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Reducing the uncertainty in wind speed estimations near the coast

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Many countries plan to meet renewable energy targets by installing near-shore wind farms, because of the high offshore wind speeds and good grid connectivity. Because of the strong relation between mean wind speed and the annual energy production, there is an interest in reducing uncertainty of the estimation of the wind speed in these coastal areas. The RUNE project aims to provide recommendations on the use of lidar systems and mesoscale models results to find the most effective (cost vs. accuracy) solution of estimating near-shore wind resources.

Here we show some first results of the RUNE measuring campaign at the west coast of Jutland that started in December 2015. In this campaign, a long-range WindScanner system (a multi-lidar instrumentation) was used simultaneously with measurements from several vertical profiling lidars, a meteorological mast and an offshore buoy. These measurements result in a detailed picture of the flow in a transect across the coastline from approximately 5 km offshore up to 3 km inland.

The wind speed obtained from a lidar in a sector-scanning mode and from two time-synchronized lidars that were separated horizontally but focused in the same point, will be compared. Furthermore it will be shown how the resulting horizontal wind speed transects compare with the wind speed measurements from the vertical profiling lidars and the meteorological mast. The behaviour of the coastal gradient in wind speed in this area is discussed.

Satellite data for the wind over the RUNE measurement area were also collected. Synthetic Aperture Radar (SAR) winds from Sentinel-1 and TerraSAR-X were retrieved at different spatial resolutions. Advanced Scatterometer (ASCAT) swath winds were obtained from both METOP-A and B platforms. These were used for direct comparisons with the lidar in sector scanning mode.