LOCAL AND REGIONAL CHARACTERISATION OF THE DIURNAL MOUNTAIN WIND SYSTEMS IN THE GUADARRAMA MOUNTAIN RANGE (SPAIN)

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1. OBSERVATIONAL SITE

La Herrería observational site (40°58.70' N, 4°13.74' W, 930 m a.s.l) is located at the foot of theGuadarrama mountain range (Fig. 1) and at ~ 50 km from the city of Madrid.

Atmospheric instrumentation in the 10-m tower has been installed in order to study the evolution of the lower atmosphere under the influence of the diurnal mountain wind systems. La Herrería is part of the Guadarrama Monitoring Network (GuMNet).

2. RESEARCH INTEREST

The soil underwent a severe drying up over Summer 2016 (07/06/2016 – 13/09/2016):

RQ1: HOW DOES THIS DRYING OUT AFFECT THE DIURNAL MOUNTAIN WIND SYSTEM AND THE ASSOCIATED TURBULENCE?

RQ2: WHAT IS THE ROLE OF THE MOUNTAIN BREEZES IN THE RUNWAY/CONFIGURATION HINT?

3. SUMMER 2016: SEVERE DRYING OUT

The Bowen ratio (B) throughout Summer 2016 (07/06/2016 – 13/09/2016) for the available data:

![Bowen ratio plot](image)

4. DIURNAL MOUNTAIN WIND SYSTEM

First, we select only the cases with a WEAK LARGE-SCALE FORCING (i.e. Vmax ≤ 6 m s⁻¹ no synoptic fronts + precipitation_day < 0.5 mm). Around 30% of the total amount of days are rejected. We plot the wind roses during different time ranges for the stable days:

![Wind roses](image)

5. AIRPORT ISSUE

The preferential runway configuration at the airport of Madrid in summer is the North Configuration due to noise issues in close neighbourhoods. However, it has to be switched to South Configuration when the southerly winds exceed 10 knots.

![Airplane](image)

6. TAKE-HOME IDEAS

- Summer 2016 was characterised for its progressive and extreme drying out of the soil.
- Analysis of the diurnal mountain winds throughout the summer:
  a) Upslope/anabatic winds increase substantially in frequency but their intensity remains unchanged.
  b) Downslope/katabatic winds do not increase either in frequency or intensity, but the associated turbulence decreases slightly.
  c) The combinations of upslope + upwind winds in central hours increases both in intensity and in the associated turbulence.
- The wind in the central hours underpins an intensification over the summer that increases an increase of the runway-configuration change from North to South at the airport of Madrid.

7. ACKNOWLEDGEMENTS

This research has been partially funded by the Spanish Government (MINECO project: CGL2015-64277-C3-3-R and CGL2015-64277-C4-2-R and the GRS14/1 program supported by UCM and Becas Santander) through the Research Group: Micrometeorology and Climate Variability of the Spanish Network on Research: ‘Atmospheric Research Program for In-Flight Research of the Department of Education, Language Policy and Cultures of the Ministry of Education, Culture and Sport’ (PREDIE 2014_2 0146, MOC 14-6). We thank also the contribution of all the members of the GuMNet team.