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Climatology and changes of extra-tropical cyclone activity: Comparison of ERA40 with NCEP/NCAR Reanalysis for 1958-2001

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In this study, a cyclone detection/tracking algorithm was used to identify cyclones from two gridded 6-hourly mean sea level pressure datasets: the ERA40 reanalysis and the NCEP/NCAR Reanalysis (NNR) for 1958-2001. The cyclone activity climatology and changes inferred from the two reanalyses are intercompared. The cyclone climatologies and trends are found to be in reasonably good agreement with each other over Northern Europe and eastern North America, while ERA40 shows systematically stronger cyclone activity over the boreal extra-tropical oceans than does NNR. However, significant differences between ERA40 and NNR are seen over the austral extra-tropics. In particular, ERA40 shows significantly greater strong-cyclone activity and less weak-cyclone activity over all oceanic areas south of 40S in all seasons, while it shows significantly stronger cyclone activity over most areas of the austral subtropics in the warm seasons.

The most notable historical trends in cyclone activity are found to be associated with strong-cyclone activity. Over the boreal extra-tropics, both ERA40 and NNR show a significant increasing trend in JFM strong-cyclone activity over the high-latitude North Atlantic and over the mid-latitude North Pacific, with a significant decreasing trend over the mid-latitude North Atlantic and a small increasing trend over Northern Europe. The JFM changes over the North Atlantic are associated with the mean position of the storm track shifting about 181 km northward. Importantly, there is no evidence of abrupt changes identified for the boreal extra-tropics, although previous studies have suggested that the upward trend found in the NNR data could be biased high. However, there exist a few abrupt changes over the austral extra-tropics, which

appear to be attributable to the increasing availability of observations assimilated in the reanalyses. After diminishing the effects of these abrupt changes, strong-cyclone activity over the austral circumpolar oceanic region is identified to have an increasing trend in OND and JAS, with a decreasing trend over the 40S-60S zone in JAS.