint a committee to review the questions raised from the proposal referring to the curriculum, the rationale for courses on applied sciences versus broad basic courses, mathematics being an example, the absence of chemistry, and other related curriculum matters, as well as the budget and the budgetary projections based on different numbers of students, and finally the transportation issue. The Committee, chaired by Professor Eckstein, will be formed by Professors Brass, Greenfield, and Lorton.

Proposal for a Program in Environmental Science

Dean Wilson from the College of Arts and Sciences presented the proposal for the Environmental Science Program. The schools that will probably be involved in the program included Engineering, Medical School, RSMAS, and the Business School in addition to several different departments within the College of Arts and Sciences. The program will be drawn from new tracks within existing degree programs and majors; for example, Biology has already approved a track that will be included within this program. Moreover, the program will coordinate a set of tracks that are not under a single department but under different entities around the University as the Environmental Health Sciences and the Chemical Toxicology tracks. Professor Linda Farmer from the Department of Biology answered questions pertaining to new faculty needs, budgetary needs, and curriculum matters. Professor Brass informed the Council that the faculty at Rosenstiel School felt that the curriculum of the program was considered to be a narrow reflection of the courses they offered at the School, in particular the Division of Marine Biology and Fisheries. The Chair noted that Physical Science was also missing from the Science core. Professor Victoria from the School of Architecture asked if the environmental courses offered through Architecture could be included in the program. A discussion of administrative costs followed. It was agreed that the Faculty Senate Ad-hoc Committee that reviewed the program will have to solve several problems present in the proposal. First, the name of the degree offered, Bachelor of Arts and Sciences, has to be specified in the proposal. Second, problems about the prerequisite courses have to be solved. Third, the process to select the director and the steering committee to administer the program has to be specified. Fourth, a solution to the problem of transportation has to be presented. After discussion the members for the Committee to review the Environmental Science Program were appointed. The Committee, chaired by Professor Awad, is to be formed by Professors Green, Wilson and Clingan.

Proposal for an
Undergraduate Major in Meteorology
at the University of Miami

Division of Meteorology and Physical Oceanography (MPO)
Rosenstiel School of Marine and Atmospheric Science

April 15, 1991

1 Introduction

There has been active debate within the MPO division for more than two years on the feasibility of an undergraduate meteorology program at UM. Planning for such a program has proceeded to the point where the curriculum for a double-major baccalaureate degree in Meteorology and Applied Mathematics has been approved by MPO, the Mathematics department and the Arts and Sciences Curriculum Committee. New faculty hires by MPO have enhanced the division's ability to provide teachers for the meteorology curriculum.

Here we present MPO's arguments in favour of the proposed undergraduate program, and we outline how the program can be feasible, given the present and anticipated future resources of the division.

We consider first the rationale for the proposed program, then we compare our program with those that already exist at other universities. In section 4 we discuss the physical resources which will be required by the program, and in section 5 we discuss the proposed curriculum. In section 6 we attempt to predict as realistically as possible the level of student enrollment. In section 7 we discuss the faculty required by (and available to) the program. Next, we discuss logistical problems caused by the location of the RSMAS and Main campuses, and finally we outline how the program will be administered.

2 Rationale for the Undergraduate Program

In the next decade the U.S. is forecast to experience a severe shortage of scientists and engineers (cf. *Science*, 27 April, 1990). Meteorology is unlikely to be an exception to this trend. Consequently, there will be unprecedented employment opportunities opening up for professionally trained meteorologists. The opportunities will be enhanced by an expansion of both operational and research meteorology which will reflect growing national awareness of the importance of meteorological, climatological and related environmental issues. The National Weather Service is in

the middle of a major upgrade of its observing network. The gradual phase-in of two separate networks of ground-based remote sensing stations in the 90's will create a significant need for additional baccalaureate-trained personnel; corresponding developments can be foreseen in the private sector. Many working meteorologists are nearing retirement age and will need to be replaced by well-educated personnel who can function in a highly technical working environment involving super-computers, doppler radar and a growing suite of remote sensing products.

In this context, the role of the undergraduate meteorology program at UM will be to attract students into the discipline, and to provide them with the background to enable them to exploit the myriad future opportunities.

The Division has managed to maintain a stable graduate student population in the past five years largely because of its ability to attract qualified students from abroad. To broaden the domestic student pool RSMAS has entered into a cooperative agreement with the College of Arts and Sciences which pre-admits qualified undergraduate honors students in Physics and Mathematics to our graduate program. Early indications are that this program is a success even though the number of students is small. A logical extension of this program is to establish a full B.S. degree program in meteorology, which could generate a significant new pool of potential MPO graduate students.

While we have designed the double-major curriculum as a solid background for students wishing to advance to graduate school or research careers, we realize that operating the undergraduate program solely as a "nursery" for graduate school is unlikely to attract a viable number of students. We envisage, therefore, offering a two-track undergraduate meteorology program: an "honor" track leading to the double-major degree (with mathematics), and a general track consisting of a minor in meteorology combined with a major in an alternative subject. The most obvious choice of major would be mathematics, but other majors such as media/communications, geography/remote sensing and marine science could be considered. The general track would provide a terminal degree for students wishing to work as weather broadcasters or as operational forecasters for the National Weather Service. Furthermore, we expect to attract a large number of non-science majors into the meteorology service course (MET 118) which will discuss such hot-button topics as Global Climate Change.

Capitation support from the state of Florida is somewhat limited by the number of Florida residents in our graduate program. Students entering the undergraduate program from Florida would enhance the ability of the program to attract increased state matching funds. MPO currently offers the only academic meteorology program in South Florida. A long-term goal of the undergraduate program should be to win recognition for itself as the state-sanctioned meteorology program in South Florida.

3 Comparison with other Undergraduate Institutions

Undergraduate programs in meteorology tend to be available either from small private universities which have no corresponding graduate programs, or from large state universities which have both undergraduate and graduate programs. At present, the University of Miami is typical of large private institutions in offering only graduate degrees in meteorology. However, a good model for the type of program which we envisage is provided by McGill University in Montreal, where there is a robust undergraduate program (awarding 10 degrees a year, on average) co-existing with a graduate program similar to MPO's, and faculty who are active in funded research.

McGill offers eight undergraduate meteorology courses; the proposed program at the University of Miami has ten courses for a total of 26 credits. We propose that senior undergraduate

students should also have the option to take some of the graduate-level courses currently offered by MPO. The approved curriculum is well balanced between general introductory courses and the three sub-disciplines of synoptic, physical and dynamic meteorology. In some smaller institutions, a similar or weaker *curriculum* to that devised by us may be spread over more *courses*. Large state universities tend to offer more genuine variety in their curricula than small colleges do.

MPO currently has five faculty to share the teaching load of the undergraduate meteorology program. Of these, two are tenured professors and three are recently hired (within the past two years) assistant professors. A few of the physical oceanographers in MPO are also qualified and willing to teach undergraduate meteorology courses. Institutions which offer primarily or solely undergraduate meteorology degrees tend to have three or four instructional faculty. More diversified departments, of course, have more.

The library and laboratory resources for the undergraduate meteorology program at the University of Miami compare favourably, in general, with those available at other similar institutions. This is largely because the resources built up for the graduate meteorology program in MPO will also be available to undergraduates.

4 Physical Resources

The library resources and weather map-room facilities which are currently in place for the graduate program in MPO will also be available to undergraduates. On balance, these resources will provide an "infrastructure" for the undergraduate program which will compare favourably with that available in other institutions.

The RSMAS library currently holds all the standard meteorological texts, as well as a large collection of up-to-date volumes on ancillary subjects such as mathematics and computer science. The library subscribes to all the major meteorological journals. It will be an invaluable resource for the undergraduate program. As a specific service for undergraduates the library will need to acquire multiple (e.g., four or five) copies of some undergraduate textbooks, at a cost of approx. \ \$40 per copy.

In addition to classroom and office space, minimum facilities for an undergraduate meteorology program must consist of a system for acquiring and displaying current data on the state of the atmosphere, such as a facsimile recorder for reproducing weather maps produced at the National Meteorological Center in D.C., and a satellite receiving station. A system for receiving, storing and processing of digital information, such as individual weather station reports, is also needed. Such facilities currently exist for the graduate program at RSMAS/MPO, but a problem arises because of the physical location of these facilities, as discussed below. We should stress that we are talking about minimal facilities for undergraduate meteorology; an increasing number of schools around the country are acquiring more elaborate and impressive systems, such as color graphics workstations, real-time weather radar displays, hard-copy glossy satellite imagery, etc.

