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Downscaling studies in Chinese coastal regions

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Detailed hindcasts of the meteo-marine weather for the past six decades has been demonstrated to be not only doable but also most useful for a variety of applications, ranging from coastal defense to offshore construction. Such efforts are now underway for the Bo Hai and the Huang Hai.

One line of research deals with the changing risk of storm surges in the Bo Hai. By using an approved data set, which combines re-analyses with best track data for tropical storms, a model of the hydrodynamics of the Bo Hai and Huang Hai has been simulated the changing storm surge conditions 1961 – 2006. Interdecadal variations and long-time decreasing trends of storm surges were simulated in the Bo Hai Sea. The storm surge characteristics are statistically related to both the Arctic Oscillation (AO), and the Siberian High (SH). Thus, AO and SH were empirically downscaled to these characteristics, so that the consistent estimates of storm surge statistics could be derived for the time period 1900 to 2006.

The other line of research deals with sea surface winds and extreme winds over the Bo Hai and the Huang Hai. The atmospheric condition was reconstructed using regional climate model CCLM with high-resolution (7-km) by downscaling (through lateral and large-scale constraining) ERA-Interim (1979-2013) analyses. To begin with, different large-scale drivers have been tested, and substantial differences in both quality and covered period were found. In a second step, a 34-year simulation using ERA-I was chosen and further examined with respect to added value in the description of surface winds. Such added value has been detected in the coastal areas with complex orography. CCLM shows better skill in representing light and moderate winds, but has even more added values for strong winds relative to ERA-I. Additionally, the model proves to be robust and reliable in reproducing meso-scale atmospheric phenomena such as low-level jets, vortex streets and atmospheric fronts in coastal areas. The hindcast has been used to study the trends in regional mean and extreme wind speeds, and first efforts to assess the energy potential for offshore wind energy have been begun.

Feng J. (冯建龙), H. von Storch, R. Weisse, and Jiang W. (江文胜): Changes of storm surges in the Bohai Sea derived from a numerical model simulation, 1961-2006, submitted

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Li D. (李德磊): Added value of high-resolution regional climate model: selected cases over the Bohai and Yellow Sea areas, submitted