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Detection of small-scale structures in the neutral atmosphere using double differences of GNSS measurements.

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The presence of small-scale structures in the atmosphere (troposphere and ionosphere) can strongly affect the reliability of GNSS high precision real time applications. The concepts of reliability and integrity play a crucial role in the development of Galileo. Notably, processes of creation of thunderstorms cells due to the high density of water vapour in the neutral atmosphere can be the origin of strong disturbances in high precision real time positioning.

The GALOCAD project has been submitted in response to Galileo Joint Undertaking call for proposals 2423. GALOCAD stands for GALileo LOCal Component for the Detection of Atmospheric Disturbances which affect high accuracy Galileo applications. The objective of GALOCAD is to develop a methodology for the implementation of a Galileo Local Component for the nowcasting and the forecasting of atmospheric threats (troposphere and ionosphere) which can degrade the “integrity” of high precision Galileo applications. The paper presents the results obtained in the frame of that project about the influence of tropospheric threats on GNSS.

Since the end of 2003, Belgium is equipped with a network of 67 permanent GPS stations. The typical distance between the stations ranges from 4 to 30 km. The philosophy of GALOCAD is the following: in a first step, small-scale atmospheric distur-

bances are detected using GNSS data. Based on this dense network, we have characterized the behaviour of small-scale structures in the neutral atmosphere over Belgium. Using double differences of GNSS data, a tropospheric activity index has been developed. When this index is larger than a threshold value, the atmospheric conditions are qualified as “disturbed”. This index has been validated by comparing it to different “indicators”, in particular, meteorological radar imaging. In a second step, the effects of such atmospheric disturbances on high precision real time positioning is assessed based on software which simulates GNSS user “positioning conditions” on the field.