NCAR

S2S Verification approaches: The challenge to provide meaningful information

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

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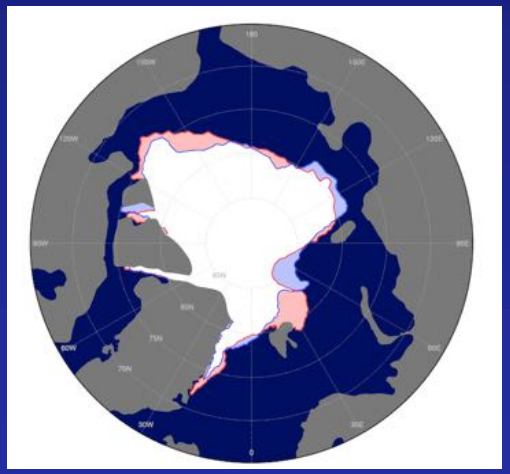
Topics

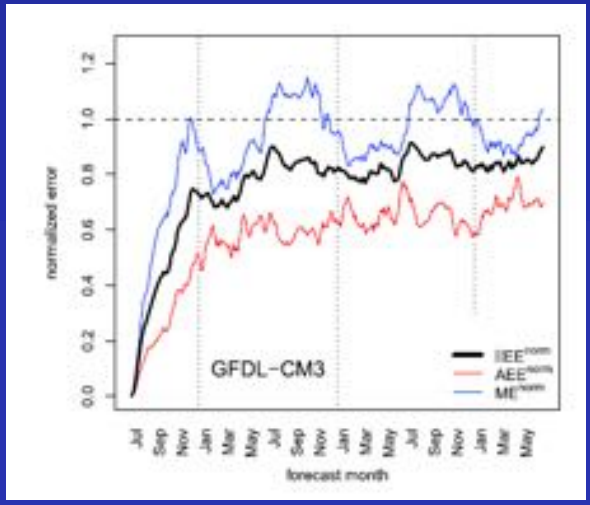
- Matching verification methods to users' needs for information (i.e., depending on the goal of the forecast and the verification);
- WMO S2S Verification Team
  - S2S verification method recommendations
- Diagnostic and user-relevant methods
  - Spatial verification examples

User-relevant verification concept

- *Premise*: Verification information should be relevant to answer users' questions about forecast performance
- Examples
  - Reliability
  - Ability to estimate extremes
  - Identify rapid changes
  - Variable-specific metrics

Example: Integrated Ice Edge Error (Gossling et al. 2016)





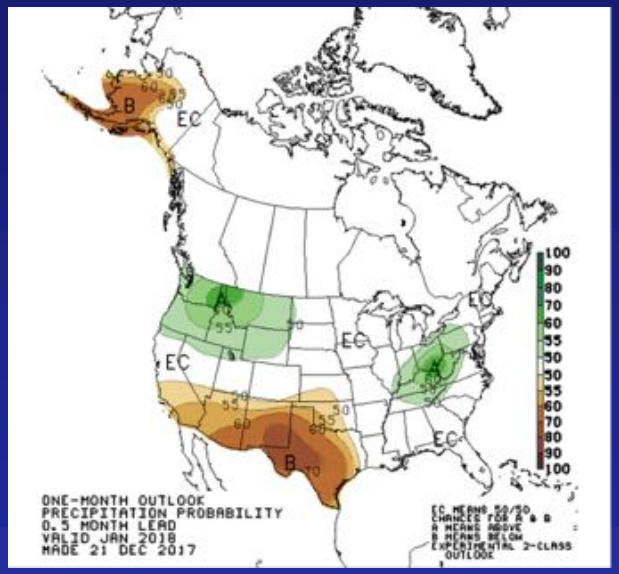
WMO/WWRP/WCRP: S2S Verification recommendations

