



World Climate Service Small Business Innovation Research Summary

Prescient Weather Ltd recently received an award of a 2021 Small Business Innovation Research (SBIR) grant from the National Oceanic and Atmospheric Administration NOAA) to study the optimization of subseasonal to seasonal (S2S) forecasts. The US federal government uses SBIRs to stimulate leading-edge research with commercialization potential. The application of subseasonal and seasonal forecasts is one area currently being supported.

Prescient Weather research focuses on several aspects including:

- 1) **Optimizing the long-range forecast skill of existing operational S2S forecasts.** For example, the World Climate Service today includes a calibrated multi-model ensemble including NOAA's climate forecast system, (CFSv2), and the European Centre for Medium-Range Weather Forecasting (ECMWF) dynamical forecast. We are now exploring the best methods to add additional models to the ensemble, including the NOAA Global Ensemble Forecast System (GEFS) and the Japan Meteorological Agency's forecast model.
- 2) **Optimizing the mix of statistical and dynamical forecasts.** Long-range forecasts can be created using both dynamical and statistical models. The published literature suggests there are several viable means to create a statistical forecast model, especially in the subseasonal timeframe. Our work will examine how to optimize long-range forecast skill by combining dynamical and statistical model forecasts.
- 3) **Exploring the role of machine learning and artificial intelligence (AI) techniques.** Machine learning can be a powerful approach when the system is presented with voluminous amounts of data. However, one of the challenges involved in studying long-range forecasts is that relatively little data are available because the information is necessarily averaged into weekly or monthly averages. This reduces the amount of data available to train models. Our research will explore combinations of data reduction techniques with readily available machine learning methods to understand how they can be applied to improve long-range forecasts.

We have engaged several commercial partners who have agreed to provide guidance about how the forecast information can best be framed to help them make decisions. End-user engagement is a critical step in any product commercialization effort because it helps to ensure that the products created solve important customer problems.

The outcome of the research will include the development of new applications based on optimized subseasonal and seasonal forecast information. Our objective is to merge the available forecast skill with end-user requirements to develop decision-making strategies that create value for our customers.