Master Topics in the OPTIMIce group

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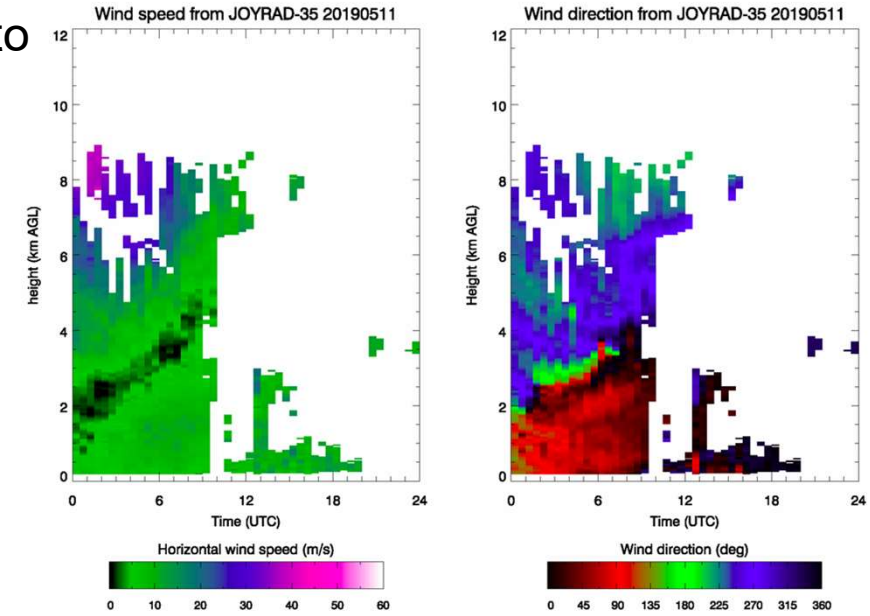
Windy atmosphere: What's the best method to measure wind in the troposphere? (MSc)

Background: The horizontal wind is one of the key variables of atmospheric dynamics and hence this variable needs to be measured with high accuracy to improve weather forecasts. Different methods exist to measure vertical profiles of wind including radio sonde, Doppler wind lidar and also Doppler radars. Recently, a new satellite (AEOLUS) was launched to measure global winds but the quality of its measurements has not been evaluated yet.

