



# Structuring the Earth and Sun Systems Laboratory to Address New Scientific Challenges

Guy P. Brasseur

National Center for Atmospheric Research

Boulder, Colorado

# Objectives of the Proposed Structure

- Discuss a structure of the Earth and Sun Systems Laboratory (ESSL) that optimises the research activities in an environment that promotes integrative earth system science.
- This an open discussion meeting. Nothing is decided. Ideas and remarks are welcome.
- The proposed model for the ESSL structuring is a straw man and a base for discussion.

# ESSL Priorities 2007-2008

- Development of a flexible modular ***Earth system modeling framework*** needed to address integrative scientific questions, and specifically of the Community Climate System Model (CCSM), the Whole Atmosphere Community Climate Model (WACCM), and the Weather Research and Forecasting Model (WRF).
- ***Modeling of the regional climate*** and two-way interactions between multiscale processes in the atmosphere and ocean, and specifically development of the Nested Regional Climate Model (NRCM).

# ESSL Priorities 2007-2008

- Implementation of new integrated ***field projects***, (UTLS Project, and the Carbon-Water Cycle Project). Enhanced emphasis on the experimental capacity of ESSL.
- Integrated understanding of the coupled ***water carbon nitrogen system***.
- Observation, analysis and prediction of ***climate and weather***. (e.g., organized convection and *hurricane predictions*).
- Observation, analysis and prediction of ***chemical weather*** at all scales. Impact of urban development on regional and **global air quality**.
- Predictability of ***solar variability and activities*** at different spatio-temporal timescales and impact of *space weather* on the Earth system.

# One Important Constraint

The objective is to maintain the overall indirect cost of ESSL at the current level

The structure should be organized so that the funding for research is maximized

# Rationale

- Reinforce scientific research at NCAR.
- Promote scientific excellence.
- Make NCAR more visible at the national and international level.
- Develop the best talents within ESSL.
- Reinforce partnerships with universities.
- Enhance scientific and leadership role of the Division Directors and reduce their administrative burden.
- Reinforce ways to integrate knowledge.

# Rationale

- Develop a coherent Laboratory that is adapted to the evolving science and is recognized as a world leader to address questions at the Earth and Sun system levels.
- Create more flexibility and adaptability within the Laboratory.
- Increase the visibility of the science, and specifically of emerging disciplines.
- Make the ESSL entities more manageable (a slightly larger number of smaller and more focused entities).
- Make the Divisions more focused on well defined research topics.

# General Philosophy

- ESSL's organization must be **simple** and understood by staff. Responsibilities of every entity/leader must be **clear**. No matrix management, but efficient integration mechanisms should be established.
- ESSL determines the overall **strategic directions**, defines scientific priorities at the highest level, and allocates budgets to the different entities, based on established priorities.
- ESSL is responsible for the **normative** aspects of the management/administration, but the principle of subsidiarity is applied and management remains largely decentralized.

# General Philosophy

- ESSL Divisions and other ESSL groups contribute to the mission of the Laboratory.
- As members of the ESSL Executive Committee, Division/Institute Directors supervise jointly the entire ESSL operations.
- Barriers between ESSL Divisions are minimized.
- To reinforce the coherence of the Laboratory and allow for easy transfer between different entities, staff is regarded as ESSL staff.

# Different Possible Structures

1. **No change.** 4 Divisions and 1 Institute.
2. **Most radical:** Divisions/Institute are replaced by a number (10-15) of rather small and flexible Projects.
3. **Moderate evolution:** A limited number of Divisions or Projects are added to the current structure, and the role of TIIMES is modified.
4. Other ideas are welcome.

# The Most Radical Option

- Have a rather large number of research groups, which focus on specific questions for a limited period of time. The groups are ‘supervised’ by a board of Directors who are collectively responsible for the scientific quality, the integration and the promotion of the science.
- ***Positive aspects:*** Flexibility and adaptability, competition for resources, leadership by mid-career scientists.

# The Most Radical Option

- ***Negative aspects:*** Big cultural change; more complex management, perhaps (?) more difficult integration, less coherence, group leaders not necessarily world-leaders and the best spokespersons, no clear relationship with NSF Programs.

