

Our Education Mission: Inspire the Next Generation of Earth System & Atmospheric Scientists



Focus of CC-CMMAP Education & Diversity Initiatives

- Improve undergraduate Earth Systems Science and climate education.
- Teach next generation of leading climate scientists to be better teachers.
- Improve the retention of women in the science and engineering “pipeline” from middle school through graduate school.
- Improve recruitment of under-represented groups into Earth Science at the undergraduate level.



CC-CMMAP Funded Grad & Faculty Activities

Graduate Student Teaching Mentorships

- Luke Van Roekel (EV 431-07): Drossman
- Jim Benedict (EV 431-08): Drossman
- Kate Thayer-Calder (EV 128-08): Leonard
- Kelley Wells (EV 431-09): Drossman
- Rachel McCrary (EV128-09): Taber
- Anna Harper (EV 128-09): Fricke
- 2009-2010: Air, Human Impacts (Drossman); Intro GCC (Taber)

Faculty Visits (CC Seminars & Class Visits)

- David Randall (2007; EV 431)
- Scott Denning (2008; EV 128)
- Jeff Collett & students (2008; EV 431)



CC-CMMAP Funded UG Students

Annual student scholarships, 2009:

Katherine Heal: Aerosol Mass Spectrometry: The next generation of aerosol analysis (Collett)

Katie Riley: The Implications of Carbon Offsets for Development (Betsill)

Meriweather Hardie: Changing Climates Video and Guides

Shannon Morgan: Changing Climates Video

Neva Jacobs: EV 431 class assistant



CC-CMMAP Funded UG Students

Annual student scholarships, 2008:

Alice DuVivier & Jette Petersen: Laplacian operators (Randall)

Tyler Ruggles: Community GHG Reduction Strategies (Betsill)

Zoe Keve: Biomass Fuel Policy (Kathlene)-Thesis

David Sullivan: Carbon Pricing Policy (Kathlene)-Thesis

Brittany Vogel: K-12 Education (LSOP, NCAR, Catamount)

Sarah Waldo: BEACHON (NCAR/Drossman)-Thesis

Summer Roberts: BEACHON (NCAR/Drossman)

Rich Brereton: EV 431 Assistant-Grad School, Ecosystems

Annual student scholarships, 2007:

Rebecca Simpson (Kreidenweiss): Atmospheric Science, U Hawaii

Parker Kraus (Denning): Atmospheric Science, CSU

Gillian Bobier (NCAR, Catamount): K-12 Education?

Beth Beckel (Collett): Grad school CSU



Undergraduate Classes Developed/ Enhanced at CC

EV 128: Introduction to Global Climate Change

("First year": no pre-reqs)

