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Use or radar satellite data (InSAR) to validate water vapor patterns in weather models

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InSAR signal delays due to the varying atmospheric refractivity are a potential data source to improve weather models [1]. Especially with the launch of the new Sentinel-1 satellites, which improves data coverage, latency and accessibility, it may become possible to operationalize the assimilation of differential integrated refractivity (DIR) values in numerical weather models. Although case studies exist on comparison between InSAR data and weather models, they generally involve only simple differencing of those DIR fields. Instead, we focus on analyzing weather patterns and statistics of DIR fields.

There are several advantages of this approach. (i) This gives us the possibility to split weather patterns and the exact location of these patterns. For example, sometimes it is much better to shift a weather model in time than trying to solve it by correcting the current model state. (ii) It enables comparison of InSAR data with other measurements, like GNSS. (iii) In this way different weather states can be classified, which gives us information on the performance of weather models on different conditions. (iv) Using this approach we can also use information from scales much smaller than the model resolution. In our case the model has a resolution of about 2 km, while the measured InSAR data can have a resolution of 10-100 meter.

In this study we will mainly focus on results for the Netherlands since the launch of the first Sentinel-1 satellite in 2014, but the methodology can be applied worldwide.
The used model is the HARMONIE model [2], which is a spectral, non-hydrostatic model with a resolution of about 2 km. Currently, this is the operational model in 11 European countries.

References:

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