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Does current precipitation play a role in the recharge of groundwater in the deserts of northern China?

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Arid and semi-arid areas account for more than one third of the Chinese landmass and are distributed over elevations ranging from 155 m below sea level to over 5000 m above sea level. The most typical landscapes of this vast and diverse region are sand seas in arid and sandy lands in the semiarid zones. The widely cited value about mean annual evaporation in the deserts of northern China is between ca. 1400 to 3000 mm / year in general and between 3000 and 3800 mm / year in dune fields. Under such a framework modern precipitation would be meaningless to the recharge of groundwater. Our new estimate, based on the weather data from the last four decades, suggests, however, there is a clear overestimate of the evaporation rate in the earlier data. In a sand sea like the Badain Jaran Desert in the western Inner Mongolia, our calculation using a modified Penman equation shows that the mean annual evaporation is ca. 1000 mm from lakes and ca. 100 mm from the land surface. Our estimate is consistent with a new analysis showing that only ca. 10% of chloride in the soluble salts of aeolian sands in western Inner Mongolia comes directly from rainfall while 90% of chloride in these salts is deposited directly by dust accumulation (dry deposition). Limited, short-term experiment with large evaporation ponds supports our new estimate also. Provided that the new estimate tells the truth, we can further conclude that the current precipitation – ca. 100 mm in the southeast of the Badain Jaran Desert – plays a significant role in the recharge of the groundwater that directly feeds a large number of “small” desert lakes in this region. The existence of measurable tritium in the shallow ground water samples from the margins of these desert lakes reconfirms the importance of modern precipitation in the recharge of groundwater as well.