Geophysical Research Abstracts
Vol. 17, EGU2015-14453, 2015
EGU General Assembly 2015

Mass balance simulations with an energy-based glacier model for the Muji Glacier on the eastern edge of the Pamirs

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A distributed energy-based glacier model coupled with a land surface hydrology model is developed and validated over the Muji Glacier (39.1865° N, 73.746°E, 5532-4715 m above sea level, 2.42 km2) on the eastern edge of the Pamirs with meteorological measurements and mass balance stake records on the glacier. Surface energy fluxes and melt rates are simulated for each 30m $\times$ 30m grid cell at a 3-hourly resolution for the period July 2011 to September 2014. The inputs of the coupled model include daily maximum and minimum air temperature, daily precipitation, wind speed, slope and aspect, and elevation of each grid cell. A new scheme of downward shortwave and longwave radiation is developed based on the limited climate inputs. The simulated incoming shortwave and longwave radiation, and albedo are compared with the measurements from 3 automatic weather stations during July 2011-September 2014. The mass balance over each 30m $\times$ 30m grid cell is simulated for the entire Muji Glacier with the distributed energy balance model for the three water years. The simulated mass balance is validated with the stake records for both melt and accumulation seasons and the validation results are plausible. The coupled energy-based-glacier-hydrology model will be further validated at the basin scale with measured glacier runoff.