As the number of undergraduate meteorology students increases over the next few years, we expect that classroom, office and other space will be provided on Main Campus as a permanent home for the program. MPO faculty will apply to NSF for funding for weather map-room equipment under the "Instrumentation and Laboratory Improvement" program of the division of undergraduate science, engineering and mathematics education (USEME). If the application is successful (which is far from certain) matching funds will be required from the University in order for the NSF money to be made available. A preliminary estimate of the cost of some essential equipment is as follows:

\$6,000 Satellite dish/receiver/demultiplexer
\$3,500 Weather-map plotter (Alden Electronics, Inc.)
\$9,000 PC-McIdas (video display unit for weather data)
\$4,000 Meteorological Instrumentation (rain gauge, thermometers, etc.)

\$22,500

Operating costs for this equipment would be minimal, the only ongoing expense being for computer paper.

The Marine Science Program currently runs a shuttle between Main Campus and RSMAS twice a week, on Tuesdays and Thursdays. This shuttle will be available to undergraduate meteorology students coming to RSMAS for classes and to make use of the library and weather-room facilities.

The proximity of the National Hurricane Center (located on South Dixie Highway across from the University of Miami's main campus), and the close ties between scientists there and the MPO faculty, will provide excellent opportunities for undergraduate students to become familiar with the work of this unique facility at first hand. Preliminary enquiries indicate that the Center is eager to play a role in the undergraduate meteorology program. Their involvement may take the form of lectures, tours, and/or summer internships for honor students before their senior year.

5 Curriculum

Historically, MPO has concentrated on graduate education with good success. In general, the students who do well at the graduate level are those with a well-rounded background in physics and math; it is from this pool that we recruit most of our students. Therefore, in order to equip B.S. degree graduates in meteorology for productive research careers it is essential that the students' training at the undergraduate level be sufficiently rigorous, in terms of emphasizing quantitative and analytic aspects of atmospheric science.

This is one reason for offering the double-major track degree option, with mathematics as the second major. A further reason is to provide graduates with a unique (so far as we are aware) and versatile qualification. The double-major aspect of the program distinguishes it from other undergraduate meteorology programs (e.g., the program at FSU). The mathematical content of the program is important from the meteorological point of view, but it should also prove to be an asset to students wishing to keep open a broad range of career options, since the double-major provides formal recognition of a broad scientific education.

For the general degree track, we foresee the minor in meteorology being combined with a major in an alternative, possibly non-scientific, subject. For this track, some of the mathematical requirements for meteorology students (e.g., the 500-level math courses) would be relaxed.

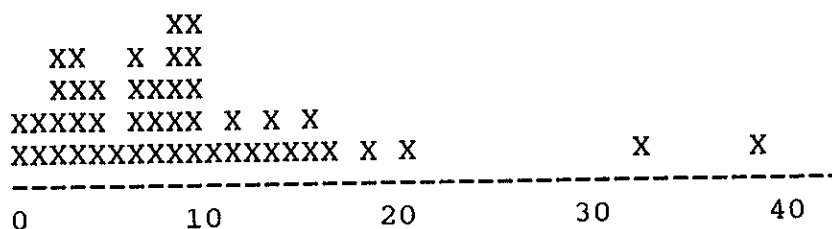
In selecting the meteorological content of the curriculum, we are guided by a policy statement recently adopted by the American Meteorological Society, which gives the minimum requirements for a "sound undergraduate meteorology program." This statement (Attachment A) requires at least 20 semester hours of course credit in meteorology leading to the B.S. degree. The program proposed by us (Attachment B) consists of 25 semester hours which is the norm in other meteorology programs across the country. This curriculum balances needs for strong undergraduate mathematics and physics exposure with introductory and intermediate atmospheric science courses.

The math, physics, chemistry and computer science course requirements, which are also part of a solid undergraduate meteorology curriculum, can be adequately served by the programs already in place at the College of Arts and Sciences.

The meteorological curriculum could easily be expanded to offer more service courses to majors in other disciplines. We envision a minor consisting of Current weather topics (MET 118), Introduction to Meteorology (MET 240), Weather Forecasting (MET 243), Physical Geography: Climatology (GEG 202), and Meteorological Instrumentation (MET 303). These courses would be taught by meteorology faculty and would be of interest to geography and marine science majors, among others.

6 Anticipated student enrollment

In order to provide some basis for estimating the number of students who would elect to obtain an undergraduate degree in meteorology at UM, we have conducted a survey of existing undergraduate programs in meteorology (excluding those that combine meteorology with related fields like oceanography, environmental sciences, geography, etc.). This survey resulted in the following histogram of meteorology undergraduate degrees conferred by U.S. and Canadian colleges and universities during the academic year 1988/89. Each "X" in the diagram represents one institution; there are 47 altogether. The number of degrees appears at the bottom of the graph. The two most prolific institutions were Penn State (which has a special program for broadcast meteorologists) and Texas A\&M (whose students are mostly ROTC) with 38 and 32 degrees conferred, respectively. The histogram represents a total of 407 degrees---down from 477 four years previously.



It appears that the "typical" meteorology program generates 8 or 9 graduates per year. Given a modest attrition rate (say 1/3 of the incoming freshmen) during the 4-year degree program, this translates into approximately 40 students for the entire undergraduate class in a given year. It would of course take the University of Miami at least four years (probably longer) to "spin up" to such an overall enrollment figure.

Based on the experience of comparable programs, we expect enrollment in the lower division courses, which would be open to both majors and minors, to be considerably larger than in the upper division courses.

It is encouraging that MPO receives a half-dozen or so unsolicited enquiries each year from within Florida about undergraduate meteorology. However, a concerted effort will be needed to publicize and popularize the program in order to attract a viable number of students. This will require promotional articles in student newspapers, promotional talks at orientation sessions, and promotional literature for dissemination to prospective students. MPO faculty are willing to participate in these efforts.

7 Faculty requirements

A minimum of three full-time faculty members, each teaching at least one 3-credit course per semester, are needed to teach the courses in the undergraduate meteorology program (see Attachment B). The fields of specialization of these individuals must be such that all three sub-disciplines of meteorology, viz. dynamic, physical and synoptic, can be adequately taught. Between incumbent faculty and new hires, all three of these areas are presently represented in MPO, so it may be argued that the undergraduate program could be launched without hiring more new faculty whatsoever. While this may be true, such reasoning defeats one of the purposes of the whole exercise, which is to bring our graduate faculty up to proper strength. In particular there is no real expertise among the present faculty for teaching MET 303 --- the course on Meteorological Instrumentation. One more faculty member with specialization in physical meteorology/instrumentation is required --- not merely to teach this course, but to bring necessary breadth and diversity to the undergraduate degree program and to the division at large. This individual could be either an Atmospheric Radiation Transfer/Satellite Meteorology specialist, or a Marine Boundary Layer specialist; new faculty in both these disciplines are envisaged in the current MPO 5-year plan.

In selecting teachers for the undergraduate courses, the Division must guard against the emergence of a "class" hierarchy among the faculty, with the "second-class" members spending most of their time teaching the introductory courses. All faculty should continue to engage in research; however, time and effort spent teaching should receive increased recognition in the tenure review process.

8 Logistics

A potentially major problem is presented by the geographical distance between the Main Campus and RSMAS. None of the alternatives for dealing with this problem are ideal, but we believe that the two optimal ones are as follows.

(1) In the absence of adequate classroom, office and especially weather situation-room facilities at Main Campus, all meteorology courses (other than the 1-credit MET 118 course on "Current Weather Topics") should be taught at RSMAS. Students would typically visit RSMAS once or twice a week to attend classes and, occasionally, the daily MPO weather map discussions. An advantage of this arrangement would be that students become familiar with the research environment in their chosen field. Disadvantages are that a relatively large number of students will have to spend a lot of time commuting between campuses, and they would not have the opportunity to maintain day-to-day contact with weather charts. (We consider such daily exposure a vital element of undergraduate meteorology training.)

