**Scientific Context and objectives:**

How useful are satellite-based rainfall estimates (SRFE) as forcing data for hydrological applications in Peruvian Andes? Which SRFE should be useful for hydrological modelling? What could researchers do to increase the performance of SRFE-driven hydrological simulations? To address these three research questions, two SRFE (TRMM 3B42RT and PERSIANN-CCS) are evaluated within a hydrological application for the time period 2004–2012. The focus is on the assessment of the hydrological performance of: (a) the individual calibration of model for observed data of precipitation (b) SRFE-specific calibration and (c) the calibration of the observed combined with SRFE precipitation, where the last one will be obtained by interpolation techniques (merging).

**Study site and data:**

The Vilcanota basin river is located in the southern Peruvian Andes at the department of Cusco, the Vilcanota river is one of the tributaries of the Amazon River system. Drainage basin 9638 km². Mean annual precipitation: 850 mm (2000 – 2012). Elevation: 1778 to 3609 m. Mean annual discharge: 136 m³/s (2000 – 2012)

In order to obtain model parameters in SWAT, a wide range of input datasets is required, including: information on topography, vegetation, soil properties and hydro-meteorological data which were obtained from different sources:

- **Digital Elevation Model (DEM)** with a 90 m resolution. Runoff 0.25 m³/s.
- **Soil:** Predominant soil types in the study area are Lithosols and Kastanozems (FAO-UNESCO 1998).
- **Vegetation:** The land cover is dominated by natural grassland (82.7%), shrublands (10.4%), scattered areas of traditional cultivation (1.7%), and small glades and lakes represent a smaller percentage.

**Methodology:**

In this work we present only the methodology and results of the hydrological modelling using the observed data of precipitation. The ArcSWAT 2012 interface is used to set up and parameterize the model. On the basis of DEM and the soil of the study area we discretized the basin into 17 subbasins, which were further sub-divided into 644 HRUs based on soil, landuse, and slope characteristics. Each HRU is thought to be a uniform unit where water balance calculations are made. The entire simulation period is from 2000 to 2012. The first 4 years are used as equilibration period to mitigate the initial conditions and so were excluded from the analysis.

We established 2004 to 2009 period for calibration and 2010 to 2012 period as validation, where 12 parameters were selected for the calibration based on precedent studies, and results from Latin Hypercube-one factor at a Time (LH-OAT) parameter sensitivity analysis using the HydroPSO package in R (Zambrano-Bigiarini and Rojas, 2012). Then the SUFI-2 algorithm (Abbaspour et al., 2004) included in SWAT-CUP software package (Abbaspour, 2011), was used for model calibration and validation.

The model performance during calibration was assessed using the modified Kling Gupta Efficiency (KGE) (Kling et al., 2012). According to Kling (cited by Themig et al. 2012) the hydrological performance can be classified using KGE as shown in Table 2.

**Results:**

As shown in Fig. 2, the SWAT model by default can characterize the overall patterns of observed flow (as intermediate) according to KGE. Where clearly we can see that the low flows were underestimated and the high flows were overestimated, so we calibrated the parameters that influence the base flow (groundwater) and superficial flow (runoff) shown in table 1 for the calibration.

**Conclusions**

In this study the hydrological model of the Vilcanota river basin was built using the well-established SWAT program. The model was calibrated for river discharge station (km. 105), using the algorithm SUFI-2 in SWAT-CUP tool. The SWAT model effectively simulated streamflow in the study area considering the five main performance evaluation metrics used.

To answer the three questions of the Scientific Context this research is still continuing to evaluate the impacts of the satellite based rainfall estimates (SRFE) as forcing data for hydrological applications in Peruvian Andes.

**References**


**Bibliography**


