

Colorado Energy Office



Governor's
Energy Office



- Former Governor Bill Ritter issued Executive Orders in 2008 *requiring* reductions in energy use, fuel, water, waste by government operations
- “Greening Government Council”
- Need for employee motivation, education, training



Greening of State Government

Lead by Example

- 5,600 state buildings
- 63 million square feet owned plus 517 leased spaces
- \$154 million annual utility budget
- 140 agencies
- 16 Executive Departments
- 30,000 employees
- Fleet ~6000 Vehicles



Greening State Government

Lead by Example Program

From baseline year
2005-06, the State
will by 2012 reduce
consumption by:

20% - energy

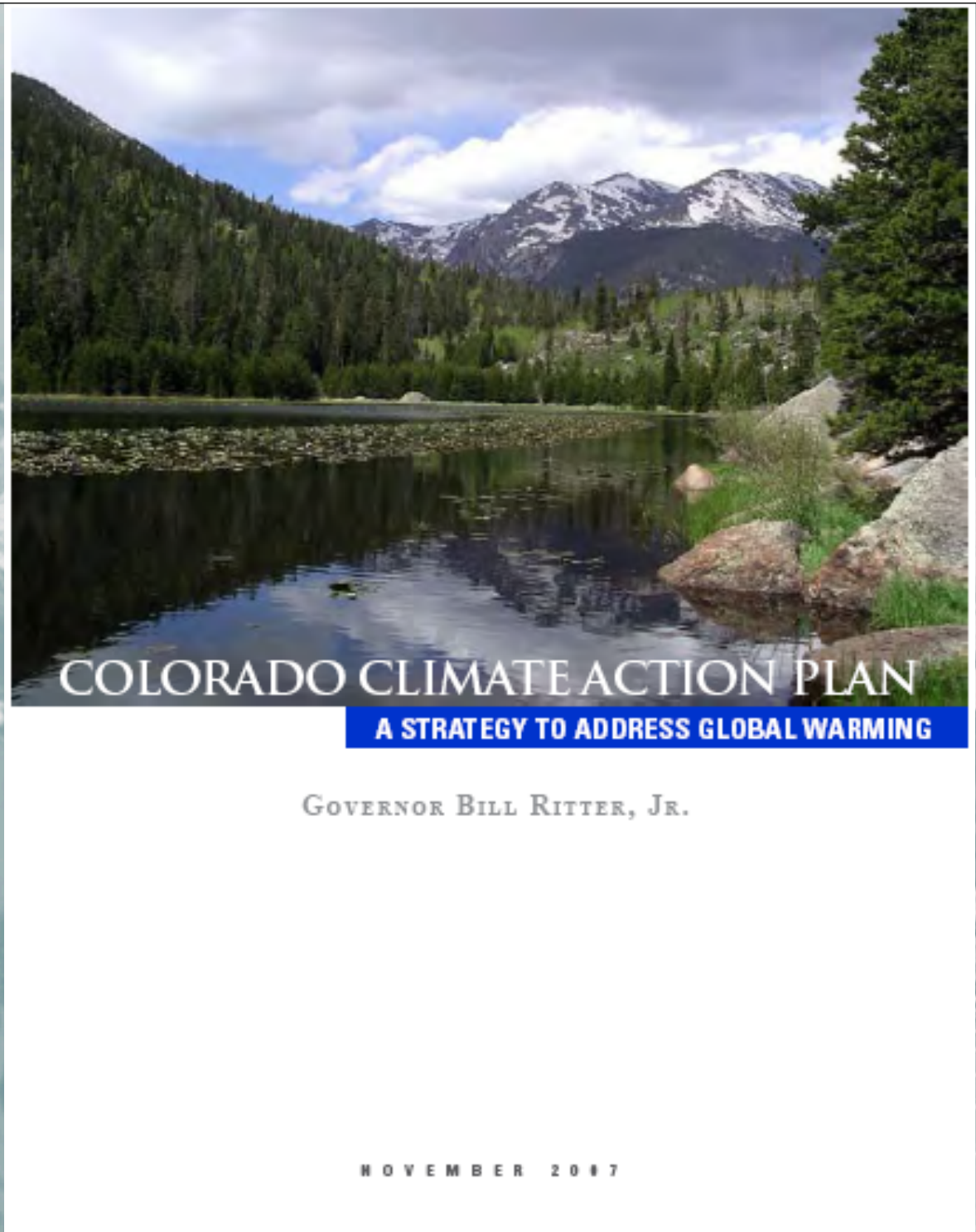
20% - paper

10% - water

25% - petroleum



- 20% Reduction in greenhouse gas emissions from 2005 baseline by 2020.
- 80% Reduction in greenhouse gas emissions by 2050.
- 75% Landfill Diversion by 2020





State employees will take a position of *leadership* in the new energy economy.



CMMAP as “Science Advisor”

1. Training and Workshops for Agency leads
2. Governor’s Office support for student conference on climate change
3. Research support for Governor’s objectives
 - Prof. Michele Betsill (Political Science) Environmental Governance Working Group
 - Soliciting “mini-proposals” from Sustainability School faculty
 - Up to \$5000, review by CMMAP and GGC