(2) With the provision of adequate facilities at Main Campus, meteorology faculty would retain their offices at RSMAS and pay short visits to Main Campus to teach undergraduate courses. This would involve more than occasional visits but trips on a daily basis for some faculty members to maintain the weather situation room and to conduct map discussions of the type currently held at RSMAS. Clearly there would be a duplication of effort and a greater demand on faculty time. This could be justified by a sufficiently large number of undergraduate students.

Given the current state of development of the program, we foresee that in the near- to medium-term future option (1) above will be easily the most viable alternative.

9 Administration

The undergraduate meteorology program will be administered, at least during its initial phase, by the Undergraduate Marine Science Program, whose name should be changed accordingly to "Marine and Atmospheric ...". In the long run we envision the incorporation of the undergraduate meteorology program into a main campus department of "Earth, Marine and Atmospheric Science".

We expect that the administration of the new undergraduate meteorology program will be a relatively minor burden. Current secretarial support should suffice to keep the program running smoothly. More demands will undoubtedly be made on photocopying facilities, causing these to depreciate faster than they otherwise would. Some funding for teaching aids will be required: e.g., the set of overhead transparencies published by the AMS cost \$100 per set.

10 Conclusion

We in MPO believe that sufficient planning has already been done to get the undergraduate meteorology program off the ground, and we are scheduled to start teaching undergraduate courses in the spring, 1991, semester. For the present, we expect students to commute to RSMAS for lectures and practical training, as outlined above.

Having considered all the aspects to the undertaking that we can think of, we feel that an undergraduate meteorology degree program is feasible at UM and we are enthusiastic about starting it and building it up. If the university administration is willing to support such an undertaking, then we can undoubtedly find a way to make it succeed.

(Written by Enda O'Brien, Naomi Surgi and Rainer Bleck)

The Bachelor's Degree in Meteorology or Atmospheric Science

Statement of the American Meteorological Society
as adopted by the Council on October 2, 1987

1. Introduction

This Statement elucidates the curricular, faculty, and facility requirements for a minimally sound undergraduate program.¹

2. Attributes of Bachelor's Degree Programs

a. General objectives

The objectives of a Bachelor's Degree Program in meteorology or atmospheric science include one or more of the following:

- 1) In-depth study of meteorology to serve as a culmination to a liberal arts education.
- 2) Preparation for graduate education.
- 3) Preparation for professional employment in meteorology or a closely related field.

b. Course offerings

A curriculum leading to the degree Bachelor of Science (or Bachelor of Arts) in Meteorology or Atmospheric Science as a minimum should contain:

- 1) At least 20 semester hours (or 30 quarter hours) of credit in meteorology, including at least six semester hours of atmospheric dynamics and thermodynamics with calculus as a prerequisite or corequisite, at least three semester hours of physical meteorology, at least six semester hours of analysis and prediction of weather systems, and at least two semester hours of atmospheric measurements and instrumentation.
- 2) Calculus through ordinary differential equations in courses

designed for majors in either mathematics, physical science, or engineering.

- 3) A one-year sequence in physics, with laboratory, with calculus as a prerequisite or corequisite.
- 4) A course in chemistry designed for physical-science majors.
- 5) A course in computer science designed for physical-science majors.

As in any science curriculum, students should have the opportunity to supplement these minimum requirements with additional course work in the major or any of the supporting areas. Students should be strongly urged to give considerable attention to course work and other activity to develop effective articulation skills, both written and oral.

c. Faculty attributes

There should be a minimum of three full-time regular faculty members teaching meteorology courses and having expertise in the areas listed in 2b above; namely, atmospheric dynamics and thermodynamics, physical meteorology, analysis and prediction of weather systems, atmospheric measurements and observations. The faculty composition should give some basis for quality and diversity of instruction as well as to the general ambiance of the degree program in meteorology or atmospheric science.

d. Facilities

There should be coherent space for the meteorology program and its students. There should be access to current weather information through equipment such as a weather-map facsimile machine and/or a minimal computer-based weather information receiving system. There should be equipment or facilities for studying atmospheric observation and measurement techniques.

¹ At the request of the chairpersons of United States departments of meteorology and atmospheric science, the Executive Committee of the Society established an ad hoc Committee on Undergraduate Accreditation to (a) consider the matter of accreditation or certification of undergraduate degree programs and (b) determine the minimum requirements and features of such a degree program. The ad hoc committee reported findings at the Fifth Meeting of Heads and Chairmen of Departments of Atmospheric Science held in Boulder, Colorado, in October 1986. Dis-

ussion there led to a recommendation that, while a formal accreditation program is not appropriate at this time, the Society should prepare and publish a Statement declaring the curricular, faculty, and facility requirements for a minimally sound undergraduate program. The Executive Committee accepted this recommendation and charged the ad hoc committee with preparation of the Statement in coordination with the Society's Commission on Education and Manpower. This Statement is the result. It should be readopted, revised, or eliminated by the end of 1992.

CURRICULUM FOR METEOROLOGY STUDENTS

April 1991

Credits

Freshman Year

MSC 118	Current Weather Topics	1
English 105	Freshman Composition	3
Math 111	Calculus I	4
Humanities Elective		3
Social Science Elective		<u>3</u>
		14

MSC 240	Introduction to Meteorology	3
English 106	Freshman Composition	3
Math 112	Calculus II	4
Social Sciences Elective		3
IEN 124 or Math 120	Computer Programming	<u>3-4</u>
		16-17

Sophomore Year

Geography 202	Physical Geography: Climatology	3
Math 210	Vectors and Matrices	3
Physics 211, 222	University Physics and Lab	5
Language		<u>3</u>
		14

MSC 243	Weather Forecasting	3
Math 310	Vectors	3
Physics 212, 236	University Physics II and Lab	5
Language		<u>3</u>
		14

Junior Year

MSC 303	Meteorological Instruments	3
MSC 305	Atmospheric Thermodynamics	2
Math 230	Introduction to Abstract Math	3
Physics 360	Modern Physics	3
Language		3
Humanities Elective		<u>3</u>
		17

MSC 405	Atmospheric Dynamics I	3
Math 311	Ordinary Differential Equations	3
Math 512	Complex Variables	3
Social Science Elective		3
Humanities Elective		<u>3</u>
		15

Senior Year

MSC 406	Atmospheric Dynamics II	3
MSC 407	Weather Analysis	3
Math 520 or 524		3
Math 533	Advanced Calculus	3
Humanities Elective		<u>3</u>
		15

MSC 408	Tropical Meteorology	3
MSC 409	Physical Meteorology	3
Math 513	Partial Differential Equations	3
Math 508	Modern Algebra	3
Social Science Elective		<u>3</u>
		15

Summary

Meteorology	27 Credits (+ 3 cr. Climatology)
Math	35
Physics	13
Comp.Prog.	3-4
Social Science	12
Humanities	12
Language	9
English Composition	6
	Total 117-118 cr.

University of Miami Undergraduate Meteorology Program

COURSE DESCRIPTION

Current Weather Topics (1 cr.): Discussion of weather- and Climate related phenomena such as hurricanes, severe storms, global warming, acid rain, etc. (Notes and analysis materials provided)

Introduction to Meteorology (3 cr.): Fundamentals of atmospheric motion and thermodynamics; basic laws of radiation; structure of tropical and extratropical cyclones, anticyclones, thunderstorms and local circulations; seasonal weather patterns. (Textbook: Anthes, Cahir, Fraser, Pansoky, The Atmosphere, 3rd Edition)

Weather Forecasting (3 cr.): Application of physical principles to weather forecasting. Use and interpretation of computer-generated forecast guidance products of the U.S. Weather Service (No text, synoptic products provided by instructor)

Meteorological Instrumentation (2 Cr.): Techniques for measuring meteorological variables at the ground and in the free atmosphere. (Selected readings)

Atmospheric Thermodynamics (2 Cr.): Equation of State; water vapor and moist air thermodynamics; phase changes and latent heat; buoyancy and atmospheric convection; thermodynamic diagrams. (Textbook: Wallace & Hobbs, Atmospheric Science an Introductory Survey)

Weather Analysis (3 Cr.): Three-dimensional analysis of synoptic-scale weather systems; application of the fundamental laws of atmospheric dynamics to observed weather patterns; practical questions of worldwide data exchange and display. (Textbook: Saucier, Principles of Meteorological Analysis)

