

IPET-OPSLS Perspective on Research Needs

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Long-range forecast research needs

- Some components of Long-range forecasts
 - Operational forecast system infrastructure/configuration
 - Product generation
 - Verification
- Some thoughts on linking operations and research

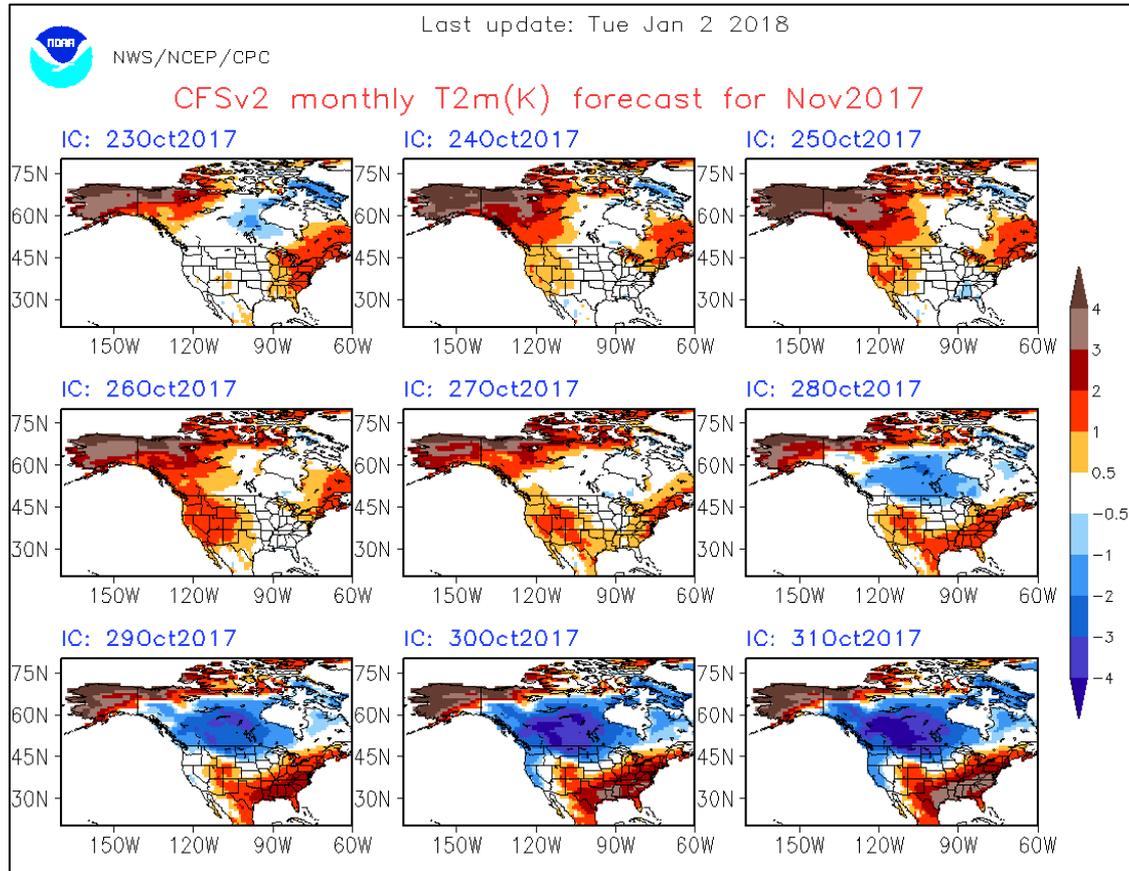
Configuration of forecast systems

- Initialization
- Ensemble generation
- Hindcasts configuration
 - Hindcast frequency
 - Hindcast period
 - Hindcast ensemble
- Real-time forecast configuration

Configuration of forecast systems: Some research questions

- Relative merits of burst vs. lagged ensembles for developing forecast products
 - Representing forecast uncertainty and consistency
 - Capturing regime transitions
- In the context of LRF, for which component of Earth System, techniques for ensemble generation are important?
- Given finite computing resources, which configuration aspects are more important to devote resources to? The trade space includes – hindcast length, ensemble size, resolution etc.
- Observational requirements (for different components of Earth System)

