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The influence of climatic changes on aquifers of Salento area – south Italy

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Climatic changes may significantly impact on a region such as Apulia, even if apparently of poor entity. This is due to the high hydrogeologic and desertification risk which characterizes that region.
Here, potential climatic changes are investigated starting from the variations of rainfalls as well as the monthly and yearly rainy days, besides looking at the maximum and minimum average monthly temperatures. The elaboration of data showed that the Apulian climate is changing, since there exists a decreasing trend of rainfall, which characterizes almost all the measurement stations. Apulia is therefore subject to a real risk of water shortage. The decreasing trends particularly shows during the winter months, in particular between October and January. These are notoriously months which are important for the aquifers recharge. In addition, the increasing groundwater pumping, which normally takes place during peak demand months, is leading to its gradual depletion. In fact, groundwater is characterized by poor renovation properties. Looking at temperatures, it is possible to see a reduction of the gap between daily and nightly peaks. In particular, the minimum values are decreasing in the spring and summer time window, while maximum values are increasing in particular during summer and fall seasons.
The analysis of hydrological curves seem to emphasize a higher probability of short but intense rainfall events, in particular for short durations. This implies an increasing environmental vulnerability of small catchments. A further analysis accounted for extreme dry periods, in particular an investigation of absolute drought durations and relative to 25 mm was undertaken. This emphasized negative trends at all stations. Dry periods are becoming shorter and shorter while the summer rainfall events increase. Afterwards, the durations of absolute and relative winter drought were investigates. Absolute winter dry periods showed negative trends, while relative winter dry periods showed positive trends.
These variations can have a strong influence on water resources availability and can be a cause of desertification processes in some area. The effect of drought periods on groundwater system can be much more severe than it can be normally thought. The analysis of a long time series (1953-2002) of groundwater level measured in a piezometer located in the coastal karst aquifer of Salento peninsula (Lecce) has shown that the during the studied period groundwater level has been subject to severe variation. During the drought period from 1987 to 1994 groundwater has been subject to a severe lowering: about 50-80 cm. It is a quite high value being Salento aquifer a coastal one; so it is really vulnerable to groundwater level lowering. This means this aquifer lost about the 20% of fresh water amount, that is quite hard to be recovered also after a wet period, because part of the aquifer has been contaminated by salt water. Comparing the hydrograph of different period has been observed that the behaviour of this karst aquifer is the same during drought and wet period, and the difference is only in the value of the measured levels.
Different behaviour were observed on a porous aquifer located in sand of Brindisi flat area. Also in this case a long time series (1952-2002) of groundwater level measured in a piezometer analyzed was analyzed. It showed a clear decrease of mean groundwater level, with a decreasing of groundwater level peak and with a delay from march to may of the period of peak level as a consequence of the delay in groundwater recharge as an effect of rainfall decreasing during Autumn and Winters periods.