Doppler Lidar Scanning of Flow Over Complex Terrain

Robert Menke
Technical University of Denmark

**Abstract**

Doppler lidars have proven to be crucial to map flow fields over complex terrain. For the Perdigão 2017 field campaign, 27 Doppler lidars (of which 19 had scanning capabilities) have been deployed to measure the flow over, within and around the Perdigão double ridges. This talk focuses on the analysis of measurements of 8 scanning lidars deployed by DTU to understand the following flow phenomena:

- recirculation zones that occur in the lee of the ridges within the valley
- wind turbine wake interactions with the flow field
- atmospheric waves

According to our data analysis, flow recirculation, with reverse flow wind speeds greater than 0.5 m s⁻¹, occurs over 50% of the time when the wind direction is perpendicular to the direction of the ridges. Atmospheric conditions, such as atmospheric stability and wind speed, affect the occurrence of flow recirculation. Atmospheric stability is also determining the propagation of the wake of the single 2 MW turbine located at the top of a ridge. When an atmospheric wave is observed under stable conditions, the wake follows the terrain down the ridge with a maximum inclination of −28°. During unstable conditions, the wake is advected upwards by up to 29° above the horizontal plane.

Atmospheric waves are observed during several nights of the experiments for both directions across the ridges. Typically, the wavelengths are similar to the ridge to ridge distance, and flow speeds are significantly increased at the downwind ridge during the presence of waves.

**Live Webcast:** [http://ucarconnect.ucar.edu/live](http://ucarconnect.ucar.edu/live)

For more information, contact Melissa Ward: mward@ucar.edu, x8713