

Supplemental Information for “Radar observation of extreme vertical drafts in the polar summer mesosphere”

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1. Figures S1.
2. Movie S1.
3. Description of datasets.

Additional Supporting Information (Files uploaded separately)

1. Movie S1.

Introduction

In this document we present supplemental material aimed to complement the information and results presented in the article.

Supporting Figures

Figure S1 shows the impacts on ice particles located at three selected altitudes at the beginning of the extreme event, that have been calculated using expected temperature and pressure profiles from empirical models (Picone et al., 2002) as well as the observed vertical drafts. We have used published vapor pressures (Murphy & Koop, 2005), a water vapor volume mixing ratio of 3 ppmv and assuming that the particles experienced the observed vertical velocities for 3 min. In the case of ice particles experiencing the extreme updrafts (pink) they could be transported up more than 8 km in less than 5 min, their temperature could decrease more than 50 K, but their particle radius does not change since there are less water molecules available at these altitudes than lower down. On the other hand, those experiencing downdrafts (green), go down 3–4 km in less than 10 min their temperature increases more than 50 K, and their particle radius could decrease significantly (more than 15 nm in a few minutes), depending on the initial temperature. In Figure S1d, estimations for three different background temperatures with respect to

the empirical model are estimated and marked with different line styles. Note that these are approximate values, since we are not using the exact spatial and temporal information of the vertical velocity.

Supporting Movie

Movie S1 shows a temporal animation of the PMSE 2D spatial cuts in Figure 2. Instead of the color bar, a cut at 87 km is included.

Description of datasets

The data used in the plots presented in this article can be found at <https://www.radar-service.eu/radar/en/dataset/RD0yben0QktKPLsT?token=MIPFqNPRJY0xNGsasNXi>.

We present three types of files:

- Spectra and spectra moments of PMSE echoes in IDL sav format (*pmse_spectra* directory).
- Three dimensional PMSE brightness as function of frequency for each time interval in HDF5 format. The metadata of all imaging files is included in metadata.h5 (*pmse_imaging* directory).
- Winds from a closely located specular meteor radar (*smr_winds* directory)

References

- Murphy, D. M., & Koop, T. (2005). *Review of the vapour pressures of ice and supercooled water for atmospheric applications*. doi: 10.1256/qj.04.94
- Picone, J. M., Hedin, A. E., Drob, D. P., & Aikin, A. C. (2002, 12). NRLMSISE-00 empirical model of the atmosphere: Statistical comparisons and scientific issues. *Journal of Geophysical Research: Space Physics*, 107(A12), 15–1. Retrieved from

<http://doi.wiley.com/10.1029/2002JA009430> doi: 10.1029/2002JA009430

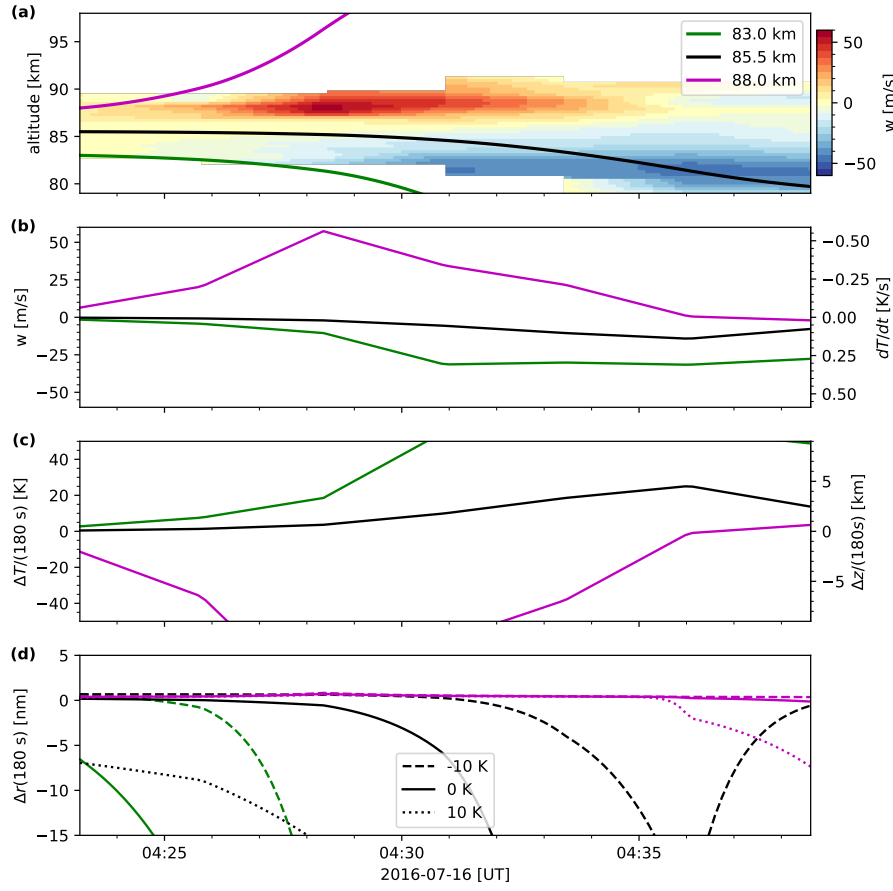


Figure S1. Effects of observed vertical drafts on air parcels located at three different altitudes: (a) observed vertical velocities and particle position, (b) vertical velocities and changes of temperatures for three altitudes, (c) changes of temperature and altitude for air parcels exposed 180 sec to the observed velocities, (d) changes of ice particle radius for three different background temperatures. Line colors correspond to the legend in panel (a).