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Quantification of wind and diurnal tide in the upper stratosphere - prospective for assimilation

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The volcano Yasur is an outstanding source of infrasound for atmospheric studies as it generates nearly continuously acoustic waves which are detected at large distances. When monitored by the I22FR infrasound array (New Caledonia, $\tilde{4}$00 km), the wavefront parameters of the events can be extracted from the coherent signals detected across the array, such as the arrival azimuth, the apparent phase velocity, the amplitude or the dominant frequency. The diurnal modulation of these parameters was extracted through binning, using the so called "superimposed epoch analysis". Most of the detections are performed during the austral summer, when the propagation occurs downwind of the dominant stratospheric flow. Clear diurnal modulations of the azimuth and the velocity are unambiguously attributed to the diurnal tide effects in the upper stratosphere where the infrasound signals propagate. The phase of this modulation is in good agreement with the predictions using ray-tracing simulations along with the ECMWF atmospheric model. However, the amplitude of the azimuth modulation is clearly overestimated by the model while the average phase velocity is underestimated. Since the model uncertainties are rather large in this altitude range, most of the observed discrepancies are attributed to the model. Since infrasound propagation is very sensitive to high-altitude winds, such studies provide means to improve atmospheric specifications for both mean flow and diurnal tide, in a range of altitude where routine measurements are rare. Future assimilation of world wide infrasound observations, could significantly contribute to the improvement of general circulation models through detailed description of the upper-stratosphere dynamics.