Use of SAR data to support agricultural water management in Burkina Faso

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The present project investigates the possibility of exploiting high resolution synthetic aperture radar (SAR) images for calibrating an hydrological model to support water resource management and agricultural policies . The study area is the district of Yatenga, northern Burkina Faso in the sub-Saharan belt of West Africa. Extreme climate conditions, with alternation of strong wet and dry seasons, affect the region. Such a climate provokes agricultural problems for the occurrence of floods in the rainy season and intense drought in the dry season. Another problem is the intense soil erosion that provokes the loss of fertile land and the rapid filling of basins for water storage. In the above presented context land-use and water resource management choices have a prominent role in order to minimize the effects of the climate conditions. Any water management policy needs a hydrological assessment to calibrate and to forecast the future effects. In this context the use of remotely sensed data plays an important role, for the implementation of hydrological models, especially in the case of in non-monitored basins. Because of the luck of long time records of rainfall and runoff data, the lumped hydrological model cannot be employed in these basins. On the other hand, the distributed hydrological models constitute a possible approach only if a good spatial description of the relevant parameters is available. One of the major aims of the present work is to evaluate the possibility of deriving the spatial distribution of many of the relevant parameters from the SAR images. The SAR data are obtained by Cosmo-Skymed program in the frame of a 2-years research project approved by the Italian Space Agency (ASI) and proposed by the Department of Biomedical, Electronic and Telecommunication Engineering of University of Napoli with the Department of Civil Engineering of University of Salerno and the Unité de Formation et de Recherche en Sceinces de la Vie et de la Terre of University of Ouagadougou (Burkina Faso). A set of strip-map, spotlight and scan-sar data is provided from April 2010 to March 2012. In the work, innovative models for the retrieving of information from SAR images, based on efficient and innovative algorithms for the image interpretation, has been employed; two main applications will be presented: the retrieval of topographic information via interferometric classical techniques and the classification of the images by means of innovative fractal tools.
Significant efforts have been made in the linkage of geographic information systems (GIS) and hydrological-models improving the management of great bulk of data and allowing for rapid parameter estimation. Moreover, an effort has been dedicated for improving the use of geographic information, derived from SAR data interpretation, in the hydrological study approaches. In this context a special attention has been given to the choice of an open source hydrological model. The model SWAT (Soil and Water Assessment Tool), developed by the USDA (Agricultural Research Service at the Grassland, Soil and Water Research Laboratory in Temple, Texas, USA) has been selected because it holds all the requested features; it is a basin scale, physically-based continuous distributed model that may give previsions of water availability, erosion-sedimentation process, crop growth and transportation of pollutant. The preliminary results of the model projections, for different land-uses and water management choices, are presented, along with possible future applications in other small sahelian watersheds in the district of Yatenga.