Development of deep convection and identification of preliminary signs in water vapour structures by GNSS

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Belgium is equipped with a network of 67 permanent GPS stations. The typical distance between the stations ranges from 4 to 30 km which allows us to estimate the 2D field of the zenith delay of the neutral atmosphere over Belgium, this is connected to the humidity field. In addition, using horizontal gradients of delay, a precise location of water vapour structures can be plotted from GNSS observations.

To study the convective rainfall event of the 28-29 June 2005, we measured GNSS observations with a time resolution of 15 minutes. Considering all the synoptic observations archived by the Royal Meteorological Institute of Belgium, we will briefly present how our GNSS observations describe the meteorological situation. Our presentation will focus on the interest of these observations for nowcasting. On the 29th of June 2005 during a few hours, several clusters of convective cells developed above the major part of Belgium. For each of these clusters we have identified the same characteristic mechanism that we call "dry-wet contrast" of the humidity field.

We will present the three criteria to use operational detections of these GNSS contrasts for nowcasting. The first aspect is the definition of a meteorological warning using a "dry-wet contrast" (criteria to obtain a contrast, "level of a warning", and the role of GNSS gradient in the precise location of a warning). The second aspect is the validity of this warning referring to the development or not of this cluster. The third element of the criteria is time: the delay between the time it takes to process GNSS observations and establish a warning, in relation to the time of the development of a cluster potentially identified by meteorological radar and satellites. Finally we will present the score of our meteorological warning in a real-time situation.