# NASA EIS Supports Species and Habitat Protection

Estimates of current and future snow changes from EIS synthesis is enabling habitat assessments and endangered species protection decisions for the U.S. Fish and Wildlife Service over the Rocky Mountains. This synthesis was enabled by integrating the NASA NEX-GDDP-CMIP6 data within the Land Information System (LIS).
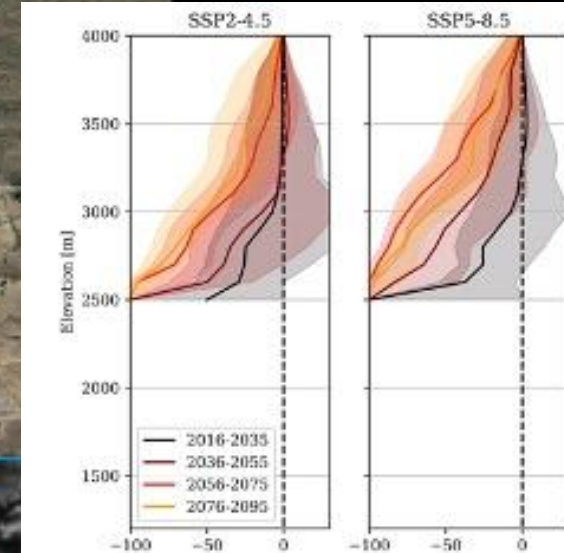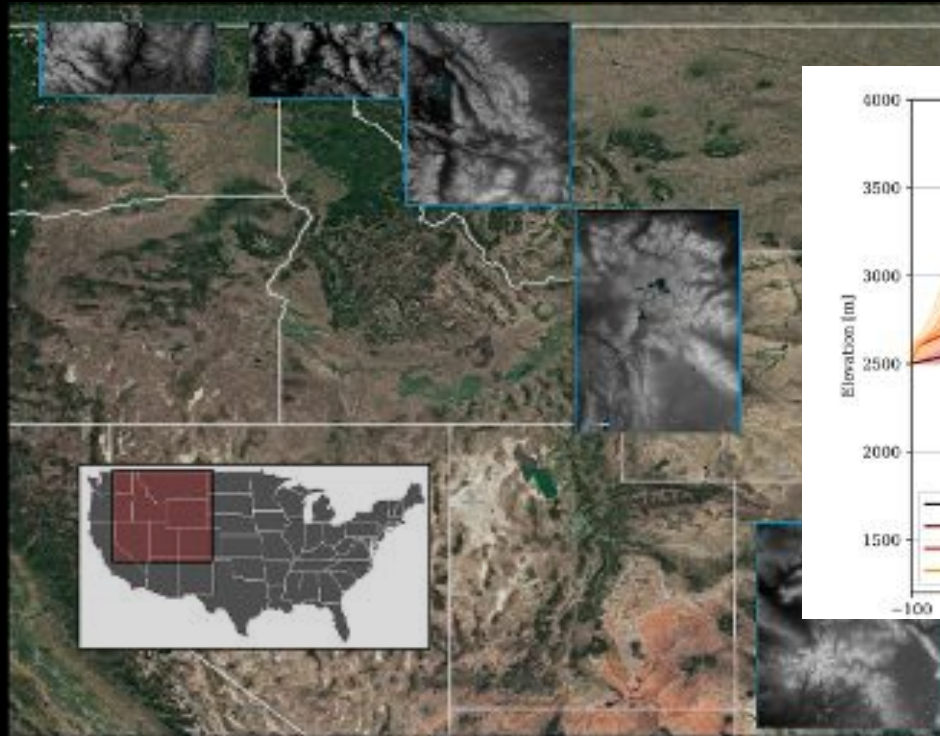
Percent change to habitat

NASA EIS Models and Data Assimilation for Water Quality

By integrating NASA's Land Information System (LIS) modeling framework with the watershed-scale water quality model SWAT (Soil and Water Assessment Tool), EIS has enabled a first-of-its-kind, spatially distributed capability for water quality monitoring over the continental U.S.