Tropical Meteorology (3 Cr.): Structure and Behavior of the tropical atmosphere; wave perturbations of the Trades and the Inter-Tropical Convergence Zone; structure and dynamics of tropical cyclones; interaction between cloud- and synoptic-scale motions. (Textbook: Krishnamurti, Compendium of Tropical Meteorology, WMO)

Physical Meteorology (3 Cr.): Atmospheric radiation; absorption and scattering in different wavelength bands, principles of remote sensing of the atmosphere; cloud microphysics: nucleation, ice crystal formation, coalescence, maintenance of the earth's electric field. (Textbook: Fleagle-Businger, An Introduction to Atmospheric Physics)

Atmospheric Dynamics I (3 Cr.): Derivation and scaling of the equations of atmospheric motion; hydrostatic and geostrophic balance; circulation and vorticity. (Textbook: Holton, An Introduction to Dynamic Meteorology)

Atmospheric Dynamics II (3 Cr.): Baroclinic and barotropic instability; boundary layer dynamics; mathematical principles of numerical weather prediction; maintenance of the general circulation. (Textbook: Holton, An Introduction to Dynamic Meteorology)



Ref. RB:jo 16 November 1990

TO: Dr. George Alexandrakis, Chairman, Faculty Senate
FROM: Rainer Bleck, ^{RB}Chairman Meteorology and Physical Oceanography
SUBJECT: Degree program in meteorology

The enclosed proposal to establish an undergraduate **m e t e o r o l o g y** degree program at the University of Miami is hereby transmitted to you for consideration by the Faculty Senate. The program so far has been approved by the RSMAS Academic Committee and the RSMAS School Council. We envision it to be administered by the Marine Science Undergraduate Program. The courses developed for this program have been approved in their entirety by the Curriculum Committee of the College of Arts and Sciences.

Please contact me if you need additional supporting material.

cc: C. Harrison, RSMAS School Council
F. Millero, RSMAS Associate Dean
O. Brown, RSMAS Associate Dean
P. Blaney, Arts and Sciences College Council
L. Farmer, Marine Science Program
R. Sheets, National Hurricane Center
L. Glaser, Provost

Proposal for an Undergraduate Major in Meteorology at the University of Miami

Division of Meteorology and Physical Oceanography (MPO)
Rosenstiel School of Marine and Atmospheric Science

November 16, 1990

1 Introduction

There has been active debate within the MPO division for more than two years on the feasibility of an undergraduate meteorology program at UM. Planning for such a program has proceeded to the point where the curriculum for a double-major baccalaureate degree in Meteorology and Applied Mathematics has been approved by MPO, the Mathematics department and the Arts and Sciences Curriculum Committee. New faculty hires by MPO have enhanced the division's ability to provide teachers for the meteorology curriculum.

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Undergraduate programs in meteorology tend to be available either from small private universities which have no corresponding graduate programs, or from large state universities which have both undergraduate and graduate programs. At present, the University of Miami is typical of large private institutions in offering only graduate degrees in meteorology. However, a good model for the type of program which we envisage is provided by McGill

University in Montreal, where there is a robust undergraduate program (awarding 10 degrees a year, on average) co-existing with a graduate program similar to MPO's, and faculty who are active in funded research.

McGill offers eight undergraduate meteorology courses; the proposed program at the University of Miami has ten courses for a total of 26 credits. We propose that senior undergraduate students should also have the option to take some of the graduate-level courses currently offered by MPO. The approved curriculum is well balanced between general introductory courses and the three sub-disciplines of synoptic, physical and dynamic meteorology. In some smaller institutions, a similar or weaker *curriculum* to that devised by us may be spread over more *courses*. Large state universities tend to offer more genuine variety in their curricula than small colleges do.

MPO currently has five faculty to share the teaching load of the undergraduate meteorology program. Of these, two are tenured professors and three are recently hired (within the past two years) assistant professors. A few of the physical oceanographers in MPO are also qualified and willing to teach undergraduate meteorology courses. Institutions which offer primarily or solely undergraduate meteorology degrees tend to have three or four instructional faculty. More diversified departments, of course, have more.

The library and laboratory resources for the undergraduate meteorology program at the University of Miami compare favourably, in general, with those available at other similar institutions. This is largely because the resources built up for the graduate meteorology program in MPO will also be available to undergraduates.

4 Physical Resources

The library resources and weather map-room facilities which are currently in place for the graduate program in MPO will also be available to undergraduates. On balance, these resources will provide an "infrastructure" for the undergraduate program which will compare favourably with that available in other institutions.

The RSMAS library currently holds all the standard meteorological texts, as well as a large collection of up-to-date volumes on ancillary subjects such as mathematics and computer science. The library subscribes to all the major meteorological journals. It will be an invaluable resource for the undergraduate program. As a specific service for undergraduates the library will need to acquire multiple (e.g., four or five) copies of some undergraduate textbooks, at a cost of approx. \$40 per copy.

In addition to classroom and office space, minimum facilities for an undergraduate meteorology program must consist of a system for acquiring and displaying current data on the state of the atmosphere, such as a facsimile recorder for reproducing weather maps produced at the National Meteorological Center in D.C., and a satellite receiving station. A system for receiving, storing and processing of digital information, such as individual weather station reports, is also needed. Such facilities currently exist for the graduate program at RSMAS/MPO, but a problem arises because of the physical location of these facilities, as discussed below. We should stress that we are talking about minimal facilities for undergraduate meteorology; an increasing number of schools around the country

are acquiring more elaborate and impressive systems, such as color graphics workstations, real-time weather radar displays, hard-copy glossy satellite imagery, etc.

As the number of undergraduate meteorology students increases over the next few years, we expect that classroom, office and other space will be provided on Main Campus as a permanent home for the program. MPO faculty will apply to NSF for funding for weather map-room equipment under the "Instrumentation and Laboratory Improvement" program of the division of undergraduate science, engineering and mathematics education (USEME). If the application is successful (which is far from certain) matching funds will be required from the University in order for the NSF money to be made available. A preliminary estimate of the cost of some essential equipment is as follows:

\$6,000	Satellite dish/receiver/demultiplexer
\$3,500	Weather-map plotter (Alden Electronics, Inc.)
\$9,000	PC-McIDAS (video display unit for weather data)
\$4,000	Meteorological Instrumentation (rain gauge, thermometers, etc.)

\$22,500	

Operating costs for this equipment would be minimal, the only ongoing expense being for computer paper.

The Marine Science Program currently runs a shuttle between Main Campus and RSMAS twice a week, on Tuesdays and Thursdays. This shuttle will be available to undergraduate meteorology students coming to RSMAS for classes and to make use of the library and weather-room facilities.

The proximity of the National Hurricane Center (located on South Dixie Highway across from the University of Miami's main campus), and the close ties between scientists there and the MPO faculty, will provide excellent opportunities for undergraduate students to become familiar with the work of this unique facility at first hand. Preliminary enquiries indicate that the Center is eager to play a role in the undergraduate meteorology program. Their involvement may take the form of lectures, tours, and/or summer internships for honor students before their senior year.

5 Curriculum

Historically, MPO has concentrated on graduate education with good success. In general, the students who do well at the graduate level are those with a well-rounded background in physics and math; it is from this pool that we recruit most of our students. Therefore, in order to equip B.S. degree graduates in meteorology for productive research careers it is essential that the students' training at the undergraduate level be sufficiently rigorous, in terms of emphasizing quantitative and analytic aspects of atmospheric science.

This is one reason for offering the double-major track degree option, with mathematics

as the second major. A further reason is to provide graduates with a unique (so far as we are aware) and versatile qualification. The double-major aspect of the program distinguishes it from other undergraduate meteorology programs (e.g., the program at FSU). The mathematical content of the program is important from the meteorological point of view, but it should also prove to be an asset to students wishing to keep open a broad range of career options, since the double-major provides formal recognition of a broad scientific education.

For the general degree track, we foresee the minor in meteorology being combined with a major in an alternative, possibly non-scientific, subject. For this track, some of the mathematical requirements for meteorology students (e.g., the 500-level math courses) would be relaxed.

