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Assessment of hydrogeochemical processes and geogenic mercury pollution in coastal karstic aquifers in semi-arid environments

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Water resources management in coastal where the freshwater availability is limited has often led to rising concerns about the capability of local resources to cover the increased water needs. This condition is especially amplified in areas whereextra stress is added to the water sources from overexploitation and/or quality degradation.

The present study is located in the island of Skiathos, which is one of the Greek islands that are most popular to tourists. Throughout the long touristic period the population of the island is steeply increased resulting to an increase in water demand compared to the remaining months.The island is dealing with serious water supply issues since groundwaterquality is deteriorated due to aquifer salinization and Hg contamination, making the tap water not safe for drinking and other household uses for more than a decade.

Mercury concentration in water for domestic usage is monitored systematically, with values up to 6 μg/L (maximum permitted European limit for total mercury in the drinking water is 1 μg/L).The local water utility company, in order to cover the increased water demand, intensifies the pumping from the main well resulting to sea intrusion in the aquifer. Mercury is present in the rocks of Skiathos with the form of the mineral cinnabar (HgS) and although it is practically insoluble, the increase of chloride concentration due to aquifer salinization, shifts the reaction equilibrium towards mercury solubilization by complexation with chloride. Thus, mercury is released from the rocks to the groundwater entering later on the water supply network.

In order to face the twofold problem of groundwater salinization and mercury contamination the present study aims at defining a threshold for thevolume that is abstracted from the aquifer on a daily basis. The investigation involves the development of a groundwater flow model covering an area of approximately 13.3 km^2 that is exploited for supplying the town of Skiathos with tap water. Information about the general hydrogeological conceptual model is derived from previous investigations in the area. The groundwater model achieves an optimizationof the groundwater pumping rates that prevent seawater from entering the aquifer and deteriorating the groundwater quality. Results show that a reduction of 27.2 % in the pumping rates, in combination with the already planned upgrade in the distribution networks, would prevent seawater from entering the

aquifer and affecting groundwater reserves, while, at the same time, the need for tap water in the town of Skiathos is met.