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Observations of microbarom-generated infrasound in Northern Norway during three different sudden stratospheric warmings

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Previous studies have shown that the stratospheric dynamics can have notable impact on the propagation of acoustical infrasonic waves that penetrate these altitude levels. Atmospheric infrasound observations can hence provide prompt evidence of the development of large-scale stratospheric events like sudden stratospheric warmings (SSWs) and the associated disruption of the stratospheric polar vortex.

For continuous infrasonic ground-based monitoring of the stratospheric dynamics, we take advantage of a continuous source that emits infrasound into the stratosphere - a hot-spot between Greenland and Iceland where interacting ocean waves generate infrasound microbaroms, which typically have a peak frequency at around 0.2 Hz. We take advantage of the favourable separation between this infrasound-generating source and a large-aperture infrasound station in Bardufoss, northern Norway, to monitor the development of three different SSW-related events: 1) the March 2016 major final warming, 2) the February 2018 major SSW, 3) the December 2018 stratospheric warming.

When a steady cross-wind acts on a propagating acoustical plane wave, a bending of the wave-front is introduced which creates a deviation in the apparent backazimuth direction of infrasonic wave-fronts impinging ground-based sensor array stations. We take advantage of this physical effect to assess the dynamical evolution of the stratosphere during these three events, as sampled by the infrasonic waves on their paths between Iceland and the station in Northern Norway. Signals recorded at other infrasound arrays in this region are also reviewed. In addition, we investigate advanced array processing concepts to facilitate the investigation of situations with simultaneous and competing wavefronts arriving at the station.

We assess the infrasound-based observations in the context of the regional representation of these events in state-of-the-art atmospheric analyses and forecast models.