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How well do ERA5/WRF generated wind fields reflect the seasonal variability of the spatio-temporal characteristics of wind field, tested for North-Atlantic conditions

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Spatial and temporal characteristics of simulated wind fields - stemming from the high-resolution weather model WRF with boundary conditions from ERA5 reanalysis data had been validated against the respective data stemming from measurements regarding annual characteristics as reported by [1]. As one result, the tendency of the WRF sets showed some overestimation of the coherency and underestimation of the power spectral density (PSD).

Here, this investigation is deepened to look on the capability of the modelled data to reflect the variability of the PSD and coherencies of the wind speed fluctuations on a monthly and seasonal (three- monthly) scale.

The intra annual variation of the PSD and the coherence functions are well captured by the WRF-generated wind speeds. No seasonal dependency can be detected for the underestimation of the spectra from the modelled data. The shape can well be modelled by the approach of [Larsén et al., 2013]. Concerning the coherences, the tendency of an overestimation as detected in the analysis of annual sets, shows up in the seasonal scale in similar magnitude, reflecting a systematic shortcoming of the simulated sets to reflect the spatial inhomogeneity of the field.

[1] Poulsen, T, Beyer, H.G., Cross spectral characteristics of modelled and measured sets of spatially distributed wind in the Faroe Islands, poster presentation EGU 2020 (2020)

[2] Larsén, X., Vincent, C., and Larsen, S. (2013). Spectral structure of mesoscale wind over the water. Quarterly Journal of the Royal Meteorological Society, 139:685–700. (2013)