Mapping of flow paths in large, anastomosing arid zone rivers: Cooper Creek, Australia

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Abstract:
Anastomosing rivers have moderately to highly sinuous, multiple, interconnected channels which form in low gradient floodplains and there are numerous examples of them in the world, such as rivers in inland Australia. Arid anastomosing rivers of Australia experience high transmission losses during floods and mapping of channels and inundation area can play an important role in quantifying the water lost via evaporation, infiltration or impoundment in wetlands. In this research, two DEM-based stream definition methods and a zero dimensional model were used to map channel patterns in Cooper Creek, Australia. The D8 and D-infinity DEM-based stream definition methods replicate a dendritic structure for the channel map of Cooper Creek which is in contradiction to its anastomosing pattern. In addition, a zero dimensional model in which a hypothetical water surface is overlain to the DEM was run in a large reach of Cooper Creek. The model cannot generate flow patterns along the length of the reach or else inundates a major part of the floodplain and does not illustrate the anastomosing patterns. It is found that the effect of scale, inability of model to calculate realistic water level dropping with flow, DEM inaccuracy and its limitation to capture micro topography are important in accurate mapping of inundation area by zero dimensional models and the model is not suitable for long river reaches. Results suggest that hydrodynamic models, informed by optical remote sensing data and satellite altimetry data, may be the most useful method to simulate and validate the flow routes and inundation area for anastomosing rivers of arid floodplains with high transmission losses.

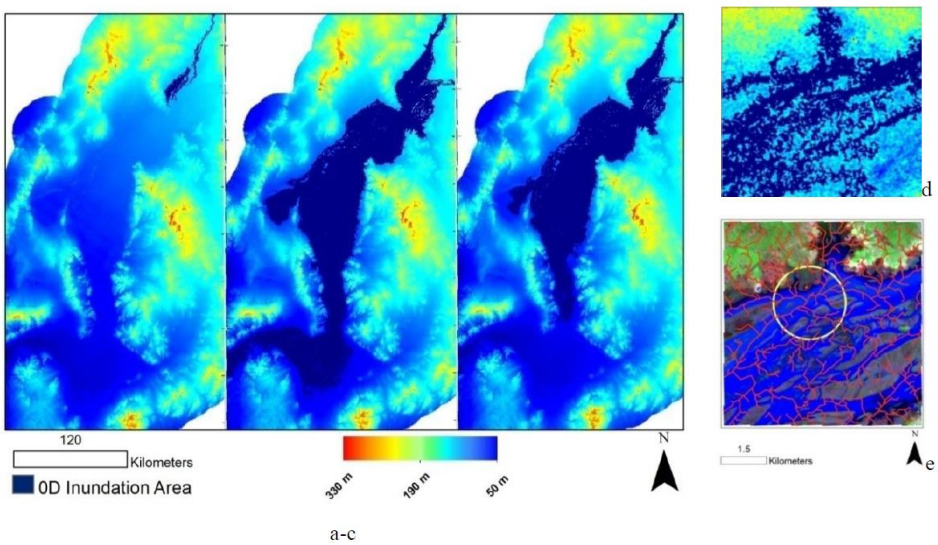

Figure (a) Flood mapping of Cooper Creek (dark blue) for a small flood with no transmission loss; (b) Medium flood with no transmission loss; (c) Medium flood with 75% reduction of water depth as transmission loss; (d) Inundation map of a small region in Thompson River downstream of Longreach (6.75*6.75 km) modelled by 0-D model (dark blue); (e) Observed coverage for the 1990 flood event, image of Landsat 5 TM (bands 2 (Red), 4 (Green), and 7 (Blue)) and overlaying TAUDEM stream network with only one replication of bifurcation in anastomosing rivers (center of yellow circle).