

Sierra de la Laguna: Research of the hydraulic balance in the south of the peninsula Baja California Sur, Mexico

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Abstract

In the south of the peninsula of Baja California, the strong growth of the population and the expanding tourist sector have affected a high consumption of ground water that exceeds the natural recharge of the aquifers. This provoked an over exploration of ground water in most of the catchment areas in the south of the peninsula and has caused an influx of seawater into several aquifers, so that many wells near the coast had to be given up. In order to plan an effective and sustainable use of water and for the rehabilitation of the aquifers, the knowledge of the recharge rate as part of the hydrological balance is essential.

On the coastal zones of Baja California Sur, with semiarid and arid climate, the potential evapotranspiration reaches up to 2 meters in a year, whereas the precipitation of an average year only reaches 200 to 300 mm (with a maximum within the months June to September). Therefore a very little recharge (often less than a centimeter in a year) has been observed.

The mayor recharge in the region has its origin at “La Sierra de la Laguna“, a mountainous hill in the center which was build by metamorphic rocks and reaches up to 2100 m above sea level. The precipitation rate in the highest parts of this hill reaches 700 mm in an average year which is equal to the potential evapotranspiration. The water flows down the mountains and infiltrates in the subsequent alluvial fans and recharges the aquifers.

Another important factor in the water balance of the region are the very intensive rainfalls caused by tropical storms like hurricanes. We observed the effects of the hurricane Juliette, that affected the area from September 26th to October 1st 2001. The hurricane caused big damages and loss of 6 people in the area. A maximum rainfall of 1100 mm was observed at the “Cadañaño“ meteorological station (180 m above sea level), which was the highest precipitation ever observed in the south of the peninsula.

After the hurricane we started to install a net of hydro metrical stations around the hill to measure the runoff. A permanent superficial flow was observed until December 2001 and at two stations we still observe a base flow, recently recharged by relatively slight rains in the mountains. Depending on the relation between metamorphic rocks and unconsolidated sediments forming the catchment areas, up to 37 % of the rainfall flows rapidly downhill into the sea and does not recharge the aquifers effectively. The results are interpreted as characterization of the aquifers of the catchment areas and to calculate the recharge rates, caused by the hurricane.

At the moment we are installing an net of observation wells to measure the flow of ground water and the superficial flow continuously in the next years.