Nitrate load (kg/day) on 2019-06-01
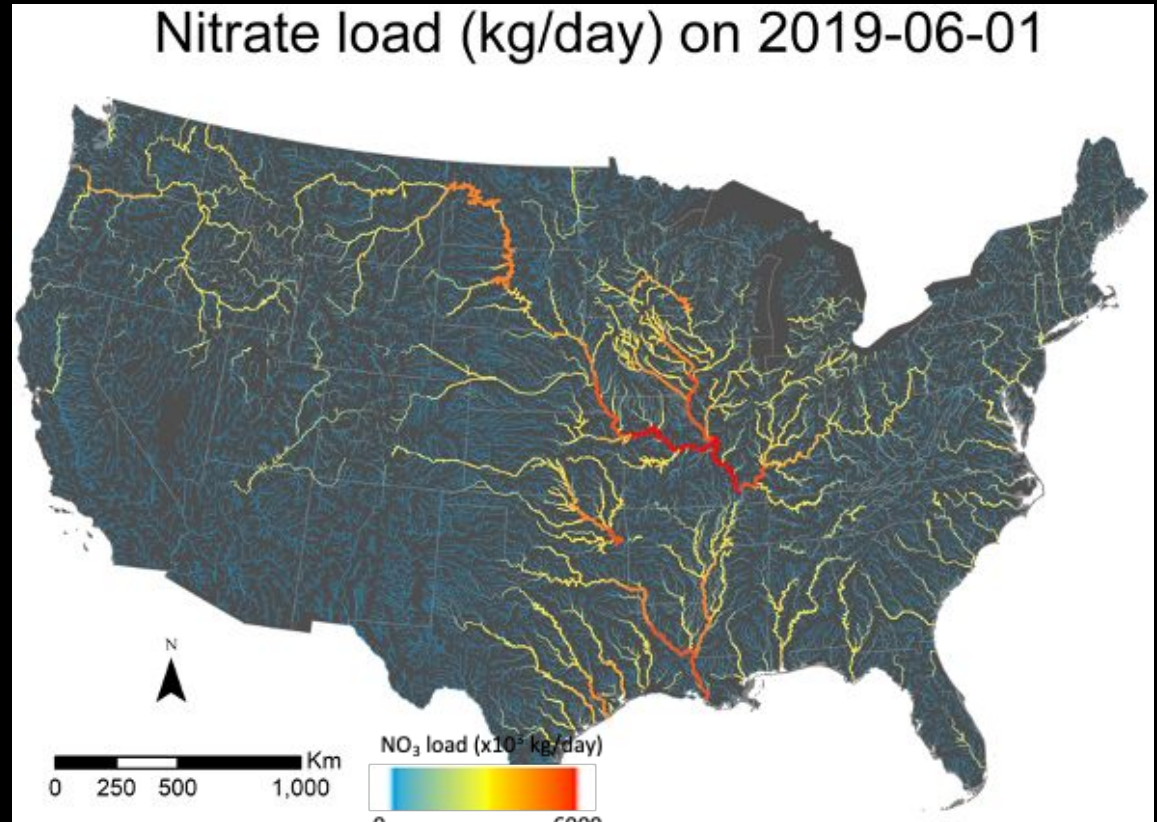
NASA EIS Lowers Barrier for ECCO Model Runs

- Perturbation Tool: computes ocean's response to a change in forcing using the ECCO model
- Useful for exploring "what if" scenarios of the ocean **without having to set up the model**

- Web and open-source Jupyter notebook interface (1-to-1 functionality)
- Maximum code re-use between notebook and webpage using Python open-source package
- ECCO model runs on SMCE cloud cluster

http://ecco.smce.nasa.gov/

Web interface   Notebook interface

Sample output (not yet implemented): time-series of sea-level anomaly resulting from change in meridional wind in the Celtic Sea

From Fukumori et al (2015), doi:10.1016/j.pocean.2015.01.013.

