NOAA's Response to Subseasonal-to-Seasonal-to-Decadal (S2S2D): A Pathway to Improved Predictions

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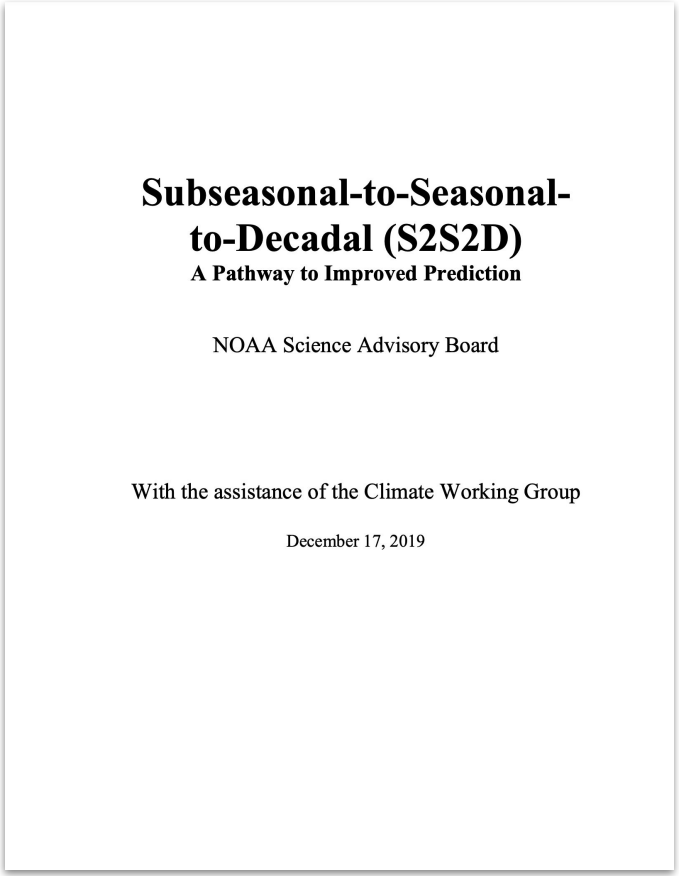
Acknowledgements

Science Advisory Board

NOAA is grateful to the
Science Advisory Board
and the
SAB's Climate Working Group

CWG Members for the S2S2D White Paper (December 2019)

Subseasonal-to-Seasonal-to-Decadal (S2S2D): A Pathway to Improved Predictions



Subseasonal-to-Seasonal-to-Decadal (S2S2D)
A Pathway to Improved Prediction

NOAA Science Advisory Board

With the assistance of the Climate Working Group

December 17, 2019

S2S2D White Paper (December 2019)

Hybrid-Statistical Models

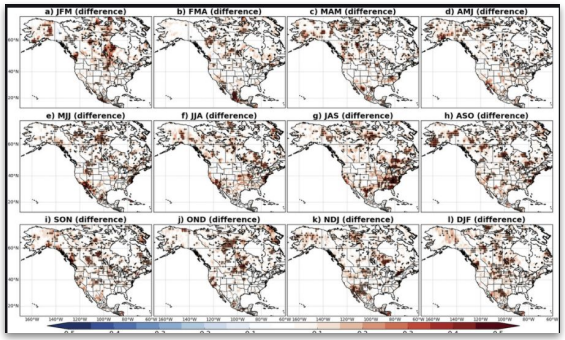
Recommendation #1: Accepted

Fund hybrid statistical-dynamic models (including contributions from machine learning, artificial intelligence, deep learning, etc.) to bridge the gap between the needs of stakeholders and limitations of the dynamic models at regional scales, especially for S2S2D predictions.

Acknowledging Opportunities for Increased Investments

Hybrid dynamical-statistical approaches, including machine learning, artificial intelligence, and deep learning, as well as support for techniques that could be implemented in close association with dynamical models.

Research to understand the underlying physical processes.



