Project 2 (Subtask 6.2 & 6.3)

HYDROLOGY MODELING OF BASIN 6 OF THE NASH DRAW NEAR THE WIPP

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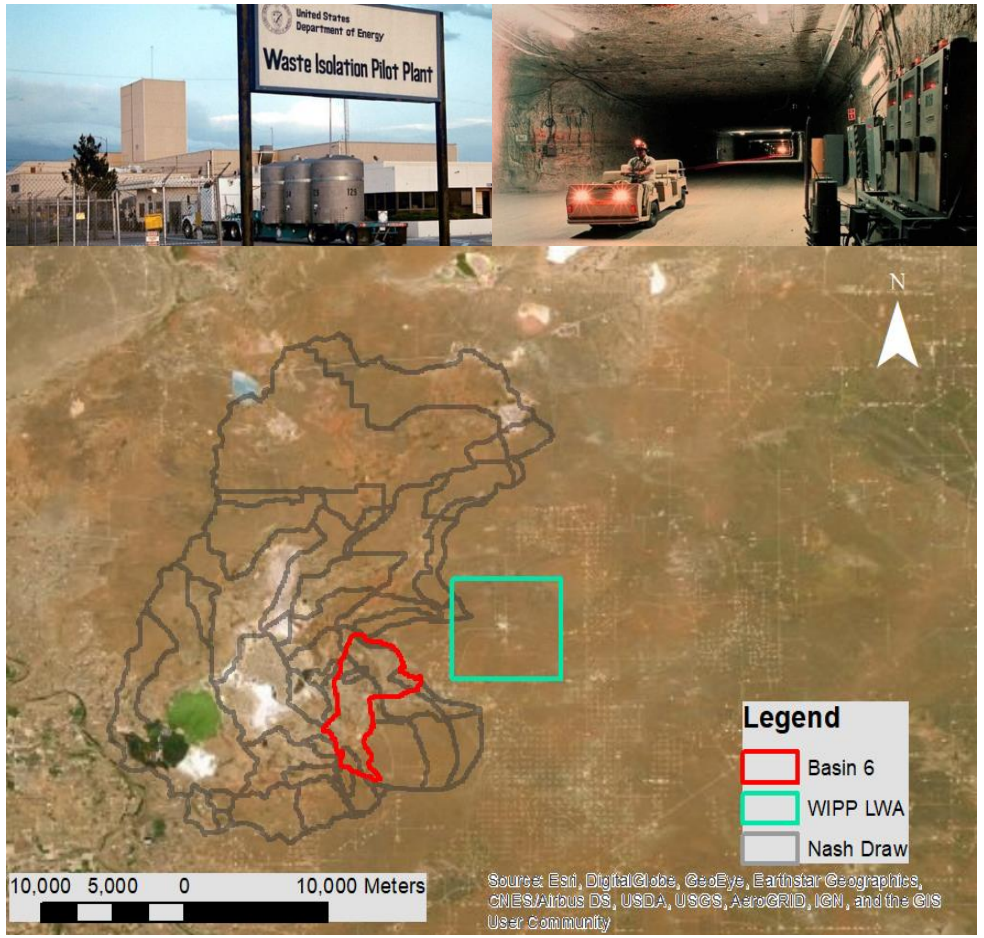
Task 6: Hydrology Modeling of Basin 6 of the Nash Draw Near the WIPP

Overall Needs:

- Understand the regional water balance near WIPP, particularly groundwater recharge, during intense, episodic precipitation events.
- Estimate the propagation rate of the shallow dissolution front.
- Assess the impact of land-use changes around WIPP on water levels in compliance-monitoring wells.
- Evaluate the impact of climate change and surface features (e.g., sinkholes and swallets).

Objectives:

- Subtask 6.2: Develop a hydrological model of Basin 6 using the Advanced Terrestrial Simulator (ATS).
- Subtask 6.3: Collect field data to support model calibration and validation.