EV 211: Human Impacts on Biogeochemical Cycles

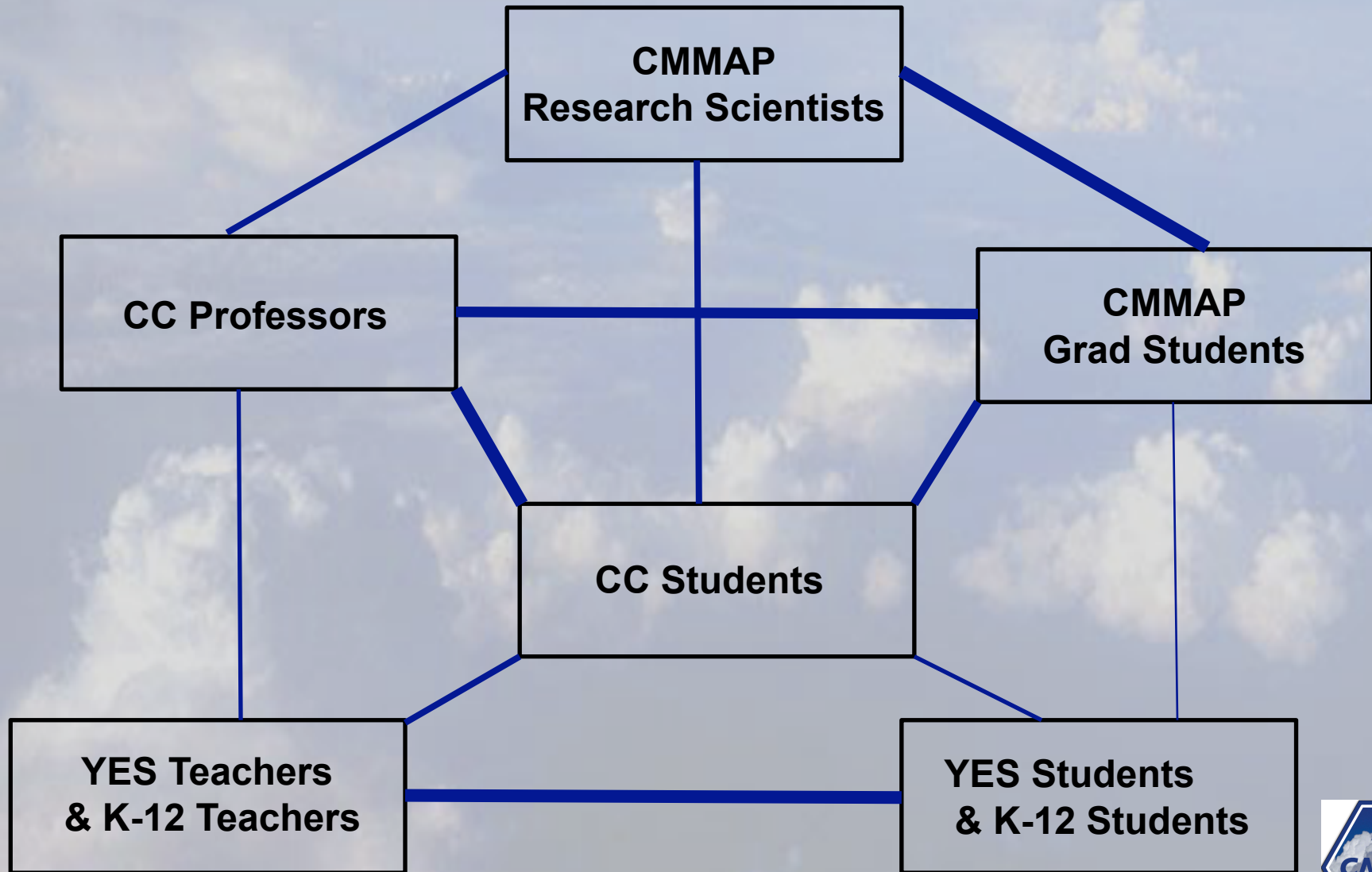
("Soph" EV 128/Calc I)