Education & Diversity



Governor's
Energy Office

CMMAP Team Meeting August 9, 2011

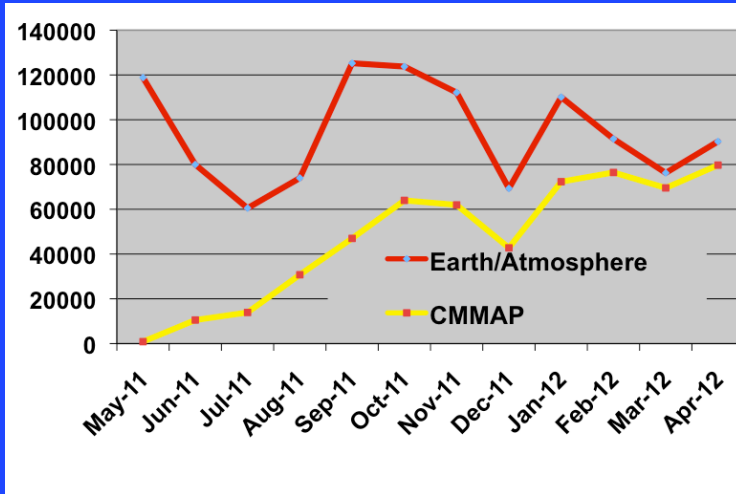


Example Research to Support GEO

- Develop metrics could be used to show the value of GEO's work
- How are different agencies doing in meeting goals; why are some agencies doing better than others?
- How can agencies improve employee engagement
- How well does the Greening Government Council function as a coordination mechanism?
- What can be done to achieve full implementation of the centralized EnergyCAP tracking system?

Web-Based Outreach via UCAR

WINDOWS TO THE UNIVERSE



- 569,678 unique users
- 971,960 page views
- 20% Spanish language readers

The screenshot shows the CMMAP website header with navigation menus. The main content area is titled "Nubes" (Clouds). Below the title, there is a warning in Spanish: "Los enlaces en color anaranjado lo llevan a páginas en Inglés aún no traducidas al Español." (Links in orange lead to pages in English not yet translated to Spanish). A large image of a cumulus cloud is shown. To the right of the image, there is text in Spanish explaining cloud formation and types. Below the image, there is a caption: "Nubes cúmulos en las montañas de Colorado. Haga click en la imagen para una vista completa (234K GIF) Cortesía de Aris Multimedia".

Center for Multiscale Modeling of Atmospheric Processes
CMMAP
Reach for the sky.

