GROUNDWATER RECHARGE ESTIMATION IN KARST AQUIFERS OF SOUTHERN APENNINES (ITALY) BY INTEGRATION OF REMOTELY SENSED DATA

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In many Italian regions, the karst aquifers are main source of drinking water and play a crucial role for socio-economic development and hydro-bio-geomorphological conservation of groundwater-dependent ecosystems (Allocca et al., 2015). The reliable estimation of groundwater recharge of these aquifers is a fundamental tool for the management of water resources, also considering the effects of climate changes.
In karst areas of southern Apennines the high-altitude rain and air temperature gauges stations are absent and the conditions of land use are quite variable (Allocca et al., 2014) therefore the assessment of hydrological parameters, needed for the estimation of groundwater recharge, is a challenging issue to be faced. In such a framework an integration of terrestrial and remotely sensed data is a promising approach to limit uncertainties.
In this research, we report results of a study aimed to estimate actual evapotranspiration (ETa) and groundwater recharge in karst aquifers of southern Apennines, by using remotely sensed data derived by the MODIS satellite. In a GIS environment, hydrogeological, geomorphological and land use data (Allocca et al., 2014), were implemented, along with the time series of annual ETa, as estimated by the MODIS Global Evapotranspiration Project (MOD16) for the period 2000-2014. To assess uncertainties in the estimation of ETa, values estimated by the MODIS ETa dataset were compared with those calculated by Turc, annual rainfall and 150 time series of mean annual air temperature recorded by regional meteorological networks in period 2000-2014 were implemented in the GIS environment, in order to reconstruct distributed models of ETa and of groundwater recharge.
Results show a strong spatial variability of mean annual ETa and a significant relationship with air temperature, rainfall, land use and vegetation coverage. At regional scale, the mean annual ETa is about 670 mm for estimations derived by the MODIS data, and about 599, 539 and 695 mm, for estimation by Turc, Coutagne and Thornthwaite formulas; the mean annual groundwater recharge is about 448 mm considering MODIS Eta, and 494, 533 and 437 mm for estimations derived by the application of the Turc, Coutagne and Thornthwaite methods.
The obtained results reveal a new perspective in the assessment of actual evapotranspiration

and of groundwater recharge of karst aquifer at the regional scale given by the application of MODIS data, which allow to overcome the absence of meteorological gauge stations in high mountainous areas.

References

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