

Developing the 20th Century Reanalysis version 3 (1850-2013)

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The historical reanalysis dataset generated by NOAA ESRL and the CIRES Climate Diagnostics Center, the Twentieth Century Reanalysis[1] version 2 (20CRv2), is a comprehensive global atmospheric circulation dataset spanning 1871-2011, assimilating only surface pressure and using monthly Hadley Centre SST and sea ice distributions (HadISST1.1) as boundary conditions. It has been made possible through collaboration with GCOS, WCRP, and the ACRE initiative. It is chiefly motivated by a need to provide an observational validation dataset, with quantified uncertainties, for assessments of climate model simulations of the 20th century, with emphasis on the statistics of daily weather. It uses, together with an NCEP global numerical weather prediction (NWP) land/atmosphere model to provide background "first guess" fields, an Ensemble Kalman Filter (EnKF) data assimilation method. This yields a global analysis every 6 hours as the most likely state of the atmosphere, and also yields the uncertainty of that analysis.

The 20CRv2 dataset provides the first estimates of global tropospheric variability, and of the dataset's time-varying quality, spanning 1871 to the present at 2 degree spatial resolution. Intercomparisons with independent radiosonde and station temperature data indicate that the reanalyses are of high quality. Overall, the quality is approximately that of current three-day NWP forecasts.

It is anticipated that the 20CRv2 will be useful to the climate research community for both diagnostic studies and model validations. Some surprising results are already evident. For instance, the long-term trends of the tropical Pacific Walker Circulation are weak or non-existent over the full period of record in this dataset.

Following 20CRv2, with GCOS, WCRP, and ACRE, we are investigating 20CR version 3: an improved version of the historical reanalysis dataset. Results illustrating the effects of higher spatial resolution and increased observational density compared to 20CRv2 will be presented. 20CRv3 will have a companion ocean reanalysis generated by Texas A&M University using the Simple Ocean Data Assimilation system. The effects of using SODA boundary conditions compared to HadISST in 20CRv3 will be investigated. Together 20CRv3 and SODA will provide global states of the atmosphere, land, and ocean back to 1850.

References

[1] G.P. Compo, J.S. Whitaker, P.D. Sardeshmukh, N. Matsui, R.J. Allan, X. Yin, B.E. Gleason, R.S. Vose, G. Rutledge, P. Bessemoulin, S. Brönnimann, M. Brunet, R.I. Crouthamel, A.N. Grant, P.Y. Groisman, P.D. Jones, M. Kruk, A.C. Kruger, G.J. Marshall, M. Maugeri, H.Y. Mok, Ø. Nordli, T.F. Ross, R.M. Trigo, X.L. Wang, S.D. Woodruff, and S.J. Worley, 2011: The Twentieth Century Reanalysis Project. *Quarterly J. Roy. Meteorol. Soc.*, 137, 654, 1-28. DOI: 10.1002/qj.776, February 2011. (Journal Article)