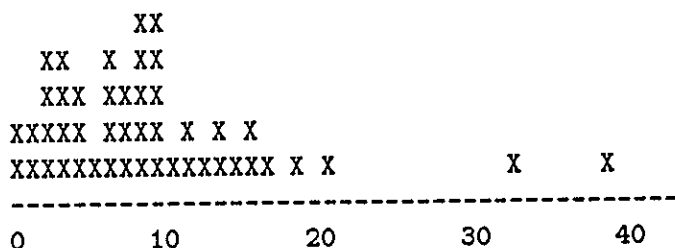
In selecting the meteorological content of the curriculum, we are guided by a policy statement recently adopted by the American Meteorological Society, which gives the minimum requirements for a "sound undergraduate meteorology program". This statement (Attachment A) requires at least 20 semester hours of course credit in meteorology leading to the B.S. degree. The program proposed by us (Attachment B) consists of 25 semester hours which is the norm in other meteorology programs across the country. This curriculum balances needs for strong undergraduate mathematics and physics exposure with introductory and intermediate atmospheric science courses.

The math, physics, chemistry and computer science course requirements, which are also part of a solid undergraduate meteorology curriculum, can be adequately served by the programs already in place at the College of Arts and Sciences.

The meteorological curriculum could easily be expanded to offer more service courses to majors in other disciplines. We envision a minor consisting of Current weather topics (MET 118), Introduction to Meteorology (MET 240), Weather Forecasting (MET 243), Physical Geography: Climatology (GEG 202), and Meteorological Instrumentation (MET 303). These courses would be taught by meteorology faculty and would be of interest to geography and marine science majors, among others.

6 Anticipated student enrollment

In order to provide some basis for estimating the number of students who would elect to obtain an undergraduate degree in meteorology at UM, we have conducted a survey of existing undergraduate programs in meteorology (excluding those that combine meteorology with related fields like oceanography, environmental sciences, geography, etc.). This survey resulted in the following histogram of meteorology undergraduate degrees conferred by U.S. and Canadian colleges and universities during the academic year 1988/89. Each "X" in the diagram represents one institution; there are 47 altogether. The number of degrees appears at the bottom of the graph. The two most prolific institutions were Penn State (which has a special program for broadcast meteorologists) and Texas A&M (whose students are mostly ROTC) with 38 and 32 degrees conferred, respectively. The histogram represents a total of 407 degrees—down from 477 four years previously.



It appears that the "typical" meteorology program generates 8 or 9 graduates per year. Given a modest attrition rate (say 1/3 of the incoming freshmen) during the 4-year degree program, this translates into approximately 40 students for the entire undergraduate class in a given year. It would of course take the University of Miami at least four years (probably longer) to "spin up" to such an overall enrollment figure.

Based on the experience of comparable programs, we expect enrollment in the lower division courses, which would be open to both majors and minors, to be considerably larger than in the upper division courses.

It is encouraging that MPO receives a half-dozen or so unsolicited enquiries each year from within Florida about undergraduate meteorology. However, a concerted effort will be needed to publicize and popularize the program in order to attract a viable number of students. This will require promotional articles in student newspapers, promotional talks at orientation sessions, and promotional literature for dissemination to prospective students. MPO faculty are willing to participate in these efforts.

7 Faculty requirements

A minimum of three full-time faculty members, each teaching at least one 3-credit course per semester, are needed to teach the courses in the undergraduate meteorology program (see Attachment B). The fields of specialization of these individuals must be such that all three sub-disciplines of meteorology, viz. dynamic, physical and synoptic, can be adequately taught. Between incumbent faculty and new hires, all three of these areas are presently represented in MPO, so it may be argued that the undergraduate program could be launched without hiring more new faculty whatsoever. While this may be true, such reasoning defeats one of the purposes of the whole exercise, which is to bring our graduate faculty up to proper strength. In particular there is no real expertise among the present faculty for teaching MET 303 — the course on Meteorological Instrumentation. One more faculty member with specialization in physical meteorology/instrumentation is required — not merely to teach this course, but to bring necessary breadth and diversity to the undergraduate degree program and to the division at large. This individual could be either an Atmospheric Radiation Transfer/Satellite Meteorology specialist, or a Marine Boundary Layer specialist; new faculty in both these disciplines are envisaged in the current MPO 5-year plan.

In selecting teachers for the undergraduate courses, the Division must guard against the emergence of a "class" hierarchy among the faculty, with the "second-class" members spending most of their time teaching the introductory courses. All faculty should continue

to engage in research; however, time and effort spent teaching should receive increased recognition in the tenure review process.

8 Logistics

A potentially major problem is presented by the geographical distance between the Main Campus and RSMAS. None of the alternatives for dealing with this problem are ideal, but we believe that the two optimal ones are as follows.

(1) In the absence of adequate classroom, office and especially weather situation-room facilities at Main Campus, all meteorology courses (other than the 1-credit MET 118 course on "Current Weather Topics") should be taught at RSMAS. Students would typically visit RSMAS once or twice a week to attend classes and, occasionally, the daily MPO weather map discussions. An advantage of this arrangement would be that students become familiar with the research environment in their chosen field. Disadvantages are that a relatively large number of students will have to spend a lot of time commuting between campuses, and they would not have the opportunity to maintain day-to-day contact with weather charts. (We consider such daily exposure a vital element of undergraduate meteorology training.)

(2) With the provision of adequate facilities at Main Campus, meteorology faculty would retain their offices at RSMAS and pay short visits to Main Campus to teach undergraduate courses. This would involve more than occasional visits but trips on a daily basis for some faculty members to maintain the weather situation room and to conduct map discussions of the type currently held at RSMAS. Clearly there would be a duplication of effort and a greater demand on faculty time. This could be justified by a sufficiently large number of undergraduate students.

Given the current state of development of the program, we foresee that in the near- to medium-term future option (1) above will be easily the most viable alternative.

9 Administration

The undergraduate meteorology program will be administered, at least during its initial phase, by the Undergraduate Marine Science Program, whose name should be changed accordingly to "Marine and Atmospheric . . .". In the long run we envision the incorporation of the undergraduate meteorology program into a main campus department of "Earth, Marine and Atmospheric Science".

We expect that the administration of the new undergraduate meteorology program will be a relatively minor burden. Current secretarial support should suffice to keep the program running smoothly. More demands will undoubtedly be made on photocopying facilities, causing these to depreciate faster than they otherwise would. Some funding for teaching aids will be required: e.g., the set of overhead transparencies published by the AMS cost \$100 per set.

10 Conclusion

We in MPO believe that sufficient planning has already been done to get the undergraduate meteorology program off the ground, and we are scheduled to start teaching undergraduate courses in the spring, 1991, semester. For the present, we expect students to commute to RSMAS for lectures and practical training, as outlined above.

Having considered all the aspects to the undertaking that we can think of, we feel that an undergraduate meteorology degree program is feasible at UM and we are enthusiastic about starting it and building it up. If the university administration is willing to support such an undertaking, then we can undoubtedly find a way to make it succeed.

(Written by Enda O'Brien, Naomi Surgi and Rainer Bleck)

The Bachelor's Degree in Meteorology or Atmospheric Science

Statement of the American Meteorological Society as adopted by the Council on October 2, 1987

1. Introduction

This Statement elucidates the curricular, faculty, and facility requirements for a minimally sound undergraduate program.¹

2. Attributes of Bachelor's Degree Programs

a. General objectives

The objectives of a Bachelor's Degree Program in meteorology or atmospheric science include one or more of the following:

- 1) In-depth study of meteorology to serve as a culmination to a liberal arts education.
- 2) Preparation for graduate education.
- 3) Preparation for professional employment in meteorology or a closely related field.

b. Course offerings

A curriculum leading to the degree Bachelor of Science (or Bachelor of Arts) in Meteorology or Atmospheric Science as a minimum should contain:

- 1) At least 20 semester hours (or 30 quarter hours) of credit in meteorology, including at least six semester hours of atmospheric dynamics and thermodynamics with calculus as a prerequisite or corequisite, at least three semester hours of physical meteorology, at least six semester hours of analysis and prediction of weather systems, and at least two semester hours of atmospheric measurements and instrumentation.
- 2) Calculus through ordinary differential equations in courses

designed for majors in either mathematics, physical science, or engineering.

- 3) A one-year sequence in physics, with laboratory, with calculus as a prerequisite or corequisite.
- 4) A course in chemistry designed for physical-science majors.
- 5) A course in computer science designed for physical-science majors.

