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Evaluation of the SAFRAN-ISBA-RAPID hydrometeorological chain on a mountainous catchment in a semi-arid region. Case of the Rheraya (Marrakech, Morocco)

Camille Szczypta (1), Simon Gascoin (1), Florence Habets (2), Amina Saaidi (3), Brahim Berjamy (4), Ahmed Marchane (5), Gilles Boulet (1), Lahoucine Hanich (5), and Lionel Jarlan (1)

(1) CESBIO, Toulouse, France (camille.szczypta@gmail.com), (2) UPMC Univ Paris 06, UMR Metis, Paris, France, (3) DMN, Casablanca, Maroc, (4) ABHT, Marrakech, Maroc, (5) LGR, FST/UCAM, Marrakech, Maroc

The water content of snow pack is an important resource for many watershed in semi-arid areas where downstream plains are dominated by irrigated agriculture. As part of the ANR Amethyst, this work is to develop, adapt and evaluate a hydro-meteorological forecasting chain for quantifying streamflows at the outlet of a mountainous watershed (Rheraya wadi, Marrakech region, Morocco), a pilot basin instrumented since 2003 as part of SudMed project. Two sets of atmospheric forcing were used: (1) The first was generated by spatializing meteorological data observed on 6 stations (Asni, Aremdt, Tachedert, Oukaimeden, Imskerbour and Neltner) using the semi-physical module Micromet (Liston and Elder, 2006) on the hydrological period September 2003 - August 2012; (2) the second is provided by the SAFRAN re-analysis, implemented by the Metoffice of Morocco (Casablanca, Morocco), during the period August 2004 - July 2008. These two sets were then used as inputs for the ISBA surface model, within the modeling platform SURFEX. Finally, runoff and drainage simulations derived from ISBA were forced into the hydrological model RAPID to predict streamflows. The flows predictions and the snow covered area (SCA) were compared respectively to the observations available for the 2003-2009 period and to the daily MODIS products of SCA. Despite time unsystematic lags and low biases on flow values, the initial results are encouraging due to topographical and hydro-complexity of the studied area. Despite a slight tendency to underestimate the SCA for the "Micromet" run and to over-estimate for the "Safran" run, SCA is well reproduced with a determination coefficient of r^2=0.76 and r^2=0.79, respectively. Given the complex topography of the basin, a sensitivity analysis to the size of the grid point (from 8 km to 250 m) was conducted. If the different simulated series of SCA are close from a resolution to another, streamflows simulations are, by contrast, highly sensitive to the resolution. The simulations obtained at a resolution of 1 km are in our case study, the most suitable to simulate the flows at the outlet of the basin (Nash = 0.15 and KGE=0.54).