Making national GHG data more accessible through EIS

- **The gridded EPA CH$_4$ inventory, supported by NASA's Carbon Monitoring System, makes it easier for researchers and citizens to understand emissions in their area. However, use of complex scientific formats limited access to the general public and even state environmental managers.**
- **As part of EIS, these datasets are made more accessible through development of the interactive VEDA dashboard. These are complemented by high-end visualizations by NASA's Science Visual Studio (SVS) being featured in the Earth Information Center. Together, these show how advances in cyberinfrastructure and science can support NASA initiatives to extend the reach of climate data.**

Draft visualizations of EPA gridded CH$_4$ inventory on VEDA dashboard (above) and SVS page (right)
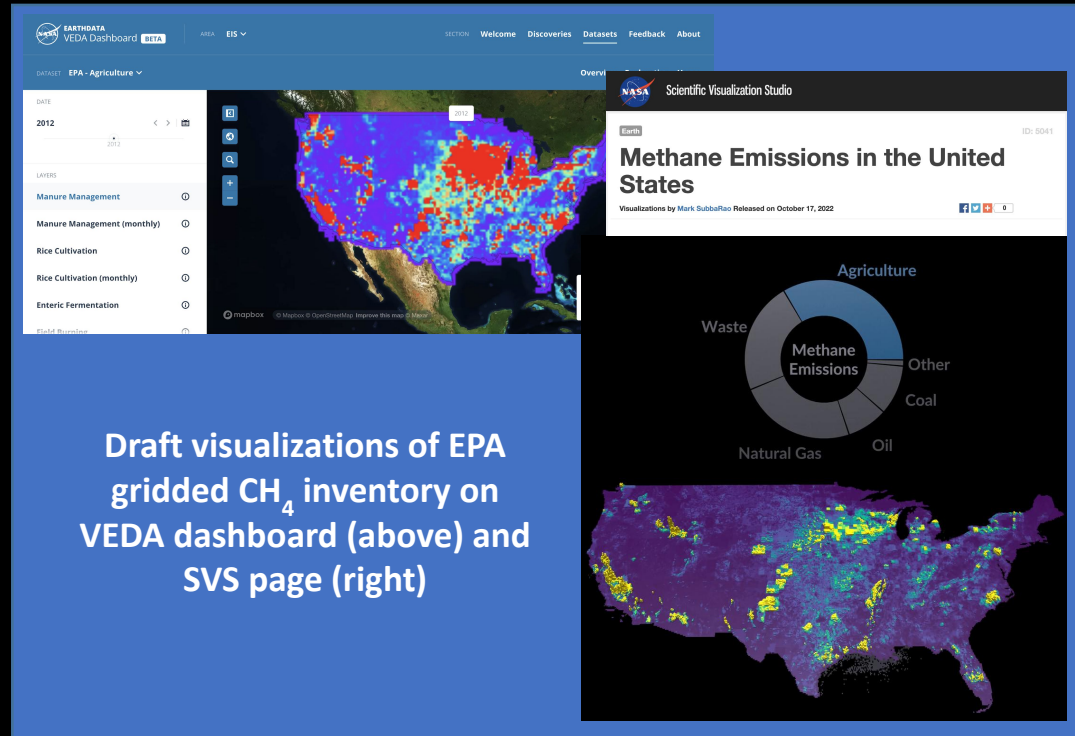
Data described in Maasakkers et al., Environ. Sci. Technol., 2016.

