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Precipitation on the lee side of the Vosges Mountains : multi-instrumental study of one case from the COPS campaign

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The rain shadow effect is well known and the mechanisms of precipitation over the ridge and the windward side of the mountains have been studied for a long time. Nonetheless, there are only a few case studies focusing on local lee side convective precipitations. Thus, in this work, we investigate the precipitations due to shallow and deep convection over the lee side of the Vosges Mountains (North-Eastern France) during an Intensive Observation Period (IOP9a, 18th July, 2007) of the Convective and Orographically-induced Precipitation Study (COPS). For that aim, we use a set of observations from radars, radiosoundings, satellite, and a network of Global Positioning System (GPS) receivers, as well as model simulations and reanalyses. Furthermore, GPS tomography provides retrievals of 4D water vapour fields. The synergic use of these different types of data and observations allows for a detailed analysis.

In particular, we demonstrate the role of water vapour accumulation and wind convergence as a precursor to the convective initiation. Also, GPS tomography exhibits water vapour depletion in the low atmosphere during the heavy precipitation and we interpret it as local water vapour condensation. Finally, we also describe how small scale orographic effects affect the precipitations, and show the role of small hills in the valleys exits during the convective initiation and growth phases.