Understanding and forecasting changes in High Mountain Asia snow hydrology via a novel Bayesian reanalysis and modeling approach

Principal Investigator – Steve Margulis (UCLA)
Co-Investigator – Marco Tedesco (LDEO of Columbia University)

Abstract:
Seasonal snow over High Mountain Asia (HMA) constitutes one of the most important components of the regional hydrologic cycle, and thus quantification of historical baseline conditions would be of significant utility for the purposes of closing the regional water balance and assessing how it might change in the future. In this project we are applying a newly developed data assimilation framework that merges remote sensing, atmospheric reanalysis, and modeling tools to characterize the spatio-temporal climatology of seasonal snow processes over the HMA region. The new reanalysis estimates of snowpack state and flux fields would include an explicit estimate of their uncertainty, which is particularly important in data-scarce regions like HMA, and should increase their utility as inputs/verification data for other High Mountain Asia Team (HiMAT) investigators. The reanalysis dataset will be analyzed with the objective of characterizing the spatio-temporal patterns of snowpack states, fluxes, and the underlying processes driving their evolution, including: accumulation and melt processes, assessing the relationship between snowmelt and streamflow, identifying the primary physiographic and atmospheric drivers of snow accumulation, and evaluating the changes in the spatial patterns of snow over the remote sensing record. The reanalysis dataset will allow for a direct characterization of the seasonal snowpack water storage, and its temporal variation, over the entire HMA region. Such information will provide inputs to water planners to assess water resource availability and to develop better models for water allocation and hazards in ungauged high-elevation regions. The reanalysis dataset will also be used to assess how well Regional Climate Models (RCMs) perform in the HMA region with respect to snow and snowmelt-runoff processes. Through this analysis we will diagnose how parameterizations in RCMs could be improved.