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An attempt to homogeneously describe 60 years statistics of TC activity in E Asia, 1948-2007

The feasibility to reconstruct the weather of E Asia for the last decades using an atmospheric regional climate model was analysed. Global National Centers for Environmental Prediction - National Center for Atmospheric Research (NCEP-NCAR) re-analyses data were dynamically downscaled to a 50 km grid and in a double-nesting approach to a 18 km grid distance using a state-of-the-art regional climate model, the Climate version of the "Lokal Model" (CLM).

First, an ensemble of one simulated typhoon case was examined (Feser and von Storch, 2008a). The regional simulations were not only driven by lateral boundary conditions, but also with a spectral nudging technique that enforced the observed large-scale state inside of the model domain. Tropical storms, which are coarsely described by the re-analyses, were correctly represented; considerably deeper core pressure and higher wind speeds were simulated compared to the driving re-analyses. When the regional atmospheric model was run without spectral nudging, significant intra-ensemble variability occurred; also additional, non-observed typhoons formed. The same lateral boundary conditions were consistent with different developments in the interior. Several sensitivity experiments with varied grid distances, different initial starting dates of the simulations and changed spectral nudging parameters were also executed.

In a second step, an ensemble of modelled typhoon events was examined for the typhoon season 2004 for E Asia and the Western Pacific (Feser and von Storch, 2008b). The simulated typhoon tracks and intensities were compared to Best Track data from the Japan Meteorological Agency. The comparison revealed improved SLP and near-surface wind values by the RCM compared to the re-analyses for most cases. The re-analyses thereby showed smaller great circle distances to the best track data than the regional model. Precipitation patterns and rainfall amounts were simulated more realistically by the RCM using the higher resolution compared to the 50 km-grid run. It is concluded that regional models can improve simulated typhoon developments from global forcing re-analyses data by giving lower core pressure and higher wind speeds and more realistic precipitation patterns even though these values still do not reach observed values.

In a third step a continuous 650 year simulation, extending from 1948 until 2007, is examined (not yet published). Using an automated tracking system, all TCs are identified in the 60-year simulation. The parameters of the tracking system have been chosen so that on average the same number of TCs is detected as in the operational best track data base of JMA, namely about 25 TCs per year.

The 1948-2007 time series of the annual numbers of TCs in the simulation and in the best track (BT) data correlate favourably (see Figure). The rms-difference between the number of simulated and BT-analysed TCs is about 5 TCs per year. Interestingly, the rms-error shows only a little tendency of getting smaller after the advent of satellite data. Seemingly, the availability of satellite data had a minor impact on the quality of the large-scale analysis of NCEP (used to run the LAM) and on the quality of the best track analysis of TCs in E Asia.

In both, the best track data set as well as in the downscaled data, a weak tendency towards less TCs emerges; this slight downward trend is masked by strong interannual variability, with an overall maximum of 39 TCs and a minimum of 16 storms. The interdecadal variability is relatively weak, albeit stronger in the best track data than in the downscaled data.

Feser, F., and H. von Storch, 2008a: A dynamical downscaling case study for typhoons in SE Asia using a regional climate model. Mon. Wea. Rev. 136, 1806-1815

Feser, F.,and H. von Storch, 2008b: Regional modelling of the western Pacific typhoon season 2004, Meteor. Z. 17, 519-528. doi 10.1127/0941-2948/2008/0282