Geophysical Research Abstracts
Vol. 16, EGU2014-5629, 2014
EGU General Assembly 2014

Global high resolution climate reconstructions

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Long-term reanalysis products represent an important data source for numerous climate studies. However, their coarse spatial resolution for data sets spanning the last more than 50 years and well known inhomogeneities in space and time make it difficult to derive changes in meteorological variables over time. We therefore use spectral nudging technique to down-scale the global reanalysis data to a finer resolution with a general global circulation model. With this technique the new calculated higher resolved global model fields are attracted to the large-scale state of the coarse resolution reanalysis. Besides the conservation of large-scale atmospheric information and the resulting finer topography, a surplus in contents of information in meteorological phenomena of small spatial extensions is expected.

Following this strategy a simulation with the global high-resolution atmospheric model ECHAM6 (T255L95), developed by MPI-M Hamburg, will be started by spectrally nudging NCEP1 reanalysis for the time period from 1948 until 2013. Selected wavelengths of more than 1000 km of vorticity, divergence, temperature and the logarithm of the surface pressure will be imposed onto the simulated GCM counterparts at levels above 750 hPa. SST and sea ice distribution are taken from the NCEP1 data set. These simulations enable the investigation of long-term changes in meteorological phenomena; the focus is put here on intense storms. Various horizontal wavelength selections and associated vertical profiles in the strength of nudging were tested. The temporarily best configuration resulted in large time correlations for 2m-temperature and 10m wind speed at several selected locations in Germany in comparison to observations. Correlations were highest for extra-tropical regions, while over the western part of the Pacific and Indian Ocean relative low time correlations were found.

In a continuing study meteorological quantities at different levels and the influences of the nudging configuration on the detection and tracking of intense storms will be investigated.