Variations in ensemble mean forecast

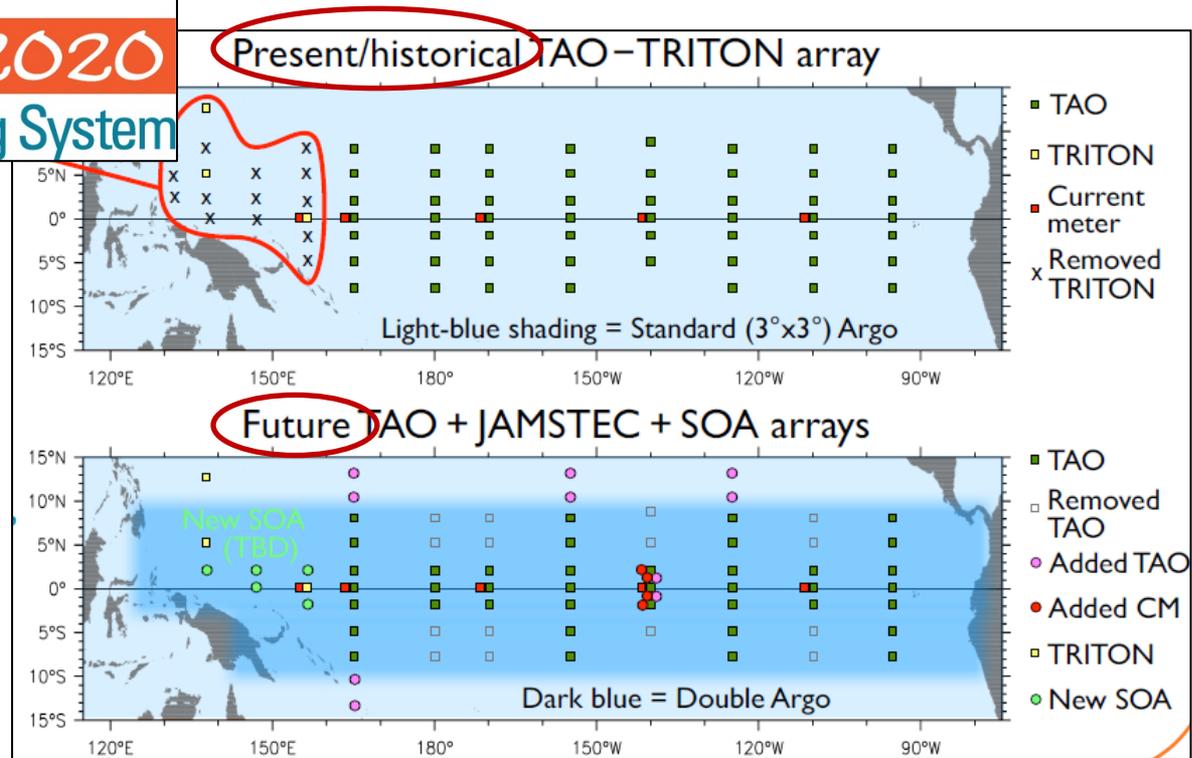


- Monthly mean forecasts from initial conditions one day apart
- 16-member ensemble
- Large changes in forecast for a fixed target month

