Next Generation Earth System Prediction:

Strategies for Subseasonal to Seasonal Forecasts

Presented by
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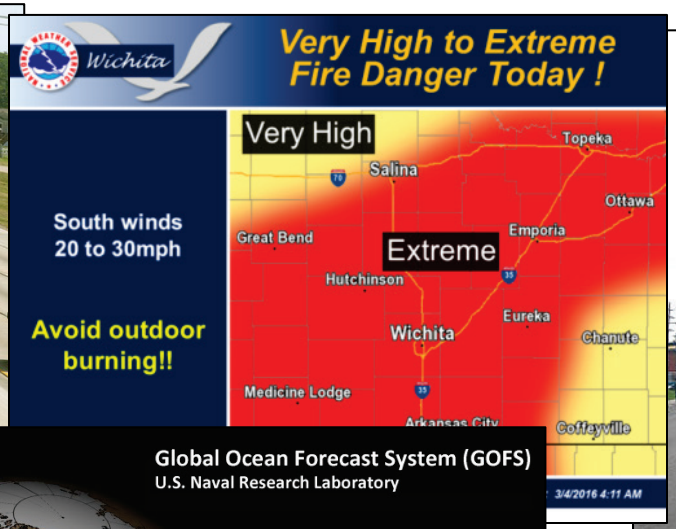
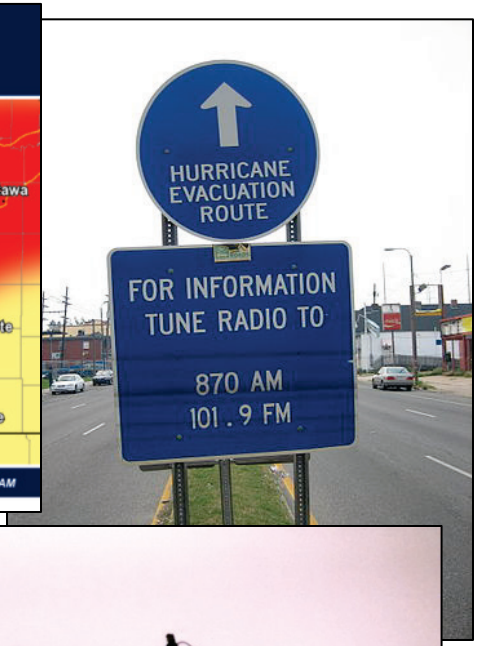
On Behalf of the S2S Study Committee

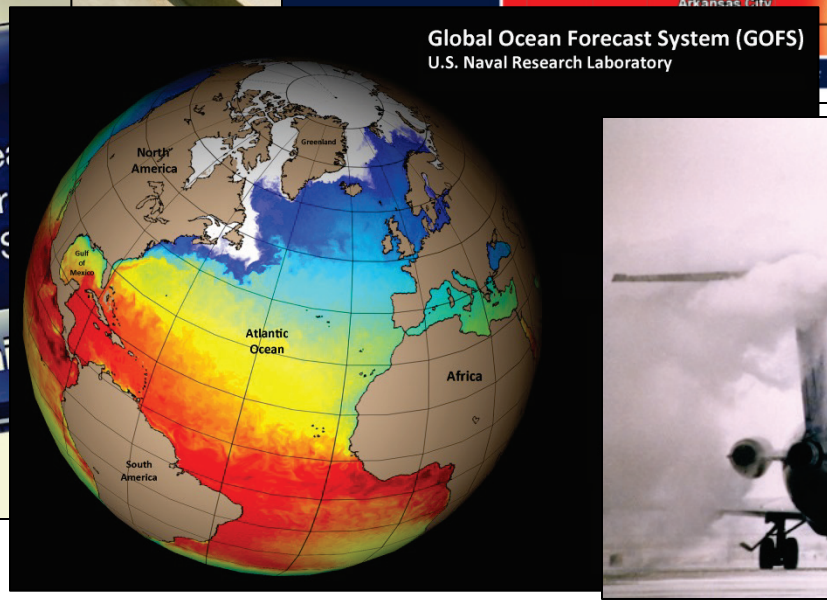
The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Weather, Water, and Climate Forecasts are Vital to Decision Making

