Modified Satellite Products on Snow Covered Area in Upper Euphrates Basin, Turkey

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Snowmelt runoff in the mountainous eastern part of Turkey is of great importance as it constitutes nearly 2/3 in volume of the total yearly runoff during spring and early summer months. Therefore, keeping track of the snow covered area and snow potential especially in the headwaters of the trans-boundary Euphrates River, where large dams are located, is an important task in order to plan dam regulations and optimize water resources.

In the last decade, Moderate Resolution Imaging Spectroradiometer (MODIS) optical satellite images are extensively used for determining areal snow coverage especially in hydrologic modeling. But optical satellites are hindered by cloud cover where at times when cloud is present, land cover can not be determined. For this reason, during winter (ablation period) and spring (melting period) it is crucial to determine snow covered areas with little or no cloud.

Karasu River in the Upper Euphrates Basin with an area of 10275 km2 and an elevation range of 1125-3500 m is selected as the study area since it is one of the main branches feeding the Keban Dam Reservoir (first dam in the series of large dams in Euphrates Basin). Daily 500 m resolution MODIS satellite images on Terra (MOD10A1) and Aqua (MYD10A1) platforms are used to determine the areal snow extent in the basin for 2008 and 2009 water years. Combination and filtering techniques are applied in a pixel-by-pixel process with the purpose of decreasing cloud cover. Daily MODIS/Terra and MODIS/Aqua images are combined as the first step in the process. A temporal day filter working backward and forward followed by an elevation filter using the Digital Elevation Model of the region is utilized. A spatial filter is passed as the final step of the process. Using the modified satellite products, cloud cover is decreased more than 99% in the basin as compared to MODIS/Terra images alone. Modified satellite images are later compared with 33 ground station data ranging in elevations between 1000-3000 m for validation purposes. Validation accuracy for modified satellite images are 96.5% for snow and 99.3% for land respectively. Finally, snow depletion curves of the basin are generated for 2008 and 2009 water years. In conclusion, it is seen that modifying daily MODIS satellite products has a significantly positive impact on achieving near to clear snow extent in the basin which will later be used for masking snow potential areas and providing snow depletion curves for operational hydrologic modeling.

Keywords: Snow covered area; MODIS; Upper Euphrates Basin