Next Generation Earth System Prediction

Strategies for Subseasonal to Seasonal Forecasts

Recommendations on the Role of Forecast Users

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Workshop on Metrics, Post-Processing, and Products for S2S

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“There is, I think, nothing in the world more futile than the attempt to find out how a task should be done when one has not yet decided what the task is.”

Alexander Meiklejohn, 1872-1964

Answering a decision maker’s specific question may be much easier and more reliable than predicting the state of the earth system at 15 months.

TABLE 3.1 Example Decisions from a Range of Sectors That Can Be Informed by S2S and Longer Forecasts

Sector	Decision Process	Weeks-Months	Seasonal-Annual	Longer-Term
Water Resources Management (see case study for more detail)	Water supply management (including flood control and drought)	Probability of heavy rainfall or runoff; probability of unusually high demand (precipitation; temperature; snowpack; runoff; likelihood of atmospheric river events)	Allocation of water supply; water transfer requests; assuring minimum flows for endangered species (accumulation of winter snowpack; timing of seasonal snowmelt; summer water demands; precipitation; temperature; snowfall; evapotranspiration)	Storage capacity and sources; conservation programs (changes in mean annual temperatures, precipitation, snowfall accumulation, runoff, evapotranspiration)
	Hydropower scheduling	Available water supply in reservoirs; anticipated demand (lake levels; stream flow; evaporation; temperatures for demand estimates)	Probability of reaching target elevation levels in reservoir (snowmelt/inflow; evaporative loss)	Changes in demand and supply (changes in mean seasonal and annual temperature across basin and service area; changes in snowmelt patterns; changes in precipitation; changes in evapotranspiration)

Table 3.1 Example decisions from a range of sectors that can be informed by S2S and longer forecasts. Variables needed to make these decisions are shown in parenthesis. The examples are based upon presentations to the Committee, examples of use solicited from the State Climatologists and other climate services providers, and from published research.

Report on Next Generation Earth System Prediction

- Strategy 1: Engage the users in the Process of Developing S2S Forecast Products
  - Develop a body of social science research that leads to a more comprehensive and systematic understanding of the use and barriers to use of seasonal and subseasonal Earth system predictions.
  - Establish and ongoing and iterative process in which stakeholders, social and behavioral scientists, and physical scientists co-design S2S forecast products, **verification metrics**, and decision-making tools.

Key Findings

3.3 Decision makers generally express a need for a wider range of skillful model and forecast variables – particularly information about the likelihood of disruptive or extreme events – that are valid at finer spatial and temporal scales to inform management practices.

3.5 Assessing tolerance for uncertainty and developing user-oriented verification metrics are important to building confidence in the use of forecasts among decision makers. At the S2S timescales this aspect has been generally under-developed.

3.6-3.9 (Paraphrased) We must understand the decision making process better and provide better explanation of the reliability and usability of forecast products in order to successfully meet the needs of decision makers at extended time scales.

User Issues

- Parameters, multi-variate (heat and RH)
- Frequency of output (Does averaging eliminate detection of likely disruptive events)
- Availability & comprehension
- Reliability
- Thresholds (many users are sensitive to specific thresholds which may be a cutoff or a combination of value and time)
- Extremes
- Onset/End
- Magnitude
- Duration (freezing temps for one night or six days)
- Location (Pacific NW or specific watershed?)

Take Aways

- “Above normal” is not: exceed reservoir capacity, plant two weeks early, a devastating storm or a killing heat wave – but it could be!
- Barriers to use:
  - Poor fit (reliability, temporal/spatial scale, lead time, parameters)
  - Contextual (Trust, inflexible operations, market fluctuations, lack of resources)
  - Lack of awareness, understanding
- Need user involvement in developing products that are: comprehensible, reliable, support decision making, and verifiable.