EMS Annual Meeting Abstracts
Vol. 15, EMS2018-292, 2018

Long-term predictability of local air quality hazards and periods of reduced turbulent mixing in Scandinavia

Igor Esau (1), Tobias Wolf-Grosse (1), Lasse Pettersson (1), and Joachim Reuder (2)

(1) Nansen Environmental and Remote Sensing Centre/Bjerknes Centre for Climate Research, Bergen, Norway (igore@nersc.no), (2) Geophysical Institut of University in Bergen/Bjerknes Centre for Climate Research, Bergen, Norway

Significant multi-decadal predictability is already known for sea surface temperature anomalies in the North Atlantic and Nordic Seas. Those anomalies have an impact on typical large-scale circulation patterns of the Atlantic-European region. More specifically, it has been suggested that frequency and persistence of the atmospheric blockings in this region is strongly affected by the wintertime anomalies in the ocean through a certain modifications of the eddy pumping mechanisms and inverse enstrophy cascades. Our study reveals that the large-scale circulation patterns are strongly correlated with wintertime air pollution episodes in Bergen, Norway. Certain large-scale circulation regimes (e.g. the West Atlantic or Greenland blockings) lead to local air quality hazards. We assessed these circulation regimes and their predictability. We modified and applied an atmospheric circulation proxy for the identification of air pollution episodes. Use of this proxy on data from a high-resolution atmospheric general circulation model showed a good reproduction of the total number of potentially polluted days per month and their inter-monthly variability. We also found a link between the persistence of the flow above the Bergen valley and the occurrence and severity of the local air pollution episodes. Analysis of the large-scale circulation over the North Atlantic-European region, with respect to air pollution in Bergen, revealed that the persistence in the meteorological conditions connected to the air pollution episodes is not necessarily caused by large-scale anomalies of the atmospheric circulation over the Norwegian west coast. It is rather connected to anomalies further upstream as far away as Greenland. Finally, we conduct a set of very high-resolution simulations with the large-eddy simulation model PALM to identify the local circulations and boundary layer regimes corresponding to the typical large-scale meteorological conditions connected to the air quality hazards in Bergen.