

Diversity in Atmospheric Sciences

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CMMAP Team Meeting
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Outline

- Diversity in the Atmospheric Science
- Contributing myths
- Suggested strategies

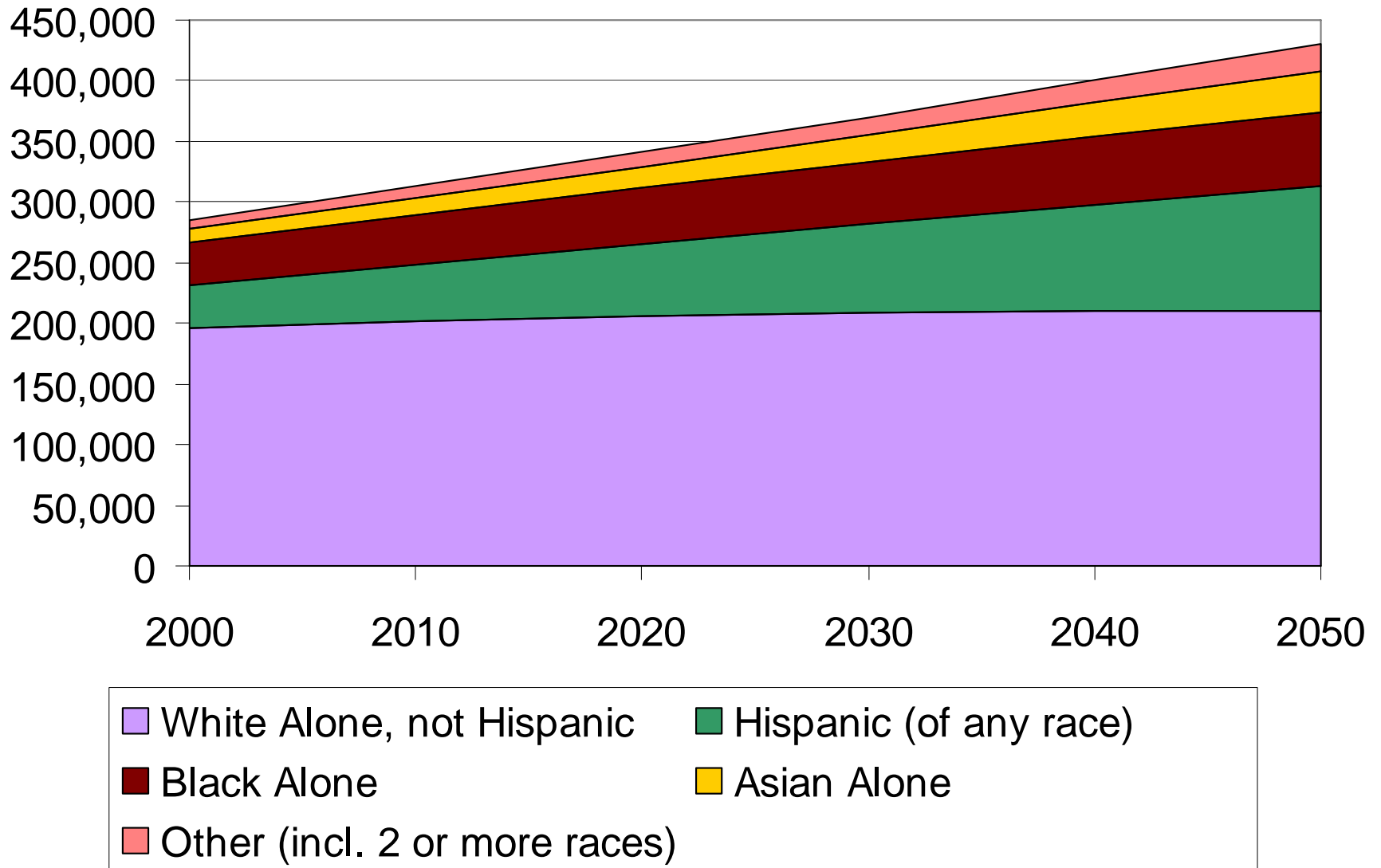
What is Diversity

- In a Post-Michigan Environment, broad definitions of diversity protect federally-funded programs and academic institutions.
- As an example, “SOARS seeks to involve more students from groups that are historically under-represented in the sciences, including Black or African-American, American Indian or Alaska Native, Hispanic or Latino, female, first-generation college students, and students with disabilities. SOARS welcomes lesbian, gay, bisexual, and transgender students.”

Diversity Contributes to Science

