



# Supplement of

## Estimation of turbulence dissipation rate from Doppler wind lidars and in situ instrumentation for the Perdigão 2017 campaign

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#### 1 Synoptic and mesoscale conditions

To understand the flow system with a LLJ from South-West which occurred in the night from 13 June to 14 June 2017, the long-term Weather Research and Forecasting model (WRF) simulation as described in Wagner et al. (2019) is consulted. The meteorological situation was characterized by a synoptic low pressure system at 850 hPa, which was located over the Atlantic

5 Ocean SW of the Iberian Peninsula. The combination of synoptic and thermally driven forcings and the interaction with the complex terrain around Perdigão resulted in a highly complex boundary-layer flow. Unlike in most nights during the Perdigão 2017 campaign a LLJ from southwest developed instead of the usual north-easterly LLJ (as it was also observed in the nights before and after this case study).

#### 1.1 Hovmoller diagram

10 The Hovmoller diagram in Fig. 1 shows how in the early mornings of 11, 12, 13 and 15 June 2017, negative cross-valley winds develop below 1 km altitude, which means that north-easterly flows occur. Only on 14 June, cross-valley winds are persistently positive.



Figure 1. A Hovmoller diagram illustrates the time series from 11 June to 16 June of cross-valley wind speed and potential temperature at the location of tower 20/trSE04. The black arrows indicate horizontal wind speed and direction.

#### 1.2 Maps of horizontal wind

Figures 2 and 3 give maps of horizontal wind speed at the 500 hPa and 850 hPa respectively on 14 June 2017. In each figure, the situation at 0000 UTC is shown on the left and the situation at 0600 UTC is shown on the right to provide an idea of the change of the synoptic conditions throughout the night.



Figure 2. Map of horizontal wind speed at 500 hPa over the Iberian Peninsula on 14 June 0000 UTC (a) and 0600 UTC (b). Contour lines mark the geopotential height at 850 hPa.



Figure 3. Map of horizontal wind speed at 850 hPa over the Iberian Peninsula on 14 June 0000 UTC (a) and 0600 UTC (b). Contour lines mark the geopotential height at 850 hPa.

Figures 4 and 5 give maps of horizontal wind speed at the 600 m above sea level (approx. 120 m above ridge height) and 80 m above ground level on 14 June 2017. the maps in this case are bound to WRF domain D03, covering a square of approximately 30 km around Perdigão. Again, the situation at 0000 UTC is shown on the left and the situation at 0600 UTC is shown on the right.



Figure 4. Map of horizontal wind speed at 600 m above sea level in WRF domain D03, over the Perdigão region on 14 June 0000 UTC (a) and 0600 UTC (b). Contour lines mark the topography.



**Figure 5.** Map of horizontal wind speed at 80 m above ground level in WRF domain D03, over the Perdigão region on 14 June 0000 UTC (a) and 0600 UTC (b). Contour lines mark the topography.

### References

Wagner, J., Gerz, T., Wildmann, N., and Gramitzky, K.: Long-term simulation of the boundary layer flow over the double-ridge site during the Perdigão 2017 field campaign, Atmospheric Chemistry and Physics, 19, 1129–1146, https://doi.org/10.5194/acp-19-1129-2019, 2019.