Businesses Governments Individuals







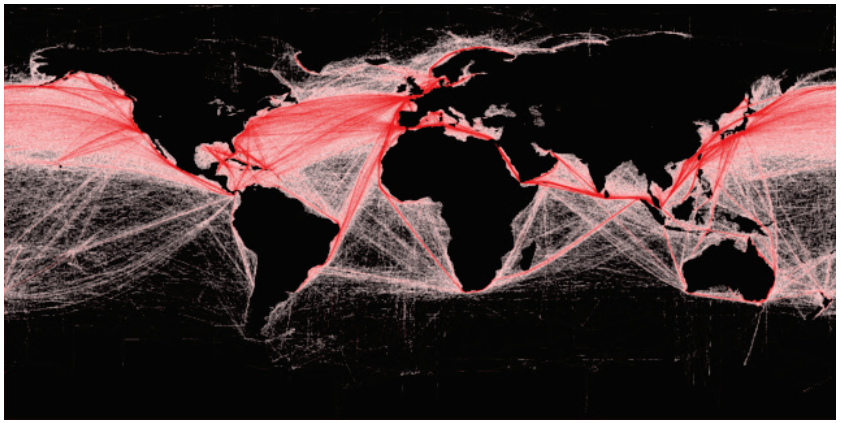
Forecast Timescales

- Weather 0-14 Days
- **Subseasonal 2-12 Weeks**
- **Seasonal 3-12 Months**
- Interannual 1 year - Decade
- Climate Decades - Centuries

Subseasonal to Seasonal (S2S)
2 weeks -12 months

What if Longer-Range Forecasts Were More Skillful and Widely Used?

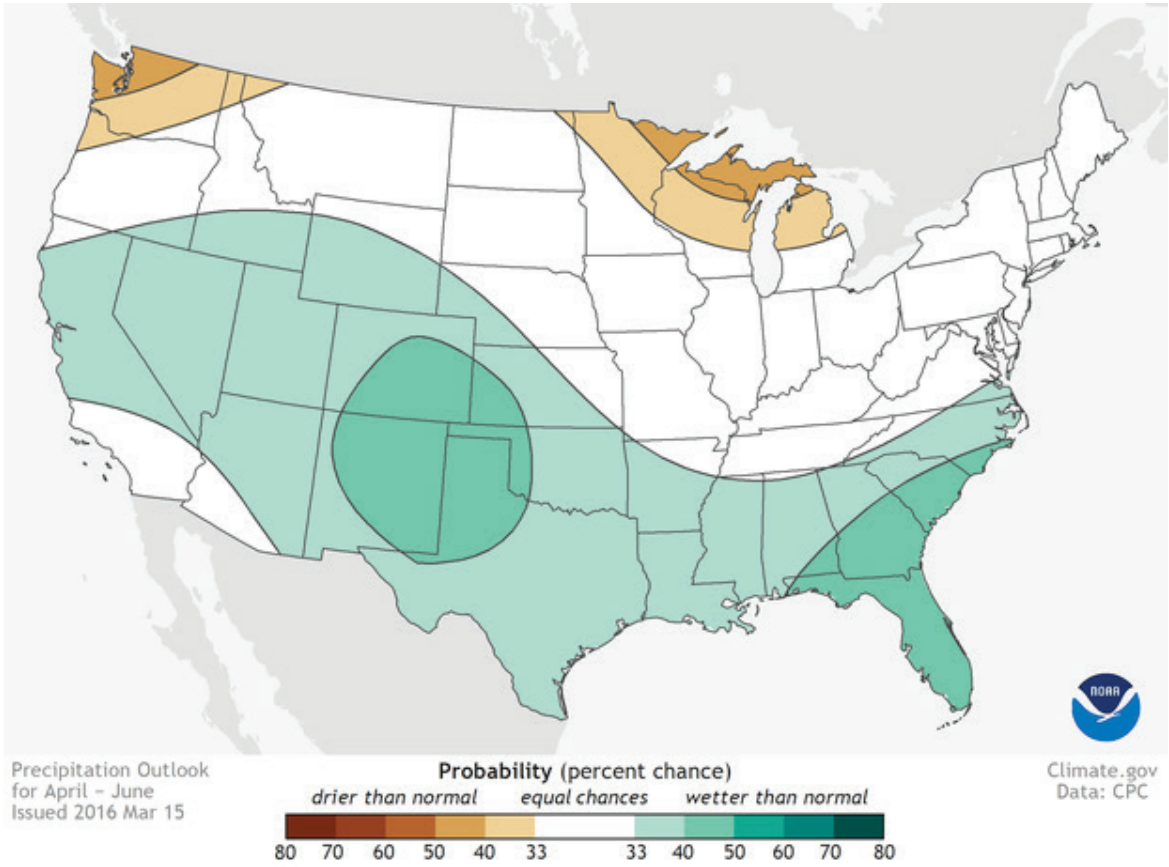
- Many decisions must be made in the space between weather forecasts and climate projections
- Improving S2S forecasts would benefit many sectors of society
- Will improve planning and preparation to help save lives, protect property, increase economic vitality