As in any science curriculum, students should have the opportunity to supplement these minimum requirements with additional course work in the major or any of the supporting areas. Students should be strongly urged to give considerable attention to course work and other activity to develop effective articulation skills, both written and oral.

c. Faculty attributes

There should be a minimum of three full-time regular faculty members teaching meteorology courses and having expertise in the areas listed in 2b above; namely, atmospheric dynamics and thermodynamics, physical meteorology, analysis and prediction of weather systems, atmospheric measurements and observations. The faculty composition should give some basis for quality and diversity of instruction as well as to the general ambiance of the degree program in meteorology or atmospheric science.

d. Facilities

There should be coherent space for the meteorology program and its students. There should be access to current weather information through equipment such as a weather-map facsimile machine and/or a minimal computer-based weather information receiving system. There should be equipment or facilities for studying atmospheric observation and measurement techniques.

¹ At the request of the chairpersons of United States departments of meteorology and atmospheric science, the Executive Committee of the Society established an ad hoc Committee on Undergraduate Accreditation to (a) consider the matter of accreditation or certification of undergraduate degree programs and (b) determine the minimum requirements and features of such a degree program. The ad hoc committee reported findings at the Fifth Meeting of Heads and Chairmen of Departments of Atmospheric Science held in Boulder, Colorado, in October 1986. Dis-

cussion there led to a recommendation that, while a formal accreditation program is not appropriate at this time, the Society should prepare and publish a Statement declaring the curricular, faculty, and facility requirements for a minimally sound undergraduate program. The Executive Committee accepted this recommendation and charged the ad hoc committee with preparation of the Statement in coordination with the Society's Commission on Education and Manpower. This Statement is the result. It should be readopted, revised, or eliminated by the end of 1992.

CURRICULUM FOR PROPOSED BACHELOR OF SCIENCE MAJOR IN METEOROLOGY

Credits

Freshman Year

English 105	Freshman Composition	3
Math 102	Analytic Geometry and Trigonometry	3
Humanity Elective		3
Sociology Elective		3
Chemistry 111	General Chemistry	4
*MET 118	Current Weather Topics	1
		<u>17</u>

English 106	Freshman Composition	3
Math 111	Calculus	4
Chemistry 112	General Chemistry	4
Humanity Elective		3
Geography 202	Physical Geography: Climatology	3
		<u>17</u>

Sophomore Year

Math 112	Calculus II	4
Physics 211, 222	University Physics and Lab	5
Language		3
MSC 240	Introduction to Meteorology	3
		<u>15</u>

Math 311	Ordinary Differential Equations	3
Physics 212, 236	University Physics II and Lab	5
Math 120	Computer Programing I	4
Language		3
		<u>15</u>

Junior Year

Math 210	Vectors and Matrices	3
Physics 360	Modern Physics	3
Language		3
Humanity Elective		3
*MET 212	Weather Forecasting	3
		<u>15</u>

Math 310 or 312	Vectors	3
Math 524	Introduction to Prob. Theory	3
Sociology Elective		3
Humanity Elective		3
*MET 303	Meteorological Instrumentation	2
*MET 305	Atmospheric Thermodynamics	2
		<u>16</u>

Credits

Senior Year

Math 513	Partial Differential Equations	3
Sociology Elective		3
*MET 405	Atmospheric Dynamics I	3
*MET 407	Weather Analysis	3
*MET 408	Tropical Meteorology	3
		<u>15</u>

Math 320	Introduction to Numerical Analysis	3
*MET 406	Atmospheric Dynamics II	3
*MET 409	Physical Meteorology	3
** Free elective		6
		<u>15</u>

Summary

Meteorology	26 Credits
Math	29-33
Physics	13
Chemistry	8
Sociology	12
Humanity	12
Language	9
English Composition	6

* Proposed New Courses in Meteorology

** In order to fulfill the requirements for a full Mathematics major one of the elective courses would be Modern Algebra

New Courses to be Designed and Approved for the Meteorology Major

MET 117	Current Weather Topics	1
MET 212	Weather Forecasting	3
MET 303	Meteorological Instrumentation	2
MET 305	Atmospheric Thermodynamics	2
MET 405	Atmospheric Dynamics I	3
MET 406	Atmospheric Dynamics II	3
MET 407	Weather Analysis	3
MET 408	Tropical Meteorology	3
MET 409	Physical Meteorology	3
		<u>23</u>

University of Miami Undergraduate Meteorology Program

COURSE DESCRIPTION

10 October 1989

Current Weather Topics (1 cr.): Discussion of weather- and Climate-related phenomena such as hurricanes, severe storms, global warming, acid rain, etc. (Notes and analysis materials provided)

Introduction to Meteorology (3 cr.): Fundamentals of atmospheric motion and thermodynamics; basic laws of radiation; structure of tropical and extratropical cyclones, anticyclones, thunderstorms and local circulations; seasonal weather patterns. (Textbook: Anthes, Cahir, Fraser, Panosky, The Atmosphere, 3rd Edition)

Weather Forecasting (3 cr.): Application of physical principles to weather forecasting. Use and interpretation of computer-generated forecast guidance products of the U.S. Weather Service (No text, synoptic products provided by instructor)

Meteorological Instrumentation (2 Cr.): Techniques for measuring meteorological variables at the ground and in the free atmosphere. (Selected readings)

Atmospheric Thermodynamics (2 cr.): Equation of State; water vapor and moist air thermodynamics; phase changes and latent heat; buoyancy and atmospheric convection; thermodynamic diagrams. (Textbook: Wallace & Hobbs, Atmospheric Science an Introductory Survey)

Weather Analysis (3 cr): Three-dimensional analysis of synoptic-scale weather systems; application of the fundamental laws of atmospheric dynamics to observed weather patterns; practical questions of worldwide data exchange and display. (Textbook: Saucier, Principles of Meteorological Analysis)

Tropical Meteorology (3 cr.): Structure and behavior of the tropical atmosphere; wave perturbations of the Trades and the Inter-Tropical Convergence Zone; structure and dynamics of tropical cyclones; interaction between cloud- and synoptic-scale motions. (Textbook: Krishnamurti, Compendium of Tropical Meteorology, WMO)

Physical Meteorology (3 cr.): Atmospheric radiation; absorption and scattering in different wavelength bands, principles of remote sensing of the atmosphere; cloud microphysics: nucleation, ice crystal formation, coalescence, maintenance of the earth's electric field (Textbook: Fleagle-Businger, An Introduction to Atmospheric Physics)

Atmospheric Dynamics I (3 cr.): Derivation and scaling of the equations of atmospheric motion; hydrostatic and geostrophic balance; circulation and vorticity. (Textbook: Holton, An Introduction to Dynamic Meteorology)

Atmospheric Dynamics II (3 cr.): Baroclinic and barotropic instability; boundary layer dynamics; mathematical principles of numerical weather prediction; maintenance of the general circulation (Textbook: Holton, An Introduction to Dynamic Meteorology)



April 23, 1990

Department of Geological Sciences
P.O. Box 249176
Coral Gables, Florida 33124

MEMORANDUM

To: Dr. George Alexandrakis
Chairman, Faculty Senate

From: Dr. Cesare Emiliani
Chairman, Dept. of Geological Sciences

Re: Change of Department's name.

A handwritten signature in cursive, likely belonging to Dr. Cesare Emiliani, written in dark ink.

Following the unanimous recommendation generated at a meeting on April 20, 1990, that included Provost Glaser, Dean Wilson, Dean Rosendhal and Associate Dean Millero (RSMAS), Dr. Brass and Dr. Fisher (MGG/RSMAS), Dr. Farmer (Marine Sciences), Dr. Huerta (Physics), and Dr. Lewis (Chemistry), the Department of Geological Sciences has unanimously voted to request that the name of the Department of Geological Sciences be changed to Department of Earth, Marine, and Atmospheric Sciences.

There is urgency that this name change be officially approved now so that we can prepare materials for a recruiting campaign early in the Fall to bring new students to the University.

I would appreciate if the Senate Council could vote on this matter this afternoon and hopefully approve the request subject to approval by the College Council (which is presently being polled by telephone) and the College Faculty (which will meet tomorrow, Tuesday, April 24). If these approvals can be secured, I would appreciate if the Senate could vote on this matter at its meeting this coming Monday.

Thank you for your attention.

Committees during the summer. Mr. McLamore will chair the Board's Development Committee for the coming year.

