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## Characteristics of North European winter lightning related to a high positive North Atlantic Oscillation index

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The variability of winter climate in the North Atlantic region is predominantly driven by a large scale alternation of atmospheric masses between the Icelandic Low and Azores High pressure systems called the North Atlantic Oscillation (NAO) and characterized by the NAO index. The calculation of the NAO index is based on the difference between sea-level pressure strengths of the Azores High and the Icelandic Low. Unusually high positive values of the NAO index were observed to manifest themselves by above-average precipitation and severe winter storms over British Isles and other parts of northwestern and northern Europe.

In the last two decades, the winter season 2014/2015 exhibited the highest positive monthly NAO indexes. During this winter, newspapers in the UK, Germany, Poland, and Scandinavia reported extremely strong storms which caused huge power outages, damages of buildings, and collapses of traffic which paralyzed the daily life. As winter thunderstorms are also characterized by a higher production of very energetic lightning, we use the World Wide Lightning Location Network (WWLLN) data and investigate properties of lightning which occurred in the north European region from October 2014 to March 2015. The dataset consists of more than 90 thousand lightning detections. We focus on spatial and temporal distribution of lightning strokes, their energies and multiplicity.

We have found that the diurnal distribution of lightning was random from November till February, while the afternoon peak typical for summer storms was noticeable only in October and March. The median energy of lightning strokes observed in October, November and March reached only about 10-20% of the median energy of strokes detected in December, January and February. The most energetic strokes were concentrated above the ocean close to the western coastal areas and appeared exclusively at night and in the morning hours.