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Observations of up- and downward propagating gravity waves in the strato- and mesosphere.

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Experimental and modeling efforts show that small-scale gravity waves (GW) essentially affect large-scale circulations, thermal states, and dynamics from the surface to the middle atmosphere. In climate modeling and weather-forecasting applications the gravity-wave drag and its interaction with large-scale dynamics are referred to as sub-gridscale, i.e. unresolved processes and are the most uncertain aspect of these models.

Advances in lidar measurement techniques allow for experimental studies of GWs at very small spatial and temporal scales, which are not accessible by other means. The state of the art Doppler lidars and radars at the ALOMAR research station located in Northern Norway (69°N, 16°E) provide an observational database of GWs at the edge of the polar vortex connected to global dynamics of the Earth atmosphere. Doppler Rayleigh Iodine System (DoRIS) provides horizontal wind measurements in addition to the temperature observation. The altitude coverage is extended from 30 to 110 km by using the temperature observed by mobile Fe lidar with wind observations taken from meteor radar system.
This give us unique possibility to obtain wave propagation direction, intrinsic frequency and horizontal wavelength from the single station. Making use of the advantage of this system, we derive wave parameters more precisely, and under some conditions we observe waves with downward propagating energy.

In this paper we will present results of analyses of the GW observations by lidars and radars and discuss implications on atmospheric dynamics.