2.2 GENDER AND ATMOSPHERIC SCIENCES: A SNAPSHOP OF DEMOGRAPHICS OF ATMOSPHERIC SCIENCE STUDENTS

Donna J. Charlevoix
The GLOBE Program
University Corporation for Atmospheric Research
Boulder, Colorado, USA

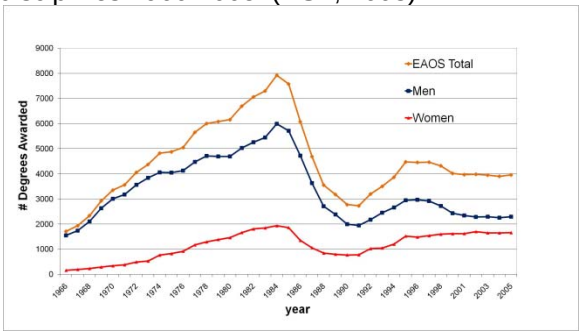
1. BACKGROUND

A review of forty years of gender statistics shows that women still comprise a small percentage of all students who earn a bachelor's degree in science (NSF, 2004c). In spite of much effort and progress made during the past twenty years, the number of women in science disciplines continues to be lower than men (NRC, 2006; NSF, 2004a,b,c,d;). A closer look at only engineering and "hard sciences" (as defined by NSF) – physical sciences, mathematics, computer sciences, biological and agricultural sciences, and Earth, Atmospheric and Ocean sciences (EAOS) – shows that in 2001 less than 40 percent of all bachelor's degrees in these hard sciences were awarded to women. The low numbers of women in science extends across all types of scientific disciplines and traditionally has been lowest in atmospheric sciences. Atmospheric sciences only moved out of the lowest ranking for percent of women earning Bachelor of Science (BS) degrees in 2003 when it surpassed engineering. This enduring under-representation of women is alarming given that significant resources have been put forth by the federal government, universities and private foundations to increase the number of women in scientific fields and in particular in atmospheric sciences.

One of the earliest reviews of women in meteorology was conducted by Simpson and LeMone (1974). Simpson and Griffith (1982) acknowledged an increasing number of women in the field by the early 1980's but pointed out that few were employed in higher-level management positions. Lewis (1995) analyzed the employment fate of approximately 200 women who were recruited as weather forecasters during World War II and found that less than 10 percent remained in the field after the war. Winkler, Tucker and Smith (1996) published a summary of the status salaries and promotion of women in academia. Analyzing data from a 1993 AMS member survey, they found that there was "pipeline leakage" at the early stages of women's careers in academia and for those who were promoted, the salary gap with men of the same status was significant (Michaels et al., 2001). A follow up to this study using data from a 2005 AMS member survey indicates that while some advances of women in the field are evident, no significant progress has been made (Charlevoix & Stanitski, 2008; Murillo et al., 2008; Tucker, Ginther, & Winkler, 2008).

Figure 1 shows the number of Bachelor of Science (BS) degrees awarded in EAOS from 1966 through 2005. Data is provided for total number of degrees per year broken down by gender. From the late 1960's through the mid-1980's there was a steady increase of degrees awarded to both males and females with the percent of BS degrees awarded to females increasing from 9 percent in 1966 to 41 percent in 2001. A sharp drop in the late 1980s and slow increase in the 1990s is primarily driven by the geologic sciences related to the need for geologists working in oil and mineral exploration as well as hydrology. The trend through the turn of the century shows the proportion of degrees awarded to women increased slightly.

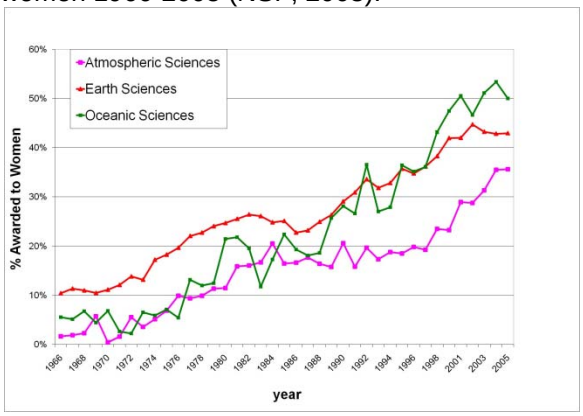
Figure 1. Number of degrees awarded in EAOS disciplines 1966-2005. (NSF, 2008)



Corresponding author address: Dr. Donna Charlevoix, UCAR, The GLOBE Program, 3300 Mitchell Lane, Boulder, CO 80307. charlevo@ucar.edu

Figure 2 shows the percentage of degrees awarded to women from 1966 through 2005 in each field of the EAOS category. While all three disciplines had on the order of 10 percent or less degrees awarded to women in the late 1960's, Earth Sciences and Oceanic Sciences have done a reasonably good job of increasing the percentage of women earning BS degrees to 41 and 50 percent, respectively. Atmospheric Sciences clearly lags far behind with only 29 percent of BS degrees awarded to women in 2001 with the value increasing to 31 percent in 2005. This persistent problem of underrepresentation of women receiving degrees in atmospheric sciences is disturbing given the progress made by earth and oceanic sciences in making their degree statistics more equitable. The atmospheric sciences community recognizes that women and minorities are underrepresented but has failed to develop a plan to close the gap.

