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Dynamics of heated (or cooled) vortices in the stratosphere

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Recent extreme events associated with forest fires and large volcanic eruptions have demonstrated that dense aerosol clouds in the stratosphere often wraps up as persistent compact structures which rotate as anticyclones and also move vertically. One of these vortices has been observed over 3 months and experienced a 20 km rise. Such observations were made after the 2020 Australian wildfires, the 2017 British Columbia fire and more recently after the 2022 Tonga eruption and a few other cases. For all these events, the link was made with anomalous warming or cooling due to the composition of the clouds. This presentation will summarize the observed events and demonstrate the general characters of the stratospheric aerosol vortices. It will also discuss how they are detected by the weather assimilation systems through their signature in temperature, the conditions of their stability and how they can be reproduced experimentally with simple experimental models. Their impact on the transport of long-lived species will be discussed.

Such structures seem so far proper to the Earth stratosphere and have found analogies nowhere else.

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