An Intercomparison of Reanalysis Products for Alaska to Facilitate Impact Studies

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The need for reliable reanalysis data for decision-making in Alaska is essential because of the large climate changes that have been documented as well as projected. These climate changes have notable impacts on many aspects of life in Alaska: wildlife management, oil and gas exploration and mining, forestry, agriculture, ecosystem services and border security. A key objective of this work is to meet the demands of managers in these sectors by providing the best dataset to help fulfill their respective needs.

This study will provide an intercomparison of five reanalysis models: the National Centers for Environmental Prediction Reanalysis (NCEP R1), the North American Regional Reanalysis (NARR), the Climate Forecast System Reanalysis (CFSR), the recent European Reanalysis (ERA-Interim), and the Modern Era Retrospective-Analysis for Research and Applications (MERRA). The study period will cover 1979-2009, using National Climatic Data Center (NCDC) station observations in Alaska that provide continuous coverage for validation in this time interval.

Another validation strategy with which we have had success in the past (e.g. Bhatt et al. 2010) in data sparse areas such as the Arctic or Alaska is to evaluate data sets in the context of their climatic relationships to other available information. Normalized Vegetation Difference Index trends in the Arctic were gauged against temperature and snow water equivalent trends to determine if they formed a consistent picture. The highest priority meteorological variables that will be investigated in this study are sea level pressure, surface air temperature, and precipitation.

Snow depth is another vital variable in Alaska with widespread implications. Wildlife management benefits from this data with assessment of caribou migration. Hydrologists use this information, particularly with river forecasting in the spring because the reanalysis output is often used to initialize finer scale hydrologic models. Snow depth has also been documented to affect wildfires and agricultural productivity due to its insulating qualities. Monthly snow depth data will be analyzed and supplemented with snow water equivalent, which is available from remote sensing.

Core statistical analysis will be performed on monthly as well as daily data to provide useful information to the climate impacts community. Means, variance and root mean square error are examples of the types of calculations that will be used to compare reanalysis and observed data. Additionally, since station data distribution is not even across Alaska, some grid cells will be better represented than others. We plan to provide a reanalysis model ranking for Alaska, both collectively and with respect to the individual variables, to help stakeholders use the data effectively. We will also provide a ranking by a new set of climate divisions calculated for Alaska (Bieniek et al. 2011). In addition, data will be made available to the stakeholders from the various models having uniform units and format. A limitation to these methods is that NCDC station data is assimilated into the reanalysis models; however, this study will provide a first step in validating reanalysis output in the Alaska region.

References

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