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Validation of Real-time Water Vapour Maps from a GPS Surface Network and the Application for Nowcasting of Thunderstorms

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The construction of real-time integrated water vapour (IWV) maps from a surface network of Global Positioning System (GPS) receivers is presented. The IWV maps are constructed using a two dimensional variational technique with a persistence background of 15 minutes old. The quality of these maps is assessed by comparison with radiosonde observations and IWV maps from a numerical weather prediction model NWP. The analysed GPS IWV maps have no bias against radiosonde observations and a small bias with NWP. The standard deviation with radiosonde observations is around 2 kg/m2, while the standard deviation increases with increasing forecast length (from 2 kg/m2 for the NWP analysis to 4 kg/m2 for a forecast length of 48 hours). Two thunderstorm cases are discussed to infer the additional value of these real-time products for nowcasting. The constructed GPS IWV maps are combined with data from the weather radar, a lightning detection network and surface wind observations. Both cases show that the location of developing thunderstorms can be identified a couple of hours prior by focusing on the convergence of moist air.