

Chapter 2. Introduction and Summary

The Department of Marine, Earth and Atmospheric Sciences, as our name implies, covers three distinct disciplines. This breadth is one of the great strengths of our department, and is also the source of some of our major challenges. Although the grouping of the three program areas in one department within the college of physical and mathematical sciences is a relatively recent event, it has proven to be a highly functional and effective structure.

The department is home to the only graduate program in atmospheric sciences in North Carolina and one of only three undergraduate programs in the state (the others are at UNC-Asheville and UNC-Charlotte). In contrast there are competing graduate programs in both geoscience and marine science at Duke and UNC-Chapel Hill and in marine science at UNC-Wilmington. There are also numerous geology and marine science undergraduate programs in the state. Directly reflecting the number of competing programs, enrollment at both undergraduate and graduate level is higher in atmospheric sciences than in the other two programs.

The department has 32 tenure track faculty, and has remained nearly constant in size over the last 10 years, in both number of tenure track faculty and in their distribution among our disciplines. Significantly we have replaced about half of our tenure track faculty in this period, including 11 in the last 4 years alone. The influx of new research-active faculty has created the highest proportion of research-active faculty at NC State, 31 of 32 of our tenure track faculty currently have active sponsored research support.

The department ranks third in the University in new grant awards (behind electrical and computer engineering and physics), and has for the past decade. The research activity includes all three disciplines. Growth in research has been steady in terms of the number of grants awarded, the value of grants received and the proportion of faculty involved in sponsored research.

As the involvement of faculty in research has increased, concern over teaching loads has mounted. Twenty years ago, the teaching load in the department was four courses per year. New faculty are now hired with a guarantee of a maximum of three courses per year and the objective of allowing two courses per year for those with substantial external support. The retirement of several faculty who were carrying heavy teaching loads (and were proportionally less active in research) with new research-active faculty, while greatly enhancing our research programs, has made it difficult to cover all the required and desired courses. Every department in our college is wrestling with the question of how to achieve the desired reduced teaching loads while maintaining a strong undergraduate program. In MEAS this has been particularly difficult in meteorology due to the large number of required courses.

Without a significant increase in the number of tenure-track faculty, something which is unlikely to occur, the desired teaching load reductions cannot be achieved with a conventional model of having tenure track faculty teach all departmental courses.

However some reduction may be attained by reducing the number of course offerings. Currently the department is also considering utilizing the new tenure-track category of teaching professor (a tenure track position that will have a higher teaching load and a lower research expectation). In the meantime the average teaching load is 2.8 courses per year, significantly higher than our vision.

Undergraduate Education:

The department offers 9 active undergraduate degrees (several more have been discontinued but are currently listed as some students remain in the programs) reflecting a historic practice of giving each concentration a separate degree. Consolidation of these programs is well underway in meteorology and geology. Each of our disciplines has had distinct issues in undergraduate education: meteorology has seen the increase in enrollment strain facilities by requiring additional sections, while a rapidly developing air quality program has required even more courses to be offered. Marine sciences has undertaken a new degree program in biological oceanography without increasing the number of faculty and earth sciences has faced staffing traditional core courses as senior faculty retired and were replaced by faculty with different areas of specialization.

Although the number of majors in the department is not small, over 230, the vast majority of student credit hours in the department are generated by introductory courses taught to non-majors. These courses are usually taken to satisfy the university general education requirements. Introductory geology (about 1500 students per year), atmospheric sciences (1000 students per year) and marine science (300 students per year) course generate most of our credit hours. The labs associated with these courses employ most of the approximately 30 teaching assistants we hire each semester.

In recognition of the role that the introductory courses play in generating credit hours, and in the fact that these introductory courses provide the only exposure to science that many of the students may receive at NC State, we have invested heavily in course development at the introductory level. A new introductory course (MEA 150, Environmental issues in water resources) was developed with NSF support (J. Fountain PI) to attract introductory students to our majors. To improve the traditional course, we hired an experienced geologist to totally redesign all introductory geology labs this fall. LCD projectors and associated equipment were installed in the physical geology labs for the first time this fall. Similarly, we hired an experienced instructor to redo the labs (MEA 135) associated with the introductory atmospheric sciences course (MEA 130, Introduction to weather and climate) and coordinate the lectures with the labs.

