

Dynamical-Process Studies using Reanalysis Data

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Reanalysis data has become one of the basic resources for dynamical-process studies of weather and climate. In particular ERA-40 provides a wonderful resource for generating and testing hypotheses and producing in-depth evaluation of model performance.

The ERA-40 Atlas, in its printed version and even more in its web version, contains updated traditional general circulation pictures and also new perspectives. The wide range of isentropic coordinate fields includes, for example, mean meridional circulation, which shows a double direct circulation structure in each hemisphere. Some fields are also given on the PV2 “dynamical tropopause” surface. At the University of Reading using ERA-40 we have been able to perform detailed diagnostic studies of storm-tracks and blocking in both hemispheres. In the Northern hemisphere both trends over the 44-year period and variability have been assessed, whereas in the Southern Hemisphere only the variability has been thought to be robust. Storm-tracks have mainly been diagnosed through a sophisticated extremum-tracking algorithm, which enables diagnostics such as genesis, lysis, and average growth rate and lifetimes of systems to be determined. The indicator for blocking has been based on a reversal of the usual gradient of potential temperature on the dynamical tropopause. A climatology of blocking has been produced and the behaviour in different sectors investigated.

Possible mechanisms for extreme seasons, e.g. the European floods of summer 2002, the very cold European winter of 1963 are also being investigated. Hypotheses can be generated and tested in models of various complexity.

One problem for these studies, which becomes crucial for trend or large-scale tropical investigations, is the lack of confidence that can be put on changes in the moist processes and diabatic heating. This will clearly be an area in which improvements will be hoped for in subsequent reanalyses.

