**NASA DEVELOP National Program**

**** University of Georgia

**Fall 2015**

**Short Title: Georgia Water Resources**

**Subtitle:** Assessing Groundwater Storage Change and Contamination Risk in Southwest Georgia

**VPS Title:** From Space to Subsurface: A Story of Groundwater in Southwest Georgia

**Project Team & Partners**

**Project Team:**

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**Partner Organizations:**

City of Albany and Dougherty County Planning and Development Services (End-User/Boundary Organization), POC: Randy Weathersby

Southwest Georgia Water Resources Task Force (End-User), POC: Randy Weathersby

**Project Details**

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

**Study Area:** Dougherty County, GA

**Study Period:** April 2002 to December 2009

**Earth Observations & Parameters:**

GRACE – Level-3 data grids of monthly surface mass changes

Terra, MODIS – Global Terrestrial Evapotranspiration 1km annual evapotranspiration data

**Ancillary Datasets Utilized:**

* Summer 2015 Georgia Disasters DEVELOP Team sinkhole inventory maps - locations of sinkholes in Dougherty County
* USGS Principal Aquifer of the United States - aquifer characteristics
* USGS National Elevation Data 30m DEM- elevation and topography
* Georgia GIS Clearinghouse STATSGO Soils - soil characteristics
* PRISM precipitation data - 4km yearly average precipitation data
* NLDAS-2 MOSAIC Land Surface Model – 0.125° monthly average grid of soil moisture and snow water equivalent data (accessed through NASA’s Giovanni system)

**Models Utilized:**

* US Environmental Protection Agency DRASTIC (stands for all parameter inputs in the model: Depth to Water, Net Recharge, Aquifer Media, Soil Media, Topology, Impact of the Vadose Zone, Hydraulic Conductivity) model

**Software Utilized:**

ArcGIS - Raster manipulation/analysis, groundwater storage change visualization and groundwater contamination vulnerability mapping

R - Statistical analysis

Python - Data preprocessing

**Project Overview**

**80-100 Word Objectives Overview:**

Groundwater resources are crucial for providing clean drinking water and supplying both industrial and agricultural needs in southwest Georgia. Dougherty County, Georgia is highly susceptible to groundwater contamination because of its location in a karst environment that promotes cover-collapse and cover subsidence sinkhole formation. This project uses water storage data derived from GRACE to analyze potential contamination by following the DRASTIC model for groundwater risk assessment.

**Abstract:**

Groundwater from karst aquifers is the primary water source for domestic, industrial, and agricultural use in southwest Georgia. However, these aquifers are highly vulnerable to pollution due to their high geological conductivity. Groundwater storage and contamination risk monitoring can improve water consumption and protection management decisions. This project used an applied methodology that incorporated remote sensing data for groundwater monitoring. Specifically, the Gravity Recovery and Climate Experiment (GRACE) was used to estimate groundwater depth change from 2002 to 2009, which was correlated with sinkhole inventory data during this time period. The DRASTIC model was combined with sinkhole susceptibility maps generated by the Summer 2015 NASA DEVELOP Georgia Disasters team to create corresponding groundwater contamination vulnerability maps. Building upon the traditional DRASTIC model, sinkhole susceptibility was incorporated as a multiplier term to calculate a final, modified DRASTIC index (DRASTICS). This augmented DRASTIC model will provide end-users working in karst aquifer systems a tool designed to enhance decision-making processes associated with managing groundwater contamination risks.

**Community Concerns:**

* Dougherty County’s sustainable groundwater supply is continuing to see growing risks for contamination and pollution associated with local sinkhole development.
* The growing population in southwest Georgia means public consumption of water will increasingly rely on a potentially contaminated groundwater supply.
* There is a lack of applicable protocol for groundwater quantity and quality monitoring which can take advantage of GIS technology in Dougherty County.

**Current Management Practices & Policies**:

The City of Albany and Dougherty County Planning and Development Services (PDS) is responsible for governing land use and development and ensuring the local environment is safe. The PDS works primarily with GIS technology for mapping purposes.

The Southwest Georgia Water Resources Task Force strives to educate the public and advise local stakeholder groups on sustainable water resource management practices. This task force is made up of volunteers with expert knowledge on a variety of related fields.

**Decision Support Tools & Benefits:**

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| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Groundwater storage change trend chart | GRACE | Groundwater storage change over multiple years will help quantify recent conditions and assist predictions of future scenarios, further enhancing decisions concerning sustainable management strategies |
| Groundwater contamination vulnerability map | MODIS, GPM | Identification of vulnerable groundwater contamination areas will help to establish protection zones and develop effective water quality management strategies |

**Project Imagery**



**Caption:** GRACE-based groundwater storage time series from April 2002 to December 2009. Columns represent months and rows represent years in sequence for available data. Image Credit: Georgia Water Resources Team.

**Image:** 2015Fall\_UGA\_GeorgiaWaterResources\_VPS\_Image.jpeg

**Software Release Requirements**

What category do the tools your project is creating fall within? Category II