Monitoring groundwater levels and simulating groundwater flow near the Ring of Cenotes, northeastern Yucatan, Mexico.

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Groundwater, the primary source of freshwater in Mexico's Yucatan Peninsula, is a critical resource that is threatened by emerging groundwater contamination issues. To better define the physical processes that control flow paths and chemical transport in groundwater, data logging pressure sensors were placed in cenotes and wells at nine locations in and around the Ring of Cenotes, a prominent geomorphic feature in the Yucatan. Twelve locations were surveyed using a Trimble Net R9 GPS system and an autolevel to provide topographic control for water level measurements. Manual water levels in wells and cenotes were measured with an electrical water level indicator from surveyed control points and converted to water levels relative to sea level. Water level data show expected flow patterns toward the coast. Strong ocean tide signals were observed in monitoring stations near the coast and decreased inland. These tidal signals were not observed in a shallow well near Progreso, suggesting a dense carbonate layer acts as a confining unit and separates shallow and deep aquifers in the coastal zone. A dramatic, one meter increase, in groundwater levels was measured near Progreso and Merida (Mexico) associated with precipitation from Hurricane Kay and Tropical Storm Lester. This localized change in hydraulic head dissipated over the following month and locally altered groundwater flow patterns. Groundwater flow and solute transport models are currently being developed using The U.S. Geological Survey's MODFLOW 6 groundwater flow software to aid in the interpretation of water level data and simulate salt water intrusion within the study area. While simulations currently reproduce measured groundwater levels, the simulated position of the saltwater interface is deeper than what has been observed.