Mapping flood prone areas in southern Brazil: a combination of frequency analysis, HAND algorithm and remote sensing methods

Roberto Fabris Goerl (1), Pedro Luiz Borges Chaffe (2), Joel Robert Marcel Pellerin (3), Juan Antonio Altamirano Flores (4), Janete Josina Abreu (5), Gustavo Andrei Speckhann (6), and Gerly Mattos Sanchez (7)

(1) Universidade Federal de Santa Catarina, Florianopolis, Brasil (roberto.f.goerl@ufsc.br), (2) Universidade Federal de Santa Catarina, Florianopolis, Brasil (pedro.chaffe@ufsc.br), (3) Universidade Federal de Santa Catarina, Florianopolis, Brasil (joel_cinara@yahoo.com.br), (4) Universidade Federal de Santa Catarina, Florianopolis, Brasil (juan.flores@ufsc.br), (5) Universidade Federal de Santa Catarina, Florianopolis, Brasil (janete.abreu@ufsc.br), (6) Universidade Federal de Santa Catarina, Florianopolis, Brasil (gustavo.speckhann@grad.ufsc.br), (7) Universidade Federal de Santa Catarina, Florianopolis, Brasil (gerly.sanchez@posgrad.ufsc.br)

Floods disaster damages several people around the world. There is a worldwide increasing trend of natural disasters frequency and their negative impacts related to the population growth and high urbanization in natural hazards zones. In Santa Catarina state, such as almost all southern Brazilian territory, floods are a frequent hydrological disaster. In this context, flood prone areas map is a important tool to avoid the construction of new settlements in non-urbanizations areas. The present work aimed to map flood prone areas in Palhoça City, Southern Brazil combining high resolution digital elevations data, remote sensing information, frequency analysis and High Above Nearest Drainage (HAND) algorithm. We used 17 years of daily discharge and stage data to calculate flood probability and return period. Remote Sensing (RS) with CBERS HRC image with 2,7m resolution was used. This image was taken one day after one flood occurrence and a band difference was used to extract the flood extent. HAND using DEM to calculate the altimetric difference between channel pixel and adjacent terrain values. All morphometric attributes used in HAND were extracted directly from the high resolution DEM (1m). Through CBERS image areas where flood level was higher than 0.5m were mapped. There is some kind of uncertain in establish HAND classes, since only distance to the channel was take in account. Thus, using other hydrological or spatial information can reduce this uncertain. To elaborate the final flood prone map, all this methods were combined. This map was classified in three main classes based on return period. It was notices that there is a strong spatial correlation between high susceptibility flood areas and geomorphological features like floodplains and Holocene beach ridges, places where water table emerges frequently. The final map was classified using three different colors (red, yellow and green) related to high, medium an law susceptibility flood areas. This mapping technique can be applied on flood zonation to avoid urbanization without planning.