In marine geology, our intro course MEA 200, Introduction to Oceanography, is being taught in a combined lecture/lab mode by C. Cudaback this spring and an entire new lab, designed from the ground up for the accompanying lab (MEA 210) is included in the new wing now being constructed on our building. Thus the department has totally revamped all of its introductory courses in the past year and is continuing to invest in both the course design and infrastructure. In addition, earth system science (MEA 100) is required of majors in the interdisciplinary environmental science and natural resources programs, and Dinosaurian world (MEA 120, and MEA 121(lab)) were recently

developed explicitly to attract students to our major areas. Although the number of instructors required for the intro courses is minimized through the use of large lecture halls (>300 for both intro geology and atmospheric science), we still staff 9 introductory sections per semester (counting innovative sections and honors sections). Although instructors teach some sections (4 this fall) it does represent a significant resource sink. We feel that due to the combined importance of credit hour generation and our mission to teach science to the non-science major, it is a worthwhile investment.

Undergraduate enrollment in our programs climbed rapidly in the early 1990's as the department grew to its current size and then began to drop, the number of majors decreasing from about 240 in 1995 to 170 in 2003. Since then it has increased to 239 (Fall 2006). The increase is reflected in all disciplines. Meteorology increased from a low of 93 in 1999 to 146, Geology from a low of 11 in 2000 to 23 and Marine Sciences (all degree tracks combined) from a low of 11 to 28 today.

Table 1: Enrollment in MEAS by discipline area

| Year | Total Environ Science | Total Geology | Total Marine | Total Meteorology | Total Natural Resources | Total Majors |
|------|-----------------------------|------------------|-----------------|----------------------|-------------------------------|-----------------|
| F'90 | | 29 | | 91 | | 120 |
| F'91 | | 31 | | 103 | | 134 |
| F'92 | | 35 | | 112 | | 147 |
| F'93 | | 40 | | 127 | 16 | 183 |
| F'94 | 14 | 35 | | 136 | 33 | 218 |
| F'95 | 14 | 37 | | 138 | 47 | 236 |
| F'96 | 12 | 30 | | 121 | 51 | 214 |
| F'97 | 12 | 25 | | 118 | 46 | 201 |
| F'98 | 17 | 27 | | 114 | 36 | 194 |
| F'99 | 19 | 38 | | 106 | 24 | 187 |
| F'00 | 12 | 33 | 19 | 108 | 22 | 194 |
| F'01 | 10 | 25 | 20 | 109 | 23 | 187 |
| F'02 | 11 | 30 | 14 | 113 | 22 | 190 |
| F'03 | 11 | 22 | 11 | 106 | 21 | 171 |
| F'04 | 9 | 25 | 19 | 124 | 17 | 194 |
| F/05 | 6 | 26 | 28 | 151 | 17 | 228 |

Each column sums all degree programs in that discipline.

The department had 17 separate undergraduate degree programs at one time. The earth sciences have reorganized their degree program into two tracks (BS and BA) but marine science continues to offer multiple degrees (marine sciences – chemistry, -biology - physics and –meteorology). In addition there are two environmental science and two natural resources interdisciplinary degree tracks in the department. The confusing proliferation of degree programs, with subsequent elimination or combination of some of them makes enrollment histories hard to understand. The number of majors in the various degree programs exceeds 20 in only two programs, meteorology (146) and geology (23). It should be noted that the four tracks related to interdisciplinary study (ESA environmental science, air quality; ESG environmental science geology, NRG natural resources, geology and NRC natural resources marine and coastal) are being

reorganized as part of a university wide initiative. It is likely that ESA and NRG will be discontinued. Considerable effort has been expended in the last couple of years to minimize courses required for individual tracks. The effort to reduce the number of degrees and simplify the program is continuing.

Graduate enrollment has remained relatively stable over the past few years in all disciplines. Meteorology has grown from 49 in 2000 to 67 today while earth science has remained at 29 through this period and marine science has decreased slightly from 31 to 26. The numbers do not reflect what is happening in the graduate program however, as a large number of retirements over this period have occurred. Many of those who retired had few graduate students while all of the 11 new hires are building strong graduate programs. We expect the number of graduates to increase as our new hires (two faculty have been here only one year and four are new this year) begin supervising more students.

