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Evaluation of freely available ancillary data used for detailed soil mapping in Brazil

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Brazil is one of the world's largest food producers, and is home of both largest rainforest and largest supply of renewable fresh water on Earth. However, it lacks detailed soil information in extensive areas of the country. The best soil map covering the entire country was published at a scale of 1:5,000,000. Termination of governmental support for systematic soil mapping in the 1980's made detailed soil mapping of the whole country a very difficult task to accomplish. Nowadays, due to new user-driven demands (e.g. precision agriculture), most detailed soil maps are produced for small size areas. Many of them rely on as is freely available ancillary data, although their accuracy is usually not reported or unknown. Results from a validation exercise that we performed using ground control points from a small hilly catchment (20 km^2) in Southern Brazil (-53.7995ºE, -29.6355ºN) indicate that most freely available ancillary data needs some type of correction before use. Georeferenced and orthorectified RapidEye imagery (recently acquired by the Brazilian government) has a horizontal accuracy (root-mean-square error, RMSE) of 37 m, which is worse than the value published in the metadata (32 m). Like any remote sensing imagery, RapidEye imagery needs to be correctly registered before its use for soil mapping. Topographic maps produced by the Brazilian Army and derived geological maps (scale of 1:25,000) have a horizontal accuracy of 65 m, which is more than four times the maximum value allowed by Brazilian legislation (15 m). Worse results were found for geological maps derived from 1:50,000 topographic maps (RMSE = 147 m), for which the maximum allowed value is 30 m. In most cases positional errors are of systematic origin and can be easily corrected (e.g., affine transformation). ASTER GDEM has many holes and is very noisy, making it of little use in the studied area. TOPODATA, which is SRTM kriged from originally 3 to 1 arc-second by the Brazilian National Institute for Space Research, has a vertical accuracy of 19 m and is strongly affected by double-oblique stripes which were intensified by kriging. Many spurious sinks were created which are not easily corrected using either frequency filters or sink-filling algorithms. The exceptions are SRTM v4.1, which is the most vertically accurate DEM available (RMSE = 18.7 m), and Google Earth imagery compiled from various sources (positional accuracy of RMSE = 8 m). It is likely that most mapping efforts will continue to be employed in small size areas to fulfill local user-driven demands in the forthcoming years. Also, many new techniques and technologies will possibly be developed and employed for soil mapping. However, employing better quality ancillary data still is a challenge to be overcome to produce high-quality soil information to allow better decision making and land use policy in Brazil.