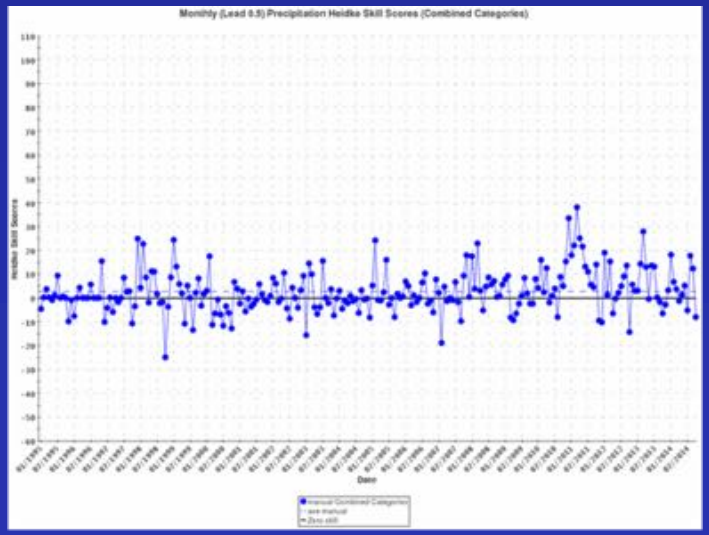
- Development of user-relevant metrics, thresholds, etc.
  - Identify relevant variables (e.g., rainfall phases) as well as procedures – beyond standard "average" events
  - Phase space methods (e.g., for MJO)
- Implement S2S framework for evaluating real-time and retrospective forecast skill
- Conditional verification (e.g., by ENSO, MJO)
- Appropriate measures for extremes and discrimination
- Spatial methods
- Account for sampling uncertainty

From book in preparation: *The Gap between Weather and Climate Forecasting: Sub-seasonal to Seasonal Prediction*; Chapter on "Forecast Verification for S2S Time Scales" (Coelho, Brown, Wilson, Mittermaier, and Casati)

Spatial verification approach(es)

- Some key questions for evaluation of S2S and climate models:
  - How well does a model
  - … reproduce S2S/climate characteristics?
  - … represent spatial and temporal variations?
  - … identify good and bad aspects of predictions?
- Goal: Expand climate/S2S model evaluation "toolkit" to include spatial methods currently being applied for weather predictions