Table 2. Graduate Student Enrollments in MEAS

| Year (Fall) | Marine | Earth | Meteorology | TOTAL |
|-------------|--------|-------|-------------|-------|
| 2000 | 31 | 29 | 49 | 109 |
| 2001 | 23 | 23 | 54 | 100 |
| 2002 | 28 | 27 | 52 | 107 |
| 2003 | 27 | 29 | 51 | 107 |
| 2004 | 23 | 29 | 60 | 112 |
| 2005 | 26 | 29 | 67 | 122 |

Research has grown steadily throughout this period of major staff turnover, reflecting the fact that most of those who retired were not among our major researchers (although Tom Drake and John Morrison, who left us were). We expect research activity to continue to increase slowly as our new faculty develop their programs; no retirements of major researchers are anticipated over the next 3-5 years except for Sethu Raman who is now on phased retirement.

Table 3. MEAS Research Grants Awarded (dollars)

| | |
|------|-------------|
| 2000 | 3.2 million |
| 2001 | 4.8 million |
| 2002 | 5.5 million |
| 2003 | 6 million |
| 2004 | 6.3 million |
| 2005 | 6.8 million |

As the number of research active faculty has increased, so has our need for appropriate lab space. Our needs exceeded our available space in 2006 – there are three faculty presently without individual lab space. The new wing of our building, which is scheduled for occupancy in mid-2007 will provide interim relief. Planned availability of

the “flex” building in which we have been promised space in 2009 should provide adequate space for the next 5-10 years.

The major issues affecting our programs include lack of a dormitory that was planned for our facility at the coast, the lack of a surface processes/geomorphologist in earth sciences, lack of a data assimilation expert in meteorology and shortage of faculty in atmospheric sciences. The department has planned a “semester at the coast” in which students stay at the coast at our Morehead City facility, the Center for Marine Science and Technology (CMAST). This has never developed as the planned dormitory has not been built. We anticipate being able to vastly increase the attraction of our marine and coastal geology programs by offering courses at the coast. After two failed NSF grant proposals, it is apparent that funds for the dorms must come from administration if we are to achieve our vision in coastal/estuarine processes. The process of seeking internal funding is now in progress. Earth science currently has no one to teach coastal processes on staff, they do have an open position that is tentatively planned to remedy this; a search will open next fall. Atmospheric sciences also has an open position that will allow hiring of a data assimilation expert with the search also opening in the Fall of 2007.

In the past few years, atmospheric sciences has had to cope with a growing number of students and with offering a new air quality program, without an increase in faculty, while several “teaching faculty” have retired. The combination of factors has necessitated offering more courses and sections while trying to reduce the faculty load. An initiative to add faculty in data assimilation was developed two years ago in an attempt to add faculty to the program but was not funded. In view of the number of majors (> 150 combining meteorology and marine meteorology) compared to marine science (~45 in all programs) and earth science (~30 in all programs) new resources are likely to be directed to atmospheric sciences.

Historically the university has been steadily growing and our department, like all others, planned for future expansion. The national economic problems in the early part of this decade combined with the national trend towards a decrease in public funding for universities resulted in a prolonged period of essentially no growth at NC State. This led to disappointment throughout the institution. The state is now apparently back on a good economic footing, and the state university system budget is now structurally sound (base funding for the system is now a part of the continuing budget). However, only limited growth in the number of faculty lines at NC State is predicted, hence we are all being asked to rethink our long term plans. We have now been told to assume there will be limited growth in the near future. This requires a significant change in our planning, from adding new resources to areas that have the greatest need to considering reallocation of resources within our department, something that is infinitely more painful than growth.

Our strategy for the future is to capitalize on our breadth, but emphasizing an earth systems approach to study the coupled hydrologic and atmospheric earth systems. We will do this by positioning new hires at the interface between our disciplines, adding strength to our existing programs and providing linkages among programs. A draft document discussing this plan, our compact plan, is attached as an appendix.