EMS Annual Meeting Abstracts
Vol. 11, EMS2014-440-1, 2014
14th EMS / 10th ECAC

Factors influencing European wind storm occurrence on different time scales - from synoptic to centennial perspectives

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Severe wind-storms are the natural hazard producing the largest share of damage in Europe. They cause more than 50% of the total economic damages in Europe, and over 2/3 of the damage covered by insurance and re-insurance companies (EEA, 2012). In specific countries winter storms are the damage record holding events (GDV, 2011) and future risk potentials were identified as potentially increasing with up to 20% in the next 30 to 50 years based on a long term average for annual mean damages for Germany (GDV, 2011, Donat et al., 2011a).
This study will analyse, specific reasons of storm occurrence variability on different time scale, from synoptic (2-8 days) to centennial (<100 years) perspectives.
On the synoptic time scale, it was shown that by the usage of an impact based parameter for cyclone intensity (SSI, Storm Severity Index, Leckebusch et al., 2008b), a well suitable measure of potential storm damages could be derived directly from surface near wind speed (Leckebusch et al., 2008b). This wind storm identification technique is thus independent of any in situ damage data and more related to storm impacts as any other meteorologically derived measures of severity of extra-tropical cyclones e.g. the core pressure. In several studies these technique has been successfully applied (Nissen et al., 2010; Renggli et al., 2011; Nissen et al., 2012, 2013; Donat et al., 2011) to investigate severe damage prone wind storms with respect to its links to large scale conditions as well as to analyses of the statistical description of frequency and intensity occurrences itself.
On seasonal timescales low but statistical significant forecast skill is identified and physical processes leading to this skill are analysed. For interannual time scales the effect and influence of clustering of severe storms is analysed from synoptic as well as interannual perspective (meteorological clustering vs. insurance clustering). For the sub-decadal time horizon, forecast skill for a 2 year lead time is diagnosed, but not for the first year for extreme storm systems over Europe and the North Atlantic region. On multi-decadal time scale the role of the phase shift of the Meridional Overturning Circulation is highlighted via its influence on the lower troposphere baroclinicity. On anthropogenic climate scales, changes in frequency of extreme cyclones and related wind storm occurrences are discussed.