- Lack of diversity may be the window into an underlying disconnect between our science and society
- Scientific priorities should be set by representatives of all communities
 - Who does science is relevant in a peer-review system
- Global problems require global solutions
 - National problems require a whole nation
- Broader perspectives improve science
- Our future workforce depends on it
 - A majority-minority USA by 2050
 - What is the impact of the aging of the current atmospheric science workforce?

Population Demographics 2000-2050



Source: U.S. Census Bureau, 2004, "U.S. Interim Projections by Age, Sex, Race, and Hispanic Origin," <http://www.census.gov/ipc/www/usinterimproj/>.

Current State of Diversity in the Atmospheric Sciences

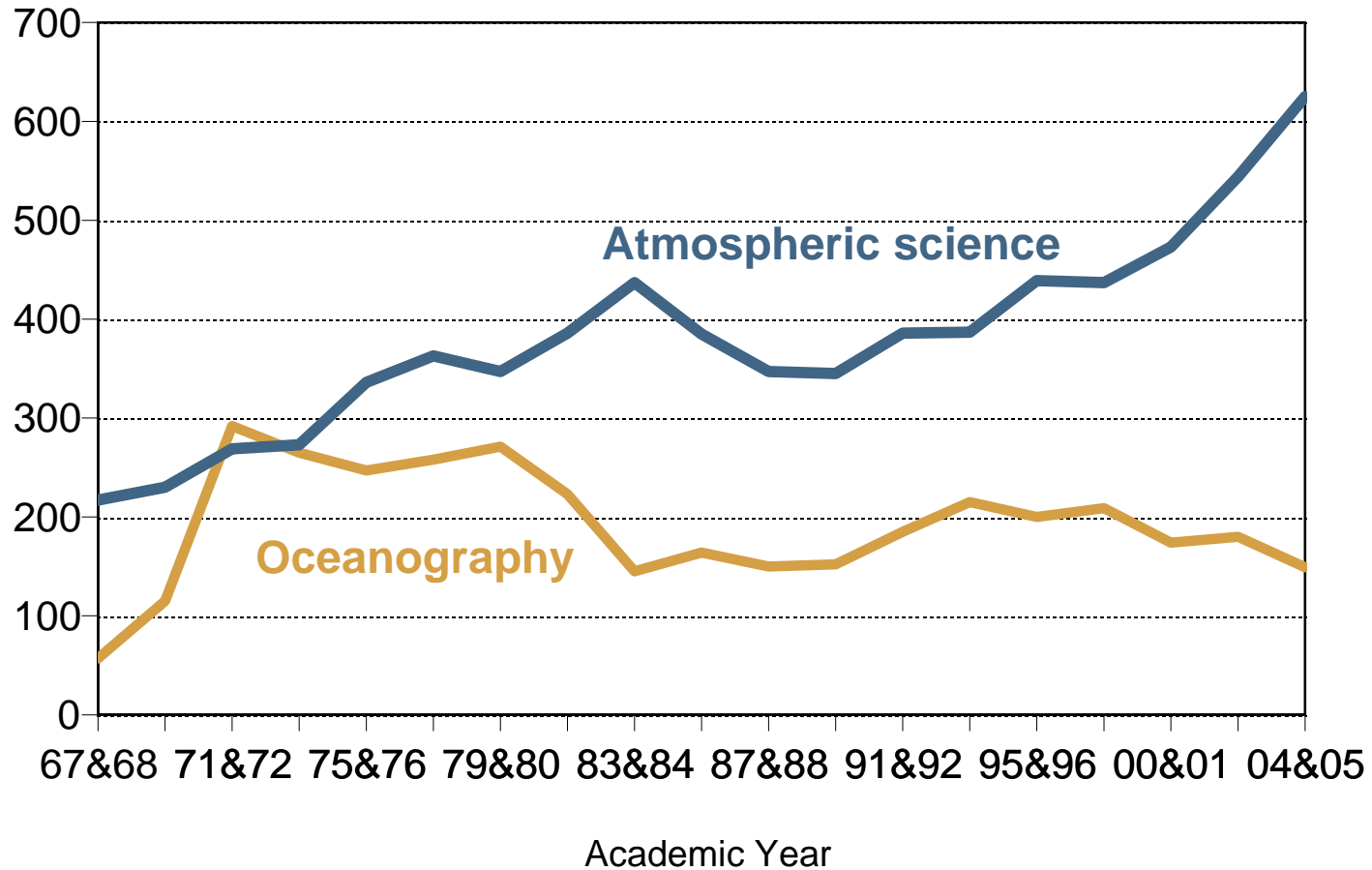
Slides borrowed from Roman Czjuko, American
Institute of Physics