Colorado State University

Spanish English

Nubes Tiempo Clima Modelos Atmósfera Acerca de CMMAP Personas Arte y Cultura Educadores Juegos

Ventanas al Universo Principiante Intermedio Avanzado Apóyanos Boletín Maestros Tienda

Nubes

Los enlaces en color anaranjado lo llevan a páginas en Inglés aún no traducidas al Español.

Las nubes pueden tener todos los tamaños y formas. Pueden formarse cerca del suelo o alto en la [atmósfera](#). Las nubes están formadas por grupos de pequeñísimas gotas de agua o cristales de hielo en el cielo. Están asociadas con distintos tipos de [precipitaciones](#), dependiendo de la [temperatura](#) de la atmósfera.

Los diferentes tipos de [nubes](#) se clasifican según su altura y apariencia. Su forma depende de la forma en que el viento se mueve alrededor de ellas. Si el viento se mueve en dirección horizontal, las nubes se extienden en capas. Las nubes crecen ascendentemente cuando el viento va en esa misma dirección.

El 50% de nuestro planeta siempre esta cubierto de nubes. Sin nubes, no tendríamos [lluvia](#), [tormentas](#), [arcoiris](#) o [nieve](#). ¡La atmósfera sería realmente aburrida si el cielo siempre fuera azul!. ¿Sabías que la Tierra no es el único planeta que tiene nubes? ¡Otros planetas, como [Venus](#), [Marte](#), [Júpiter](#), [Neptuno](#), [Urano](#) y [Saturno](#), también tienen nubes!

Nubes cúmulos en las montañas de Colorado. Haga click en la imagen para una vista completa (234K GIF)
Cortesía de Aris Multimedia



Everyday Science

- 5 shows in 2010-2011
- Behind the Scenes
- 4 new kits



← Streaming / most popular episode.



Teaching Climate

- 5 days, 40 hours, 2 CSU credits
- 5 Years, 171 teachers
- More than 100 experiments!
- 5 E's:
Engage, Explore
Explain, Extend,
Evaluate



