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Spatial analysis and statistical modelling of snow cover dynamics in the Central Himalayas, Nepal

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General circulation models are able to predict large scale climate variations in global dimensions, however small scale dynamic characteristics, such as snow cover and its temporal variations in high mountain regions, are not represented sufficiently. Detailed knowledge about shifts in seasonal ablation times and spatial distribution of snow cover are crucial for various research interests. Since high mountain areas, for instance the Central Himalayas in Nepal, are generally remote, it is difficult to obtain data in high spatio-temporal resolutions. Regional climate models and downscaling techniques are implemented to compensate coarse resolution. Furthermore earth observation systems, such as MODIS, also permit bridging this gap to a certain extent. They offer snow (cover) data in daily temporal and medium spatial resolution of around 500 m, which can be applied as evaluation and training data for dynamical hydrological and statistical analyses. Within this approach two snow distribution models (binary snow cover and fractional snow cover) as well as one snow recession model were implemented for a research domain in the Rolwaling Himal in Nepal, employing the random forest technique, which represents a state of the art machine learning algorithm. Both bottom-up strategies provide inductive reasoning to derive rules for snow related processes out of climate (temperature, precipitation and irradiance) and climate-related topographic data sets (elevation, aspect and convergence index) obtained by meteorological network stations, remote sensing products (snow cover - MOD10-A1 and land surface temperatures - MOD11-A1) along with GIS. Snow distribution is predicted reliably on a daily basis in the research area, whereas further effort is necessary for predicting daily snow cover recession processes adequately. Swift changes induced by clear sky conditions with high insolation rates are well represented, whereas steady snow loss still needs continuing effort. All approaches underline the technical difficulties of snow cover modelling during the monsoon season, in accordance with previous studies. The developed methods in combination with continuous *in situ* measurements provide a basis for further downscaling approaches.