

A feasible methodology for groundwater resource modelling for sustainable use in sparse-data drylands: Application to the Amtoudi Oasis in the northern Sahara

Alcalá F.J.

Martín-Martín M.

Guerrera F.

Martínez-Valderrama J.

Robles-Marín P.

In a previous paper, the Amtoudi Oasis, a remote area in the northern Sahara in southern Morocco, was chosen to model the dynamics of groundwater-dependent economics under different scenarios of water availability, both the wet 2009?2010 and the average 2010?2011 hydrological years.

Groundwater imbalance was reflected by net aquifer recharge (R) less than groundwater allotment for agriculture and urban uses in the average year 2010?2011. Three key groundwater sustainability issues from the hydrologic perspective were raised for future research, which are addressed in this paper. Introducing a feasible methodology for groundwater resource modelling for sustainable use in sparse-data drylands, this paper updates available databases, compiles new databases, and introduces new formulations to: (1) refine the net groundwater balance (W) modelling for years 2009?2010 and 2010?2011, providing the magnitude of net lateral inflow from adjacent formations (RL), the largest R component contributing to the oasis; (2) evaluate the non-evaporative fraction of precipitation (P) (B) from 1973 onward as a proxy of the potential renewable water resource available for use; and (3) define the critical balance period for variables to reach a comparable stationary condition, as prerequisite for long-term modelling of W . RL was about 0.07-fold P and 0.85-fold R . Historical yearly B -to- P ratios were 0.02 for dry, 0.04 for average, and 0.07 for wet hydrological years; the average yearly P being 124 mm. A critical 17-year balance period with stable relative error below 0.1 was defined from the 44-year P and B time-series statistical study. This is the monitoring period proposed for the stationary evaluation of the variables involved in the

long-term modelling of W. This paper seeks to offer a feasible methodology for groundwater modelling addressed for planning sustainable water policies in sparse-data drylands. © 2018

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Net groundwater balance

Northern Sahara

Oases

Renewable water resource

Stationary evaluation

Sustainable groundwater use

Aquifers

Groundwater

Recharging (underground waters)

Water conservation

Water management

Water resources

Evaporative fraction

Groundwater modelling

Northern Sahara

Oases

Stationary conditions

Stationary evaluation

Sustainability issues

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ground water

feasibility study

groundwater resource

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