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DEM generation from high resolution satellite stereopairs for hydraulic hazard analysis

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The aim of this study is the evaluation of DEMs extracted from high resolution satellite stereopairs for their application in hydraulic hazard analysis.
As far as the monitoring of the hydraulic hazard of flat areas is concerned, a very important role is played by studies concerning the outflow of water after river floods or downpours. Such studies are based on complex forecasting hydraulic models, which need an accurate and detailed DEM as input together with planimetric and altimetric data regarding all the natural and anthropic objects, as riverbanks, roads in relief or buildings, which may interfere with the outflow of water.
The use of satellite imagery could reduce costs and speed up the elaboration. On the contrary, the main problem is represented by a higher bare ground height due to an erroneous matching (depending also on the geometric resolution of the satellite image): this can happen both for the streets in urban areas and for zones covered by vegetation, orchards and cultivated land. Obviously, this fact reduce the possibility of using DEMs generated from satellite imagery as input for hydraulic modeling.
The investigation has been carried out on an in-track GeoEye stereopair acquired over the area of Argenta, a small village in the province of Ferrara (Northeastern Italy, near the Reno river) on March 2010. Most of the area is covered by vegetation, orchards and cultivated fields.
The stereo orientation, image matching and DEMs extraction have been performed using the commercial software PCI Geomatics OrthoEngine v10.3, editing the final model also with Arcmap 9.3: not only the Panchromatic pair but also the NIR band one has been used during the whole process trying to reduce problems during the DEMs extraction.
To evaluate the DEMs accuracy, areas with different land cover have been selected, in order to identify critical zones with low mean accuracy which may introduce significant errors in hydraulic modeling. All the generated DEMs have been checked by sample comparisons, based on a consistent number of Check Points (CPs), surveyed by stop&go and kinematic GNSS with a mean 3D accuracy of about 0.15 m.
Finally, the most accurate DEM has been used as input in a forecasting hydraulic model run with the commercial software Mike 21 which simulates the outflow of water after the Reno river flood: the results have been compared with the ones obtained using as ground truth the model derived by GNSS stop&go survey.