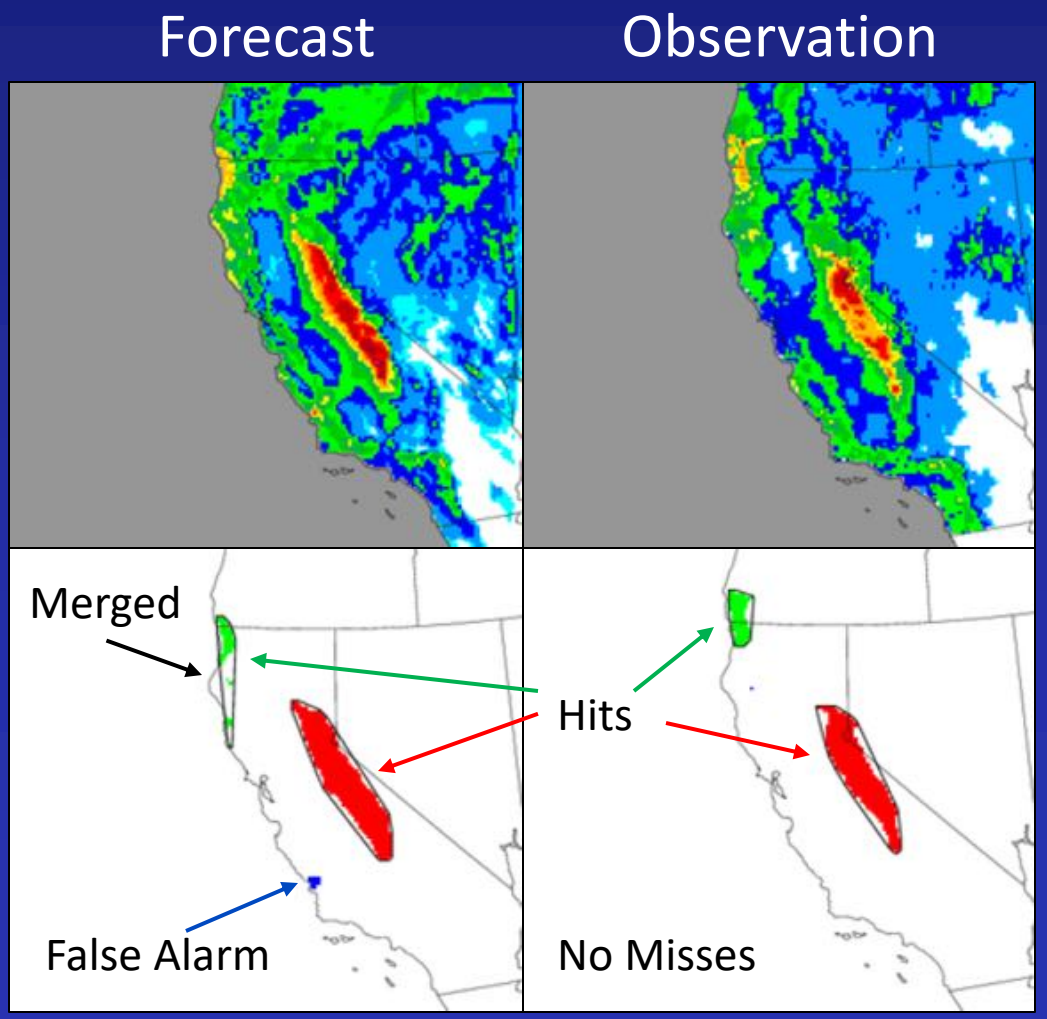




Object Based Evaluation

MODE: Method for Object-based Diagnostic Evaluation

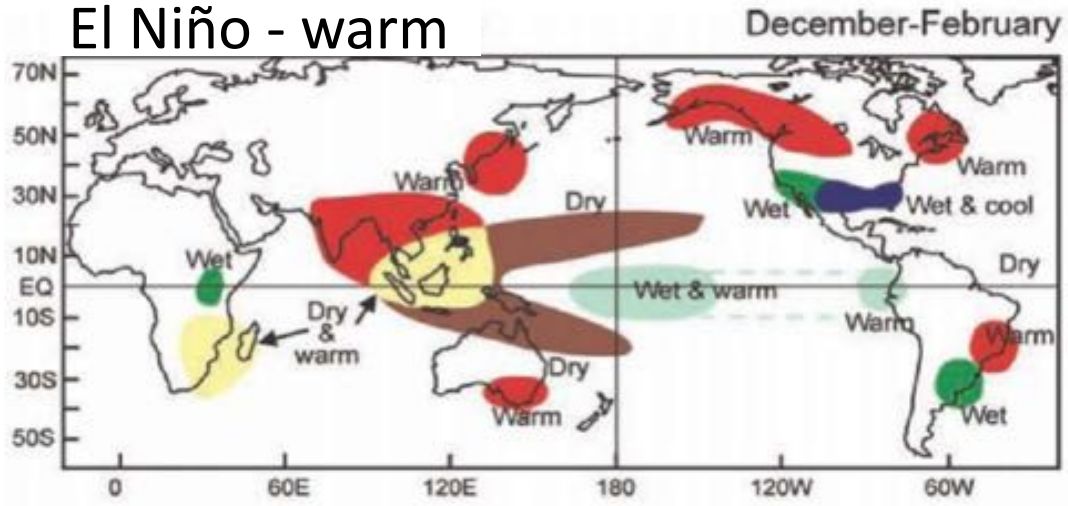
- Identify objects using smoothing/threshold
- Merge/Match using fuzzy logic
- Object attributes
  - Size, orientation, intensity distribution, location
- Matched pairs
  - Differences in centroid, size, orientation



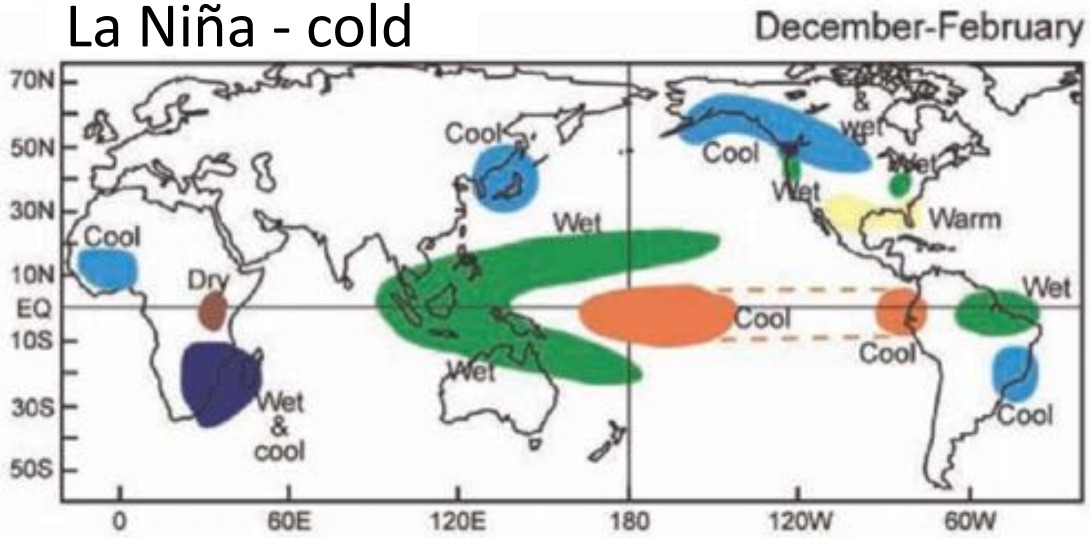
MODE is available in the Model Evaluation Tools verification package

