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Application of Google Earth Engine (GEE) to obtain calibration data for a large-scale hydrosedimentological model: a test case in South America

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In hydrosedimentological modelling, the lack of high temporal resolution field data is a limiting factor for the assessment of the performance of models. This way, the remote sensing images have been studied to correlate imagery information with suspended sediment concentration (SSC) in the last decades, aiming to complement field data, by improving the SSC information temporal and spatial resolution. Thus, the present work used the Google Earth Engine (GEE), a cloud-based platform, to systematically obtain red band reflectance information from Landsat 5 imagery to support large-scale hydrosedimentological modelling. The test case was to the Rio Grande do Sul state hydrological region in Brazil, a South American region with scarce SSC data. The methodology applied consisted in nine steps using GEE code: (1) river width analysis using remote sensing imagery to localize the virtual gauge stations (VGS) from the intersection between the discretization of hydrosedimentological model and the chosen rivers, (2) TM sensor definition, onboard of Landsat 5 satellite, (3) collection of red reflectance information between 1990 and 2010, based on previous works that presented better correlation between red reflectance and SSC, (4) in each VGS, we created a circle of radius equal to 1000 m, (5) to each image, we removed clouded-pixels, using the Landsat 5 quality bands, (6) we generated a dynamic water mask to each image to ensure that only pixels with water would be used to collected reflectance information, (7) finally, we calculated the mean of red band reflectance inside the intersection of water mask and circle buffer, removing the clouded-pixels, (8) we calculated a filter to remove remnants clouded-pixels and random errors from imagery, (9) we used the MGB-SED model to simulate long-term SSC in the region and we calibrated the model with the GEE data based on a correlation approach. The results found were: (i) 1267 virtual gauge stations, approximately 20 times the number of in situ SSC gauging stations available in the region, (ii) a larger area of data and greater temporal resolution, (iii) improvement in the correlation between model results and red reflectance, when we assess the model with SSC observed data. In conclusion, the work shows the potential of GEE to simply obtain large-scale reflectance data that could be used to improve the calibration processes of large-scale hydrosedimentological modelling.