Diverse Teachers

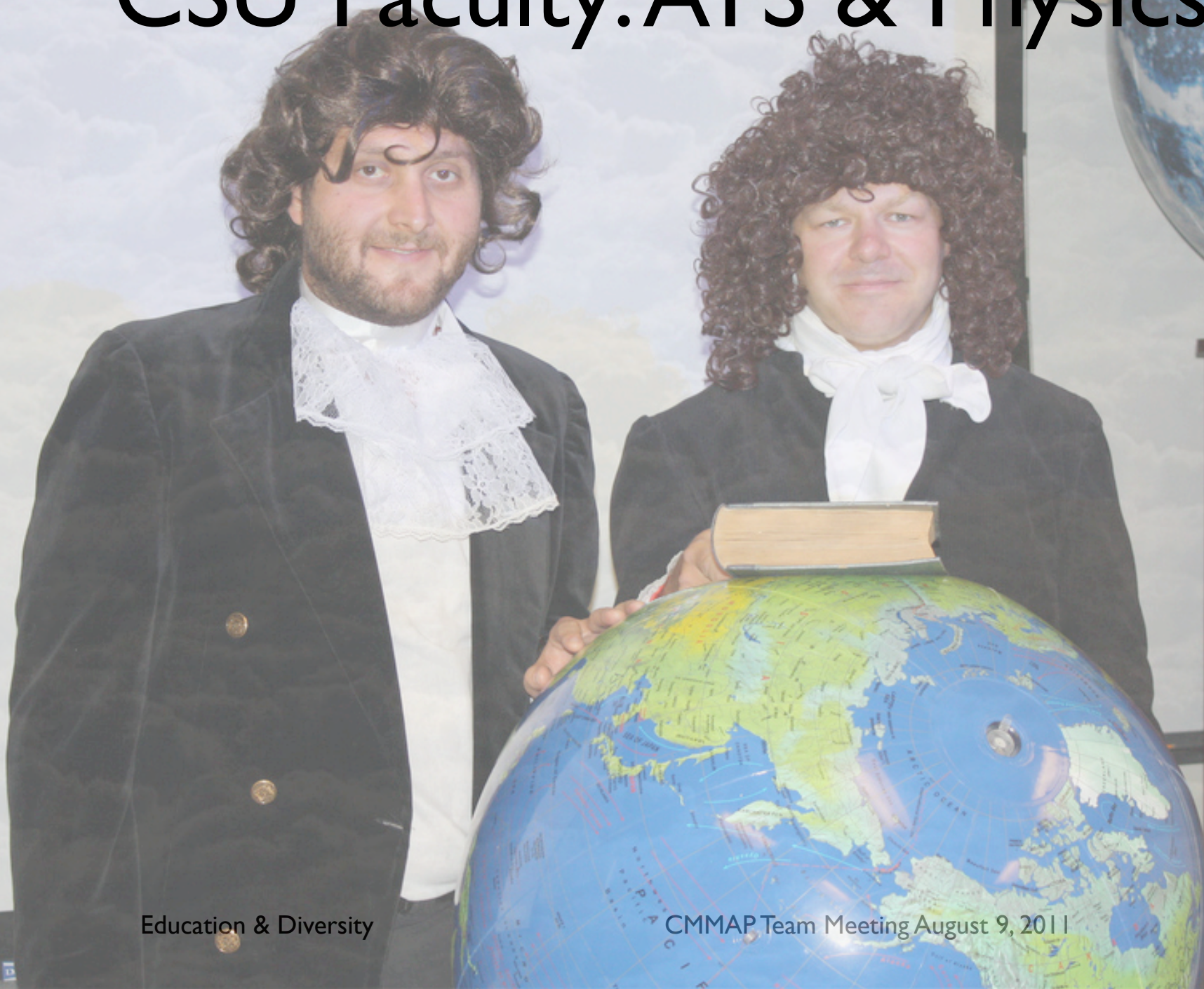
- Alliance Schools: 33
- Pine Ridge: 6
- Front Range: 118
- Outside of region: 13

Education & Diversity

CMMAP Team Meeting August 9, 2011



CSU Faculty: ATS & Physics



Education & Diversity

CMMAP Team Meeting August 9, 2011

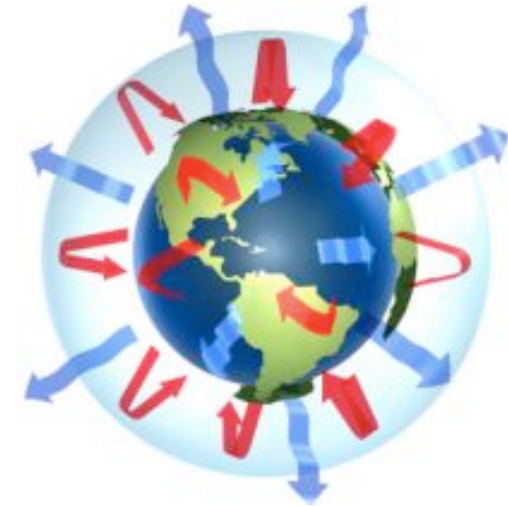


Undergraduate Education

- ◆ **Changing Climates @ CSU**
- ◆ **Summer undergraduate research internships**
- ◆ **Three Courses at Colorado College**
 - ▲ **Global Climate Change**
 - ▲ **Human Impacts on Global BGC**
 - ▲ **“Air”**
- ◆ **Teaching Internship at Colorado College**
- ◆ **ATS 150 “Climate Science for Poets”**

Climate Science for Poets

- ◆ **NO PREVIOUS EXPERIENCE REQUIRED!**
- ◆ **3 credits, 45 hours of classroom time**
- ◆ **No prerequisites**
- ◆ **Multi-mode learning: lecture, reading, video, hands-on**
- ◆ **class size ~ 45**
- ◆ **web distribution**