Data collected by

NSF, US Dept of Educ., Bureau of the Census
Research supported by Packard Foundation

Bachelors degrees in Atmospheric Science and Oceanography.

2 year averages 1967 & 68 through 2004 & 05.*

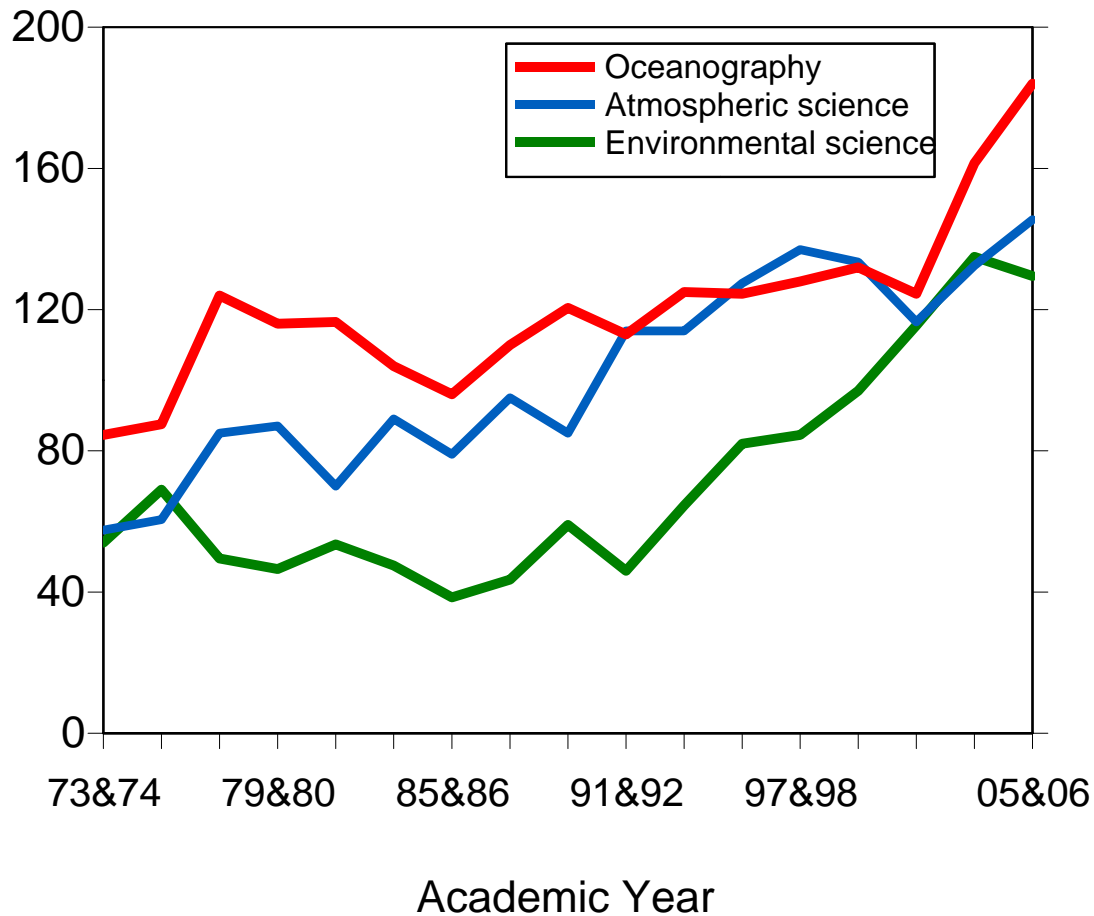


*No data available for 1999.

Source: AIP Statistical Research Center compiled from data collected by the National Center for Education Statistics IPEDS Completions Survey

PhD degrees in atmospheric science, environmental science, and oceanography.

2 year averages 1973 & 74 through 2005 & 06.



AIP Statistical Research Center compiled from data collected by the National Science Foundation.

Bachelor's Degrees Awarded in Selected Fields by Race, Class of 2004

	African American %	Hispanic American %	Total Number
Computer Science	12	6	59,488
Psychology	11	8	82,098
Business & Management	11	7	307,149
Chemistry	8	7	9,300
Biological Sciences	8	6	61,509
Mathematics & Statistics	6	5	13,327
Engineering	6	6	77,949
Education	6	5	106,278
Physics	4	4	4,140
Geosciences	2	4	3,916
TOTAL	9	7	1,399,542

Engineering includes Engineering Technologies.

Source: NSF WebCASPAR database. Compiled by AIP Statistical Research Center.

