EGU22-5972
https://doi.org/10.5194/egusphere-egu22-5972
EGU General Assembly 2022

Ascending smoke vortices in the stratosphere

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Ascending persistent smoke mesoscale anticyclonic vortices have been recently discovered in the mid-latitude stratosphere after several large wildfires. Such vortices can survive up to three months are rising to top altitudes between 20 and 36 km distributing aerosols along their way. They are also associated with a mini ozone hole. We will survey these observations from active and passive satellite instruments and the reconstruction of vortices by assimilation of the signature left in the ozone and temperature measurements. We will show in particular how the temperature dipole associated with the vortices is retrieved from the GPS-RO occultation and reproduced by the assimilation and describe a remarkable case of superimposition during the crossing of two vortices.

We will then describe our current understanding of the dynamics and stability of such structures where the radiative heating by solar absorption on the black carbon is the key forcing and where long wave radiative transfer provide a damping and diffusive effect. We will discuss the similarities and differences between simulations representing and full dynamics and the analysis that relies only on the temperature information. A simplified 1D-model will be used as a tool for interpretation and sensitivity studies.