**NASA DEVELOP National Program**

****NASA Jet Propulsion Laboratory

**Summer 2015**

**Short Title: New Mexico Water Resources & Agriculture**

**Subtitle:** Delivering Automated Evapotranspiration Data to the New Mexico Office of the State Engineer for Enhanced Water Resource Decision Making

**VPS Title:** ET Phones New Mexico

**Project Team & Partners**

**Project Team:**

Sol Kim (Project Lead), [solkim1@gmail.com](mailto:solkim1@gmail.com)

Agustin Muniz

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**Advisors & Mentors:**

Joshua Fisher (NASA Jet Propulsion Laboratory)

Greg Moore (NASA Jet Propulsion Laboratory)

Manish Verma (California Institute of Technology)

**Partner Organizations**

New Mexico Office of the State Engineer, End-User, POC: John Longworth

**Project Details**

**Applied Sciences National Applications Addressed:** Agriculture, Water Resources

**Study Area:** New Mexico (NM)

**Study Period:** March 2000 - Present

**Earth Observations & Parameters**

Terra & Aqua, MODIS – Evapotranspiration (MOD04\_L2, MOD05\_L2, MOD07\_L2, MOD11\_L2, MCD12Q1.051, MOD13A1, MOD15A2, MCD43B2.005, MCD43B3.005)

**Ancillary Datasets Utilized**

* National Centers for Environmental Prediction (NCEP) Reanalysis II – 2 meter temperature, specific humidity, minimum temperature, U-wind

**Software Utilized**

Python – to submit download requests for 14 datasets total – 6 MODIS land, 4 MODIS atmosphere, and 4 National Centers for Environmental Prediction datasets

Cron – to automatically run Python scripts on daily basis

HDF-EOS to GeoTIFF Conversion Tool (HEG) – used for converting MODIS atmospheric swath data into sinusoidal tiles/stitching of various MODIS data/data subsampling

R – used to visualize evapotranspiration (ET) data

MATLAB – calculations for ET products

**Project Overview**

**80-100 Word Objectives Overview**

The goal of this project is to automate MODIS data acquisition and to streamline evapotranspiration product generation and delivery to the New Mexico Office of the State Engineer. We will generate an evapotranspiration product by utilizing MODIS land, MODIS atmosphere, and National Centers for Environmental Prediction datasets. We will disseminate the final evapotranspiration product to decision-makers in the ranching, water resources, drought assessment and fire-response communities in the Eastern Plains Region of New Mexico through an easily accessed online interface.

**Abstract**

As New Mexico is experiencing some of the most severe drought in the US, equipping water resource management with evapotranspiration data becomes increasingly vital. Knowledge of rangeland conditions is necessary for decisions regarding cattle management, emergency response for rapid rangeland and farmland deterioration, fire management risk decisions, and determining drought severity. New Mexico land managers and decision-makers currently assess rangeland conditions using spatially-limited *in situ* spot checks which provides limited information. Additionally, weekly Normalized Difference Vegetation Index (NDVI) and evapotranspiration products for New Mexico counties are not widely distributed nor easily accessible. By providing an automated, streamlined, non-proprietary evapotranspiration product to the New Mexico Office of the State Engineer, New Mexico decision makers will have easy access to critical evapotranspiration data which will drive water resource decision making and drought assessment. To create the evapotranspiration product, we utilized the MODerate resolution Imaging Spectroradiometer (MODIS) sensors on NASA’s satellites Aqua and Terra to retrieve several six MODIS land and four MODIS atmosphere datasets.

**Community Concerns**

* The eastern portion of New Mexico suffers from consistent drought conditions throughout the last decade, negatively impacting agriculture, ranching, and the gas and oil industries.
* Drought conditions are expected to continue and possibly to worsen due to climate change in the coming century, putting further stress on an already strained water community.
* Decision makers such as agricultural producers, ranchers, fuel producers, emergency assistance organizations and fire responders need tools that facilitate accurate and timely rangeland condition assessments to help guide water use and land use decisions.
* There is a need for remotely-sensed products that are easily accessible and provide ET information in a friendly format.

