

Inter-comparison of extra-tropical cyclone activity in four reanalysis datasets

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Summary

This poster inter-compares extra-tropical cyclone activity in the following four reanalysis datasets: NCEP-NCAR Reanalysis (NCEP1), NCEP-DOE Reanalysis (NCEP2), ERA40 Reanalysis, and the 20th Century Reanalysis (20CR; ensemble of 56 runs for 1871-2008). The intercomparison is based on the results (cyclone counts, intensity and activity index) from applying an objective cyclone identification/tracking algorithm to each of the four datasets.

The results show that

- (1) ERA40 shows more medium-strong cyclones than NCEP1&2 and 20CR, with more remarkable differences in the cyclone intensity than in total cyclone counts (Fig. 2). This is at least in part due to its higher model resolution: T159 (ERA40) versus T62 (NCEP1).
- (2) 20CR is more similar to NCEP1&2 than to ERA40 (Fig. 2). However, 20CR shows more medium-strong cyclones in the SH, but fewer medium-strong cyclones in the NH, than does NCEP1&2 (Figs. 3-4). In particular, 20CR shows fewer and weaker cyclones over North America (Central_NAM and CanArctic; Figs. 2 & 4). In the SH, 20CR appears to be more homogeneous over time than NCEP1 and ERA40 (Fig. 2). Over the majority of the oceanic regions, 20CR shows stronger cyclone activity than does NCEP1 (Fig. 4).
- (3) interpolating a dataset onto a finer EASE grid on which to identify/track cyclones also increases the number of cyclones identified (especially for regions of complex terrain) and their mean intensity (Fig. 5).

Datasets – global 6-hourly MSLP from

- 1) 20CR: the ensemble (56 runs) of 20th Century Reanalysis for 1871-2008 (20CRv2), 2°-by-2° lat-long grid (Compo et al. 2010).
- 2) NCEP1: NCEP-NCAR reanalysis for 1948-2001, 2.5°-by-2.5° lat-long grid (Kalnay et al. 1996, Kistler et al. 2001)
- 3) NCEP2: NCEP-NCAR reanalysis for 1979-2007, 2.5°-by-2.5° lat-long grid (NOAA/OAR/ESRL PSD, Boulder, CO; Kanamitsu et al. 2002)
- 4) ERA40: ERA40 reanalysis for 1958-2001, 2.5°-by-2.5° lat-long grid (Uppala et al. 2005).

Cyclone identification/tracking algorithm

Adopted from Serreze (1995) and Serreze et al. (1997)
 MSLP data are first interpolated onto a (250km)² EASE grid [also (200km)² in Fig. 5]

Terminology

- Cyclone: a single low pressure center identified at a specific location and time → **cyclone counts**
- Cyclone track: consists of a cyclone and its trajectory during its lifetime (usually lasts more than one observing interval (6 hours in this study)).
- Cyclone **intensity**: local Laplacian of pressure unit: 10⁻⁵ hPa km⁻².
- Cyclone **activity index** = counts * mean-intensity

Major references

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5. Kanamitsu et al. 2002: NCEP-DOE AMIP-II Reanalysis (R-2). *BAMS* (Nov. 2002), 1631-1643.
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7. Serreze et al. 1997: Icelandic low cyclone activity: Climatological features, linkages with the NAO, and relationships with recent changes in the Northern Hemisphere circulation. *J. Clim.*, 10, 453-464.