Current State of S2S Forecasting

- S2S forecasts are increasingly used in agriculture, energy, and water resource management—but more engagement with users in other sectors will increase use

Precipitation Outlook for April–June 2016
Issued March 15, 2016



Current State of S2S Forecasting

- Scientific knowledge gap, gaps in observations and modeling, and limited computational capacity currently limit accuracy of S2S forecasts

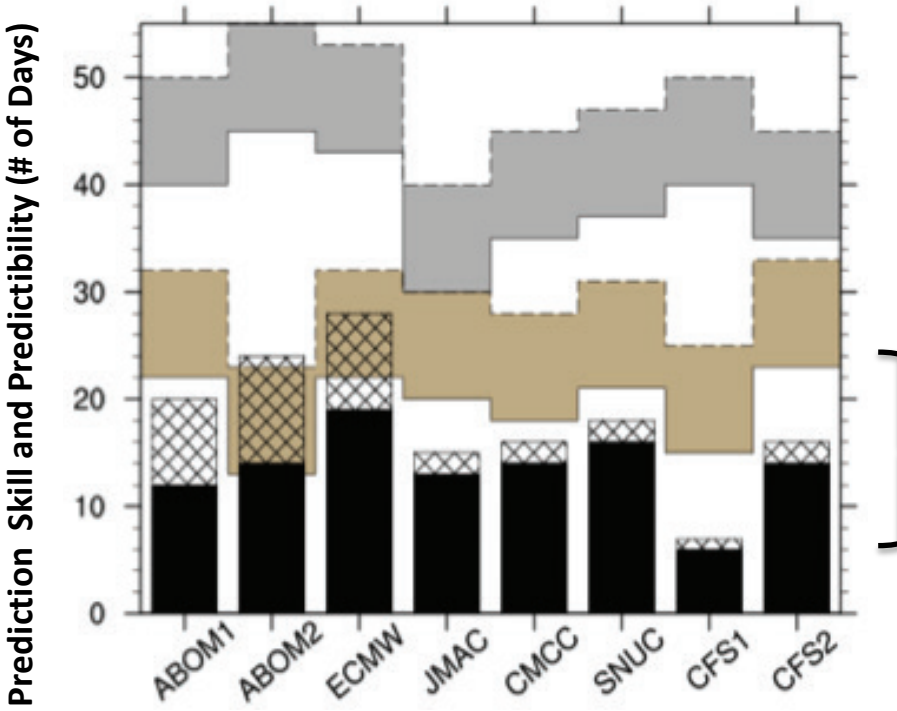


Figure 4.2
Neena et al., J. Climate, 2014

Why This Study?

- Sponsored by Office of Naval Research, Heising-Simons Foundation, NASA, and NAS Arthur L. Day Fund

Task:

- To describe a strategy to increase the nation's capacity for S2S forecasting
- To develop a 10 year scientific research agenda to accelerate progress