**Learn how the climate system works,
how and why it's changing,
likely climate futures,
and what can be done about it!**

*Non-Science Majors
Especially Welcome*

Climate Science for Poets

COURSE OUTLINE

1. **Introduction (1 lectures)**
2. **Overview of the Earth System (2 lectures)**
3. **Energy and Electromagnetic Radiation (4 lectures)**
4. **The Atmospheric Greenhouse Effect (2 lectures)**
5. **The Energy Balance of the Earth (3 lectures)**

6. **Circulation of the Atmosphere and Oceans (4 lectures)**
7. **Weather and Climate (3 lectures)**
8. **Climates of the Past (4 lectures)**
9. **The Global Carbon Cycle (3 lectures)**

10. **Fossil Fuels and Energy (3 lectures)**
11. **Climate Modeling and Projections (2 lectures)**
12. **Climate Impacts and Economics (3 lectures)**
13. **Mitigation, Adaptation, and Policy (4 lectures)**
14. **Climate Change Communication and Culture (2 lectures)**

Coriolis Class



Final Exam for Poets

1. Name **three processes** by which the total amount of **carbon stored on land** can increase over a period of decades.
2. What is the **“Kaya Identity,”** and how is it used to estimate future emissions of CO₂?
3. Under a high emission scenario, how much CO₂ will be emitted by fossil fuel burning in 2100? How much will be emitted under a low growth scenario?
4. What is meant by **“climate sensitivity” to radiative forcing?**
5. What is **climate feedback?** Give an example of a positive and a negative climate feedback
6. What are **two different ways to estimate the sensitivity of the Earth’s climate** to CO₂? Do estimates of climate sensitivity derived by the two methods agree or disagree with one another?
7. Name three major components of a modern global climate model. What do modern **climate models predict well? What don’t they include?**
8. How much is the **sea level expected to rise in the 21st Century?** Why is this difficult to estimate?
9. Describe likely changes in **temperature and water availability over the central USA** in the late 20th Century, as projected by climate models. What are the main sources of uncertainty in these projections?
10. Choose **any 8 wedges** you like from the 15 described by Pacala and Socolow, and list one **advantage and one disadvantage** for each one.

Summer Interns, Graduate Students, and Diversity



Where do we come from?



2007

CMMAP welcomed three interns in our first year.



One of our first summer interns, Beth Beckel explored cloud and precipitation chemistry. She learned the basics of gas-phase atmospheric chemical sampling techniques and spent most of the summer learning about the mist chamber.



Claudette Ojo worked on the Tropical Ozone Dataset for Satellite Validation Processing and Modeling looking at spatial and temporal relationships between ozone and temperature as a function of height.

Parker Kraus investigated land-atmosphere interactions in the West African country of Mali, looking at evaporation and photosynthesis rates.



2008

CMMAP enjoyed six interns in 2008.

Claudette Ojo, a business major, interviewed companies for the organization ClimateWise to learn the progress they were making in reducing greenhouse gas emissions.



Alice Duvivier and Jette Petersen worked together on a numerical approximation for mathematical operators used in climate modeling.



Tyler Ruggles, interested in environmental science and policy, helped a city become part of the Mayors for Climate Change organization.



Zoe Keve has a strong interest in helping people and improving our world. She worked at the National Conference of State Legislators constructing a booklet on biofuels.



David Sullivan studied carbon pricing and taxation for the National Conference of State Legislators finding advantages and disadvantages of different methods and creating a booklet.

Summer Internship Program

Watch us grow!

Find out more about us here:
www.cmmmap.org/scienceEd/internships.html



2009

Ten interns spent a summer at CMMAP in 2009.

Laura Witte worked with the Ft Collins Sustainability Group estimating how much CO₂ would be conserved by implementation of policies.



Lance Vanden Boogart worked with the land-surface modeling group comparing a chemistry transport model with observed CO₂ concentrations in the midwest.