Strazzo et al. 2019. "Application of a Hybrid Statistical-Dynamical System to Seasonal Prediction of North American Temperature and Precipitation, *Monthly Weather Review*.

Boundary Layer Processes

Recommendation #2: Accepted

Fund boundary layer chemical dynamics research to help weather forecasting and calculations, and quantification of surface fluxes for air quality and climate needs.

Acknowledging Opportunities for Increased Investments

Research to advance understanding of chemistry and aerosols in the land-atmosphere and ocean-atmosphere interfaces.

Research on the related implications for microphysics, radiation, and air quality.

Global Ocean Observations

Recommendations #3, #4: Accepted

Work towards realizing an expansion of observations networks into the tropics, deep, and polar oceans; obtain global oceanic BGC observations through the implementation of deep Argo, BGC Argo and enhancements in Argo beyond the 2020 design.

Restore ship time funding in support of sustained observations and deployments.

Acknowledging Opportunities for Increased Investments

Increased observations could yield increased skill if they are the right observations.

While the Global Ocean Observing System has a gap in the collection of biological observations, NOAA has opportunities to support the active international effort.

Also must integrate diverse ocean data into a useful, quality-controlled set of ocean observations.

Biogeochemical Observations

Recommendations #5, #6: Accepted

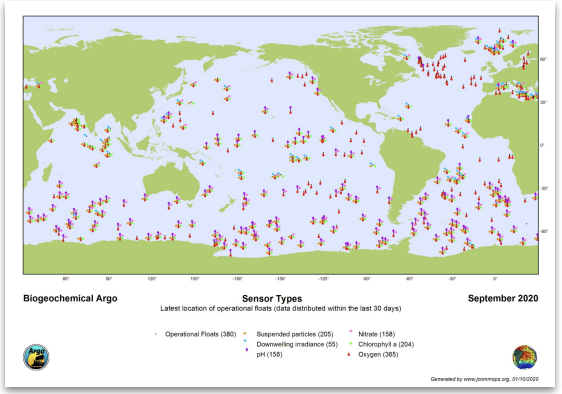
Fund a global biogeochemically sensored autonomous profiling float array and train the personnel to deploy and calibrate them.

Invest in terrestrial biogeochemical research and modeling, especially collaborations with USDA. Collaboration between GFDL and CPC would accelerate improvement of terrestrial biogeochemical processes in S2S2D predictions.

Acknowledging Opportunities for Increased Engagements

NOAA is is leading a whole-of-government response.

NOAA is partnering across government, academia, and industry to leverage resources and prioritize investments.



JCOMMOPS.org. 2020. "Biogeochemical Argo," *Image*.

Improving NOAA's Engagement and Communications with Stakeholders

Recommendations #7, #8, #9: Accepted

Train NOAA's workforce, academics, and commercial enterprises in the use of FV3 and invest in educational outreach and resources.

Invest in the social sciences and human infrastructure for engaging sectors and communities in supporting decision-making and communicating earth system predictions.

Expand capacity to assess the return on science investment using multiple metrics such as economic impacts, diversity and number of people and locations served.

Acknowledging Opportunities for Increased Investments

NOAA continues to enhance social science research investments and to incorporate research- and practice-based social science.

NOAA is committed to long-term studies of the returns on investment.

NOAA Takes a Broad View of S2S2D Prediction

Improving theoretical understanding as theoretical foundations lead to better understanding of the sources of predictability.

Augmenting the observing system toward increased predictive skill.

Improving models in ways that seek to exploit that increase in our fundamental understanding.

Addressing model systematic errors, especially through the reformulation of moisture-related parameterizations, improved resolution, and improved component couplings.

Focusing on a strongly-coupled ensemble-based data assimilation system that can update all the components simultaneously—using the observations of all components together.

Expanding the current S2S2D prediction system, continuously expanding and improving the current seamless subseasonal-to-decadal prediction system, SPEAR.

Post-processing. Statistically post-processing of forecasts and projections will remain a critical process in providing early warning and informing preparedness at S2S2D.

Thank you!

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