Geophysical Research Abstracts
Vol. 13, EGU2011-10325, 2011
EGU General Assembly 2011

HIMALA: Understanding the contribution of glacier and snowmelt in the Himalaya using a spatially-distributed energy balance model and remotely sensed data

Adina Racoviteanu (1), Guleid Artan (2), Mandira Shrestha (3), Samjwal Bajracharya (3), Pradeep Mool (3), Giriraj Amarnath (3), Molly Brown (4), Shahid Habib (4), Maria Tzortziou (4), and Hua Ouyang (3)

(1) University of Colorado, Institute of Arctic and Alpine Research, Geography, Boulder, United States (racovite@colorado.edu, 3034926388), (2) USGS, Sioux Falls, (3) ICIMOD, Kathmandu, Nepal, (4) NASA Goddard Space Flight Center, (5) University of Maryland

Snow and ice constitute an important component of the hydrologic regime of many large mountain ranges and regions, including the Himalayas. However, the hydrologic regime of Himalayan catchment basins, and the role of glaciers in the hydrologic regime of this mountain range (particularly their contribution to base flow) are not well understood. There are concerns about the impact of climate change on cryosphere as well as population growth, changing economic activity, land use change, rapid urbanization and inefficient water use on water resources. The HIMALA project, funded by the NASA's Applied Sciences Program and the United States Agency for International Development (USAID), in collaboration with the Integrated Center for Integrated Mountain Development (ICIMOD), Nepal, addresses the urgent need for integrated snow and ice hydrology in the Himalaya. Specific objectives are to: (i) introduce the use of NASA Earth Science products and models to ICIMOD and its member countries through collaboration with USAID and USGS and (ii) enhance the decision making capacity of ICIMOD and its member countries for management of water resources (floods, agricultural water) in the short (snow, rainfall) and the long-term (glaciers).
Here we present methodology for a sub-basin hydrological model for Langtang watershed in Nepal, that includes modeling both snow and glacier-melt water contributions to streamflow. Snow- and glacier-melt and outflow is estimated using a spatially distributed version of the Utah Energy Balance (UEB) snow accumulation and ablation model, driven by remotely sensed data (TRMM, MERRA) and downscaled meteorological data. Glacier outlines and glacier characterization parameters (albedo and volume) are derived from Landsat (1980s to present) and ASTER data (2000 to present) and used as input to the UEB model. Snow cover and albedo are acquired from MODIS data. We estimate the relative contribution by snow and glacier melt to total melt, which is validated using discharge at various gauge stations in the watersheds. We use the Geospatial Stream Flow Model (GeoSFM) hydrologic model to simulate dynamics of runoff processes. Static input data are SRTM DEM, land cover, and soil information. The model is forced by daily estimates of precipitation and evaportranspiration to predict daily streamflow at ground rain gauge stations.

We are developing new user interfaces so that models will be easy to learn and can be used to monitor streamflow in other basins in the region. ICIMOD will implement the prototype model in three large basins of the Himalaya (Koshi, Manas and Jhelum) ranging from east to west. This will provide a better understanding of the contribution of snow and ice to hydrology in the region with relation to the Asian monsoon.