Basin 6 and the Nash Draw in reference to the WIPP.

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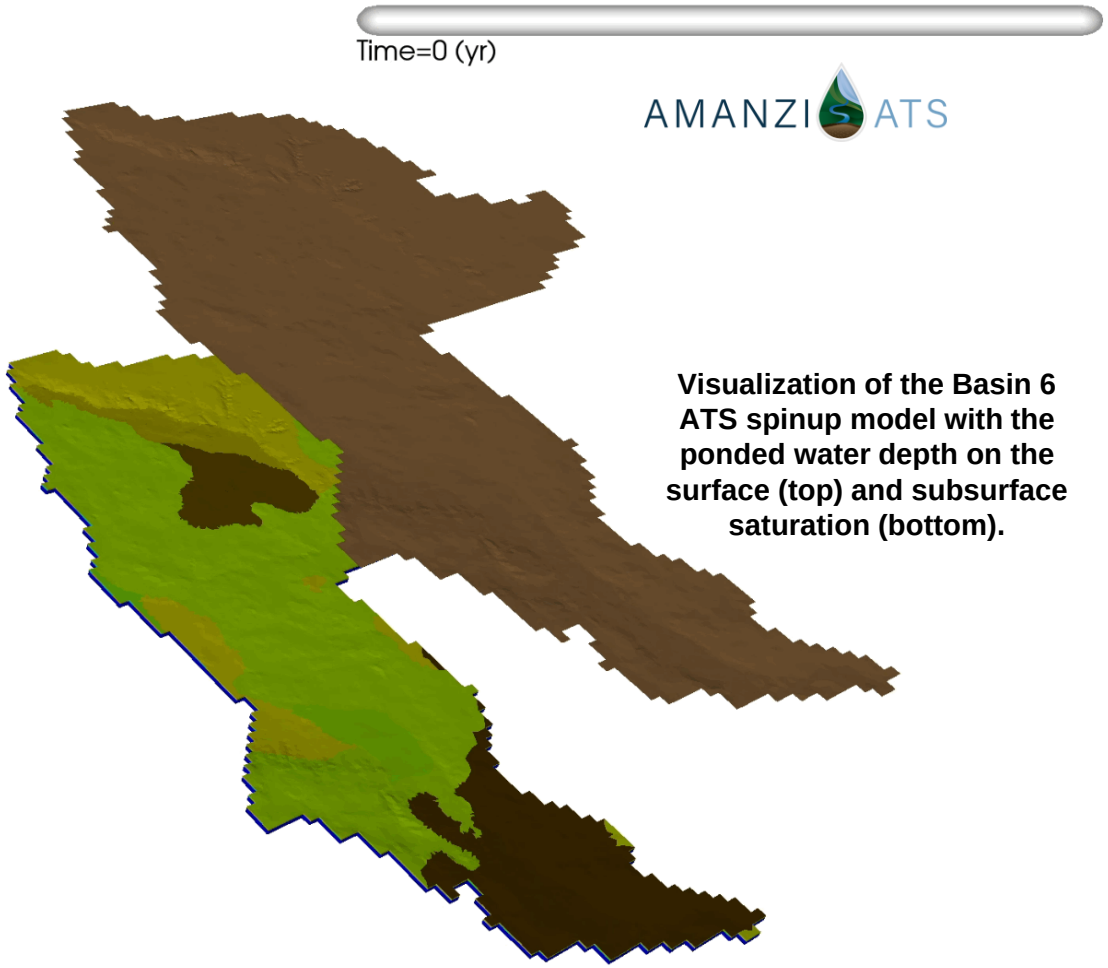
Subtask 6.2: Model Development

ATS is an ecosystem-based, integrated, distributed hydrology simulator that is built on the underlying multi-physics framework provided by Amanzi, the high-performance computing simulator

FIU Year 3 Highlights:

- Implemented Python package, **Watershed Workflow** - enables quick generation of a site mesh from publicly available data.
  - High-res. mesh of Basin 6 (includes spatial variations in NLCD land cover types, SURRGO soil texture & subsurface information) with Daily atmospheric forcing using DayMet data.
- Developed a spinup and transient ATS model for Basin 6 by establishing an equilibrium state and then using that state to model multiple years of meteorological data.