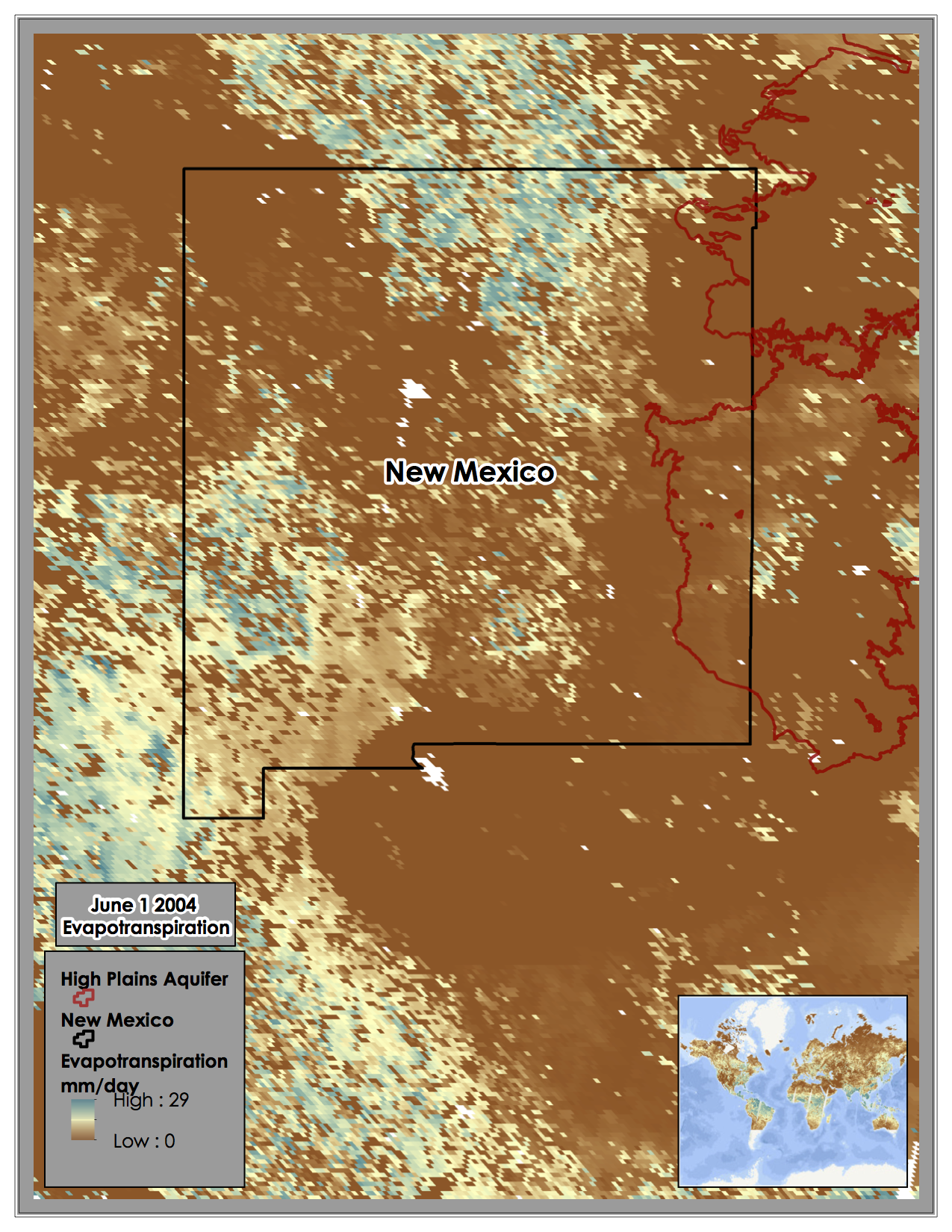
**Current Management Practices & Policies**

New Mexico land managers and decision-makers currently rely on spatially-limited *in situ* spot checks and NDVI products from the New Mexico Department of Agriculture from data supplied through the USDA Forest Service. However, this information is not widely distributed nor easily accessible. Generating evapotranspiration measurements from the field on the scale that is needed is not practical and NDVI has limitations on the information it can provide. Evapotranspiration products are available but are either too coarse in resolution to be useful or are proprietary in nature which prevents accessibility. Employing NASA Earth observations to generate a non-proprietary high-resolution evapotranspiration product would provide data to New Mexico decision makers that is comprehensive and easy to access.

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Easily accessible online interface for New Mexico evapotranspiration data | Suite of MODIS data from Terra & Aqua | Provide high resolution, remotely sensed evapotranspiration data to analyze water/land practices and conditions in New Mexico |

**Project Imagery**



**Caption:** Modeled Evapotranspiration (ET) within New Mexico, Blue indicates high ET while brown indicates low ET. ET was derived using the Priestley–Taylor based Evapotranspiration method and MODIS data. Image Credit: New Mexico Agriculture and Water Team.

**Image:** ET\_NewMexico.pdf