Subseasonal-to-Seasonal (S2S) Prediction Projects
Associated with a New NOAA Task Force

Heather Archambault, Dan Barrie, Annarita Mariotti

Modeling, Analysis, Predictions, and Projections Program

US-CLIVAR PPAI Panel Meeting
Washington, DC
July 26, 2016
Mission
To enhance the Nation’s and NOAA’s capability to understand, predict, and project variability and long-term changes in Earth’s climate system.

- Supports research, transition to applications and engagement activities focused on coupling, integration, and application of Earth system models and analyses

- Works across NOAA, among USGCRP, CLIVAR, and ESPC partner agencies, and with external research community to extend NOAA’s research capabilities
MAPP Focus Areas

- Prediction – Weeks to Decades
- Climate Reanalysis
- Climate and Earth System Modeling
- Drought and Other Applications
- Climate Projections

- MAPP supports these research areas via cycling annual grant competitions open to all
A Task Force: a coordinated research effort by MAPP investigators over a three-year period, coincident with duration of the individual MAPP grants.
Some Key Events Leading to MAPP’s S2S Prediction Initiative

**2010:** National Academy of Sciences publishes NOAA-sponsored report on intraseasonal to interannual prediction and predictability

**2012:** World Meteorological Organization Executive Council approves WWRP/WCRP S2S Prediction Project
2014: Obama Administration announces a NOAA-led coordinated U.S. effort to develop extreme-weather outlooks in Weeks 3-4 time range

2015: S2S Prediction Project portal goes live

Tools to Support CPC’s Experimental Week 3–4 Outlooks

PIs: Nat Johnson and Shang Ping Xie
CPC Investigators: Michelle L'Heureux and Steven Baxter

El Niño and MJO Phase 7, January

Generates probabilistic forecasts by leveraging information about current states of ENSO and Madden-Julian Oscillation (and for temperature, trend information)
1. Understand how to improve prediction systems’ representation of S2S predictability sources
   → Focuses on exploratory research

   **Goal:** Advance NOAA’s S2S prediction capabilities in the **medium-term**

2. Test prediction tools via Climate Test Bed
   → Focuses on transition (R2O)

   **Goal:** Advance NOAA’s S2S prediction capabilities in the **short-term**

**This two-pronged initiative will**
- Complement S2S Prediction Project activities
- Be a substantial NOAA contribution to USGCRP and ESPC interagency goals
14 new CTB projects that include projects to
  ○ Test experimental subseasonal prediction systems (SubX; Subseasonal Prediction Experiment)
  ○ Advance statistical techniques for prediction of tropical–midlatitude teleconnections

Funding partners:
  • NOAA National Weather Service – Science and Technology Integration Program
  • NOAA National Environmental Satellite, Data, and Information Service
  • Department of Defense Office of Naval Research
  • NASA Modeling, Analysis, and Predictions Program

Program Manager: Dan Barrie
FY16 Competition: Research to Advance Prediction of S2S Phenomena

- 14 multi-year projects to examine how prediction of S2S phenomena and interactions (i.e., sources of predictability) are influenced by prediction system setup
- Contribute to a broad, coordinated research effort via a new S2S Prediction Task Force

**Partner:** NOAA National Weather Service – Science and Technology Integration Program

**Program Manager:** Heather Archambault

[Map image with caption: Total precipitable water loop for March 11–14, 2016]

[Link to data: http://tropic.ssec.wisc.edu/real-time/mimic-tpw/global/main.html]
## New S2S Prediction Projects and Task Force PIs
(ordered alphabetically by PI last name)