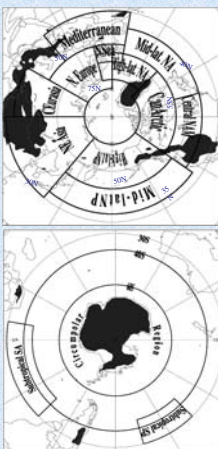
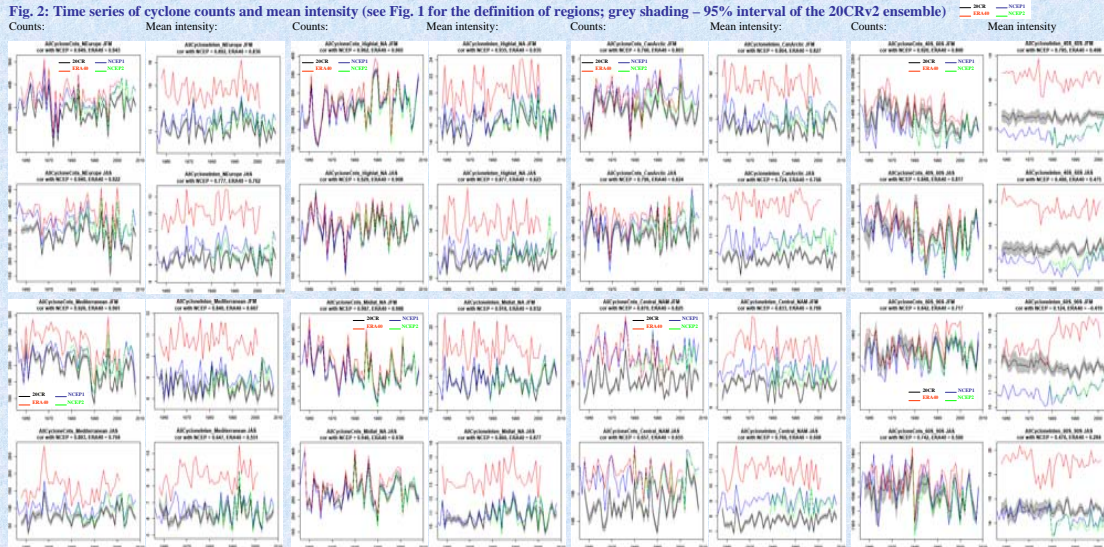


Fig. 1: Selected regions for performing more detailed analysis and comparison. Note that the elevated areas (i.e., black-shaded areas) were excluded from the selected regions.

Fig. 3: Probability distribution of cyclones in the period from 1958-2001:

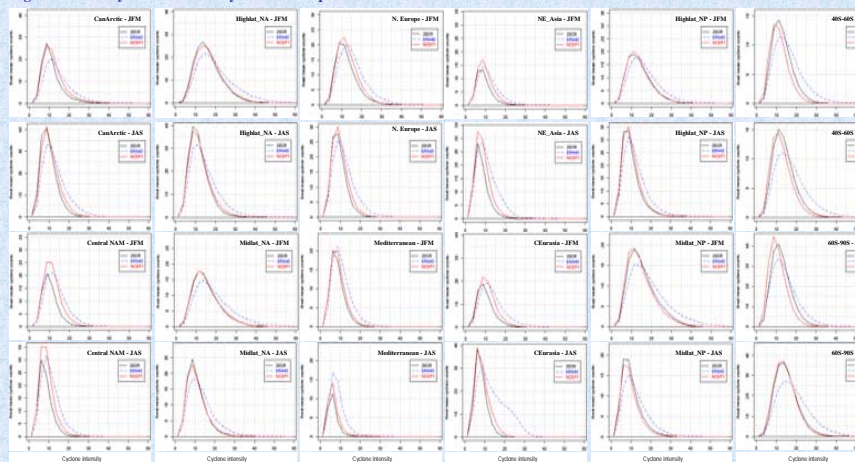


Fig. 4: Differences (NCEP1 – 20CR) in 1958-2001 mean activity index:

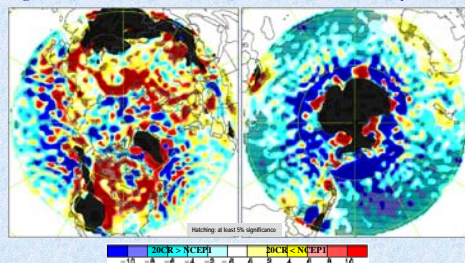


Fig. 5 Effects of the resolution of data used to identify/track cyclones: (250km)² versus (200km)² EASE grid (data: 20CRv2)

