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Intercomparison of extra-tropical cyclones in nine reanalysis datasets

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This presentation inter-compares extra-tropical cyclone activity in the following eight reanalysis datasets: (1) the Japanese 55-year Reanalysis (JRA55), (2) the Twentieth Century Reanalysis (20CR), (3) the ERA-20C Reanalysis (ERA-20C), (4) the NASA Modern Era Retrospective-analysis for Research and Applications (MERRA), (5) the NCEP Climate Forecast System Reanalysis (CFSR), (6) the ERA-Interim Reanalysis (ERAint), (7) the ERA40 Reanalysis, (8) the NCEP-NCAR Reanalysis (NCEP1), and (9) the NCEP-DOE Reanalysis (NCEP2). The inter-comparison includes trends and variability in cyclone counts and intensity, as well as track-to-track comparison of cyclones in each pair of these datasets. It is based on cyclones that live for more than 24 hours and travel more than 500 km during their life time, as identified by applying an automatic objective cyclone tracking algorithm to each of the datasets.

Specifically, MERRA shows higher counts of strong cyclones (of stronger wind force) than the others. CFSR shows many more cyclones of moderate intensity than the others. JRA55 and ERAint are similar in terms of deep cyclone (core pressure $\leq$ 980 hPa) statistics in both hemispheres; but JRA55 shows more strong cyclones in the SH than does ERAint.

The best track-to-track agreements are between NCEP1$\sim$NCEP2, CFSR$\sim$ERAint, and ERA40$\sim$JRA55 in the NH; and between JRA55$\sim$ERA40, JRA55$\sim$ERAint, CFSR$\sim$ERAint, and CFSR$\sim$NCEP2 in the SH. The poorest track-to-track agreements are between 20CR$\sim$MERRA in both hemispheres. The best-match tracks are generally those with deeper mean core pressure than the unmatch tracks. Results of comparison with ERA-20C will be added in the presentation.

In general, there is more similarity in temporal trends and variability than in specific cyclone counts and intensity. This is especially true for deep cyclone counts, which show very good agreement since 1960. There is also more similarity in deep cyclone statistics than in all cyclone statistics. All the datasets agree very well on temporal trends and variability of deep cyclone activity over the NH major storm track regions, with some discrepancies in all-cyclone activity in the pre-satellite era. The agreement in temporal trends and variability in the SH is generally not as good as in the NH. In particular, one should note that there exist temporal inhomogeneities in these datasets for both hemispheres, which shall be taken into account when using these datasets to analyze trends.