# Moderate Evolution

- Maintain the existing Divisions, and add 2 new Divisions that highlight important aspects of Earth and Sun systems research.
  1. A Division focusing on **bio-hydro-geosciences**
  2. A Division focusing on **solar-terrestrial relations and upper/middle atmosphere**
  3. A new role and structure for **TIIMES**

# HAO Solar Physics (SP)

- This Division contains the part of the current HAO that deals with solar physics, solar dynamo, planets and astrophysics including MLSO.
- The natural community for this Division is the astronomical and astrophysical community.
- Internationally: The International Astronomical Union.
- There must be a renewed long-term commitment that NCAR will host and support these activities.

# HAO Upper and Middle Atmosphere (UMA)

- This new Division includes the scientists involved in magnetospheric and aeronomic issues, solar-terrestrial relations, space weather, and upper/middle atmosphere – WACCM.
- The natural scientific community includes solar-terrestrial physicists, aeronomers, and stratospheric ozone researchers – AGU.
- Internationally: IAGA, SCOSTEP, SPARC

# CWO Climate and Global Dynamics Division (CGD)

- No change, except that biogeochemists and perhaps biogeophysicists move into the new BHG Division.
- Natural scientific community: Climate community.
- Societies: AMS, AGU
- Internationally: WCRP (CLIVAR), IPCC

# CWO Mesoscale and Microscale Meteorology (MMM)

- MMM focuses on the weather and regional climate scales, including modeling, experimental and theoretical work.
- It maintains and develops the Advanced Research WRF model system, including data assimilation.
- It coordinates the development of the new NCAR Nested Regional Climate Model.
- Community: AMS, AGU
- Internationally: WMO (CAS), IAMAS

# BACO Atmospheric Chemistry (ACD)

- ACD focuses on air quality questions (gas phase and aerosols), issues related to the free troposphere and stratosphere and to chemistry climate interactions.
- It develops strong **experimental projects** on photochemistry and aerosol microphysics/chemistry and on tropospheric/stratospheric transport (including MOPITT, HIRDLS).
- It also deals with global and regional chemical transport **modeling** (MOZART, CAM-Chem, WRF-Chem).
- Community: AGU
- Internationally: IGBP (IGAC), IAMAS (CACGP)

# BACO Bio-Hydro-Geosciences (BHG)

- The focus of this new Division is land biogeochemistry, dynamic vegetation and eco-hydrology. It deals with large biogeochemical cycles (carbon, nitrogen, etc.) and the water cycle.
- It manages the Biocomplexity Project at NCAR, and includes the biogeosciences currently in TIIMES.
- It also develops the water system project.
- Internationally: WCRP (GEWEX), IGBP (iLEAPS)

# BACO Bio-Hydro-Geosciences (BHG)

- To understand the **dynamics of the land system** and the consequences of land changes.
- To integrate, observations, analysis and modeling to better understand and predict the **coupled human-natural** system.
- To understand how physical, chemical, and biological processes transport and transform energy and matter (including **water**) through the **land-atmosphere-marine interface**, with emphasis on interactions and feedbacks at all scales.

# The New TIIMES

- TIIMES will evolve into an interdisciplinary entity directed by a group of mid-career scientists originating from different disciplines and representing (on a rotating basis) the ESSL Divisions and other NCAR Laboratories/Institutes.
- TIIMES will not manage projects, but will be a **forum** to test **new ideas**, launch **new initiatives**, host **visitors** and distinguished **scholars** to reinforce ESSL integrative programs.
- It will be led by a Director and managed by a small unit (linked to the AIMES Office).

# The New TIIMES

- The purpose of TIIMES is to:
  - facilitate the **integration** of the work conducted within ESSL and NCAR, and with universities;
  - serve as a **forum** (think tank) for development of ideas and initiatives;
  - enhance **links** with the university community;
  - provide an **advocacy** for ESSL in support of major projects, new initiatives, and related activities; and
  - link with other NCAR institutes to develop new **methodologies** (mathematics, computer science, social sciences).

