

Prametrization of integrated hydrological model of Nam Co lake catchment on Tibetan Plateau using synergy of SAR and optical data

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Abstract

Understanding of exchange processes over Tibetan Plateau including hydrological cycle is becoming increasingly important since their influence on the formation of the Asian monsoon system is known. Recent variation of levels of Tibetan lakes and retreat of mountain glaciers has to be studied in detail with respect to global change. Tibetan Plateau is source area for main Asian rivers that are of crucial importance for downstream communities of China, India, Bangladesh, Pakistan and SE Asia. Accurate and up-to date information of the characteristics and the current trend of these changes, provided by modern satellite systems like TerraSAR-X, are thus needed.

The study area is delimited by the watershed of Nam Co basin on Tibetan Plateau in Tibet Autonomous Region of China approximately 100 km NNW from Lhasa. The no-outlet basin of the lake offers an excellent example of landscape unit characteristic for Tibetan Plateau where all exchange processes between land and atmosphere can be studied. The area extends in range from E 89° 23' to E 91° 20' longitude and between N29° 59' and N31° 07' of latitude. The altitude of the lake is 4718 m above sea level. The study area of approx. 15,000 km² includes the lake itself (1870 km²), North flanks of Nyainqêntanglha mountain ridge with highest peak of altitude 7162m and large extent of steppe with wetlands on flat parts. Precipitation is less than 300 mm, a semi-arid winter cold steppe climate (warmest month < 10°C). The highest mountains of Nyainqêntanglha ridge are ice covered, several large alpine glaciers are developed in highest parts of mountain valleys.

There is a limited amount of ground data available thanks to field station of the Institute of Tibetan Plateau on the southern lake shore. There are namely records of hydro-meteorological data at the station and on several tributaries. Hydrologic modelling of Nam Co lake basin will be supported by complex interpretation of TerraSAR-X data that will provide whole set of hydrologic parameters. The TerraSAR data will be processed in synergy with other available microwave and optical remote sensing data sets. Basic extracted variables will be thus transformed into more complex ones for example evapotranspiration, interception and infiltration.

Data evaluation will take into account various aspects of landscape qualities with respect to water cycle. Variability of lake extent, seasonal changes of soil moisture, influence of wetlands, snow melt will be estimated and will be converted into meaningful variables for

hydrologic modelling. The synergetic approach to interpretation of TerraSAR-X data will benefit from major advantages of the high spatial resolution, the fast repetition cycle and the full-polarimetric capabilities in combination with high resolution optical data (QuickBird, Kompsat-2, ASTER, Landsat etc.) and digital elevation models.

Nam Co catchment area has very low precipitations. The tributaries are mostly fed by snow melt in spring period. In order to study snow melt-runoff variability in melt season time series of TerraSAR images over Nyainqêntanglha mountain ridge will be acquired. An accurate and up-to date information on characteristics and current trends of mountain glaciers in Nam Co basin is missing. Mapping based on high resolution TerraSAR-X are therefore needed. Icing patterns over Nam Co lake and their dependency on various factors like prevailing wind will be studied using combination of SAR and optical data. The oldest relevant datasets are Corona reconnaissance images from 60's. Wetlands in Nam Co basin have not been studied in detail yet. Since they play an important role in interception, their annual changes will be examined using time series of microwave data.