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Simultaneous wind and temperature measurements in the middle atmosphere with a twin Doppler lidar

Jens Hildebrand, Gerd Baumgarten, Jens Fiedler, and Franz-Josef Lübken
Leibniz-Institute of Atmospheric Physics, Kuehlungsborn, Germany (hildebrand@iap-kborn.de)

Winds play an important role for the filtering of gravity waves traveling from the ground to higher altitudes. They control the propagation of gravity waves and the amount of transported energy and momentum. The thermal structure of the atmosphere determines its stability, hence the buoyancy frequency. Therefore, knowing winds and temperatures in the middle atmosphere is crucial to study and interpret atmospheric dynamics comprehensively. Both temperature and wind affect the propagation of infrasound waves through the middle atmosphere.
Observing winds and temperatures in the middle atmosphere on routine basis is challenging since a large part of this altitude range is not accessible by radars or satellites. Using the Doppler Rayleigh Iodine Spectrometer DoRIS, our Rayleigh/Mie/Raman lidar at the Arctic station ALOMAR in Northern Norway (69°N, 16°E) is capable to measure winds and temperatures simultaneously in the middle atmosphere between about 20 and 80 km altitude. Since two independently steerable telescopes are used, we can derive two wind components at once. Winds and temperatures are measured even under daylight conditions, yielding observations spanning multiple days, which is essential for, e.g., gravity-wave studies.
We will present results from case studies and a larger data set covering winter situations between 2012 and 2015, including stratospheric warmings and periods of enhanced gravity wave activity.