

## Abstract: **Lessons Learned from the Assimilation of Cloud-affected SEVIRI Radiance Observations at NCEP**

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Cloud-affected Spinning Enhanced Visible and Infrared Imager (SEVIRI) radiance observations from Meteosat-10 (MSG-10) are assimilated at NCEP. The three-dimensional variational and EnKF Hybrid (3D-Hybrid) system assimilates cloud-affected SEVIRI radiance in overcast condition beyond the clear sky SEVIRI radiance observations. The model state vector is locally extended at the observation location to include cloud top pressure, which describing a single-layer cloud is simultaneously adjusted together with temperature and humidity inside the main analysis. Initial assimilation experiments with overcast SEVIRI data have led to the following results:

- The assimilation of fully overcast SEVIRI infrared radiances in both global and regional was shown to systematically affect temperature, humidity and winds analysis increments in area of overcast cloud regime, showing a very good correspondence between the altitude where the changes occur and the diagnosed height of the overcast cloud.
- Experimentation with the assimilation of cloud-affected SEVIRI radiances in the context of without those data experiments has revealed that the forecast impact is pretty neutral.
- In general, low-level overcast scenes add most of the overcast situation to the system. High-level and middle-level overcast scenes are much fewer assimilated than low-level cloud in the system.

From the research and experimentation, we found:

- The main challenge of assimilating overcast SEVIRI radiances with this method is how to make the cloud top pressure as accurate as possible. Therefore, the cloud detection scheme in the space of brightness temperature is modified to radiance space in NCEP 3D-Hybrid data assimilation system. This modified scheme reduced the departure between observed overcast brightness temperature and the model simulated at window band 10.8 and 13.3 $\mu\text{m}$ . The entire data amount at water vapor band 6.2 and 7.3  $\mu\text{m}$ , and window band are increased with the new cloud detection scheme.
- The main shortcoming of assimilating overcast cloudy infrared data is only a few amounts data could be selected with the overcast restriction, which is possible not enough to represent the real cloud situation. So, in the next step, we need to investigate the directly assimilating of SEVIRI all-sky radiances through most sophisticated and accurate cloudy radiative transfer scheme with the inputs of cloud liquid and ice content profiles that describe the cloud's detailed characteristics.