Two deans' searches have been completed: Javier Cenicacelaya, School of Architecture, effective January 1, 1991 and Martin Becker, College of Engineering, effective October 1, 1990. Search committees will be appointed shortly for new deans of the School of Education and the College of Arts and Sciences since the current deans have decided to step down. The Provost praised the work of both Dean Simpson and Dean Wilson in their respective schools. In response to a query by the undergraduate student representative whether students would have any input in the decision making process of choosing the new deans, he stated that he would discuss the matter with the President.

Dr. Glaser announced that additional patrolmen have been hired to increase security on campus and that the escort service will operate until 3:00 a.m. The administration will also look at providing more security in the residential colleges.

The Provost stated that all Florida students receiving financial aid from the state are required to take the CLAST test. With the strengthening of standards for the CLAST test, it will be important to provide both pre-tests and seminars for those students who have deficiencies.

Some of the things impacting this year's budget will be increased energy costs, increased financial aid due to increased enrollment, soaring health care costs and a smaller enrollment in summer school. Dr. Glaser also mentioned that the area of grant activity is of some concern to the administration.

The Provost responded to questions regarding the Issues Committee, the contingency fund, parking, and the surplus funds from an increased enrollment. He agreed that the Issues Committee sub-committees recommendations will be brought to the Senate before implementation. It was suggested that, in light of the composition of the Issues Committee, increased female faculty appointments should be sought for the sub-committees. He also stated that any surplus from the increased enrollment should be put into a reserve as a cushion.

Proposed Name Change for the Department of Geological Sciences

The Chairman reported that Professor Emiliani had requested a postponement of discussion on this item.

Report on Medical Benefits

Professor Steven Green, Chairman of the Faculty Senate Budget and Compensation Sub-committee on Employee Benefits, reported on the University Employee Benefits Committee current discussions of increasing medical costs. The University Employee Benefits Committee has recommended that Signa, an HMO provider, be replaced by CAC Ramsay. Professor Green explained ways the Committee is exploring to reduce the estimated deficit of 4.5 million dollars for this year. He stated that the premium increase that would be required, approximately \$150 per month/per person,

issues as they progress; 4)that the smoking policy has been reconsidered and modified; and 5)that the Issues Committee's work has been impressive with several good ideas emerging.

The President announced the following: 1)that he would approve the Librarian Faculty legislation; and 2)that Dr. Rita Bornstein, Vice President for Development, has been selected as the new President of Rollins College.

Academic Standards Committee Report on Drop and Add Dates

Professor Jane Connolly presented a summary of the recommendations from the Academic Standards Committee on drop and add dates. There was discussion on the interpretation of a "W" grade on transcripts and the length of time to be adopted for dropping courses. It was *moved* and seconded to amend the Council's motion to approve the recommendations by approving the Committee's first three recommendations. The fourth recommendation regarding the drop date with a "W" will be returned to the Academic Standards Committee for further study. *The amendment carried. The motion as amended carried.*

Proposed Charter Legislation for Librarian Faculty (Second Reading)

Professor Susi Seiler presented the proposed legislation with two corrections which had been approved by the Senate Council. The last sentence of Section 2.1 should read "**Regular** faculty ... shall constitute a majority of that faculty." *The motion, as recommended by the Senate Council, carried.*

Proposal to Establish a University-wide Freshman Seminar Program

Vice Provost Ross Murfin presented the background of two committees which have worked on devising proposals to establish a University-wide Freshman Seminar Program. He explained that it would be beneficial to faculty and students alike and would enhance the student retention efforts. The process of selecting students for the program and measuring the effectiveness of the seminar were discussed. The Vice Provost solicited suggestions and recommendations for the proposal which will be discussed further during the Fall semester. The President recommended that the Freshman Seminar Program be implemented as soon as possible to give the freshman student a better experience with the regular faculty of the University.

Proposed Change of Name for the Department of Geological Sciences

The Chairman announced that the faculties of RSMAS and the College of Arts and Sciences have approved the proposed change of name for the Department of Geological Sciences to the Department of Earth, Marine, and Atmospheric Sciences. Professor Emiliani presented the background of the current undergraduate Marine Science program and the rationale for changing the departmental name. He suggested keeping the academic program under an interdepartmental committee. It was *moved* and seconded to change the name as requested by the department.

Professor Green objected to the proposal since indications are that it is a new program with a new location for the present Marine Science program. He urged the Senate to defer the item and refer it back to the College of Arts and Sciences. Dean Wilson explained the need for approval of the proposal as quickly as possible to gain grant support. He stated that the Provost's committee had discussed the possibility of several new majors and moving the Marine Science program to the new department. The name change would reflect an increased role by RSMAS faculty into undergraduate teaching through the new department and would allow the College to continue teaching geological sciences. It was *moved* and seconded to approve only the name change for the department. It does not involve any changes in personnel or programs. *The motion carried with one opposed and one abstention.*

Report from the Faculty Senate Budget Committee

Professor Brass presented a brief report from the Senate Budget Committee on faculty pay raise information submitted recently to the Administration.

Information on the Issues Committee

Professor Clasby informed the Senate that the Issues Committee has arrived at a consensus on the following points: 1) student quality; 2) student/faculty ratio; 3) targets on faculty productivity and rewards; 4) committees to be used to evaluate the curriculum of the schools and colleges and to examine the possibility of a four-course curriculum; and 5) identification of programs to be developed into programs of national prominence.

The meeting adjourned at 6:50 p.m.



Barbara L. Hoadley
Secretary to the Faculty Senate

Dean Holden objected to the recommendations of the Academic Standards Committee. Professor Knoblock explained that the main issue was where the program should be housed. If the program was transferred to the College of Arts and Sciences then the name should also be changed. The second issue, Dr. Knoblock said, was that all academic programs have supervisory committees composed of the faculty who deal with the programs. The third issue was that the School Council was appointed instead of being elected. It was *moved* and seconded to accept the first recommendation. The *motion failed*. It was *moved* and seconded to accept the second recommendation. No vote was taken for the second motion. It was *moved* and seconded to defer the consideration of the third and fourth recommendations and to appoint a committee to draft new legislation for the School of Continuing Studies that defines the composition of its School Council and that in the interim current arrangements be permitted to continue. The *motion carried*.

Proposed Bylaw for Librarian Faculty Legislation

After discussion, it was *moved* and seconded to accept the proposal to establish a Librarian Faculty category with the exception of Section 6.2 which has to be re-written. The *motion carried*.

Matters from the Floor

It was *moved* and seconded that the Chair write a letter of appreciation to the students for their work sponsoring the celebrations of Earth Day. The *motion carried*.

Professor Alexandrakis introduced the request for a name change of the Department of Geological Sciences to the Department of Earth, Marine and Atmospheric Sciences. It was *moved* and seconded to include the request for a change of name in the next Senate agenda subject to approval by the Faculties of the College of Arts and Sciences and the School of Marine and Atmospheric Sciences. The *motion carried unanimously*.

The Provost summarized the Strategic plan as a conservative, transitional document. He explained that the Issues Committee and the sub-committees appointed will draft a different document defining how the University is expected to operate during the next decade.

When asked about the letters of intent sent to student athletes with low GPAs, the Provost assured the Council that the students were not going to be accepted to the University.

Meeting with the General Faculty

Professor Alexandrakis started the discussion of the procedures to follow for the meeting with the President and the Faculty on May 7th. After discussing the document that a sub-committee drafted to send to the Faculty before the May 2nd



Sept. 7, 1990

Department of Geological Sciences
P.O. Box 249176
Coral Gables, Florida 33124

MEMORANDUM

To: Dr. George Alexandrakis
Faculty Senate

From: Cesare Emiliani
Chairman, Geological Sciences

A handwritten signature in cursive script, appearing to be "CE", written in dark ink.

Re: Change of Department's Name.

We would appreciate if the Faculty Senate, at its second reading on above subject, would consider approving the proposed name change (from Department of Geological Sciences to Department of Earth, Marine, and Atmospheric Sciences) subject to the incorporation of the Marine Science Program into the new Department.

Rationale: It does not make any sense to have a Department of Earth, Marine, and Atmospheric Sciences without the Marine Program in it.

Thank you for your attention.