Katie Riley researched and summarized trends in the carbon offset market. She also created a hypothetical model of offset design.



Liz Huddle spent the summer determining parameters for a mist chamber to try to increase its efficiency.



Having a strong passion for disaster research, Heather Morgan tried to find a connection between the MJO and Atlantic hurricanes.



Samantha McGraw conducted interviews and researched New Jersey city climate action plans.

Terreka Hart focused her research on how concentric eyewalls and mesovortices influence the intensity of hurricanes in the Atlantic basin.



Cara Tabor performed research with a spin tank to compare mathematical models of a balanced vortex and what she observed in ice-generated vortices in the spin tank.



JoBeth Minniear came to CMMAP to research how water vapor, temperature, and vertical velocity relate to one another in a very high resolution simulation of a tropical convection system.



Katherine Heal learned to use an aerosol mass spectrometer to analyze aerosol emissions from types of biodiesel and later, perform sampling in Rocky Mountain Nat'l Park.

2010

Watch us grow, indeed! We hosted 12 interns this year!



Idamis Del Valle came from Puerto Rico to study the effects of enhanced moisture triggers on precipitation and winds.



Nick Geyer used the Vector Vorticity Model to simulate the Tropical Western Pacific-ICE case.



Erin Kashawlic compared data assimilation schemes used by operational forecast centers.



Chris Alston researched hurricane activity along the US northeast coast.

Kyle Hemes researched the spatiotemporal influence of vegetation on global surface-atmosphere exchange.



Jackie Gushue looked at electrical rate structures and their impact on demand response decision making with a company in Fort Collins.



Stormy Stevens looked at the impact of tropical cyclone rainfall on drought in Alabama.



Tina Laboy spent her summer researching the propagation of the Madden-Julian Oscillation.



Ariana Marrero, from Puerto Rico, studied the variability of the seasonal cycle in the Tropical Eastern Pacific and Caribbean.



Marie-Christine Razaire examined the responses of the ocean carbon cycle to climate change.

Daniel Rothenberg got into the nuts and bolts of a climate model dynamical core.



Christina McCluskey researched nitrogen samples collected from Rocky Mountain National Park.



5 summers - 41 interns



research | mentoring | community
SOARS



In 2006, Zizi Searles came to us from San Francisco State University. She worked with CMMAP Faculty, Dr. A. Scott Denning studying emission CO2 scenarios.



Alex Gonzalez worked with CMMAP Faculty Dr. Wayne Schubert studying tropical dynamics. His research was entitled an “Analytical study of tropical flows using an improvement of the longwave model. He has participated in the program for 3 years and is now a M.S. student under Wayne Schubert at Colorado State University.



Kimberley Trent worked with Dr. Warren Washington at NCAR during 2006 and 2007. Her research focused on hurricane modeling looking at different climate change scenarios.

During Summer 2010, Diamilet Perez-Betancourt worked with science mentors Jonathan Vigh (an NCAR postdoctoral fellow, and CSU and SOARS alum) and Shuyi Chen (University of Miami) she studied Environmental factors influencing hurricane eye formation in the North Atlantic basin.



Rosimar Rios-Berrias came to us from the University of Puerto Rico at Mayaguez.



In 2008, Nicole Ngo came to us from Irvine, CA. She worked with science mentors Chin-Hoh Moeng and Jeff Weil (NCAR) on “The effects of convective clouds on vertical scalar transport using a numerically simulated flow field”



During Summer 2010, Maxino Menchaca worked with Dr. Bill Skamarock on Building a New Weather Model: Testing a Nonhydrostatic Dynamical Core on Unstructured Variable Resolution Hexagonal C-Grids. Maximo has a peer reviewed publication based on this work in Monthly Weather Review.



In 2008, Karen Diaz’ research focused on the “Effects of transport and meteorology on the particles measured at the Storm Peak Laboratory (SPL)” under the guidance of CMMAP Faculty Dr. Sonia Kreidenweis and Science Mentor Christine Wiedinmyer at NCAR.



