

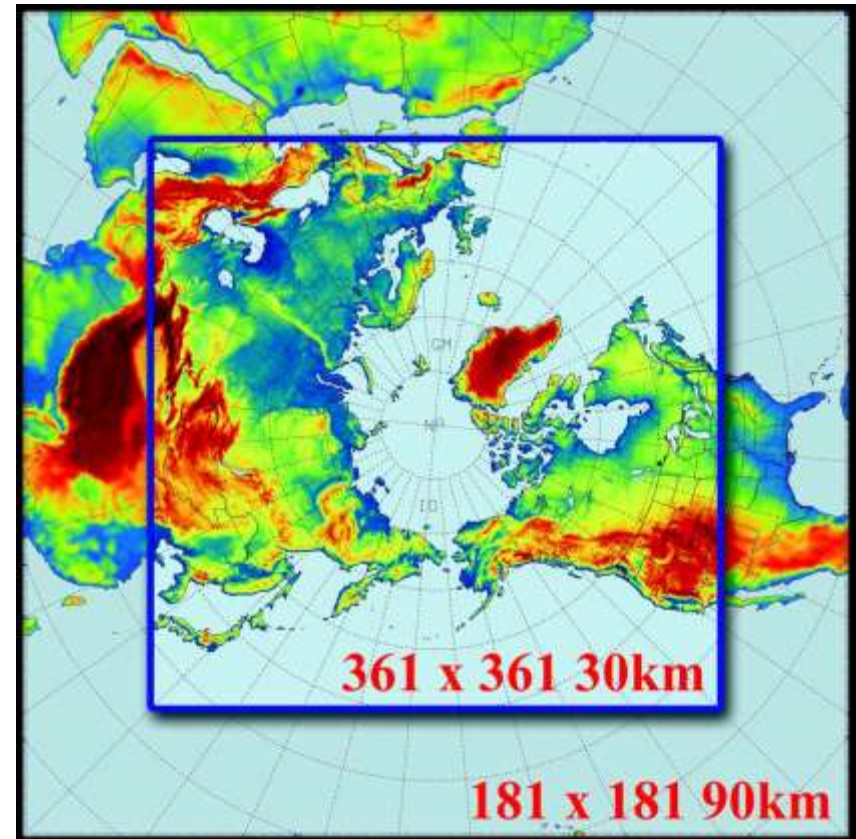
Simulation/Modeling

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What We Can Do

- Atmosphere
 - Powerful reanalyses at finer resolutions
 - Investigations into teleconnections:
 - A changing Arctic Ocean and its impacts

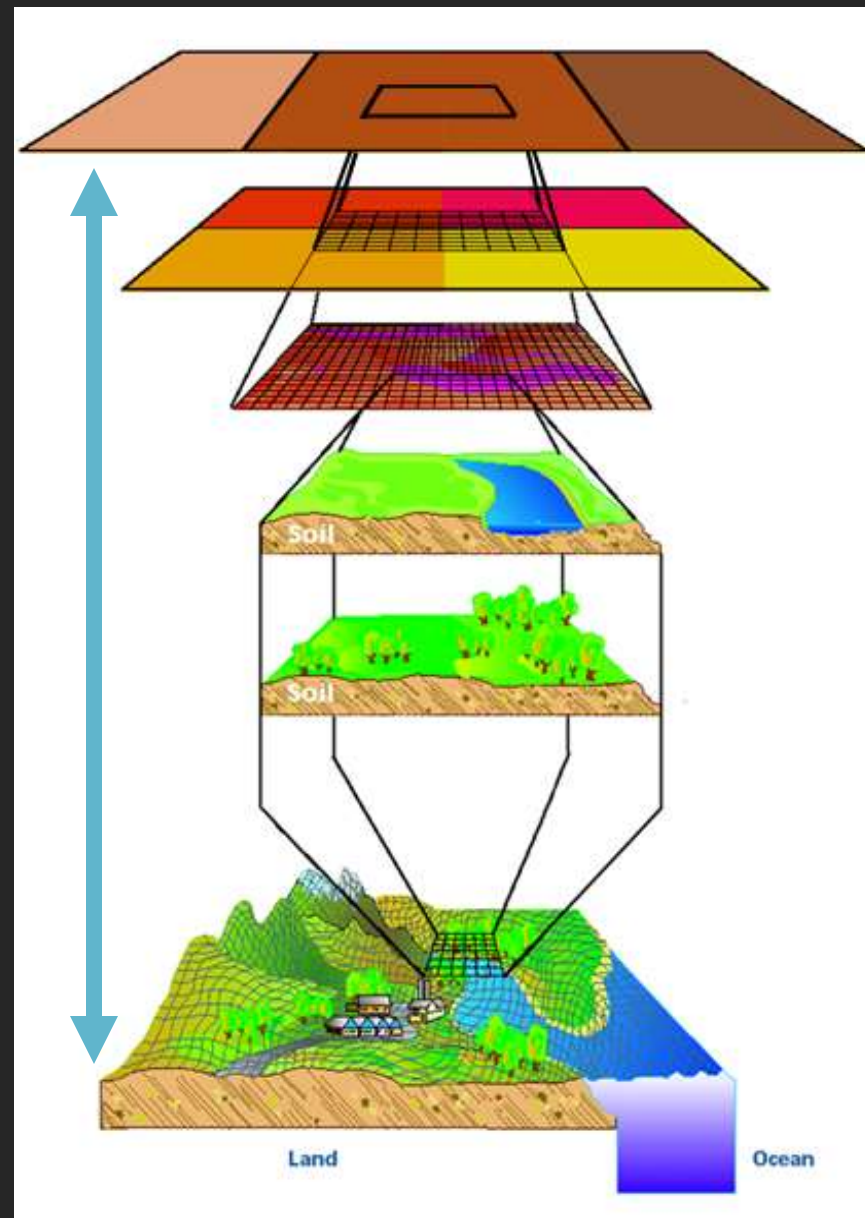
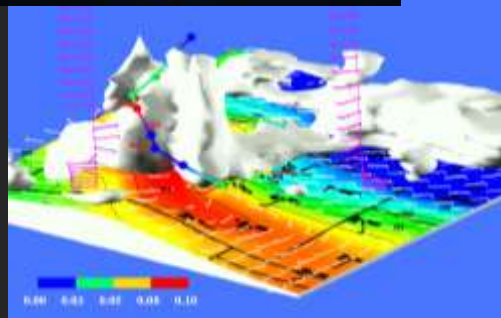
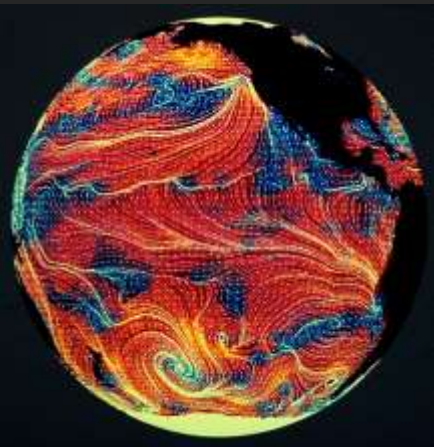


