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Near real time assessment of the ionosphere effect on high accuracy GNSS applications which require ambiguity resolution.

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The goal of our study is to assess the effect of the ionospheric activity on differential GNSS positioning techniques based on carrier phase measurements. In practice, we want to evaluate the residual ionospheric error which affects positions obtained in real time using the so-called Real Time Kinematic (RTK) technique.

The main problem which arises from the analysis of phase measurements for precise real time positioning is the ambiguity resolution in real time or near real time. Most of the ambiguity resolution algorithms are based on an “a priori” assumed ionospheric differential variability between the reference station and the user. If the real differential variation is too different from the differential variation supposed “a priori” in the algorithm, the ambiguity resolution can be strongly affected.

The paper addresses the impact of a given ionospheric variability in terms of ambiguity resolution. In practice, we used the following methodology: we developed a software allowing the phase ambiguity resolution similar to the software used on the field by RTK users. In addition to this ambiguity resolution software, we created a second software able to measure the differential phase variation due to the ionosphere. By comparing the results of both software, we can evaluate the ionospheric effect on the ambiguity resolution. Basically, the differential phase variation due to the ionosphere affects the ambiguity resolution when this variation is not negligible compared to the wavelength of GPS signals. Based on the results of this study, we would like to establish an ionospheric variability index which could be a measure of the ionosphere effect on RTK positioning accuracy. Such an index could be used to warn RTK users against a degradation of positioning conditions.

In a first step, this method has been tested on short distances where the ionosphere is the only error source which could affect the ambiguity resolution. The inter-distance between the two stations we considered is 4.08 km. The paper demonstrates that even on such a short distance, the presence of a strong ionospheric disturbance (i.e. a strong Traveling Ionospheric Disturbance) can be the origin of residual differential ionospheric effects which can affect the ambiguity resolution and degrade the accuracy of real time positions at a few decimeter level.