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The SINERGY project: assessing the impact of InSAR data on weather forecasts using 3DVAR and the WRF mesoscale model, aiming at a better understanding of the atmospheric moisture content

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In the framework of the Synthetic aperture Instrument for Novel Earth Remote-sensed MetereoloGy and hydrologY (SINERGY) project, co-funded by the Italian Space Agency (ASI), a challenging task has been investigated: improving high resolution Initial Conditions (IC) of the Weather Research and Forecasting model (WRF) through the three dimensional variational assimilation (3DVAR) of InSAR (Interferometric Synthetic Aperture Radar) data. InSAR provides the phase difference of the radar electromagnetic pulse scattered by the earth surface that, in absence of surface displacement, is predominantly determined by the propagation delay through the atmosphere. The latter is a function of the atmospheric profiles and greatly affected by the total columnar quantity of the tropospheric water vapour. The evaluation of the atmospheric contribution from the interferometric products is achieved by applying the SBAS (Small Baseline Subset) technique to a series of Sentinel-1 acquisitions. To evaluate the impact of the assimilation of SAR data on the forecasted precipitation field, a geographic area without complex topography is chosen: the Po Valley, in Italy. Two main case studies are selected to perform the experiments: the first one is in the spring of 2015 and the other one in the autumn of 2016; in both cases, the interested areas are covered by the descending track 168 of Sentinel 1. Model configuration domains have been run to very high resolution (1 km). Final comparisons have been made using available data such as those derived from rain gauges, radar soundings and GNSS stations.