Global Change Future Issues:
Linkages and Feedbacks.

Jeff Gaffney
Argonne National Laboratory
The U.S. Climate Change Science Program: 
Vision for the Program and Highlights of the 
Scientific Strategic Plan

July 24, 2003

http://www.climatescience.gov/
CCRI – FY 2003 – Budget

http://www.climatescience.gov/about/ccri.htm

7 Areas – Total Millions of Dollars - Agencies

1. Aerosols – 4 – NOAA-2, NSF-1, NASA-1
2. Carbon Inventory and Models – 15 – NSF-9, DOE-3, NOAA-2, USDA-1
3. Climate Modeling Center – 5 NOAA(Princeton)
4. Risk Management – 6 – NSF-5, NOAA-1
5. Atmospheric Observations – 4 – NOAA-4
6. Ocean Observations – 4 – NOAA-4
7. Satellite Observations – 2 – NASA

TOTAL FY 2003 – 40 M (Much of it Redirected!).
National Research Council Reviews

At the National Academy, Wash. D.C.

Most have been closed conference calls..

Next one Aug. 25th 2003

Key Chapters not being discussed!
PLAN CALLS FOR INVENTORIES and REVIEWS – 2 YEARS

FIELD WORK – MEASUREMENTS – 2-4 YEARS
- AEROSOLS HIGHLIGHTED
- UNCERTAINTIES……

NOTE: It took over two years for the PLAN Draft
Time Frame may be a little optimistic!
UNCERTAINTIES MAJOR FOCUS

Reviews of Current Status – 2 Years
WATER CYCLE EXAMINED…. Aerosol linkages to clouds

2-4 Years to have Modeled for Policy
AEROSOLS
UNCERTAINTY – Stressed

2-4 Years to Resolve
CARBON CYCLE
Main Focus – 2-4 years

UNCERTAINTY…
OK --- SO MUCH FOR THE CHANGING POLITICS..

Lets talk about some LINKAGES..

Figure from Rick Behl – Cal State Long Beach
Let's take a look at MORE CO₂ from the Anthrosphere
IMPORTANCE OF SCALE

CO$_2$ is Fertilizer! (NO, NO$_2$
Nitrate-Sulfate – Ammonia)
CO₂ Impacts not just Temperature but Biosphere!
Temperature Effects Evaporation and Evapotranspiration
Ecosystem Responses – Increases in Trace Gases?
Vector-Born Diseases
Changes in Species Distributions?
Precipitation?

FEEDBACKS – Isoprene Increases in presence of Nitrogen Oxides --- Increases in Regional Ozone Levels.
Ozone – Greenhouse gas
Ozone – Plant Toxin – Regulates Plant Growth?
Our Planet is not HOMOGENEOUS

Wetter!

Drier!

Hotter!

Colder!

This used to be full of big icy mountains... now look at it!

Have you heard the latest? Dublin may become as cold as Spitzbergen in the Arctic Circle because of global warming...
SO THESE SCIENTISTS DID THIS EXPERIMENT THAT IF YOU DROP A FROG INTO BOILING WATER HE JUMPS OUT.

BUT IF YOU PUT HIM IN WARM WATER AND HEAT IT SLOWLY, HE JUST SWIMS AROUND UNTIL HE'S COOKED.

WHAT'S THE POINT OF THAT EXPERIMENT?

BEATS ME.

SCIENTISTS, GO FIGURE.

PROBABLY THE SAME ONES STUDYING GLOBAL WARMING.

Hey, let's swim around some more!
Increases in Severe Weather – EXTREMES!
RATE of CHANGE – Will Determine How We ADAPT!

Temperature in ’97 set a record

Global Temperature Rising
Every year scientists collect surface temperatures from around the world to create a global temperature index. Since 1990, the index has risen—up 1 degree, making 1997 the warmest year of the century.

This is your planet on greenhouse gases
Of Course, Some Habits May be Hard to Change!
Global Change Scientists Must Also Adapt!
Of Course, WE MAY BE MAKING IT EASIER FOR OTHER SPECIES TO ADAPT AS WELL…

You Know Now that they got rid of that Nasty Ozone layer and added Soot and Smog – the Air is a lot better to breath!

Yes, And its Warmer Now..
ANYWAY – Lots of Work to be DONE – AND I PREDICT IT WILL TAKE A CONTINUING EFFORT BY MANY SCIENTISTS DOING INTERDISCIPLINARY WORK TO GET THE JOB DONE!

KEEP IN TOUCH and Let us know HOW YOUR ADAPTING!

Thanks!

Peter Lunn – Rick Petty – DOE

Milt Constantin – Mary Kinney – ORAU

Pat Shoulders – Donna Holdridge – ANL

AND YOU - OUR SURE AND GREF STUDENTS!