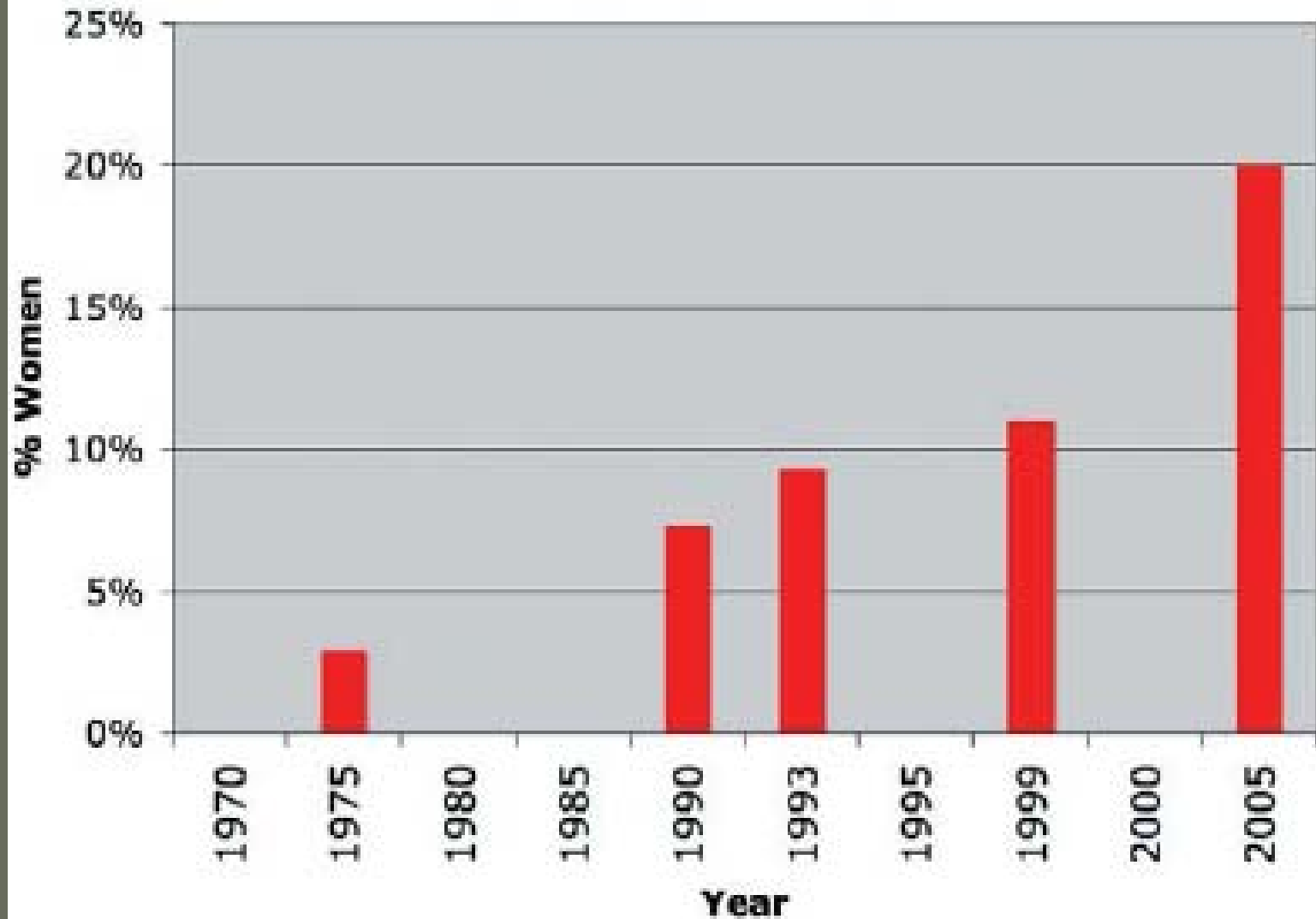
Ethnicity of Atmospheric Science PhDs (1973 to 2004)

- 3,166 Total PhDs
- 2,140 Total earned by US Citizens
- 30 Hispanic American PhDs (1.40%)
- 21 African American PhDs (0.98%)

Percentage of PhDs Earned by Women by Fine Field, Two-Year Averages

	1989- 1990	2001- 2002
Oceanography	23	39
Earth Sciences	19	29
Astronomy & Astrophysics	15	21
Atmospheric Sciences	14	25

Women Members of AMS



Some Notes

- Increase in female Atmospheric Science professors at associate level is from 14% in 1993 to 16% in 2005
- In atmospheric science, women with PhDs are less likely to enter the tenure stream than men, and more likely to leave
 - This is common to all science fields, according to “Beyond Bias”.

Myths about science that inhibit diversity

Ideas suggested by Shirley
Malcom, AAAS

Myths about science held by students

- Science will separate me from my community
 - Requires an itinerant lifestyle
 - Contradicts spiritual learning
 - Little opportunity to solve issues that are relevant to a community
 - Be careful of “forcing” societal relevance on minority students
- Science isn't family-friendly
 - Being good requires no life outside of work
- Graduate school is too expensive
- Science careers don't pay well

Myth: American students aren't competitive

- PISA assessment in 2006 showed US 19th in Mathematical Literacy, 14th in Science (consistent drop)
- General science literacy is increasing
 - A growth in ability to understand reports in newspapers from 10% to 28% from 1988 to 2005
- largely reflects the requirement that all college students have at least some science courses
 - According to Jon D. Miller, 2007