What We Can Do

- Sea Ice
 - Model intercomparisons and improving simulation accuracy and model behavior
- Land Surface
 - Estimating changes in snow, ice mass balance, biomass, species composition, productivity, and permafrost thaw

Nested-Grid, Snow-Evolution Modeling System

(Liston and Hiemstra, in prep)



Global Analysis
(200-100 km)

Regional Model
(60-5 km)

MicroMet
(1000-5 m)

SnowModel
(100-5 m)

Other Terrestrial
(100-5 m)

Impacts Models
(100-5 m)

Land

Ocean

What We Can Do Continued

- With more, better, and increasingly available observations and emerging hypotheses, more realistic model improvements follow
- Moving toward integration among processes
- Improving submodel accuracy and looking at aggregated interactions and emerging signals.
 - Sea Ice, Snow, and Vegetation Interactions
 - Shrub, Snow, Biogeochemical Interactions

What We Can't Do

- Many gaps in observational record remain (temporal and spatial).
 - Models are nice way to bridge spatial gaps, but much remains to be done.
- With few data sources, existing observations can have high leverage.
- Quality of historic datasets change and evolve over time
- Quality of data used are unknown
 - Are inadequate data better than nothing?
- GIGO
 - The model gets the system right, but ingested data are wrong.

What We Can't Do

- Model and idea marketplace can be brutal
 - “Overselling” models
 - Lack of trust in models and modeling skillsets
- Error assessments
 - Verification is difficult or impossible
 - Brutal marketplace hinders honest assessments



Obstacles

- Sharing Data Rapidly (wait until I publish this paper)
- You are not allowed to see these data under this license because you are a _____ or work at _____, or are funded by _____.
- QAQC can require formidable efforts, hindering rapid distribution.
- Lack of interest and resources for maintaining networks and observations. Getting good measurements takes time and energy, but is that all you are going to do?
- Lack of credit, lack of control (take the dataset and run)

Filling the Gaps

■ Data

- Obtaining the right dataset and using it appropriately are occupational hazards.
- Sometimes data exist, but they can't be obtained or worse, you never know about them until after you needed them.



■ Methods

- Better model and dataset QAQC is required. It's impossible to ask where models and data perform well and where they don't.
- Tracking and comparing model DNA. How similar are they?
- Sometimes we can substitute a better variable that is more easily measured (e.g., gauge precipitation vs. snow depth).
- Finding better allocation of resources using models (can we look at where we have too many measurements?)

Filling the Gaps, continued

■ Tools

- The largest peril is not knowing about database and needing it.
- Once you can find it, how does the process remain iterative for the data provider?
 - Dataset ratings? User fixable datasets? Feedback to data providers?

■ Resources

- Needs to be a community effort to link datasets or highlight where they are.

Holy Grails

- Integrated land surface, ocean, and atmosphere modeling system that addresses the processes and their attendant feedbacks accurately.
- Modeling system that can assimilate multiple-scale data and run process models at appropriate scales (global to leaf).
- Datasets that are easy to find and adapt, and have ratings for their extent, longevity, and quality.