Visualization of the Basin 6 ATS spinup model with the ponded water depth on the surface (top) and subsurface saturation (bottom).

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Subtask 6.2: Model Development

FIU Year 3 Highlights:

Using Element Tree Python module, we can generate sections of the ATS input file that are repetitive

CSV tables and data are obtained from the watershed workflow notebook

Cycle times are obtained from the DayMet notebook

The XML generator notebook is added to the watershed workflow mesh and DayMet notebook to create a full workflow

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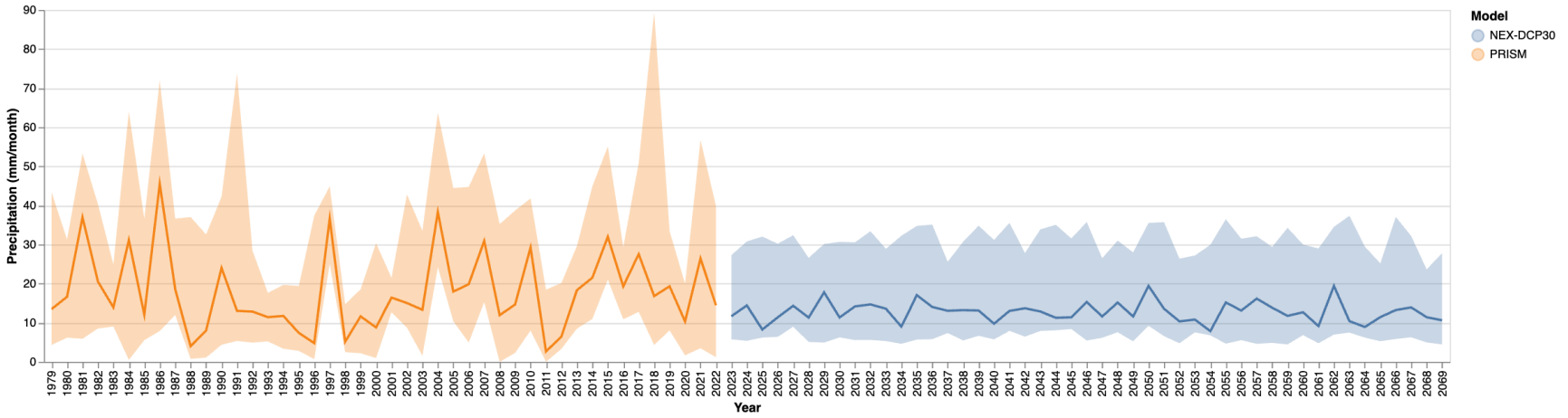
Subtask 6.2: Model Development

FIU Year 3 Highlights:

- Analyzed SE New Mexico meteorological characteristics and climate change in the WIPP region using Google Earth Engine Python API data catalogs.
- Started working with PFLOTRAN and how it can be integrated into the Amanzi-ATS ecosystem for modeling the dissolution of the Nash Draw salt layers.

Flood event in Carlsbad, NM during Sept. 9th -18th , 2013.

Climate change precipitation prediction for Nash Draw (1979 to 2069) using Google Earth Engine.



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Subtask 6.3: Fieldwork and Data Collection to Support the Hydrological Model

FIU Year 3 Highlights:

- Collected 48 soil samples up to 10 feet below the surface with Basin 6 for lab analyses to obtain soil texture information.
- Deployed 5 water level monitoring devices in Basin 6 to obtain specific location and magnitude of surface flow as forced from intense precipitation events (part of the North American Monsoon).
- Fieldwork support provided by Dr. Anderson Ward (CBFO) and Dr. Dennis Powers (Consulting Geologist & subject matter specialist on Nash Draw hydrogeology).