# The New ESSL Divisions in 3 Observatories

## **High Altitude Observatory (HAO)**

1. Solar Physics (SP)
2. Upper and Middle Atmosphere (UMA)

## **Climate and Weather Observatory (CWO)**

3. Climate and Global Dynamics (CGD)
4. Mesoscale and Microscale Meteorology (MMM)

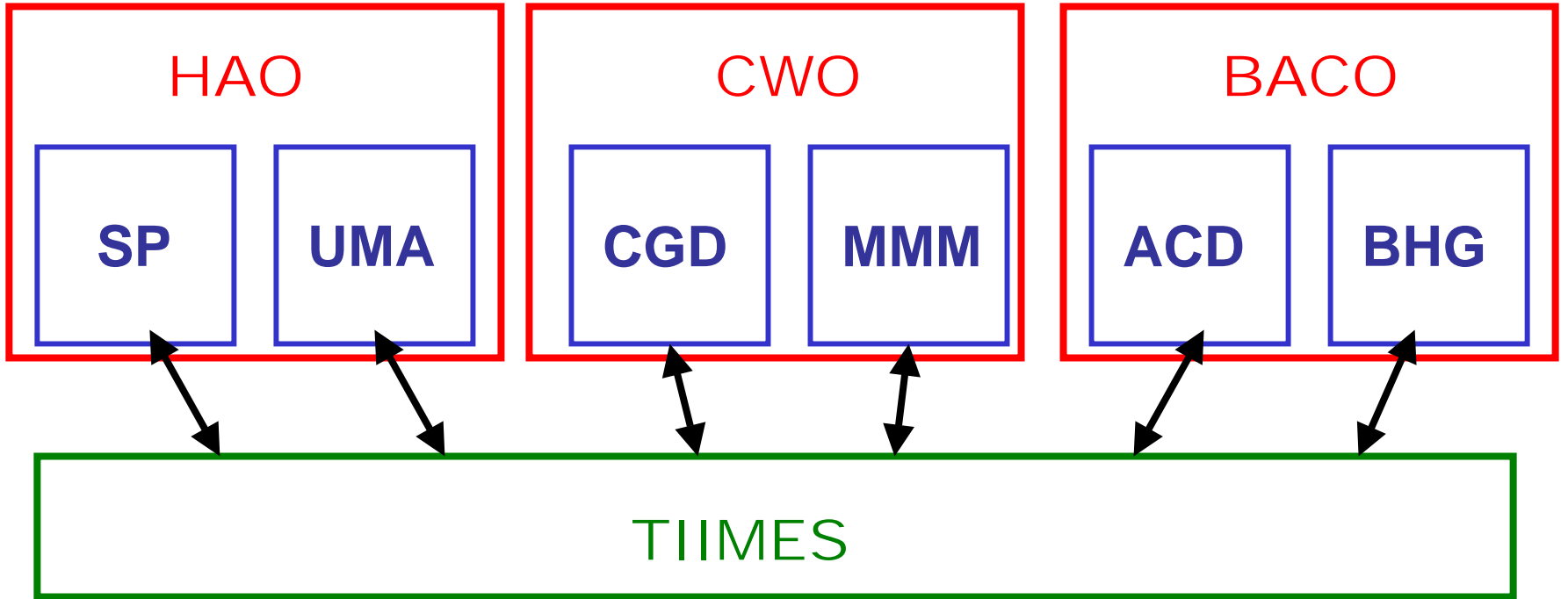
## **Biosciences and Atmospheric Chemistry Observatory (BACO)**

5. Atmospheric Chemistry (ACD)
6. Bio-Hydro-Geosciences (BHG)

# The Observatories

- The Observatories represent a logical grouping of divisions with considerable activities in common.
- The creation of Observatories does not bring further bureaucratic costs or personnel.
- They will be coordinated by the Divisional Directors and will have a joint 'strategic committee' made up of staff from both divisions, which decides on long-term directions.
- All 6 Division Directors are members of the ESSL Executive Committee and of the NCAR Director's Committee (Leadership team).

# ESSL



# ESSL

- ESSL is led by the NCAR AD and a Deputy, together with the ESSL Directors (Executive Committee).
- The ESSL Executive Committee oversees the entire ESSL operation. Directors have an overall responsibility (see models used for ADs).
- Overall strategic scientific and technical directions are discussed at the Laboratory level with input from the Divisions/Institute.

# ESSL Management

- ESSL is already dealing with the strategic plan, advisory board, GAU allocation, budget.
- The normative aspects of the ESSL management are under the responsibility of ESSL. These include primarily the management of personnel issues (procedure for hiring, promotions, evaluations, salary increases, budget). A decentralized management structure (Divisions or Observatories) deals for example with issues related to visitors, space, travel, budget, etc.

# Time Schedule

- After a definition phase, we are now entering in a **consultation** phase. Comments are welcome and should reach me in the coming weeks.
- **End of August:** Discussion by the ESSL Advisory Board and by the NCAR Executive Committee.
- Decisions on the overall project by **1 October, 2006**
- After 1 October, **consultation** about **more specific issues** before gradual implementation.