LSTM-based Deep Learning Approach for Prediction and Predictive Snow Depth in Atlas,Morocco.

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Abstract

Water resources management has always been a challenging task in the Moroccan context where ground measurements are scarce and climatic and physical conditions are very heterogeneous. In the last decade, machine learning and deep learning have emerged as a promising tool for developing watershed planning process due to their high-performance, accuracy and predictive capability.

For Many Moroccan basins, snowmelt is a key component for hydrological cycle (e.g in Tensift and Oum Er Bia). Snow water equivalent (SWE) is the snow-related variable that is most used input in runoff modelling over basins with snow influence, as it expresses the total quantity of water stored in the snowpack. However, measurements of SWE are expensive, and not continuously accessible in real-time. This motivates a search for alternative ways of estimating SWE from measurements that are more widely available and continuous over time and distributed in space. Sturm et al. (2010) estimated SWE measurements to be 20 times more expensive than snow depth measurements. SWE can also be calculated, however, using snow depth and the volumetric mass density of snow.

To overcome these challenges, we propose in this work, a new deep learning-based framework approach to predict snow depth at a local scale using meteorological variables recorded through the available Automatic Weather Stations installed in the Atlas Mountain (Oukaimden and M'Goun). In order to spatialize the retrieved model at the basin level, variables from Reanalysis data ERA5 will be used as a predictor of snow height. To this end, the deep learning as long term memory (LSTM) algorithm was used to compare the prediction accuracy of the proposed model and a dataset including weather variables was used to train, test and validate our model.