Evolution of observing system and LRF requirements



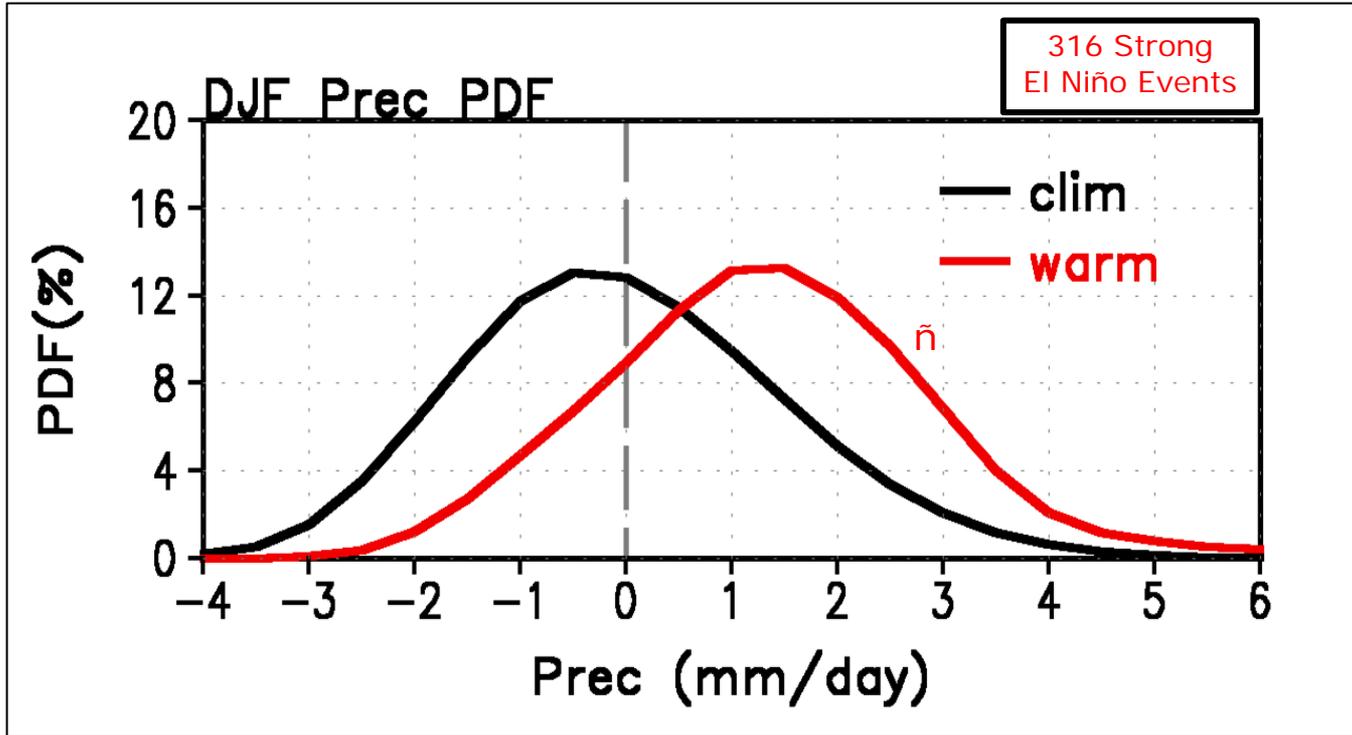
Observing system evolution



Product generation: Some research Issues

- What is optimal lagged ensemble?
- Equal vs. skill weighted averaged multi-model ensemble; which is better?
- What is the value of (dynamical) downscaling?
- Is there a spread-skill relationship?
- What is the feasibility (merits) of forecasts for alternate variables?

Distribution of seasonal mean rainfall over California:
Climatological (black); El Niño (red)

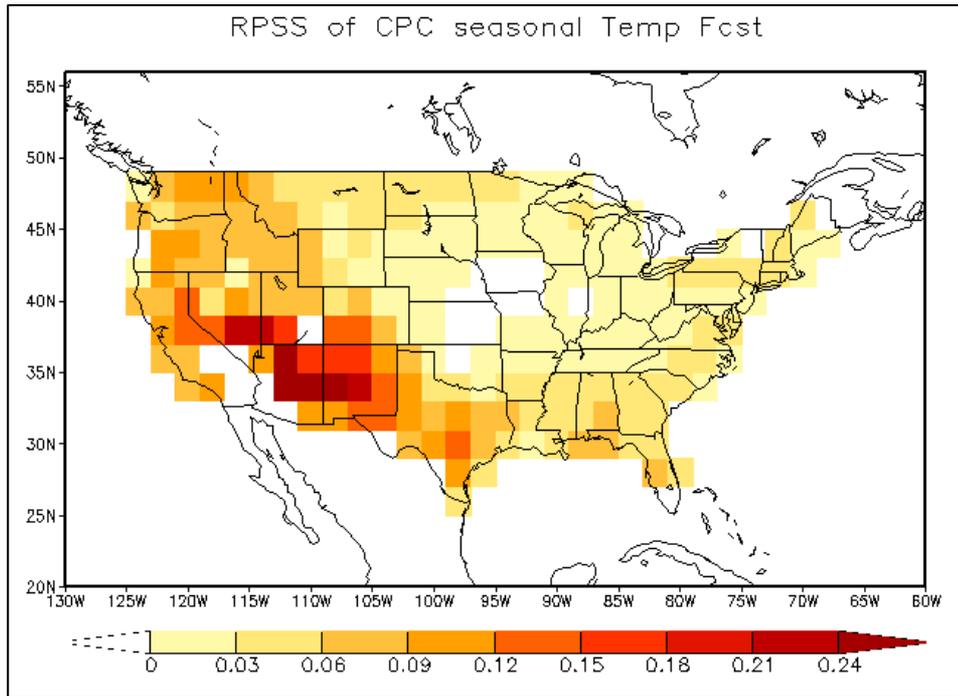


- How does the spread (forecast uncertainty) changes from event-to-event

Forecast Verification: Some research questions

- How to quantify progress in long-range forecast systems?
- Can we quantify unconditional skill?
- Do we need to use different verification measures for forecasts on different time-scales?

Skill (RPSS) of CPC's seasonal mean surface temperature forecast over last 20-years



- Skill is over all years and events (unconditional skill)
- Skill information is conveyed to the users
- How does it change during different El Niño events? (conditional skill)

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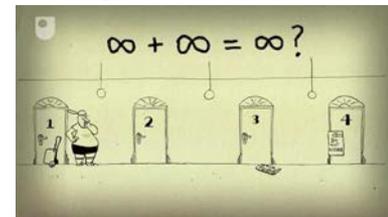
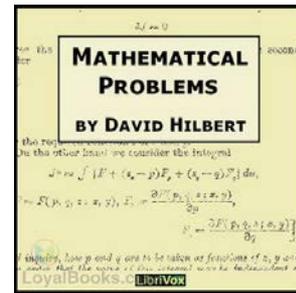
Linking operations and research

- It is a challenging task!
- Some requirements in building meaningful partnerships
 - Understand differences (pace, reward mechanisms,...)
 - Build communication
 - Learn the flow of innovation (how to transition into operations and what are operational constraints)



Thoughts on path forward (1)

- Identify what **enabling mechanism** would be required to develop tangible interaction between operations and research (e.g., providing hindcast/forecast data bases).
- Develop community papers that outline some of the **outstanding problems** to draw younger generation of students and scientists and can guide funding agencies in setting their budget priorities.



Thoughts on path forward (2)

- Develop some joint demonstration project that can be tracked.
- Even if there may not be definitive answers to some of the questions, jointly develop position papers, that to the extent possible, can guide best practices in operations.
- That something is now operational, does not mean that a range of practical issues no longer exist.

Thank you