



## **Estimation of daily Snow Cover Area combining MODIS and LANDSAT information by using cellular automata**

Eulogio Pardo-Iguzquiza (1), Antonio Juan Collados Lara (2), and David Pulido-Velazquez (2)

(1) Instituto Geológico y Minero de España, Ríos Rosas, 23, 28003 Madrid (Spain). , (2) Instituto Geológico y Minero de España, Urb. Alcázar del Genil, 4. Edificio Zulema Bajo, 18006, Granada (Spain)

The snow availability in Alpine catchments is essential for the economy of these areas. It plays an important role in tourist development but also in the management of the Water Resources Snow is an important water resource in many river basins with mountains in the catchment area. The determination of the snow water equivalent requires the estimation of the evolution of the snow pack (cover area, thickness and snow density) along the time. Although there are complex physical models of the dynamics of the snow pack, sometimes the data available are scarce and a stochastic model like the cellular automata (CA) can be of great practical interest. CA can be used to model the dynamics of growth and wane of the snow pack. The CA is calibrated with historical data. This requires the determination of transition rules that are capable of modeling the evolution of the spatial pattern of snow cover area. Furthermore, CA requires the definition of states and neighborhoods. We have included topographical variables and climatological variables in order to define the state of each pixel. The evolution of snow cover in a pixel depends on its state, the state of the neighboring pixels and the transition rules. The calibration of the CA is done using daily MODIS data, available for the period 24/02/2002 to present with a spatial resolution of 500 m, and the LANDSAT information available with a sixteen-day periodicity from 1984 to the present and with spatial resolution of 30 m. The methodology has been applied to estimation of the snow cover area of Sierra Nevada mountain range in the Southern of Spain to obtain snow cover area daily information with 500 m spatial resolution for the period 1980-2014.

**Acknowledgments:** This research has been partially supported by the GESINHIMPADAPT project (CGL2013-48424-C2-2-R) with Spanish MINECO funds. We would also like to thank NASA DAAC and LANDSAT project for the data provided for this study.