



The Release of the Twentieth Century Reanalysis Dataset Version 2 (1871-2008)

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Climate change studies are increasingly focused on moving beyond understanding and predicting global scale changes to regional scale changes, especially changes in the statistics of severe weather and droughts. Assessing the evidence for such variations over the last hundred years, and evaluating the quality of models making predictions for the next hundred, requires a sub-daily (as opposed to monthly or longer-term average) tropospheric circulation dataset. The only large-scale dataset available for the early 20th century consists of error-ridden hand-drawn analyses of the mean sea level pressure field over the Northern Hemisphere. Modern data assimilation systems have the potential to improve upon these maps, but prior to 1948, few digitized upper-air sounding observations are available for such a “reanalysis.” National and international plans to study climate change specifically require global gridded reanalysis datasets extending across the instrumental period to achieve their goals. Under the Twentieth Century Reanalysis Project, we have demonstrated that the quantity of newly recovered surface pressure observations is sufficient to generate useful reanalyses of the tropospheric circulation back to the 19th century. The surface pressure observations have been made available through international cooperation facilitated by the Atmospheric Circulation Reconstructions over the Earth initiative and working groups of the Global Climate Observing System and World Climate Research Programme. In version 2 of the Project dataset, we have generated 4-times daily reanalysis fields back to 1871. Surprisingly, we have found that using an Ensemble Kalman Filter that blends an ensemble of 6-hour numerical weather prediction model forecasts with the available surface observations, one can produce high-quality reanalyses of even the upper troposphere using only synoptic surface pressure observations and monthly sea surface temperatures and sea ice concentrations. For the end of the 19th century, the accuracy of such upper-air circulation fields for the Northern Hemisphere in winter would be comparable to that of modern two to three day weather forecasts.