5.21 SOLAR ENERGY PERSPECTIVE ON THE DATA ASSIMILATION OF RADAR REFLECTIVITY IN A LIMITED AREA NWP MODEL

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Traditionally radar reflectivity observations have been used for getting information about precipitation. Thus, in the context of renewable energy the main users of radar reflectivity data have been water power companies. However, as the data assimilation of radar reflectivity data has an impact on cloudiness inside the NWP model through the humidity information, it also affects the forecast solar radiation and therefore might be of interest also for the solar energy sector.

In our work the radar reflectivity data was assimilated into the HARMONIE (ALADIN-HIRLAM) limited area numerical weather prediction (NWP) model to study its impact on solar radiation forecasts. The Harmonie-AROME configuration of the model was used (Bengtsson et al. 2017). Radar reflectivities were assimilated using indirect 1D+3D-Var assimilation method (Wattrelot et al. 2014) in which vertical humidity profiles are first retrieved using 1D Bayesian method and are then assimilated inside the 3D-Var data assimilation system.

Our HARMONIE model domain covers Finland, Scandinavia and the Baltic countries. The assimilated radar data were quality-controlled full-volume scans of radar reflectivity from Finland, Sweden, Norway and Denmark. We ran two one-month-long HARMONIE model experiments for July 2016 to study the impact of assimilation of radar reflectivity data: one experiment in which both radar reflectivity data and in-situ observations were assimilated and a control run with only in-situ observations assimilated. Verification scores against SYNOP and radiosonde observations were calculated and studied for both experiments. Assimilated radar reflectivity observations and their impact on the analysis were also monitored. Additionally, to study the impact of radar reflectivity assimilation specifically from the point of view of solar energy we compared the forecast global radiation against observations from 26 stations of the Finnish solar radiation monitoring network.

Verification against radiosonde observations showed that the radar reflectivity data had a slightly positive impact on the specific humidity between 300 hPa and 700 hPa. There was a slight negative impact on temperature between 200 hPa and 700 hPa. Other studied parameters in verification against SYNOP and radiosonde observations showed mainly neutral impact from data assimilation of radar reflectivity observations. These results are in line with earlier studies.

Comparison against global radiation observations showed positive impact from data assimilation of radar reflectivity at some stations, which looks promising. However, at some stations the impact was negative. We would next like to look more into reasons on why global radiation is sometimes well forecast and sometimes not and why the impact of radar reflectivity assimilation varies.

References

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Wattrelot, E., O. Caumont, and J.-F. Mahfouf, 2014: Operational Implementation of the 1D+3D-Var Assimilation Method of Radar Reflectivity in the AROME Model. Monthly Weather Review. Vol. 142. 1852-1873.