Completed Milestone (2022-P2-M12)

The field work in Basin 6 consisted of soil sampling (left) and installing pressure transducers (right).

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Internship - Subtask 3.2: Model Development for the F-Area Wetlands

FIU Year 3 Highlights (Internship at LBNL):

- Historical nuclear waste in surface & subsurface areas of Fourmile Branch at SRS, specifically F-Area.
- During the internship, a spinup model and transient model of the F-Area domain was developed using ATS.
- Moving forward, the model developed during the internship can be used to understand potential impact of intense precipitation & long-term changes in climate on fate & transport of heavy metals and radionuclides.

Visualization of the F-Area ATS spinup model with the ponded water depth on the surface (top) and subsurface saturation (bottom).

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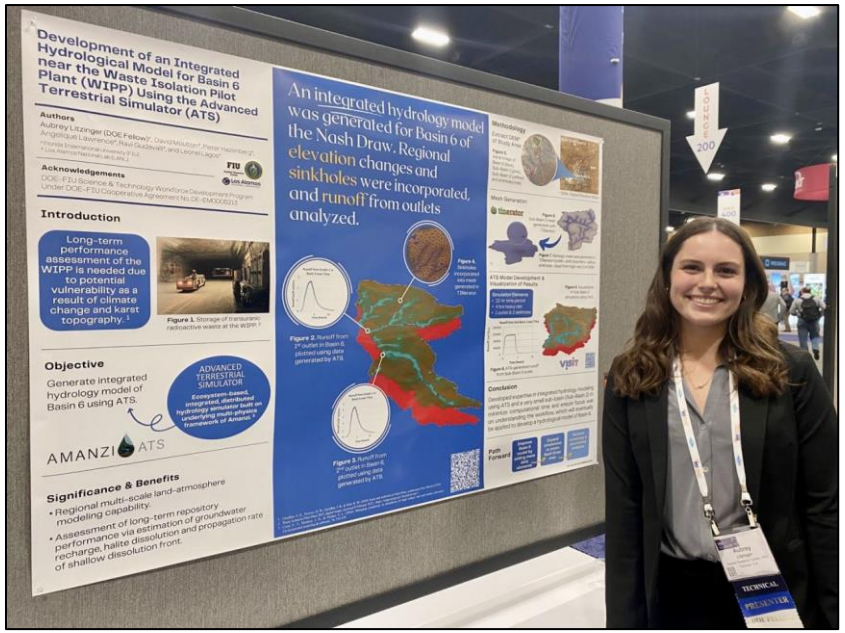
Task 6 Future Work

- Perform multi-year simulations of Basin 6 hydrological response using ATS.
- Calibrate ATS model using data collected during summer of 2023.
- Incorporate significant surface features (sinkholes & swallets) that increase infiltration and can have impact on regional GW recharge.
- Use calibrated model to evaluate impact of seasonal & decadal variations in weather (including climate change) on regional hydrology & GW recharge, so DOE-EM can better predict rate of halite dissolution and propagation of shallow dissolution front so potential impact on WIPP performance can be quantified.

Waste Management Symposium 2023



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Acknowledgments

- Dr. Leonel Lagos, *FIU*
- Dr. Ravi Gudavalli, *FIU*
- Dr. Pieter Hazenberg, *FIU*
- Ms. Angelique Lawrence, *FIU*
- Dr. David Moulton, *LANL*
- Dr. Anderson Ward, *WIPP*
- Dr. Zexuan Xu, *LBNL*
- **DOE-FIU Science and Technology Workforce Development Program**
- **Sponsored by the U.S. Department of Energy, Office of Environmental Management, under Cooperative Agreement #DE-EM00005213.**

Thank You. Questions?