Committee Roster

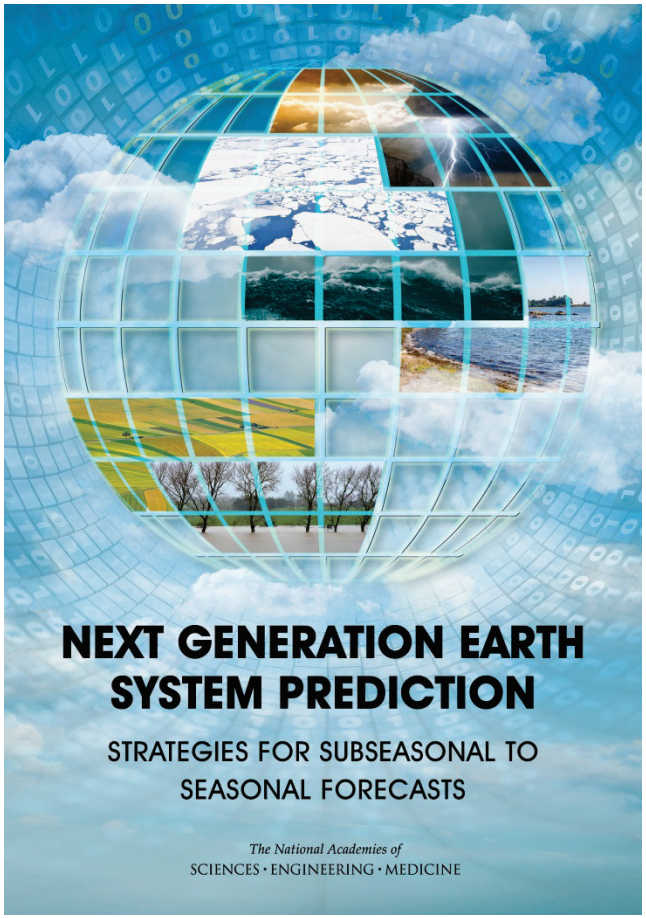
- **Raymond J. Ban (Chair),** Ban and Associates, LLC
- **Cecilia Bitz,** University of Washington
- **Andy Brown,** UK Met Office
- **Eric Chassignet,** Florida State University
- **John A. Dutton,** Prescient Weather, Ltd.
- **Robert Hallberg**, NOAA Geophysical Fluid Dynamics Laboratory
- **Anke Kamrath**, National Center for Atmospheric Research
- **Daryl Kleist,** University of Maryland, College Park
- **Pierre F.J. Lermusiaux,** Massachusetts Institute of Technology
- **Hai Lin,** Environment Canada
- **Laura Myers,** University of Alabama
- **Julie Pullen,** Stevens Institute of Technology
- **Scott Sandgathe,** University of Washington
- **Mark Shafer,** The University of Oklahoma
- **Duane Waliser,** Jet Propulsion Laboratory
- **Chidong Zhang,** University of Miami

Committee held five in-person meetings, spoke with dozens of researchers and users
Report reviewed by 12 outside experts

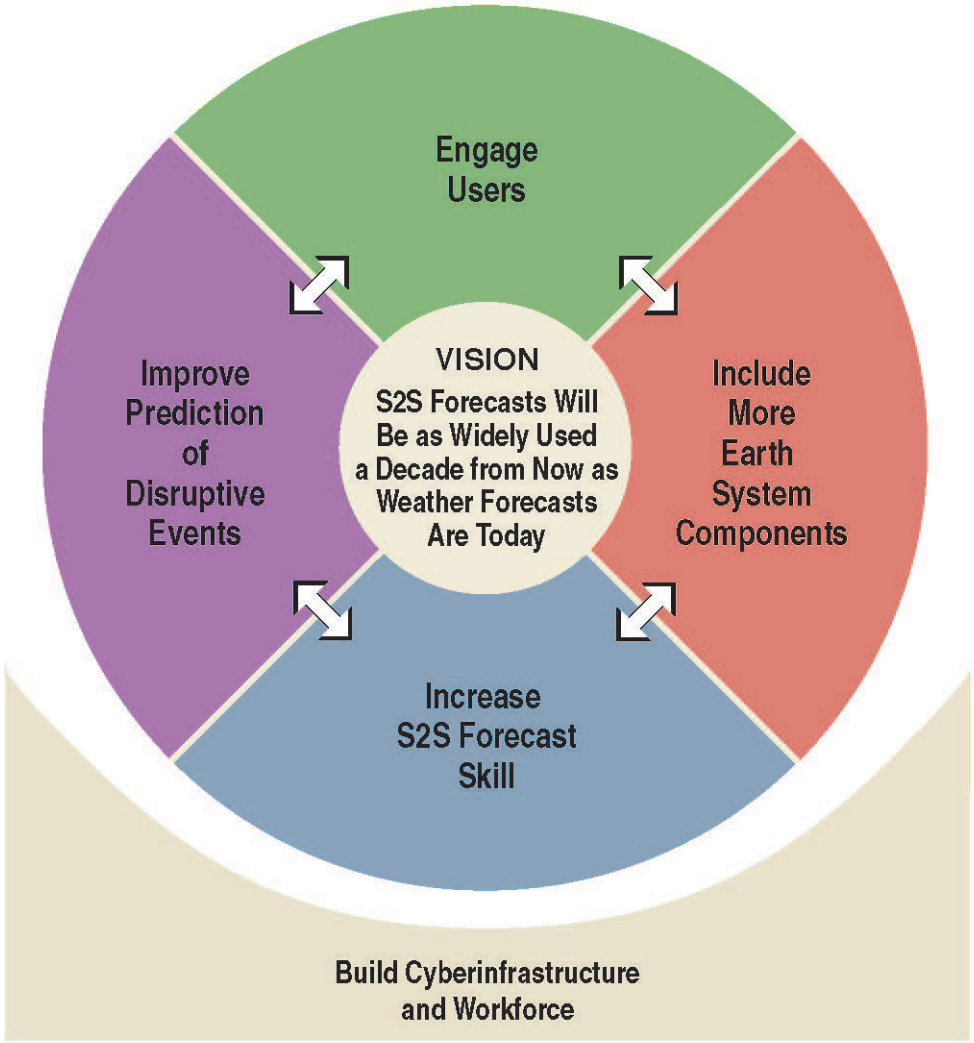
The Committee's Vision

S2S forecasts will be as widely used a decade from now as weather forecasts are today

