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North Atlantic cyclones; trends, impacts and links to large-scale variability

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Based on the cyclone detection and tracking algorithm previously developed (Trigo, 2006) we have assessed the inter-annual variability and cyclone frequency trends between 1960 and 2000 for the Euro-Atlantic sector using the highest spatial resolution available (1.125º x 1.125º) from the ERA-40 Surface Level Pressure. Additionally, trends for the u and v wind speed components are also computed at the monthly and seasonal scales, using the same dataset. All cyclone and wind speed trend maps were computed with the corresponding statistical significance field.

Results reveal a significant frequency decrease (increase) in the western Mediterranean (Greenland and Scandinavia), particularly in December, February and March. Seasonal and monthly analysis of wind speed trends shows similar spatial patterns. We show that these changes in the frequency of low pressure centers and the associated wind patterns are partially responsible for trends of the significant height of waves. Throughout the extended winter months (ONDJFM), regions with positive (negative) wind magnitude trends, of up to 5 cm/s per year, often correspond to regions of positive (negative) significant wave height trends. The cyclone and wind speed trends computed for the JFM months are well matched by the corresponding trends in significant wave height, with February being the month with the highest trends (negative south of 50ºN up to –3 cm/year, and positive up to 5cm/year just north of Scotland).

Using precipitation data from ECMWF reanalyses and a CRU high resolution dataset we show the impact of these trends in cyclone frequencies upon the corresponding precipitation trends in the influenced areas. It is also shown that these changes are partially linked to major shifts on the indices of large-scale patterns modes, namely the North Atlantic Oscillation (NAO), the Eastern Atlantic (EA) and the Scandinavian Patterns (SCAN).

Trigo, I. F. 2006: Climatology and Interannual Variability of Storm-Tracks in the Euro-Atlantic sector: a comparison between ERA-40 and NCEP/NCAR Reanalyses. Clim. Dyn. DOI 10.1007/s00382-005-0065-9.