ENSO Variability and Teleconnections

El Niño - warm

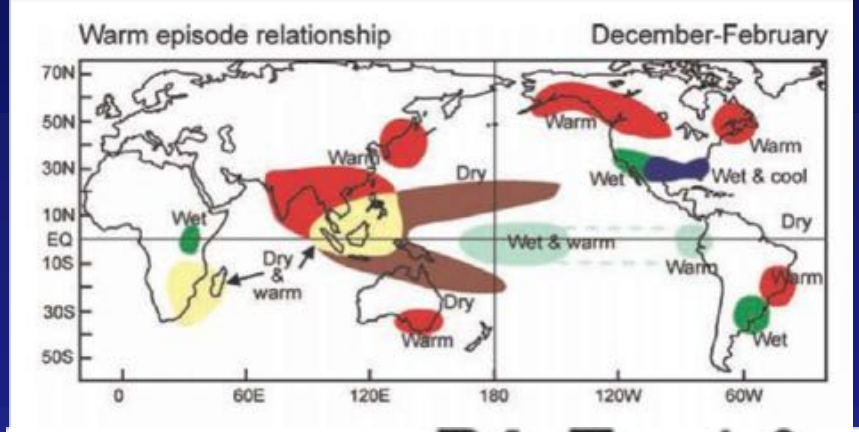


La Niña - cold



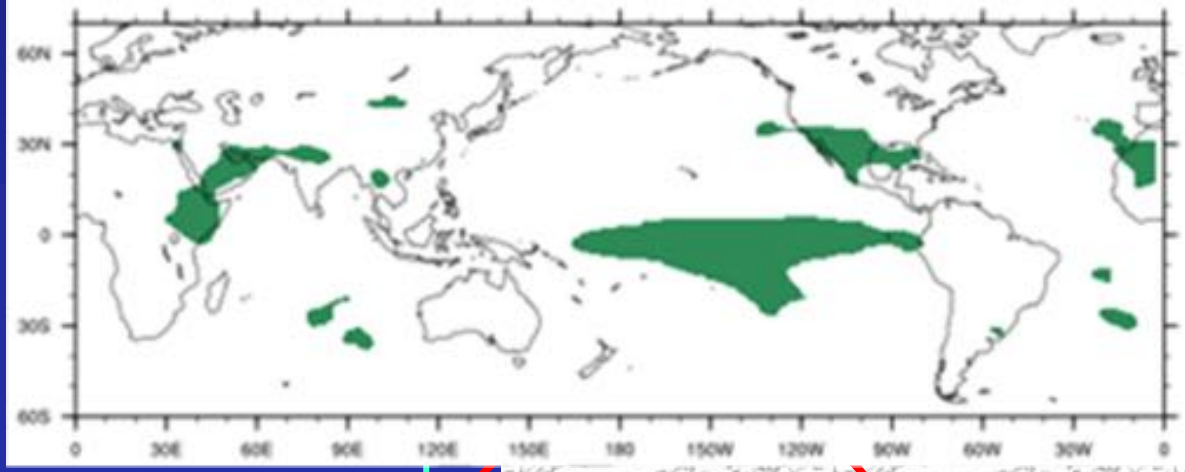
- Can we replicate with model and observations?
- How well do they compare?
- Temperature and precipitation anomalies
  - 1979 - 2015

