The CRCES Workshop on Decadal Climate Variability

Modelling the Variability of Midlatitude Storm Activity on Decadal to Century Time Scales

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The output of several multi-century simulations with a coupled Ocean-Atmosphere General Circulation Model is examined with respect to the variability of global storm activity in winter on time scales of decades and longer. The frequency of maximum wind speed events within a grid box, using the lower limits on the Beaufort wind speed scale of 8 and 10 Bft as thresholds, is taken as the characteristic parameter. Two historical climate runs with time-dependent forcing of the last five centuries, one control simulation, and three climate change experiments are considered.
The storm frequency shows no trend until recently. Global maps for the industrially influenced period hardly differ from pre-industrial maps, even though significant temperature anomalies temporarily emerge in the historical runs. Two indicators describing the frequency and the regional shift of storm activity are determined. In historical times they are decoupled from temperature. Variations in solar and volcanic forcing in the historical simulations as well as in greenhouse gas concentrations for the industrially influenced period are not related to variations in storm activity. Also, anomalous temperature regimes like the Late Maunder Minimum are not associated with systematic storm conditions.
In the climate change experiments, a poleward shift of storm activity is found in all three storm track regions. Over the North Atlantic and Southern Ocean, storm activity increases, while it decreases over the Pacific Ocean. In contrast to the historical runs, and with the exception of the North Pacific storm frequency index, the storm indices parallel the development of temperature, exceeding the 2 s-range of pre-industrial variations in the early 21st century.