Figure 2. Percent of BS degrees awarded to women 1966-2005 (NSF, 2008).



The research reported here is part of a larger study exploring what facilitates "success" for females majoring in atmospheric sciences. In particular, this work looks at the gender breakdown of a select group of undergraduate students and gathers preliminary data examining what prompts students to choose atmospheric sciences (or meteorology) as a major over other disciplines.

2. RESEARCH METHODS AND DATA

Approximately 80 colleges and universities offer BS or BA degrees in meteorology or atmospheric sciences (AMS, 2006). This study surveyed seven universities in the Midwest, primarily within the Committee on Institutional Cooperation (CIC). As such, there is a potential bias toward programs that have a strong focus on research as a mission. It does, however, provide a consistent base on which to collect and compare data. Some student participants in this study were enrolled in graduate programs in a CIC university but had obtained their Bachelor's degree at a non-CIC school.

Collectively, the seven programs surveyed for this study had a total undergraduate population on the order of 800 declared atmospheric sciences/meteorology majors (AMS, 2006). The size of programs varied. The largest two programs accounted for almost half of all students. The smallest two programs had ten or fewer students. The gender breakdown of students enrolled in these programs is not documented by university or department, with the exception of one atmospheric sciences department that listed student names on the departmental web site. In that program, females made up 30 percent of the undergraduate students declared in the major.

Students enrolled in core courses of atmospheric dynamics and atmospheric synoptics were surveyed as to their decisions for selecting a college major. The survey was a single page and queried students on: contact information, gender, academic year, major, minor, if undeclared what intentions are, previous college or universities attended, year of high school graduation, and other majors considered or declared. The gender breakdown of survey respondents is shown in Table 1.

Table 1. Number of respondents and percent of respondents who were female from each of 7 universities surveyed.

University	Total Respondents	% Female
1	38	45%
2	14	50%
3	42	48%
4	46	37%
5	31	26%
6	21	29%
7	7	43%
Total	199	

Students were asked to identify their intended major upon entry into college. One hundred twenty-three of the 199 respondents (62%) indicated their intent to declare atmospheric

sciences/meteorology as freshmen. Forty-three were female and 80 were male.
Examination of the responses by gender as compared to the total number of respondents by gender shows that 55% of females who responded to the survey indicated they planned to major in atmospheric sciences/meteorology, compared to 66% of male respondents.

Students were also asked to report if they had ever considered a major different from atmospheric sciences/meteorology. Thirty-two of the respondents stated they had considered switching from atmospheric sciences/ meteorology to another discipline. Table 2 shows the other majors considered, listed by gender response.

Table 2. Major disciplines atmospheric sciences/ meteorology students considered switching to during their undergraduate career. Values in parentheses indicate the number of respondents if greater than one.

Women	Men
Engineering (2)	Engineering (2)
Architecture (2)	Architecture (2)
Business & Finance	Business & Finance (4)
Psychology	Psychology
Pre-pharmacology	Actuarial sciences
Communications	Chemistry
Oceanography	Broadcast
Broadcast Journalism	Kinesiology
Teaching	Mathematics (2)
Spanish	Aerospace science
Anthropology	
Considered switching but unclear to what (3)	

3. DISCUSSION AND CONCLUSIONS

The number of females represented in earth, atmospheric and ocean sciences majors from 1966 to 2005 increased substantially, as did the percent of females of the total. However, as of 2006, the atmospheric sciences disciple has considerably fewer women being awarded Bachelor Degrees compared to Earth Sciences and Oceanography. In 2003, Earth Sciences and Oceanography awarded females 43% and 51% of all Bachelor degrees in the field, respectively. Up until 2003, atmospheric sciences had the lowest percentage of women receiving Bachelor degrees than any other science or engineering discipline. Atmospheric sciences surpassed engineering in 2003 but females still only account for 31% of all Bachelors Degrees.

Upon entrance to college, a large percentage of both men and women surveyed knew they planned to major in atmospheric sciences/meteorology. Males were slightly more likely to be inclined toward the discipline than females (55% of females and 66% of males).

Once a major was declared it was unlikely that they changed their mind about their decision to major in atmospheric sciences/meteorology. Only 32 indicated that they contemplated changing majors. Women were slightly more likely to consider changing majors. Of the majors considered by both male and female, approximately half were focused on science and mathematics and half on humanities and social sciences. Women indicated a slight preference toward considering non-science majors.

The data indicate that almost 2 out of 3 students enrolled in junior-level core courses were likely to have known their major discipline upon entering college. Additionally, once their major was declared, they were not likely to consider switching out of the major without moving forward with the change. A significant limitation of this study is that those students who considered switching to a different major and carried through are not able to be identified.

Future work includes the expansion of this study beyond the Midwestern portion of the U.S. A more comprehensive analysis of what initiated students to consider switching out of the major will also be examined. Additionally, results will be compared to degree retention in other disciplines.

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5. ACKNOWLEDGEMENTS

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