April 23, 1990

Department of Geological Sciences
P.O. Box 249176
Coral Gables, Florida 33124

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Chairman, Faculty Senate

From: Dr. Cesare Emiliani
Chairman, Dept. of Geological Sciences

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A handwritten signature in cursive script, appearing to be "CE", located to the right of the "From:" line.

Following the unanimous recommendation generated at a meeting on April 20, 1990, that included Provost Glaser, Dean Wilson, Dean Rosendhal and Associate Dean Millero (RSMAS), Dr. Brass and Dr. Fisher (MGG/RSMAS), Dr. Farmer (Marine Sciences), Dr. Huerta (Physics), and Dr. Lewis (Chemistry), the Department of Geological Sciences has unanimously voted to request that the name of the Department of Geological Sciences be changed to Department of Earth, Marine, and Atmospheric Sciences.

There is urgency that this name change be officially approved now so that we can prepare materials for a recruiting campaign early in the Fall to bring new students to the University.

I would appreciate if the Senate Council could vote on this matter this afternoon and hopefully approve the request subject to approval by the College Council (which is presently being polled by telephone) and the College Faculty (which will meet tomorrow, Tuesday, April 24). If these approvals can be secured, I would appreciate if the Senate could vote on this matter at its meeting this coming Monday.

Thank you for your attention.

Professor Green asked the Chairman to request from the Administration a response on the medical benefits matter.

Professor Green mentioned that the proposed name change for the Department of Geology had been deferred at the last Senate meeting at the request of the departmental chairman. It was agreed that the Chairman would appoint an independent committee, if necessary, to resolve the problems of the proposed change.

Professor Awad brought to the Council's attention a situation whereby individuals who compete for national fellowships funded directly by the awarding agency find themselves unable to obtain medical insurance. The Chairman suggested that Professor Green contact Mr. Greenfeder to work out some solution to the problem. There is no appropriate classification for post-doctoral candidates in the *Faculty Manual*.

The remainder of the meeting was held in Executive Session. A summary of that portion of the meeting is on file in the Senate office.

Report of the Ad Hoc Faculty Senate Committee to Review a Proposal for a Double Major Involving Mathematics and Meteorology

To gain a further appreciation for the proposal, members of the committee met on different occasions with Professors Rainer Bleck, Linda Farmer, and Enda O'Brien. The following major topics were discussed.

1. Financial aspects. The undergraduate program in meteorology would be administered by Professor Farmer and the Office of Marine Science. In large part, it will be an expansion of the Marine Science program, offering another opportunity for undergraduates to benefit from the University resources centered at RSMAS. An attached letter from Professor Farmer notes that administrative expenses can be met through the existing U-budget of the Marine Sciences program. The letter also notes that an arrangement for remuneration of faculty for teaching in the Meteorology program is to be worked out by the respective Deans and the Provost. No capital needs are critical for initiation of the program. Ultimately, the Division of Meteorology and Physical Oceanography at RSMAS expects to make proposals to NSF for equipment. Such proposals would require matching funds, to be justified by the tuition revenue generated by the program.

2. Number of interested undergraduates. By far, the largest topic of conversation centered on ways to attract a financially viable number of undergraduates, particularly in junior and senior level meteorology courses. The proposal is hamstrung at the current time because it has been approved only as a double major program. Most discussants concurred with the opinion that a less directed undergraduate curriculum, e.g. one without some of the math courses in the senior year, would attract a wider range of students. Discussions also noted that students intending to pursue graduate studies in meteorology should focus on the combined math/meteorology program. Since not all students will be interested in graduate study, the committee feels that the choice of a more directed, applied science bachelor's program (B.S. and a job) versus the more thorough double major program should be made by students in conjunction with faculty advisors. The major point being that over the long term, the meteorology program should not be restricted to the double major (math / meteorology).

An alternative way to increase enrollment in junior and senior meteorology classes would be to attract minors by students in the physical sciences and engineering. Such students usually have the prerequisite mathematics required for the more advanced meteorology courses. Obvious interests might be provoked in atmospheric physics, instrumentation (electrical engineering and physics), and perhaps atmospheric chemistry.

Courses for a minor are already approved and sections of two courses have been taught. The sparse enrollment in these sections (about 10 students) probably reflected the absence of a well-known path toward a meteorology minor. As envisaged in the original presentation to the Council, the revenue generated by

relatively larger enrollments in the early courses of the meteorology sequences will offset the costs of offering later courses in the sequences.

3. Logistical arrangements. Transportation is crucial because the laboratory and library facilities for this program are at RSMAS (all initially facilities except for the Marine Science advising office). As currently envisaged, transportation for this program will piggy-back onto arrangements made for other programs. Fortunately, those arrangements appear sound. Weekday shuttle service from Metrorail to the RSMAS area is to begin in the fall (October is a current target date). This service, while useful, is not ideal since it involves two stops, and at least one fare each way. The environmental sciences program plans to add a van, which meteorology students could also use. This service is preferable since it would be from campus to campus.

4. Focus of the program / content of the curriculum. If this program were proposed from a "College of Pure and Applied Sciences," it would be applauded for its breadth. It offers significant amounts of language, humanities, and social sciences. In part this reflects the fact that the current form of the curriculum meets the new requirements for undergraduate degree programs.

A single major meteorology curriculum with a lesser amount of required mathematics should be developed. The extra flexibility in the program would facilitate student transfers into the program and make it more attractive to persons seeking only a BS level training in meteorology. It would also make the program attractive to students with broader interests. As an example, if two courses of mathematics were replaced by two courses of chemistry, the program might appeal to students interested in atmospheric chemistry and air pollution.

5. Type of student appropriate for the program. All sections of the university should benefit from the students who can prosper (survive?) in the proposed (or in a single major) curriculum. The students must have strong quantitative skills; yet the very subject demands that the student extract qualitative, but repetitive patterns from observations. Such mental agility will be tied to higher SAT scores and better high school performance. It is probable that it will also be obvious in other classes. Majors like meteorology should allow the University to attract and retain talented students. The meteorology program is very unlikely to become large, and thus, these students will flavor, but not dominate the student body. This flavoring is of a type that is hard to achieve; it consists of students who are generally taking more difficult and challenging courses.

6. Competition. The major feature of the program will be its tie to RSMAS with its Division of Meteorology and Physical Oceanography. The presence of the both the Hurricane Forecasting Center and the NOAA tropical storm research group in Miami also provide near-unique attractions.

Recommendation. We recommend temporary approval of the dual major program in mathematics and meteorology. The program should be reviewed in two years to see if the class size of is economically viable (eight or more students projected for each the junior and senior years). With such a program, it will be important that the early courses for both minors and majors be well filled (of order 25 students). Such enrollment will be needed to justify matching funds for and NSF funding of capital equipment. An offsetting factor is that the program will direct a number of students into courses that are probable to have low enrollments (e.g., the 500 level math courses) and into courses with only moderate enrollments (e.g., mid-level math courses). To avoid a future negative review, we urge the appropriate groups (RSMAS-MPO, Marine Sciences, and CAS) to prepare a proposal for a single major in meteorology and shepherd it through the appropriate university structures. A meteorology program with slightly greater numbers will be important not only for internal financial reasons, but also for attracting funding of capital equipment from agencies such as NSF.

Eugene Eckstein
Eveleen Lorton
Daryl Greenfield



May 23, 1991

Dr. Gene Eckstein
Faculty Senate Council

Dear Gene,

As chairman of the faculty senate council's review committee for the proposed new meteorology major you have sought a fuller understanding of the financial requirements. The following arrangements have been proposed and sanctioned by the Deans of the schools involved and the Provost:

- 1). Equipment and supplies (including secretarial services, phone, supplies etc.) will be provided for teachers and students by the marine science program U budget. Currently this budget supports 360 majors, and we feel that an additional 30-40 meteorology majors can be accommodated.
- 2). RSMAS teaching faculty will be remunerated at a level negotiated between the Deans and the Provost, but for the foreseeable future no new faculty will be hired. Undergraduate teaching will be included in the time commitments of extant faculty.
- 3). Capital needs, as outlined in the proposal are not critical initially, since the RSMAS weather situation room may be used by small numbers of students. We do plan to seek extramural funding for the eventual establishment of a similar lab on main campus.

If I can be on further assistance, please let me know.

Sincerely,

A handwritten signature in dark ink, appearing to read "Linda Farmer".

Linda Farmer
Coordinator