- Fulfilling this vision will take sustained effort and investment



Fulfilling the Vision: Research Strategies

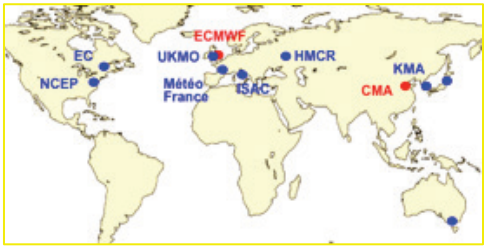


1. Engage Users
2. Increase S2S Forecast Skill
3. Improve Prediction of Disruptive Events
4. Include More Earth System Components

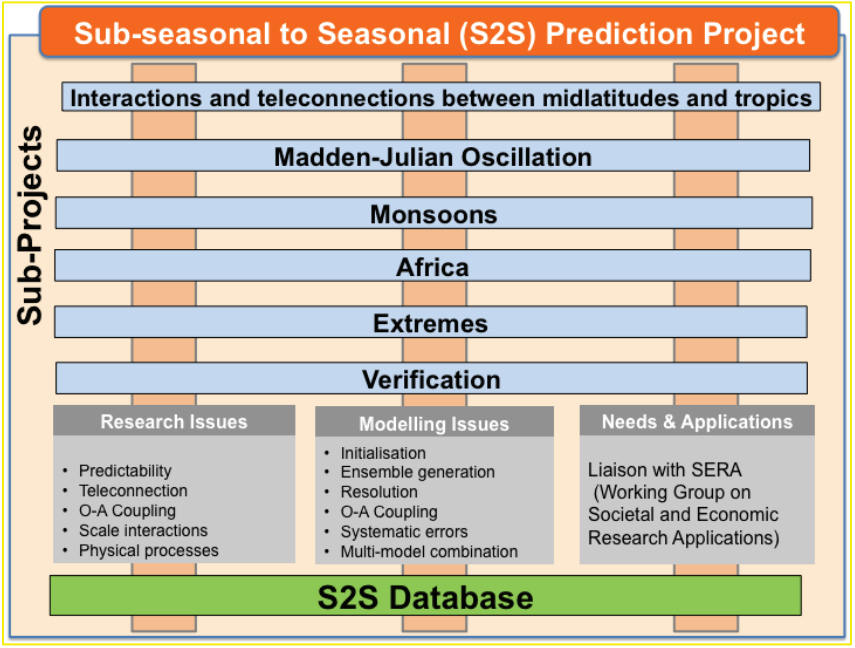
Subseasonal Forecast Database

WCRP-WWRP S2S Project

S2sprediction.net



International Program for S2S Research



S2S Database

	Time-range	Resol.	Ens. Size	Freq.	Hcsts	Hcst length	Hcst Freq	Hcst Size
ECMWF	D 0-46	T639/319L91	51	2/week	On the fly	Past 20y	2/weekly	11
UKMO	D 0-60	N216L85	4	daily	On the fly	1996-2009	4/month	3
NCEP	D 0-44	N126L64	4	4/daily	Fix	1999-2010	4/daily	1
EC	D 0-32	0.6x0.6L40	21	weekly	On the fly	1995-2014	weekly	4
CAWCR	D 0-60	T47L17	33	weekly	Fix	1981-2013	6/month	33
JMA	D 0-34	T319L60	25	2/weekly	Fix	1981-2010	3/month	5
KMA	D 0-60	N216L85	4	daily	On the fly	1996-2009	4/month	3
CMA	D 0-45	T106L40	4	daily	Fix	1886-2014	daily	4
CNRM	D 0-32	T255L91	51	Weekly	Fix	1993-2014	2/monthly	15
CNR-ISAC	D 0-32	0.75x0.56 L54	40	weekly	Fix	1981-2010	6/month	1
HMCR	D 0-63	1.1x1.4 L28	20	weekly	Fix	1981-2010	weekly	10