Models Used in Integration and Synthesis Efforts in EIS

Model	Domain	Lead organization
Land Information System (LIS)	Land hydrology	NASA
Soil Water and Assessment Tool (SWAT)	Water quality, hydrology	Texas A&M
GEOS	Earth system model	NASA
GEOS-Chem	Chemical Transport Model	Harvard University
ECCO	Ocean model	NASA
CFM	Firn model	NASA
ISSM	Ice sheet and sea level model	NASA

NASA EIS Engagement and Outreach Examples

Organization/ Meeting	Thematic Area	Outcome
NASA Applied Sciences Water Program Annual	EIS Overall, Water, Weather	Follow-on Discussions
CMS Science Team Meeting	GHGs	
Digital Twin Workshop	Cyberinfrastructure	
ESDS/CSDO Quarterly Meeting	EIS Overall, Cyberinfrastructure	
NASA FireSense Meeting	Fires, Overall EIS	
FEMA Disaster Response Team	Fires, Debris Flows, Floods	Co-developing Product
NOAA Gulf of Mexico Nutrient Runoff Workgroup	Water, Weather, Sea Level Change	Follow-on Meetings
COP27	Overall EIS, GHGs	
EPA Office of Water	Hydrology Models and Water Quality	Follow-on Discussions
US Forest Service	Fire Hydrology, Post-Fire Risk	Follow-on Discussions

EIS Representation at AGU

Hyperwall
- NASA's Earth Information System, Alexey Shiklomanov, Tuesday Dec 13, 11:25-11:35 am CST, Exhibit Hall

Townhall
- NASA's EIS: Enabling Open, Accessible and Integrated Earth System Science, Doug Morton + EIS Leads, Tuesday Dec 13, 6:30 pm CST, S103ab

Presentations
- Modeling the impacts of wildfires on hydrologic response in the Western U.S., Tim Lahmers, Mon Dec 12, 4:35 pm CST, E265
- Understanding the human impact on water partitioning using data assimilation and Budyko-space approaches, Justin Pflug, Mon Dec 12, 4:45 pm CST, E352
- Merging remote sensing and models to improve performance and accessibility of snow information, Melissa Wrzesien, Mon Dec 12, 5:55 pm CST, E258
- New sea-level projections accounting for tight spatio-temporal covariances in the barystatic contributors, Eric Larour, Mon Dec 12, 6:05 pm CST, C16B-03
- Climate and Human Impacts on Hydrological Processes and Flood Risk in the Ganges-Brahmaputra Delta, Augusto Getirana, Tues Dec 13, 3:15 pm CST, E451a
- Two decades of global water cycle variability – non-stationarity assessed by land data assimilation, Wanshu Nie, Wed Dec 14, 3:55 pm CST, E450b
- Improving the Representation of a Fire's Diurnal Cycle in Fire Emissions Inventories and Smoke Modeling Frameworks, Liz Wiggins, Wed Dec 14, 12:15 CST, E253cd
- Low latency flux and concentration datasets in support of greenhouse gas monitoring based on NASA's GEOS modeling and data assimilation system, Lesley Ott, Wed Dec 14, 11:01 CST, S406a

EIS Representation at AGU (contd..)

Presentations
- Contemporary Climate-Fire Feedbacks and the Potential Amplification of Future Fire Emissions (Invited), Doug Morton, Thu Dec 15, 16:26 CST, S501bcd
- Vegetation changes and burn severity drive post-fire hydrological response as shown by high resolution ET observations in Western U.S., Shahryar Ahmad, Fri Dec 16, 11:08 am CST, S406b

Posters
- Western US snow projections and potential impacts on snow adapted wildlife habitat, Justin Pflug, Mon Dec 12, 3:45 pm CST, Poster Hall A
- Vulnerability of soil moisture and groundwater stocks to meteorological droughts from anthropogenic influences, Sujay Kumar, Wed Dec 14, 9am CST, Poster Hall A
- Advancements in GRACE(-FO) and SLR time variable gravity products at GSFC, Michael, Croteau, Thurs Dec 15, 9:00 am CST, Poster Hall, Digital Poster Monitor Zone 1
- Understanding the stress on water resources due to climate change and human activities in Bangladesh using satellite observations, Nishan Biswas, Fri Dec 16, 9 am CST, Poster Hall A