Myth: It's all over by 8th Grade

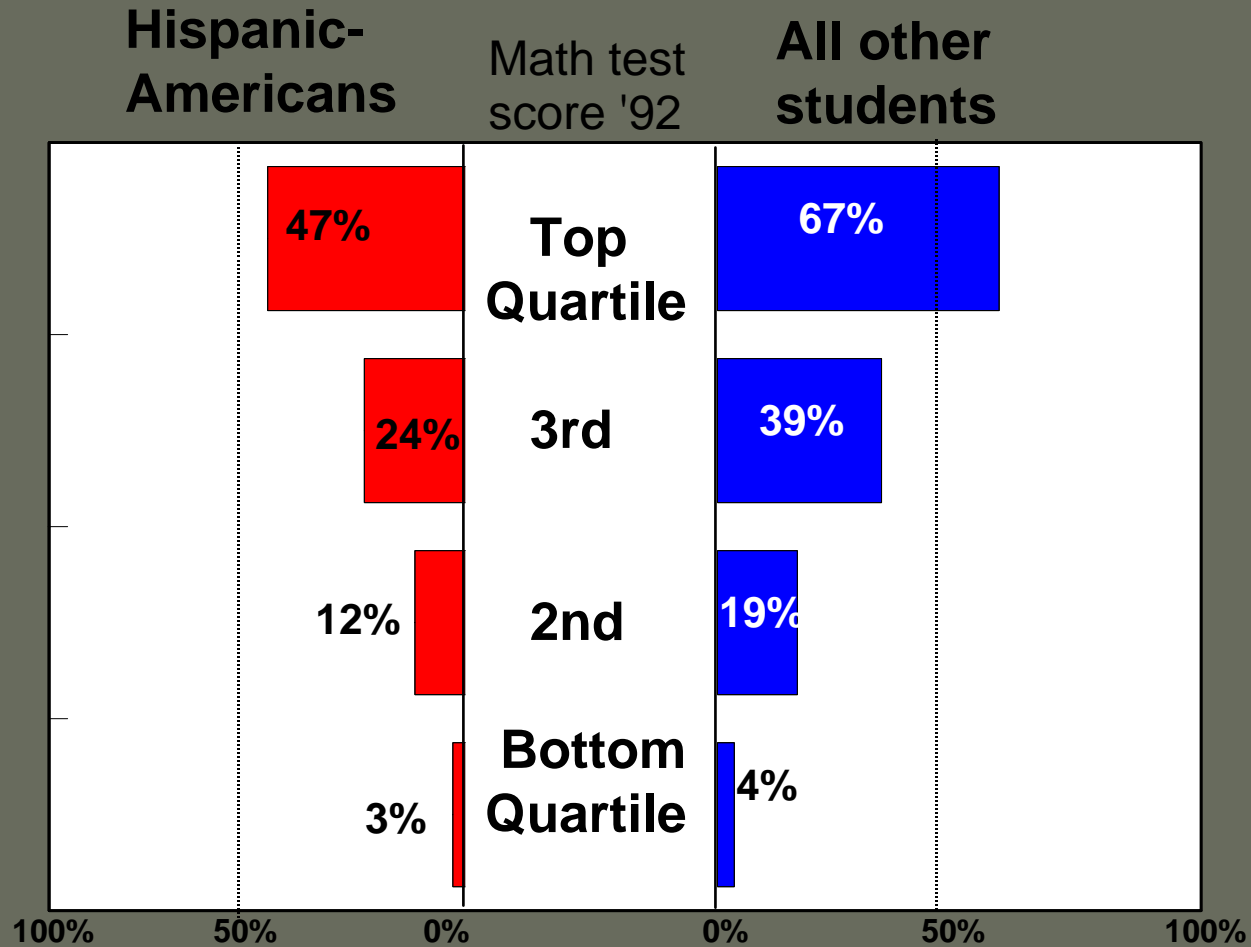
- In a study of 1800 male and female science graduates from a public university between 1970 and 1990 over a 12 ½ year period, 31.5 percent of the women who had started science careers and 15.5 percent of the men had left science.
- Data on individuals graduating with science degrees in the mid 1990's reveal that women are leaving at 1½ times the rate of men
 - » Anne Preston, Swathmore University
 - In meteorology, this is compounded by the “weather-weenie” myth. That you have to love severe storms at 10....

