

NASA Short-term Climate Prediction Downscaling and Application

Science Advisory Committee Meeting

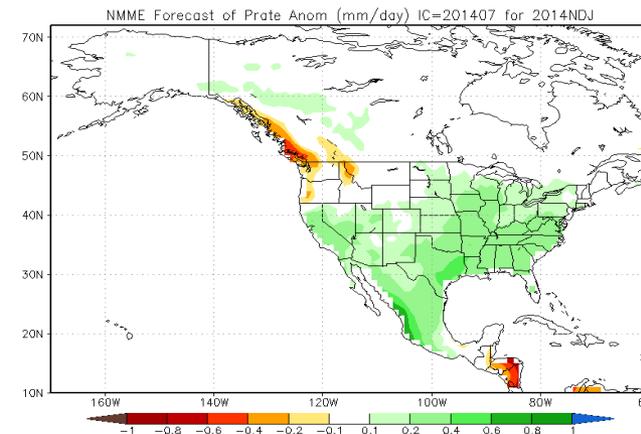
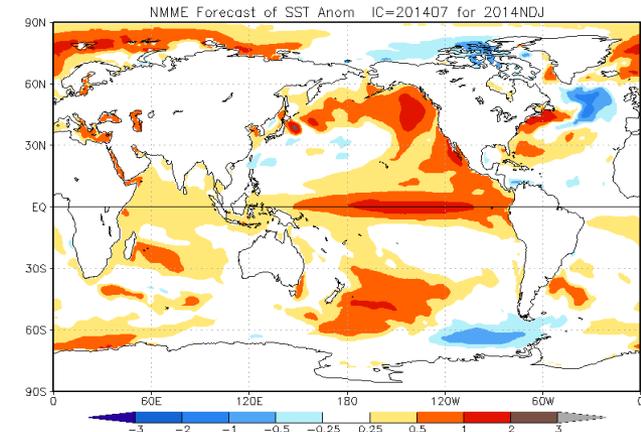
26 – 28 August, 2014

National Space Science and Technology Center, Huntsville, AL



Short-term Climate Prediction Efforts

- Subseasonal to interannual predictions from GCMs is an area of active research
 - The North American Multi-Model Ensemble (NMME), a NOAA-sponsored effort is but one example of an experimental ensemble forecast system
- Outlooks focus on surface temperature and rainfall, among others
 - Seek to capture the evolution of large-scale climate forcing signals (e.g. ENSO, MJO)
- Seasonal forecasts contributed from NASA Global Modeling and Assimilation Office (GMAO)
- At seasonal time scale, better initializations of ocean and land surface state may improve predictability.



NDJ Seasonal Forecast of surface temperature (top) and US rainfall (bottom) from NMME initialized July 2014.

Short-term Climate Prediction Needs

Operations

What is actionable?

- Define forecast issues
- Scope of decision-making including outside factors
- Feedback to developers

Research

What is achievable?

- Predictability studies
- Source of seasonal climate information relevant to problem
- How to incorporate new observations into seasonal forecasts

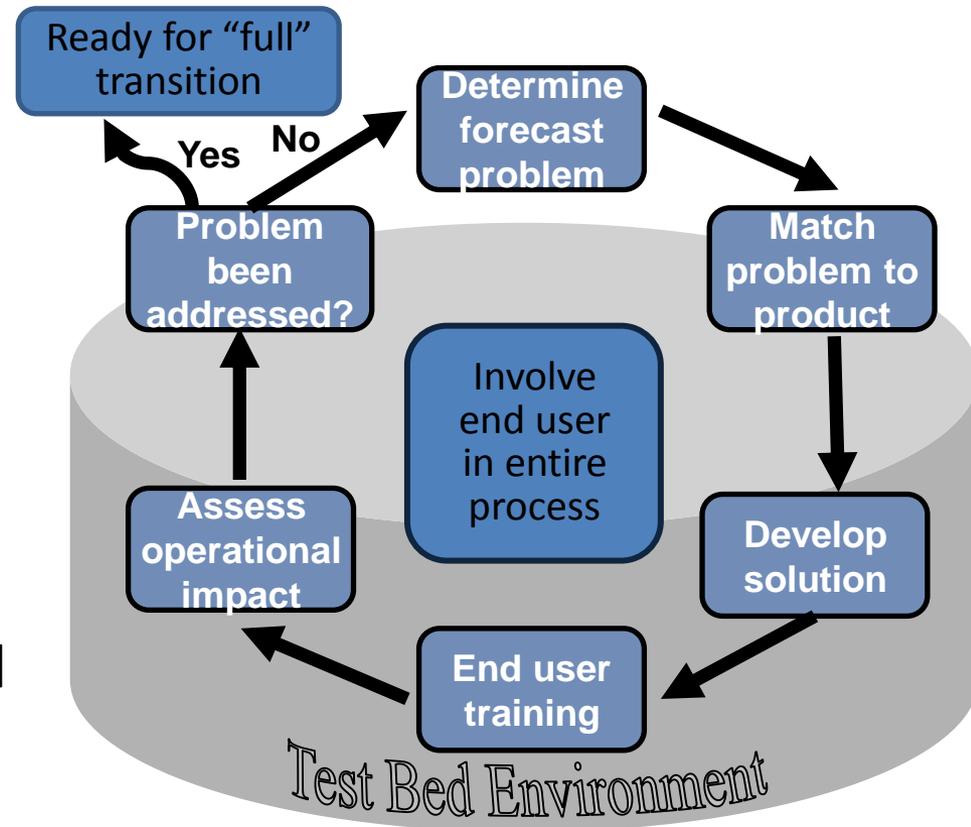
Modeling

What is available?