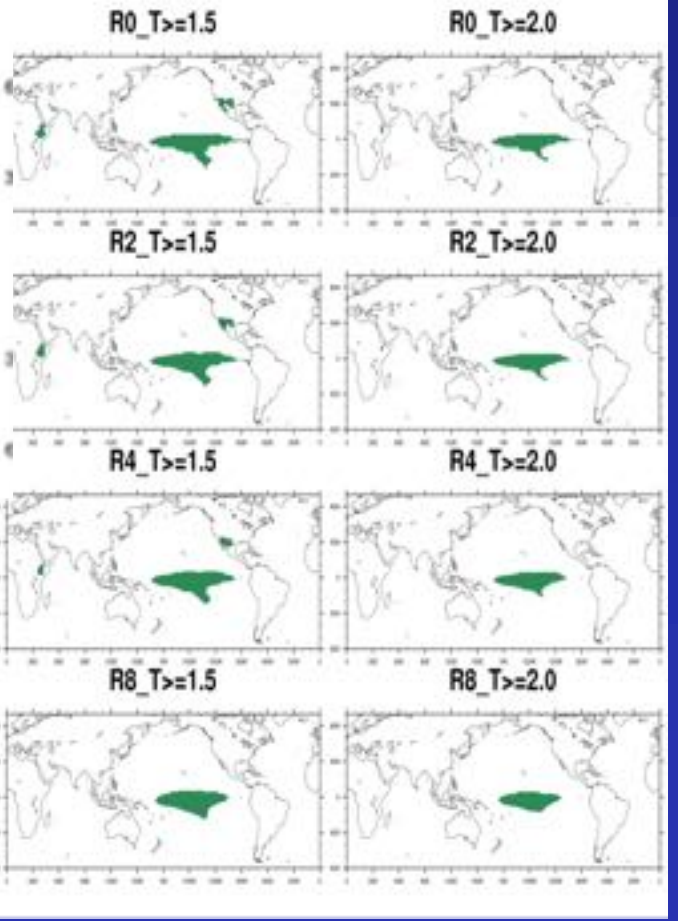
Positive (wet) EN precip anomalies (GPCP)



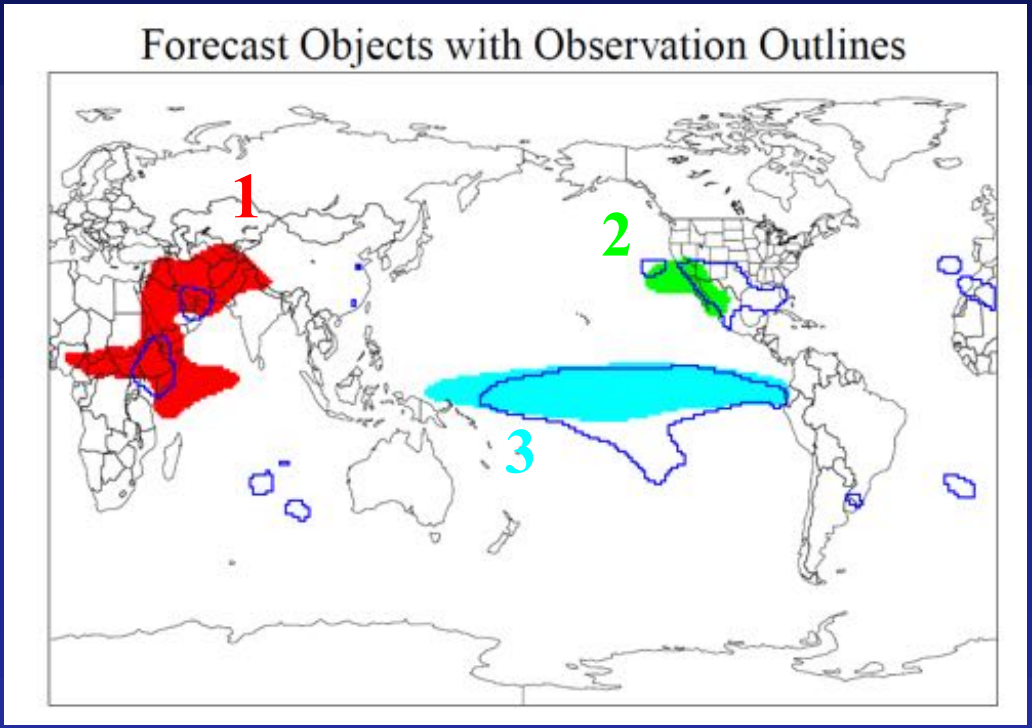
Incr Thresh →

R4_T>=1.0





Object Comparisons (EN Wet anomalies)



Attribute	Cluster 1		Cluster 2		Cluster 3	
	Fcst	Obs	Fcst	Obs	Fcst	Obs
Area	1269	237	242	333	1405	1498
Median intensity	1.6	1.5	1.2	1.4	3.0	2.2
0.90th intensity	3.0	2.0	1.4	1.9	5.0	4.9
Area ratio (F/O)	5.4		0.73		0.94	
Centroid difference	6.3		10.1		7.7	

Conclusions/Recommendations

- Considering *user-relevant* and *diagnostic* verification information is fundamental to developing meaningful forecasts for users
- Diagnostic and spatial methods provide *useful quantitative information* for climate and seasonal/subseasonal model evaluation
- Tools and experience already exist for these applications and have been applied to S2S forecasts
  - Making these tools (and relevant data) easily available to the community is critical to reach common goals

Questions?

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