Geophysical Research Abstracts
Vol. 17, EGU2015-7770-2, 2015
EGU General Assembly 2015

Spatial and altitudinal variation of precipitation and the correction of gridded precipitation datasets for the Upper Indus Basin and the Hindukush-Karakoram-Himalaya

Asif Khan (1,2), Keith S Richards (3), Geoffrey T Parker (1), Allan McRobie (1), Martijn J Booij (4), Zheng Duan (5), Bibi S Naz (6), Jun H Lee (7), and Mujahid Khan (2)

(1) Department of Engineering, University of Cambridge, Trumpington Street, CB2 1PZ, UK, (2) Department of Engineering, KPK University of Engineering and Technology, Peshawar, Pakistan, (3) Department of Geography, University of Cambridge, Cambridge, CB2 3EN,UK, (4) Department of Water Engineering and Management, Faculty of Engineering Technology, University of Twente, P.O Box 217, 7500AE Enschede, the Netherlands, (5) Delft University of Technology, Stevinweg 1, 2628 CN Delft, The Netherlands., (6) Oak Ridge National Laboratory, Oak Ridge, TN, USA, (7) Earth and Environmental Science, University of Texas at Arlington, USA

Precise and accurate precipitation data (of both snow and rain) are a vital input for hydrological modeling, climatic studies and glacier mass balance analysis. This study investigates the accuracy of eight widely used gridded datasets, based on mass balance assessments, for the Upper Indus Basin (UIB) in the Himalayas-Karakoram-Hindukush (HKH) mountain region. The eight datasets are: 1) Global Precipitation Climatology Project (GPCP) v 2.2, 2) Climate Prediction Centre (CPC) Merged Analysis of Precipitation (CMAP), 3) National Centers for Environmental Prediction (NCEP) / National Center for Atmospheric Research (NCAR), 4) Global Precipitation Climatology Centre (GPCC), 5) Climatic Research Unit (CRU) v 3.2.2, 6) Asian Precipitation Highly Resolved Observational Data Integration Towards Evaluation of Water Resources (APHRODITE), 7) Tropical Rainfall Measuring Mission (TRMM) 3B33 v 7, and 8) European Reanalysis (ERA) interim data. Precipitation derived from these datasets has been compared with the sum of flow, MODIS ETact (Actual Evapo-transpiration), and glacier imbalance contribution to flows. All these datasets significantly underestimate precipitation, being 40-80% less than the measured flows, except for the NCEP/NCAR and ERA interim datasets, which only slightly underestimate precipitation. This is the case for almost all watersheds in the UIB, particularly the Gilgit, Hunza, Shigar and Astore watersheds. To provide alternative, more physically-reasonable precipitation estimates, annual and seasonal (October-May and June-September) precipitation values have been derived for the entire UIB using multiple regressions relating precipitation for 46 climate stations to the local altitude, slope, aspect, latitude and longitude. The results are distributed across the whole basin on a 1km grid, with an estimated uncertainty of 5-10%. The spatial pattern shows good agreement with the Randolph Glacier Inventory (RGI) v 3.2 data, and with previous local studies that have measured and or modelled precipitation for various altitudes and watersheds. For the entire UIB (at Tarbela Dam), the revised annual average precipitation is 794 ± 79 mm/yr compared to the sum of flow and ETact of 877 ± 77 mm/yr, and a glacier melt contribution of about 20-40 mm/yr ($6 \pm 2\%$ of annual average flows). This provides the best precipitation estimate currently available. This study therefore cautions against use of the gridded data products listed above without substantial effort in bias correction; and argues that previous hydro-climatic studies for the UIB and its region, based on these datasets, need significant re-evaluation,. The precipitation distribution estimated here can, however, be used in the future to correct existing gridded data products and to improve hydro-climatic studies in the Himalayan region.