EV 431: Air-Atmospheric Physics & Chemistry

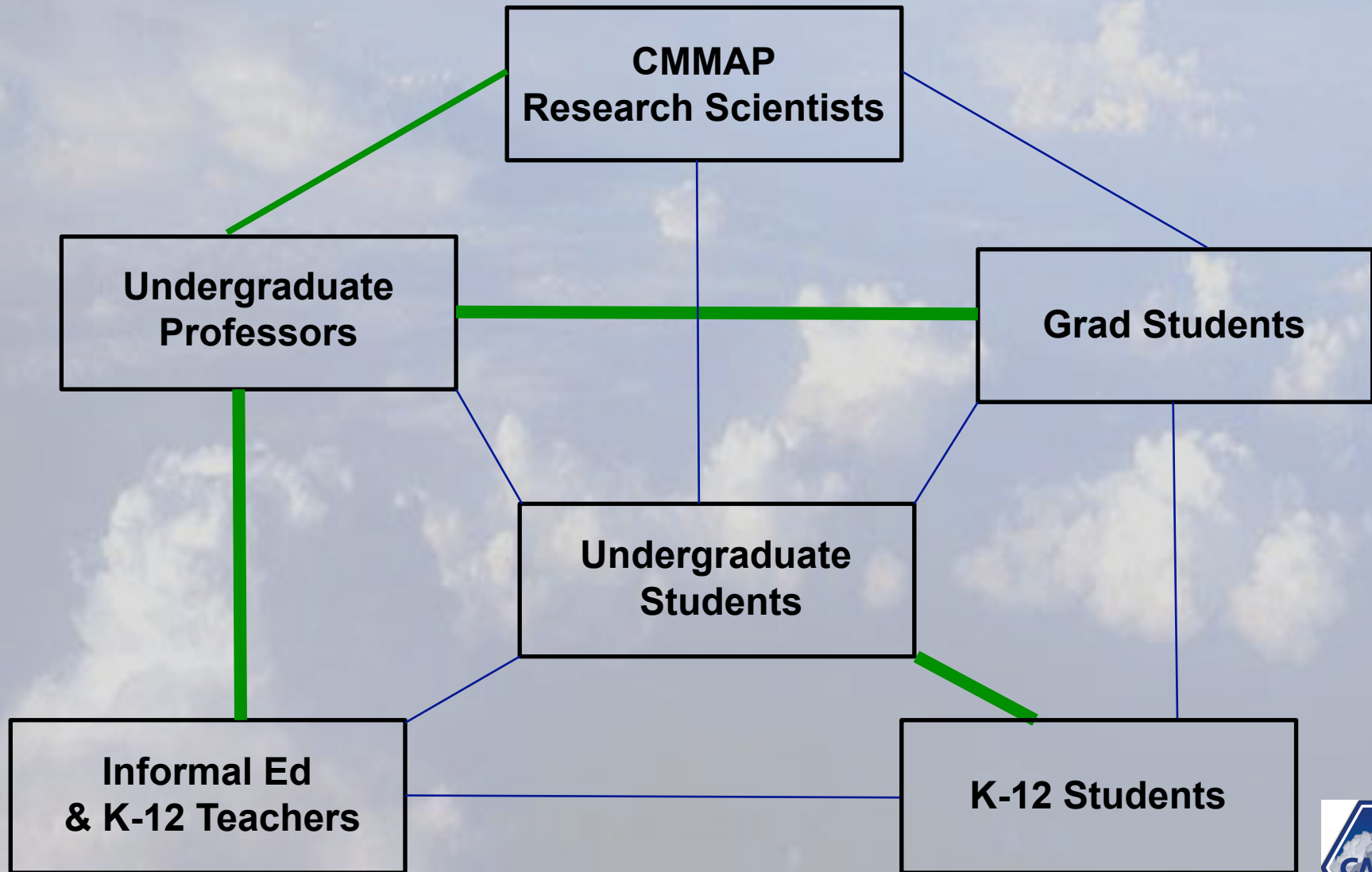
("Junior": EV 211/Energy/Calc I)



