HIGH-RESOLUTION ESTIMATION OF EVAPOTRANSPIRATION IN NON-IRRIGATED LANDS FOR THE STATE OF NEW MEXICO USING A SOIL WATER BALANCE MODEL – YEAR TWO

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The Question and What We Did

Quantification of the annual volume of groundwater recharge in the mountains of New Mexico is a critical component of the statewide water assessment. The volume of groundwater recharge equals the volume of precipitation minus the volumes of evapotranspiration and runoff. The question of this study is "what is the annual volume of evapotranspiration in the mountains and planes of New Mexico?" We have answered this question by adapting a proven soil water balance method for the environmental and topographical conditions in New Mexico and calculating the daily evapotranspiration for each 250×250 m pixel in the state. Summing the daily evapotranspiration values over one year yields the annual evapotranspiration.

How We Did It

We used a two-step process for the assessment of the daily evapotranspiration. The first step is the calculation of the reference evapotranspiration for a tall crop (ETr) using daily meteorological values of incoming solar radiation, temperature and relative humidity of the air, and wind speed. The second step yields the daily evapotranspiration by multiplying the daily reference ETr by a crop coefficient (Kc). The daily meteorological data for each 250×250 m pixel in the state were obtained from the gridded weather data in the North American Land Data Assimilation System (NLDAS) produced by the National Aeronautics and Space Administration (NASA). The NLDAS data could not be used directly but required a tedious downscaling process taking into account the elevation, slope, azimuth and shading of each 250×250 m pixel. The crop coefficients were obtained from biweekly greenness images acquired by NASA's MODIS satellite.

What We Found Out

The figure shows the percentage of the total annual precipitation that leaves the soil as evapotranspiration in the state of New Mexico. In the lower areas of the state all precipitation is lost by evapotranspiration while at higher elevations in the mountains a lower fraction of precipitation is lost by ET and, therefore, groundwater recharge can take place.

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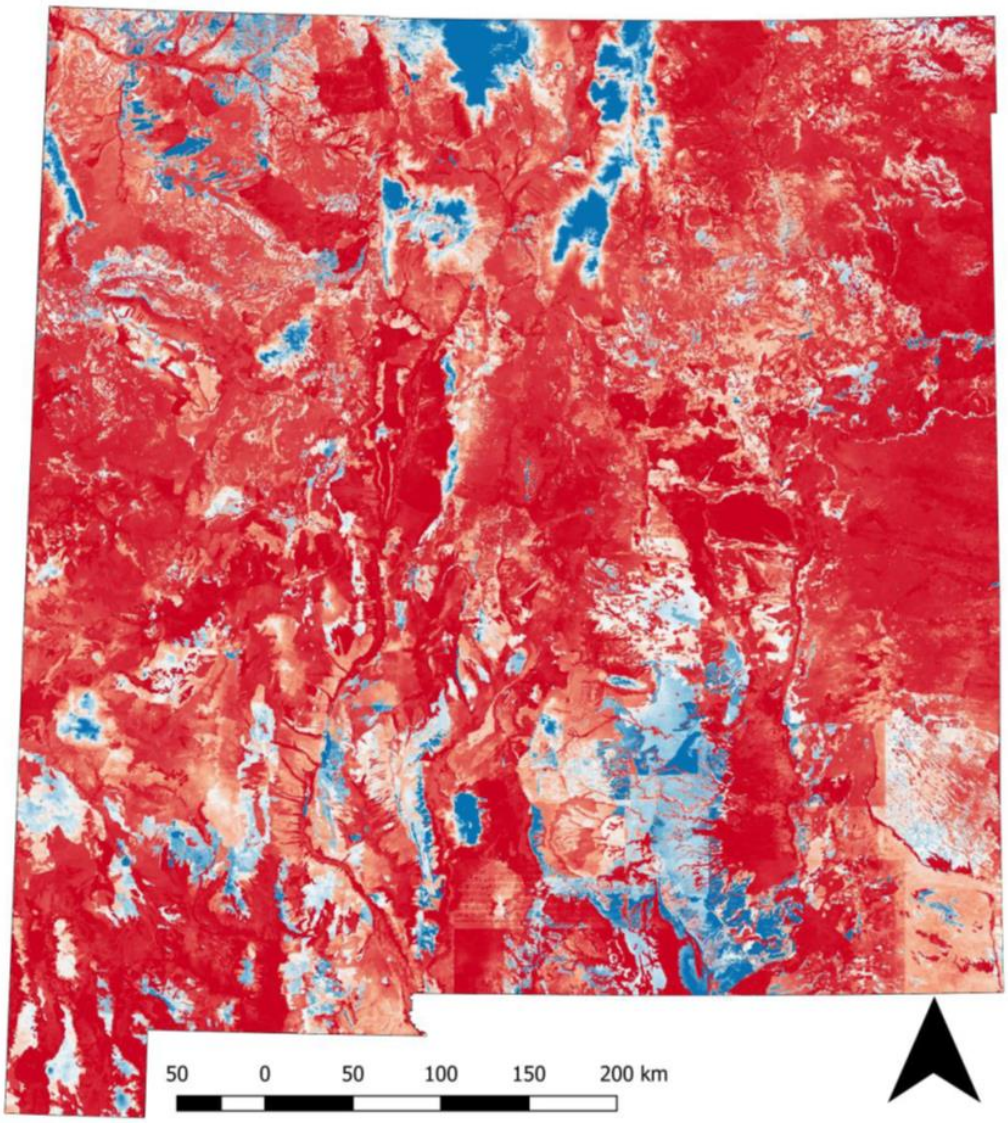

Figure: The ET Index (i.e., the fraction of precipitation lost to ET) shows ET is the dominant flux of water out of the soil layer. Over 85% of the state loses 70% of precipitation to evapotranspiration, by far the dominant flux of water from the soil layer. Figure prepared by Ketchum, D., B. T. Newton, and F. Phillips (2016), High-resolution estimation of groundwater recharge for the entire state of New Mexico using a soil water balance model. New Mexico Water Resources Research Institute, Las Cruces NM.

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