MANAGED AQUIFER RECHARGE AS A TOOL TO COUNTERACT GROUNDWATER DROUGHT: INSIGHT FROM LOS ARENALES AQUIFER.

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Groundwater levels in Los Arenales aquifer in Spain were subjected to a dramatic decrease (about -1.0 m/year) in the second half of the 209th century. To counteract this water crisis, since the late 90s, the local authorities put into action a series of measures, including managed aquifer recharge (MAR), the control on demand, and the modernisation of the irrigation infrastructure and legislative modifications to easy certain IWRM´s related activities. In recent years, the overall groundwater availability has improved, but notable differences are still observed between regions in Los Arenales aquifer. The present study exploits these differences to assess the potential of MAR to offset the effects of groundwater drought. For this purpose, we contrast two neighbouring regions series within Los Arenales aquifer, namely Los Arenales (LA) and Medina del Campo (MC) groundwater bodies (GB), who are believed to be very similar in all their intrinsic (e.g. lithological units) and extrinsic (e.g. groundwater use and demand) characteristics, but differ predominantly in the presence of large-scale MAR systems in the former (i.e. LA).

Methodologically, firstly, we analyse groundwater level trends employing the Theil-Sen estimator and the Mann Kendall test coupled with the trend free pre-whitening (TFPW). Secondly, we compute standard precipitation indexes (SPI) and standard groundwater indexes (SGI) to study the response of both GBs to below-average precipitation conditions. In this analysis, we detrend the time series to isolate the response of the high permeability water bodies to precipitation. We complement the analysis by estimating the average groundwater level time series for each GB. The trend analysis shows a significant increase in the local and average piezometric levels in LA of about +12 cm/years. On the other hand, the average trend in MC is not statistically significant, and local trends feature slopes around -10 cm/year. Furthermore, in 2001-2019, the average groundwater level show the fastest and highest recovery in LA and less susceptibility to drought events.

As results, the SGI analysis indicates that LA experiences slightly more prolonged droughts (12 vs. 10 months) but with less frequency (0.5 vs. 0.6 droughts/year), which can be explained by the higher inertia at LA, as reflected by the higher autocorrelation in groundwater tables. Additionally, a cross-

correlation analysis between the SPIs and the SGIs reveals that groundwater levels in MC are more dependant on precipitation. Despite these relatively minor differences, the total accumulated magnitude of below-average groundwater levels during the analysis period is nearly the same for both GBs (84 in LA and 82 in MC). Such minor difference in the response to drought events can hardly explain the differences in the groundwater level evolution between LA and MC.

In conclusion, MAR and demand control are likely the most responsible measures for the notable replenishment of groundwater storage in LA GW, MC is expecting new implementations to corroborate these trends in the future. whilst