ISSE Research Frontiers
Climate Change

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ISSE Climate Change Research Initiative

**Mission:**

- Climate change is one of the most critical challenges faced by humans and our planet.
- Researchers at ISSE, working closely with the Climate Change Science Institute at Oak Ridge National Lab, are advancing our understanding of climate change and its impacts on human and natural systems.

**Research Area**

Vegetation, wildfires, water availability, drought, soil moisture, etc.

[Images of researchers]
Key feature of ISSE Climate Change Center:
Conjunction of RS, AI & ESM
Empowered by High Performance & Scientific Computing Resources from UT & ORNL

- CPU
- GPU
- Massive storage
- Parallel computing

ORNL's Frontier: world's fastest supercomputer
Monitoring Global Vegetation Activity Based on Remote Sensing

Mao et al. (2016, Nature Climate Change)
Zhang et al. (2017, Remote Sensing of Environment)

Full Animation: https://www.youtube.com/watch?v=Kvh--ydNVR8
Quantify Global Carbon & Water Dynamics

GEE App: https://planetlab.users.earthengine.app/view/gvmsccw

Zhang et al. (2019a, JGR-B)
Impacts of ENSO on Global Carbon Uptake

Zhang et al. (2019b, JGR-B)
Global Wild-fire Modeling & Control Attribution

Machine-learning–based approach revealed global fire controls related to climate, vegetation and human activity

Zhang et al. (2022, Under Review)
Tang et al. (2021, ACCR)
Development of Observation-based Global Multilayer Soil Moisture Products

Seven global, gap-free, long-term (1970–2016), multilayer (0–10, 10–30, 30–50, and 50–100 cm) SM products at monthly 0.5° resolution

Wang et al. (2021, Earth Syst. Sci. Data)
Quantification of human contribution to soil moisture–based droughts

Global mean time series of the 3-month SSI values and the associated latitude-by-month 1971–2016 trends in the zonally averaged 3-month SSI of the pseudo-observation (Mean NonCMIP) and the CMIP6 ALL simulations.

Wang et al. (2022, Nature Communications, Accepted)

Fingerprints of the CMIP6 simulations under different forcings for the 3-month SSI.

Wang et al. (2022, Nature Communications, Accepted)
U.S. Runoff Changes & Relevant Controls (1950-2010)

Forbes et al. (2018, Environmental Research Letters)
Forbes et al. (2019, Water Resources Research)
Wang et al. (2018, IJC)
Summary

• Diverse climate change researches including vegetation activity, carbon & water dynamics, hydrological change, wildfire modeling etc have been conducted from regional to global scales.

• Remote sensing, AI, and Earth System Modeling based on high-performance computing resources are key features of past and ongoing climate change studies in ISSE.

• Feel free to contact and seek potential collaborations with research scientists in ISSE (https://isse.utk.edu/isse-research/climate-change/)

• For questions or references in the PPT, please contact me (ylzhang@utk.edu)