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Height correction of AMVs with airborne lidar observations

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Uncertainties in the height assignment of Atmospheric Motion Vectors (AMVs) are the main contributor to the total AMV wind error and these uncertainties introduce errors that can be horizontally correlated over several hundred kilometers, which poses a severe issue for their assimilation in NWP models. For this reason, we investigate how to improve the height assignment of AMVs, at first with independent airborne lidar observations and by treating AMVs as layer-winds instead of winds at a discrete level. In a second step, AMVs are now corrected with CALIPSO satellite observations based on the results of the airborne study.

The airborne lidar-AMV height correction reveals that the wind error of AMVs can be reduced by 10-15% when AMV winds are assigned to a 100-150 hPa deep layer beneath the cloud top derived from nearby lidar observations. The correction is performed using airborne lidar observations during the THORPEX Pacific Asian Regional Campaign 2008. In addition to the reduction of AMV errors, the lidar-AMV height correction is expected to reduce the correlation of AMV errors as lidars provide independent information on cloud top heights. First results from the correction of AMV heights with spaceborne lidar observations from CALIPSO indicate that similar improvements can be reached.

Furthermore, AMVs have been compared to dropsonde and radiosonde winds averaged over vertical layers of different depth to investigate the optimal height assignment for AMVs in data assimilation. Consistent with previous studies, it is shown that AMV winds better match sounding winds vertically averaged over $\sim$100 hPa than sounding winds at a discrete level. The comparison to deeper layers further reduces the RMS difference, but introduces systematic differences of wind speeds.