ESRL Review of the Regional and Local-Scale Assimilation and Modeling Theme

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Goal

- Provide you with a familiarization of regional and local modeling activities at ESRL
- How regional modeling fits in with prediction, understanding, and monitoring of the earth system
Basics

- **Modeling or Numerical Environmental Prediction** - Time-integration of pertinent governing equations of a system, subject to specified initial conditions, leading to a prediction of a future state.

- **Data Assimilation** - the combining of spatially and temporally sparse observations into a unified and consistent description of a system specifying an initial condition.
What does “Regional and Local” imply for Assimilation and Modeling?

- The domain is a sub-set of a larger assimilation and modeling domain
- Environmental conditions on the boundaries of the regional domain are provided by a model running on the larger domain...inner domain is termed a “nest”
- Regional models tend toward forecasts of higher spatial resolution and short time spans.
- Computational costs are much lower with a limited domain
We have a global model running at course resolution; we need high resolution forecasts over the northeast US.
A regional domain is nested in a global domain.
Global model sets the time-dependent conditions on the regional boundary; high resolution forecast is made in the interior.
What are the applications for Regional and Local Assimilation and Modeling?

- Applications that require higher resolving capability unavailable in say, a global domain
  - Aviation/transportation weather
  - Air quality
  - Urban weather
  - Fire weather
  - Severe weather
  - Hydrology and Flooding
CHEMISTRY and URBAN AVIATION

FIRE

SEVERE WEATHER
What are the aims of Regional and Local Assimilation and Modeling?

- Improved forecast services - providing the time and space detail required
  - Weather warnings
  - Transportation decisions
  - Probabilistic prediction
- Phenomenological understanding - providing a complete picture from sparse sets of observations
  - Air chemistry
  - Air-sea interaction
  - Atmospheric and ocean dynamical systems
- Regional and local impacts of global climate
  - Impact of oceans
  - Impact of aerosols and chemistry
Ensuring Relevancy of ESRL Modeling

- Earth System Modeling Framework
- Developmental Test Center
Community Collaboration: The Earth System Modeling Framework (ESMF)

- The Earth system is complex and no longer can we isolate one earth process from another. e.g. ocean/atmosphere
- ESMF offers a simplified means to combine earth system modeling components to address problems of interest
- ESMF has a growing set of toolkits, interfaces, and process models that allow rapid transfer of knowledge and efficient model development
- Regional and local modeling and assimilation efforts are key contributors -- ESRL will utilize ESMF in its regional modeling activities.
Transfer to Operations: The Developmental Testbed Center (DTC)

- Gains made in some ESRL modeling efforts must have a path to operations.
- The DTC serves as a bridge between research and operations to facilitate the transfer of new science to the operational centers.
- The research community gets an operations-like testbed to evaluate new NWP methods; the operational community sees how the new NWP methods fare prior to consideration for implementation.
- ESRL is heavily involved in DTC activities related to regional modeling and assimilation.
DTC Concept

New Science and Technology

Research Community

DTC

Operational Community

Operational codes
ESRL Efforts (15 min each)

- Model Development........Georg Grell
- Data Assimilation..........Stan Benjamin
- Ensembles and Probabilistic Post Processing
  .................Paul Schultz
- Air Quality..................Jim Wilczak
- Air-Sea Interaction.........Jian-Wen Bao
- Regional Climate............Ola Persson
ESRL performing a broad range of research using regional models and assimilation
- Model development
- Data assimilation
- Ensembles and post processing
- Air quality
- Air-sea interaction
- Regional Climate

ESRL playing a key role in development of operational systems and performing phenomenological research

Through ESMF and the DTC, good connectivity will be maintained with the research and operational communities