Educational Objectives Integration

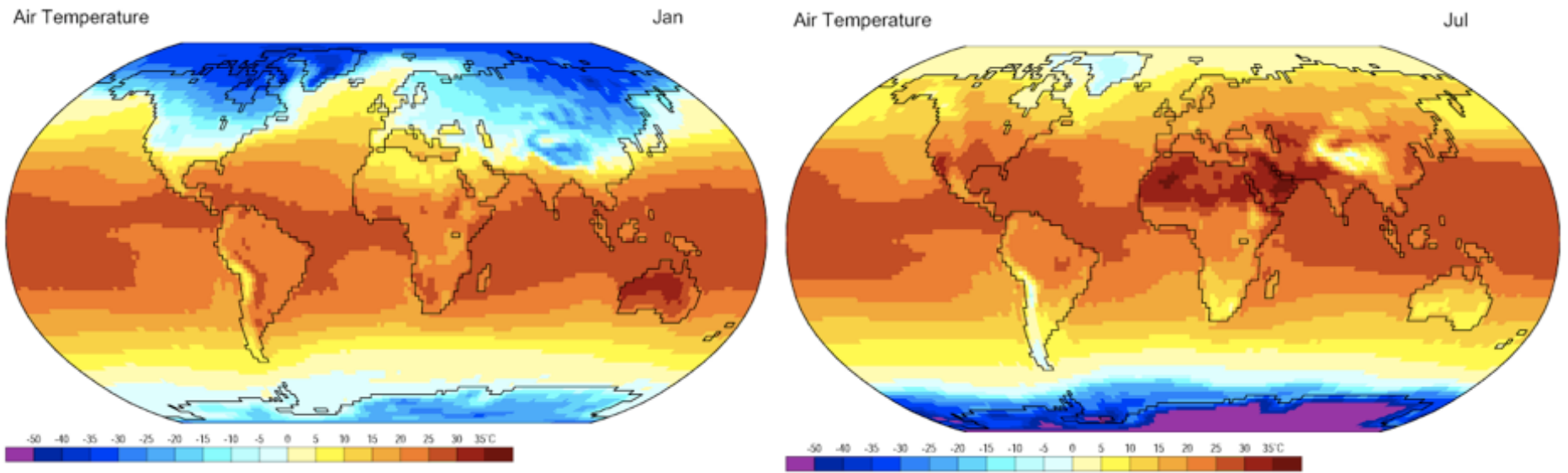


Strengthen Ties with Leverage



POGIL MODELS

Below is the average global surface temperature for January and July (averaged from 1959 – 1997). Purples are the coldest temperatures and reds are the warmest.



1. Compare the Equator-to-North Pole T gradient in January to the Equator-to-South Pole T gradient in July. Which is stronger? In which hemisphere is the Equator-high latitude T gradient *more* dependent on the choice of longitude? Why?
2. Using the set of equations in Model 1 and your answer to Model 2 Q2, describe the wind aloft (tropopause) in terms of speed, direction, and overall how wavy the flow is.
3. Would you expect any motion from the troposphere to the stratosphere (vertically) over the winter pole? Why or why not?
4. Based on your responses to the questions in Model 1 and Model 2, in their respective winters, do you expect the Arctic or the Antarctic to be more isolated from the rest of the Earth? Why?

Using the Research Literature as an Educational Tool

- Literature vs. Textual Readings
- Literature-based exams
- POGIL literature-based exercises

Representative Papers in EV 211:

1. Overall Human Impact: Vitousek, P. M., H. A. Mooney, et al. (1997). "Human Domination of Earth's Ecosystems." *Science* 277(25): 494-499.
2. Hydrologic Cycle: Oki, T. and S. Kanae (2006). "Global hydrological cycles and world water resources." *Science* 313(5790): 1068-1072.
3. Net Primary Productivity: Haberl, H., K. H. Erb, et al. (2007). "Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems." *Proceedings of the National Academy of Sciences of the United States of America* 104(31): 12942-12945.
4. Nitrogen Cycle: Galloway, J. N., A. R. Townsend, et al. (2008). "Transformation of the Nitrogen Cycle: Recent Trends, Questions, and Potential Solutions." *Science* 320(5878): 889-892.
5. Complexity: Lenton, T. M. (1998). "Gaia and natural selection." *Nature* 394(6692): 439-447.
6. Human Population : Tilman, D., K. G. Cassman, et al. (2002). "Agricultural sustainability and intensive production practices." *Nature* 418(6898): 671-677.



Design and implement assessments

- SALG Assessment
- ACS Exams
- Project-based assignments
- POGIL
- Literature-based evaluations
- Demographic Surveys
- Tracking student interns