Likelihood of Earning a Bachelor's Degree and Mathematics Scores in Senior Year of H.S.

Standardized Math Test Scores, 1992 (in deciles)	Earned a Bachelor's or more within the next 8 years %
Highest	79
9th	63
8th	47
7th	40
6th	32
5th	20
4th	17
3rd	11
2nd	4
Lowest	2
Overall	32

Source: National Center for Education Statistics

Likelihood of earning a bachelor's degree by 2000, Hispanic-Americans compared to all others.



Percent earning a bachelor's degree by 2000

A Strategic Approach

1. Value multiple forms of excellence
2. Expand avenues into CMMAP
3. Build broad awareness of atmospheric science
4. Broaden commitment by institutions
5. Create a more welcoming field – mentoring and community
6. Science that is relevant to underserved communities

1. Value multiple forms of excellence

- “Womanly” skills are traditionally undervalued
- *Beyond Bias*, NAS Report
- Studies suggest women need longer publication lists than men to be considered for the same honor
- Some minority students struggle with their perception that they have to give up their heritage to do our science (“unzip” themselves before coming to work)
- Enhanced emphasis on interdisciplinary science and societal impacts requires expertise we can’t currently evaluate easily

2. Expand avenues into climate

- Climate Affairs model/front-end minor
- Community college partnerships
- Partnerships to build research programs at MSIs
- Develop curricula that integrate diverse perspectives (e.g. Indigenous Environmental Science)
- Expand avenues out of climate...

Bachelor's Earned by African Americans in STEM Fields by Type of Institution, 2004

Number Awarded per 1,000 Bachelor's

	All Colleges All Students	Blacks Not HBCU	Blacks At HBCU's
Geosciences	2.8	0.7	0.3
Engineering	55.7	33.4	24.5
Physics	3.0	1.7	3.7
Chemistry	6.6	5.1	10.0
Mathematics	9.5	8.2	10.9
Biological Sci.	43.9	52.0	68.0
Computer Sci.	42.5	61.7	58.9