Vanessa Vincente came to us from Valparaiso University. Her Summer 2012 research focused on analyzing hurricane data . Vanessa is now a M.S. student under Dr. Russ Schumacher at Colorado State University.

6 summers - 9 proteges



After the internship... where do our interns go?

BS programs: 17

MS programs: 17

PhD programs: 6

Scientific workforce: 10

7 interns in Atmospheric Science at CMMAP/CSU

1 intern in Political Science with CMMAP Faculty

Diversity Studies in Atmospheric Science



In what ways and why are students and faculty in climate sciences lacking in diversity?

Examines ATS graduate students' and faculty perceptions of their education and career goals -- CSU and MIT



Focuses on factors supporting or interfering with interest in STEM education.

Results subject of 2 Ph.D. dissertations

Hispanic Engineering, Science, and Technology Week

Bringing the LSOP Road Show to Texas!

Teacher workshops

Middle School
Challenge

Career Fair

Community Day

The image shows a screenshot of the UTPA HESTEC website banner. At the top left is the UTPA logo with a star and the text 'UTPA'. To the right is 'THE UNIVERSITY OF TEXAS-PAN AMERICAN'. Below the logo is a smaller version of the HESTEC logo with the text 'THE UNIVERSITY OF TEXAS-PAN AMERICAN UTPA HESTEC Hispanic Engineering, Science, and Technology Week'. The main banner features the dates 'Sept. 25 to Oct. 1, 2011' in large yellow text. Below the dates is the slogan 'A DECADE OF INNOVATION: Pushing Frontiers and Inspiring Future Leaders'. To the right of the dates is a large number '10' filled with small images of people. Below the banner is a navigation menu with links: Home, Schedule, Sponsors, Registration, Speakers, Contact, and Science Bowl. Below the navigation menu is a section for 'STUDENT LEADERSHIP DAY' with a date of 'Tuesday, Sept. 27, 2011'. The text describes the event: 'Hundreds of students are introduced to a wide range of career opportunities in the science, technology, engineering and math (STEM) fields.' There is a photo of students working on a project. To the right of the photo is the text 'SPONSORED BY: LOCKHEED MARTIN' and a 'Read More>>' link.

4000 students, 1000 teachers, hundreds of undergrads

WHAT IS HESTEC?



- And, why are these slides so red?
- HESTEC is Hispanic, Engineering, Science and Technology Week through the University of Texas - Pan American
- It is REALLY hot and humid on the Rio Grande

WHY IS LSOP GOING TO HESTEC?

- Invited by NSF to participate
- CMMAP always welcomes the opportunity to promote Education and Diversity
- Spoke with the Coordinator. She loved us. We are going.

MINORITY PARTICIPATION

- Over 90% of participants Hispanic, very poverty stricken area
- Participants include Middle and High School Students and their teachers

LSOP STEALS THE SHOW

- LSOP is happenin' at HESTEC
- Six Full Days - Included in each day of the event

Monday: Teacher Workshop

Tuesday-Friday: Middle School Hands on Science.

250 students per session: 2 rooms (1 with lights on, 1 with lights off) large enough to hold 125 students in each. - Four Sessions - TOTAL 1,000 students per day.

Friday: Career/Internship Fair

Booth at the career/internship fair. We will promote our summer undergraduate internship.

Saturday: Community day

Center Stage. We will do 15 minute live sessions, perhaps we will do science in front of the audience, perhaps the Science Cheerleaders will interact with the audience. As many as 10,000 visitors to this event.

HIGHLY PROMOTED BY NSF

- The LSOP will be visited on Tuesday by Anne Petersen, NSF Deputy Director for Engineering
- LSOP will be featured in an NSF magazine promotion for this event, banners, billboards and more

WHAT WILL PARTICIPANTS TAKE AWAY?

- Teacher kits, experiments...
will all be given back to participants

QUESTIONS?