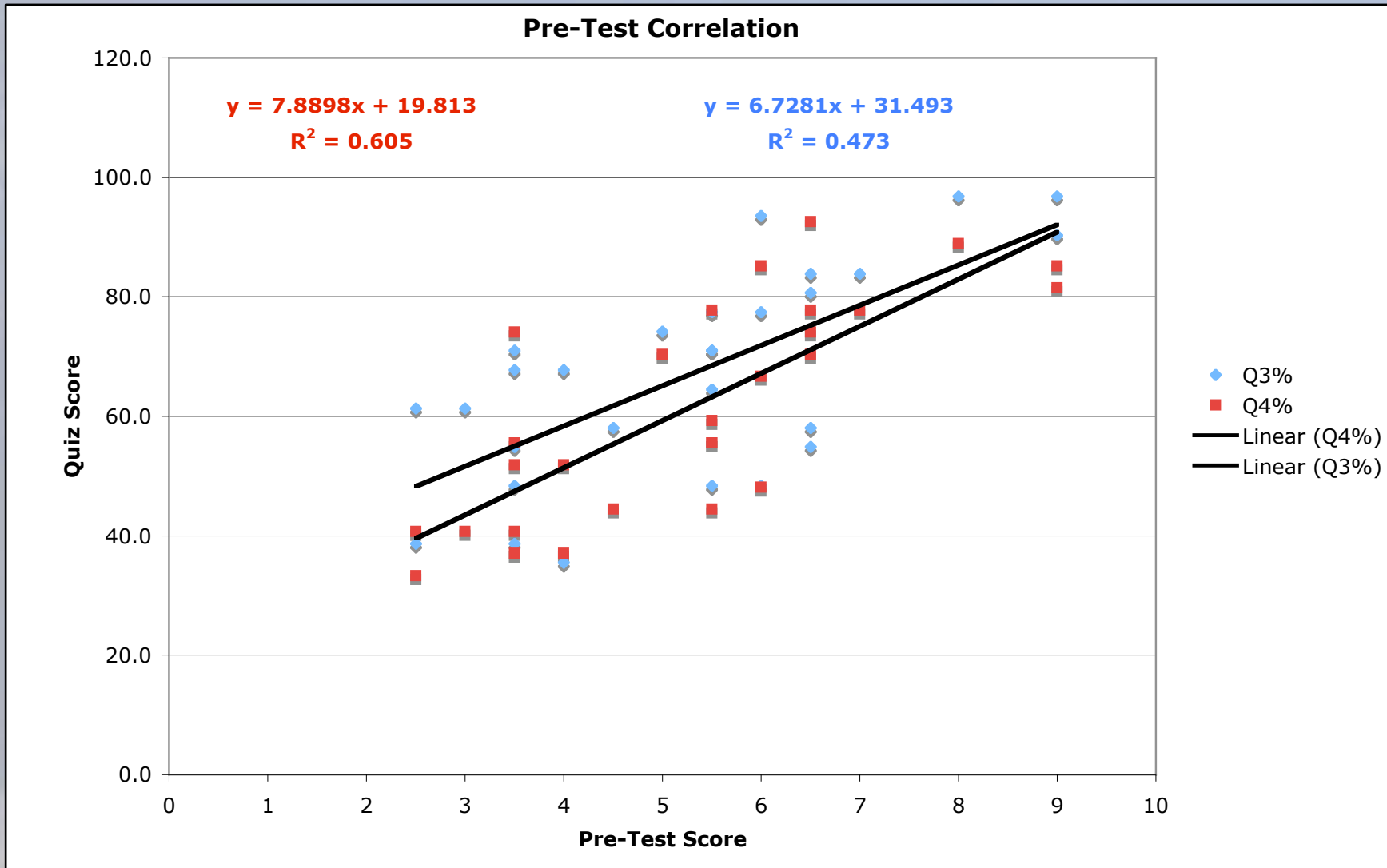
EV 221 assessment example

EV 211 ACS Exam Results

	Prior Chemistry	No Prior Chemistry
Conceptual Test Mean Grade	69.8%	62.5%
	p = 0.142	
Standard Test Mean Grade	67.8%	51.1%
	p = 0.009	



EV 221 assessment example



Disseminate Classes & Strategies

WHAT

- POGIL Atmospheric materials (Book; BAMS article)
- Research literature-based POGIL materials for Intro GCC
- Graduate student mentoring paper (JAMES)
- Inquiry-Based Pedagogy in ATS
- Assessment strategies and results
- Classes

HOW

- Web (Video, Syllabi, Peer-review video?)
- JAMES, BAMS articles
- Workshops (PKAL, CUR, SENCER, AMS, AGU, NSF)

