



How large is the Indus Basin? Facts, artefacts and basin delineation improvement needs

Asif Khan (1,2,3)

(1) University of Cambridge, Cambridge University, Engineering, Cambridge, United Kingdom (engrasif_civil@yahoo.com), (2) Department of Civil Engineering, University of Engineering and Technology Peshawar, Pakistan, (3) International Institute for Applied System Analysis, Schlossplatz 1 A-2361 Laxenburg, Austria

Digital Elevation Models (DEMs) are increasingly used for basin boundaries delineation in a variety of hydro-climatic studies. However, accuracy of basin areas depends on quality of DEMs and adopted methods. This study presents auto and supervised delineation in a case study of the Indus Basin (IB), which originates in the Himalayan Mountains and ends in the Arabian Sea. The published estimates of the IB area show significant variability, ranging from 866,000 to 1,230,000 km². Auto-delineation has been carried out using four DEMs: 1. GTOPO 30 (1km resolution), 2. GTOPO 30 Hydro1K (1km resolution), 3. CGIAR SRTM DEM (90m resolution), and 4. HydroSHEDS SRTM DEM (90m resolution). It is shown that discrepancies between different estimates reflect differences in the initial extent of the DEMs used for basin delineation, and are due to reiterating auto pit-filling process. Four critical points (where overestimates were suspected) have been selected, based on auto-delineated streams together with overlay of the minimum and maximum available basin boundaries, and were evaluated based on Google Earth and flow data. This study shows that the Pangong basin (in western Tibet), Gaggar-Hakra basin (starts from Himachal Pradesh and ends in the western part of the Thar desert) concomitant with downstream part of the Sukkur Barrage are not part of the IB, but are areas of either internal drainage basins or downstream command areas of the Indus River. Our best estimate of the IB area is ~833,000 km², and is in good agreement with the basin area by HydroSHEDS. This study recommends a revisit of earlier hydro-climatic studies, which are based on overestimated basin boundaries, and recommends to use the current study's results for future improvements. The important cautionary message of current study is to adopt supervised delineation, and to evaluate accuracy of auto-delineated areas based on geomorphology and flow data, particularly when there are endorheic lake basins or deserts in the vicinity.