Source: AIP Statistical Research Center tabulations of NCES data

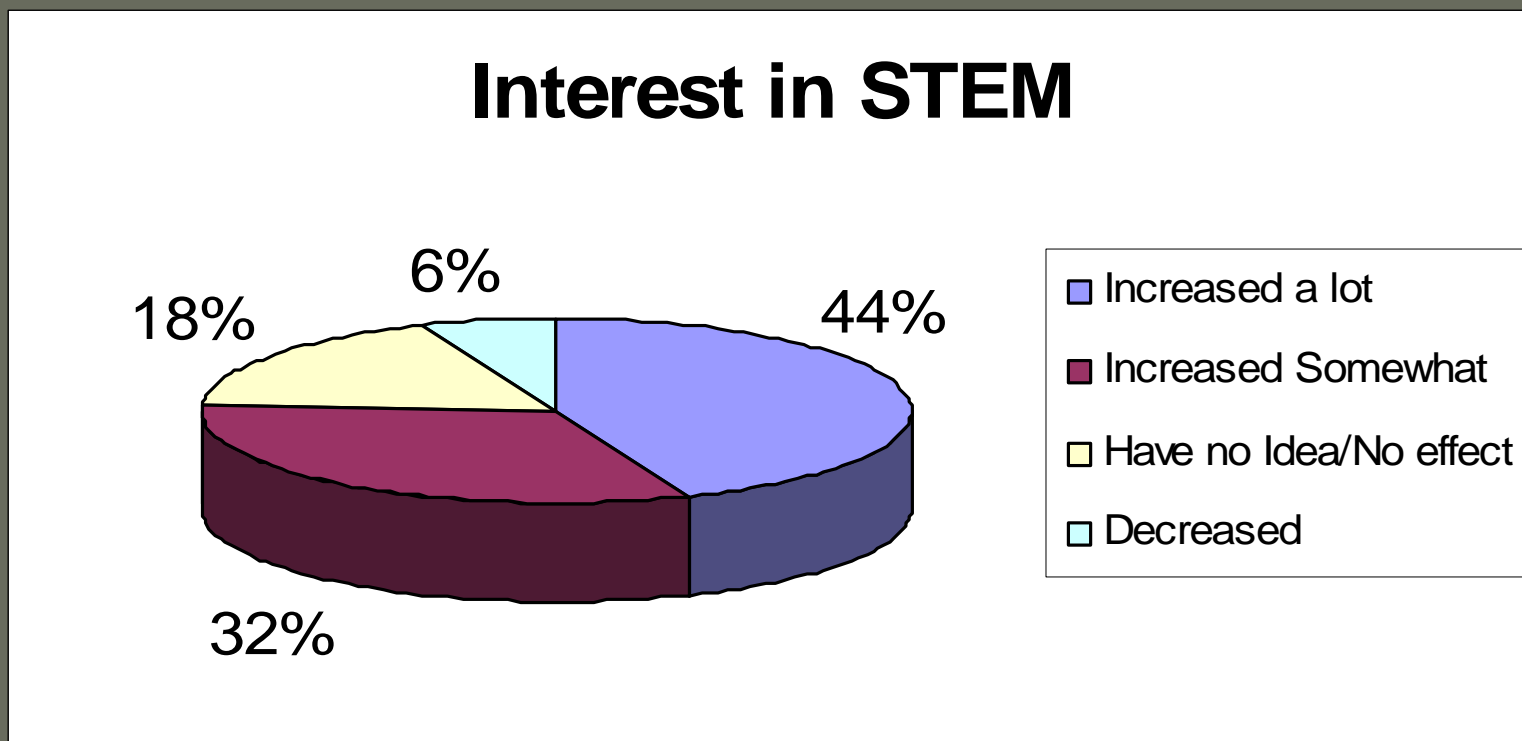
3. Build broad awareness of atmospheric science

- Rocky Mountain Climate Institute
- Changing Climates
- Little Shop of Physics

4. Broaden commitment by institutions

- CMMAP has two ½ scholarships available for any member institution
- Graduate curriculum that extends beyond preparation for academia

5. Create a more welcoming field – mentoring and community



Change in interest for participants in REU programs; research suggests the **mentoring** relationship may be more important than the success of the research

The Extent and Impact of Mentoring differs by gender

- Study of 1800 men and women graduating with S&E degrees from a common public university between 1970 and 1990
- Mentoring differed by gender in educational programs
 - Undergraduate programs: 13.5 % of women and 40 % of men had mentors
 - Graduate Programs: 20.5 % of women and 65.7 % of men mentors
 - First Jobs: 52 % of women and 51 % of men had mentors.
- For women having a mentor increased the probability of:
 - earning the graduate degree from .6 to 1.0
 - A successful employment situation from .52 to 1.0
- For men having a mentor did not influence probability of program completion or successful employment situation

6. Do science that is relevant to underserved communities

- Casey Thornburgh, PhD Candidate, Geography & Regional Development, University of Arizona, and visiting professor at Tohono O'odham Tribal College

It isn't just who we hire...

- The science we do
- Where we do it
- Relationships we have
- How we communicate





Thank You

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“ Understanding the complex, changing planet on which we live, how it supports life, and how human activities affect its ability to do so in the future is one of the greatest intellectual challenges facing humanity.

It is also one of the most important for society as it seeks to achieve prosperity and sustainability.”

National Research Council