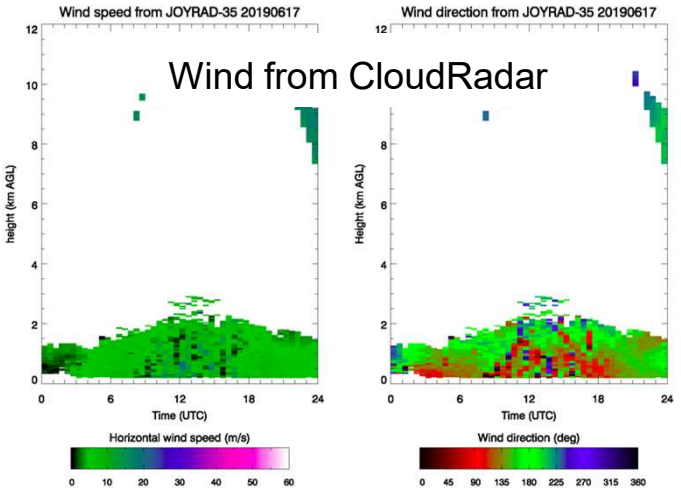


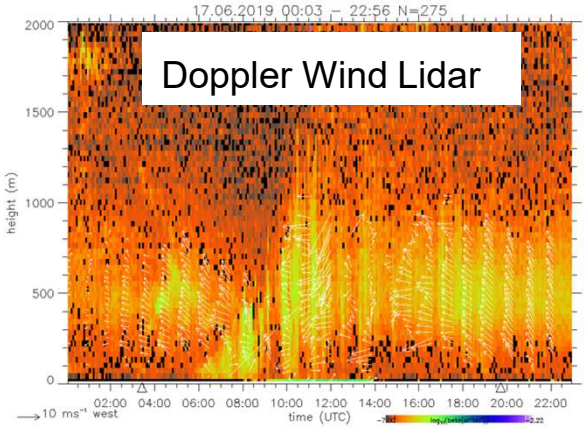
Tasks: At the Jülich Observatory for Cloud Evolution, we derive wind speed and direction with our cloud radar for regions where the radar can see clouds or insects (see example figure). In addition, a wind lidar provides the wind information within the boundary layer. Your task will be to compare the radar wind profiles with wind lidar and radiosonde. You will use these wind profiles to evaluate the overpasses of the new AEOLUS satellite which hasn't been done before. Can the satellite measure winds as good as our instruments from the ground?

Can we use insects as wind tracers? (MSc)

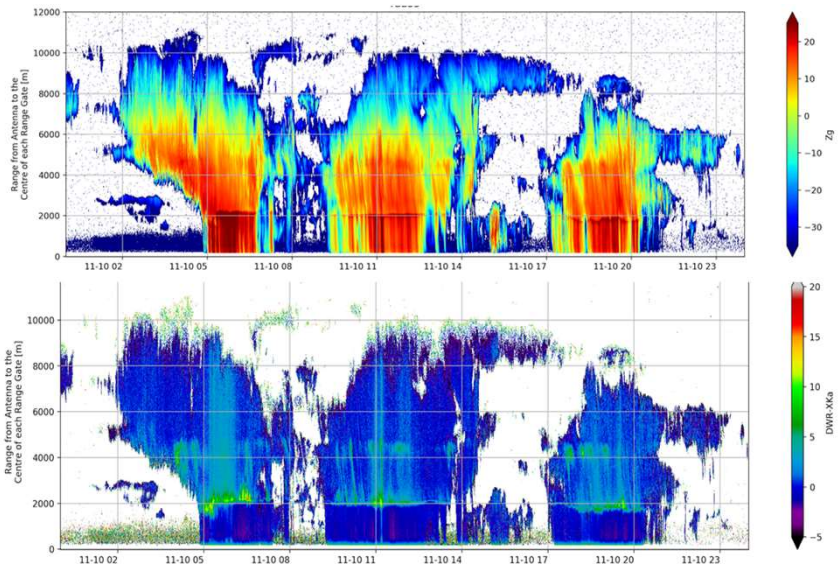
Background: Insects are almost omnipresent in the boundary layer and can be well detected by our cloud radars (see 3km thick insect layer in right plot). It looks like one can use insects as tracers to determine the horizontal wind in the lower atmosphere. However, this is only possible if the insects have no systematic own flight speed and direction. The badic research question is thus: Do insects as a whole have non-zero speed and flight direction and how large is it?

Tasks: At the Jülich Observatory for Cloud Evolution, we operate cloud radars which can only see clouds and insects but no aerosols. The wind lidar can only see aerosols (perfect wind tracers) but no insects. By building the difference, the residual would be the individual flight speed and direction of the insects. You will analyze wind products from lidar and radar for several cases to estimate the magnitude of insects flight speed and direction and relate it to the magnitude of the atmospheric wind.





Title: Attenuation of the melting layer (MSc)



Background: The melting layer (ML) is the region where snowflakes melt into raindrops. For space-borne retrievals, the ML is a big issue since it attenuates e.g. radar signals before reaching the lower regions of rainfall. Hence, this attenuation has to be corrected for in order to derive accurate global rainfall retrievals. Recently, multi-frequency radar observations allow new ways of directly measuring ML attenuation from the ground in order to constrain models and retrievals.

Tasks: You will use our multi-frequency radar dataset and derive ML attenuation for different radar frequencies as function of rainfall rate. You will have the possibility to compare different methods using Doppler spectra and scanning radar observations. You will also have the possibility to perform your own scan patterns with our cloud radar in order to collect specific ML scan data which complement the existing dataset. Finally, you will compare your results with recent literature values.