- Finite resources limit model resolution
- Skill assessment of model predictions
- Downscaling approaches

Connections to SPORT & ESO

- SPORT has an established approach to address R2O and make use of NASA capabilities
- SPORT has experience in RCM development and downscaling strategies
- SERVIR has strong connections to the NASA Applied Sciences Program and connection with end users who want seasonal forecast information.
- NOAA Climate Test Bed



NASA Downscaling Experiment

- Evaluate the utility of RCM dynamical downscaling of climate projections

Northeast Wintertime Storms (NESs)

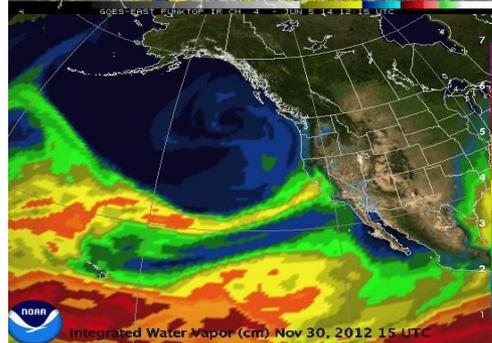
- Extreme precipitation/snowfall events
- Extreme wind events

Midcontinent Summertime MCSs

- Warm / Dry Climate Model Biases
- Extreme weather events

West Coast Wintertime Atmospheric Rivers (ARs)

- Crucial for water resources/availability ~40%
- Associated with most flooding events



Predictions for Application

- Seasonal climate forecasts offer the opportunity to impact decision-making activities across multiple sectors

- Water Resources
- Agriculture & Ecosystem
- Public Health (e.g. CDC BRACE)
- Energy (Supply and Demand)
- (Re)Insurance & Commodities

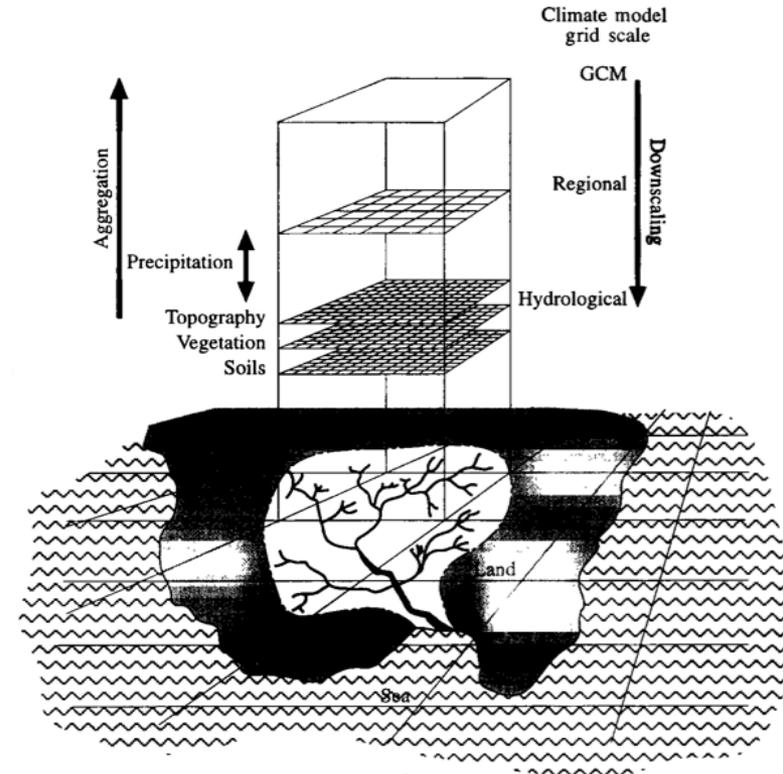
- Both public and commercial interests

- Several federal agencies are involved in efforts to make use of climate data, including seasonal guidance
 - Presidential Climate Data Initiative; NOAA CPC; DOI Climate Science Centers
- NASA Applied Science Program: “Climate” as a future program
 - ROSES A.45 Water Resources Call: 30-180 day outlook specifically targeted



(Backup) Climate Models vs. End-Users

- Seasonal prediction made using GCMs are performed at coarse scales ($1^{\circ} \times 1^{\circ}$)
- Impact modeling and decision making activities occur at much finer resolution (5km or higher)
- Two basic approaches are used to bridge this gap
 - Statistical downscaling
 - Dynamical Downscaling
- Both approaches have pros and cons
 - Increases uncertainty of seasonal forecast utility



*From Wilby and Wigley (1997)
Illustration of the multiple scales
involved in the prediction and decision
making process.*