Convective initiation

The C-Band radar detects the first precipitation particles in a developing convective cell about 4 kilometers away from the lidar at 10:10 UTC.

Two minutes earlier, the Doppler lidar detects two lines of radial wind convergence (labeled A and B). Zone A is located to the west of the lidar and corresponds with the location where the emitted beam crosses the interface between the upwind and downwind branches of the mountain-valley breeze system.

The location of zone B corresponds with that above which the radar indicates the first precipitation particles. It appears that the radial convergence in this case has been caused by the convective updraft which a few minutes later started to produce precipitation.

Convective feedback

The research aircraft Do-128 has measured the air under the storm system’s anvil cloud starting at 11:39 UTC.

While flying legs at 1300 m above MSLL it detected a divergent wind field, a local minimum of moisture, a local maximum of precipitation and slightly lower density.

The simple possible source of the air was the air previously present at higher altitudes and the air must have subsided.

The fact that the air is less dense than its mesoscale environment (and positively buoyant) suggests that the forcing for the downdraft motion originates elsewhere.

Removing subsonic particles from the radar signal is seen in the radar reflectivity below 10 km.

Indications for subidence under the anvil cloud are seen in radarsonde data taken at station 5 on the southwestern flank of the storm system.

As it matures and decays, the air below the 600 hPa-level warms. Lidar observations by the Do-128 on the summit of Hornisgrinde have revealed the development of a warm, dry downdraft on the flanks of a mature storm system.

This feature has had profound implications for the subsequent development of convection: in vicinity of the forcing for the downward motion with 11:00 UTC over the eastern slopes of the Hornisgrinde. The downdraft has been very useful, because delivered simultaneous data of the quasi-horizontal wind field, potential temperature and slightly lower density.

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