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Effect of densifying the GNSS GBAS network on monitoring the troposphere zenith total delay and precipitable water vapour content during severe weather events

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The dense ground based augmentation networks can provide the important information for monitoring the state of neutral atmosphere. The GNSS&METEO research group at Wroclaw University of Environmental and Life Sciences (WUELS) is operating the self-developed near real-time service estimating the troposphere parameters from GNSS data for the area of Poland. The service is operational since December 2012 and it's results calculated from ASG-EUPOS GBAS network (120 stations) data are supporting the EGVAP (http://egvap.dmi.dk) project. At first the zenith troposphere delays (ZTD) were calculated in hourly intervals, but since September 2015 the service was upgraded to include SmartNet GBAS network (Leica Geosystems Polska - 150 stations). The upgrade included as well: increasing the result interval to 30 minutes, upgrade from Bernese GPS Software v. 5.0 to Bernese GNSS Software v. 5.2 and estimation of the ZTD and it's horizontal gradients. Processing includes nowadays 270 stations. The densification of network from 70 km of mean distance between stations to 40 km created the opportunity to investigate on it's impact on resolution of estimated ZTD and integrated water vapour content (IWV) fields during the weather events of high intensity. Increase in density of ZTD measurements allows to define better the meso-scale features within different synoptic systems (e.g. frontal waves, meso-scale convective systems, squall lines etc). These meso-scale structures, as a rule are short living but fast developing and hardly predictable by numerical models. Even so, such limited size systems can produce very hazardous phenomena - like widespread squalls and thunderstorms, tornadoes, heavy rains, snowfalls, hail etc. because of prevalence of Cb clouds with high concentration of IWV. Study deals with two meteorological events: 2015-09-01 with the devastating squalls and rainfall bringing 2M Euro loss of property in northern Poland and 2015-10-12 with the very active front bringing snowfall in southern part of the country. There are presented as well: the evaluation of differences in 2D fields of ZTD and IWV obtained from ASG-EUPOS network only and from ASG-EUPOS and SmartNet networks, their validation using IWV from numerical weather model and CM-SAF (Satellite Application Facility on Climate Monitoring) data. The results are interpreted towards the increase of possibility to detect the meso-scale weather features with densification of GNSS sensors network.