<table>
<thead>
<tr>
<th>Project</th>
<th>PIs</th>
<th>Institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Forecasting North Pacific Blocking and Atmospheric River Probabilities: Sensitivity to Model Physics and the MJO</td>
<td>Elizabeth Barnes and Eric Maloney</td>
<td>Colorado State University</td>
</tr>
<tr>
<td>2) The Relationship of Tropical Cyclones to MJO and ENSO in the S2S Database</td>
<td>Suzana Camargo, Adam Sobel, Chia-Ying Lee, Frédéric Vitart</td>
<td>Lamont-Doherty Earth Observatory, Columbia University, IRI, ECMWF</td>
</tr>
<tr>
<td>3) Understanding the Sources of Subseasonal Predictability of Extratropical Cyclone Activity and Improving Their Representation in Forecast Systems</td>
<td>Edmund Chang, Minghua Zhang, Hyemi Kim, Wanqiu Wang</td>
<td>Stony Brook University, NOAA NCEP Climate Prediction Center</td>
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*Some awards may be pending acceptance by recipient institute*
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<td>4) Collaborative Research: Assessing Oceanic Predictability Sources for MJO Propagation</td>
<td>Charlotte DeMott and Nicholas Klingaman</td>
<td>Colorado State University, University of Reading, UK</td>
</tr>
<tr>
<td>5) North American Heat Wave Predictability: Assessing the Role of Land Surface Initialization on S2S and NMME Model Forecasts</td>
<td>Trent Ford and Paul Dirmeyer</td>
<td>Southern Illinois University, COLA/George Mason University</td>
</tr>
<tr>
<td>6) Investigating the Underlying Mechanisms and Predictability of the MJO-NAM Linkage in the NMME Phase 2 Models</td>
<td>Jason Furtado, Michelle L’Heureux, Adam Allgood, Elizabeth Barnes</td>
<td>University of Oklahoma, NOAA/NCEP Climate Prediction Center, Colorado State University</td>
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<td>7) Improving Subseasonal to Seasonal Forecast Skill of North American Precipitation and Surface air Temperature using Multi-Model Strategy</td>
<td>Zhichang Guo and Paul Dirmeyer</td>
<td>COLA/George Mason University</td>
</tr>
<tr>
<td>8) Prediction, Sensitivity, and Dynamics of Subseasonal To Seasonal Phenomena Diagnosed Through Linear Inverse Models, Their Adjoints, and Numerical Weather Prediction Models</td>
<td>Brett Hoover, Matt Newman, Dan Vimont, Michael Morgan</td>
<td>CIMSS, University of Wisconsin - Madison, NOAA ESRL/Physical Sciences Division</td>
</tr>
<tr>
<td>9) Exploring Pathways to Improve MJO Predictions</td>
<td>Arun Kumar, Wanqiu Wang, Jieshun Zhu</td>
<td>NOAA/NCEP Climate Program Office</td>
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<td>10) A Categorical Assessment of Forecast Skill, Uncertainty and Biases in Extended-Range Ensemble Forecasts of Stratospheric Regime Changes</td>
<td>Andrea Lang</td>
<td>University at Albany</td>
</tr>
<tr>
<td>11) Role of Stratospheric Processes in Predicting ENSO-NAO Connections on Subseasonal Time Scale</td>
<td>Judith Perlwitz, Jadwiga Richter, Lantao Sun, Julio Bacmeister, Joseph Tribbia</td>
<td>CIRES/University of Colorado, and NOAA/ESRL/PSD, NCAR</td>
</tr>
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<td>12) Investigation of the Effects of Oceanic Mesoscale Eddies on the Midlatitude Storm Tracks and Their Predictability</td>
<td>Istvan Szunyogh</td>
<td>Texas A&amp;M University</td>
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<td>13) Madden Julian Oscillation - the Maritime Continent Barrier and Seamless Verification</td>
<td>Shuguang Wang, Adam Sobel, Michael Tippett</td>
<td>Columbia University, Lamont–Doherty Earth Observatory</td>
</tr>
<tr>
<td>14) Variability of Rossby Wave Breaking and its Impacts on the Large-scale Circulation and Extreme Weather: Implications for S2S Prediction and Predictability</td>
<td>Zhou Wang, Melinda Peng, Stan Benjamin</td>
<td>University of Illinois at Urbana-Champaign, Naval Research Lab, NOAA/ESRL Global Systems Division</td>
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- Projects cover a variety of S2S phenomena:
  - MJO, tropical-extratropical teleconnections, Rossby wave breaking & blocking, S2S modulation of tropical cyclone activity, extratropical storm tracks, land-atmosphere feedbacks, and tropospheric-stratospheric interactions.

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Summary

• New MAPP initiative (S2S Prediction Task Force including SubX) aims to help close weather–climate prediction gap

• These activities are consistent with overall thrust of recent National Academy of Sciences reports and several specific recommendations therein

• The new MAPP PIs will form an S2S Prediction Task Force to examine how model setup influences prediction of S2S phenomena and links to extremes, and to test experimental subseasonal prediction systems

• S2S Prediction Task Force will coordinate MAPP-funded S2S projects and connect activities with community-wide efforts