U.S. DEPARTMENT OF ENERGY | Office of Science

Office of Biological and Environmental Research

Urban Integrated Field Laboratories (Urban IFLs)

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DOE BER Program Managers

BERAC Spring Meeting

April 20, 2023

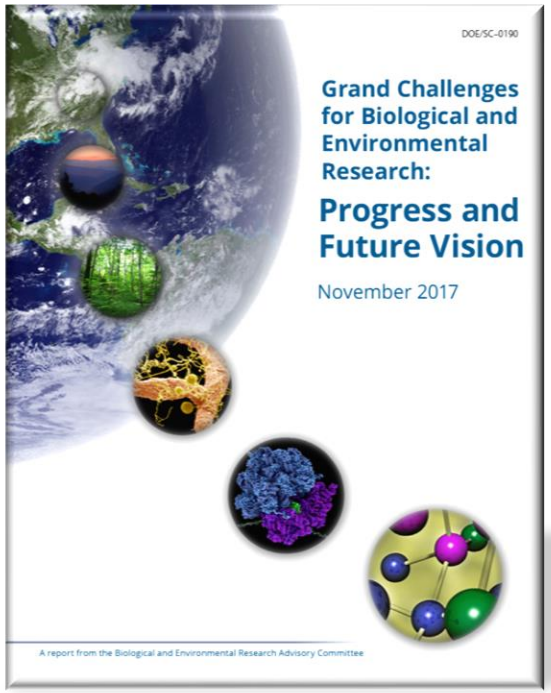
Urban IFL PIs: Cristina Negri (ANL), Paola Passalacqua (UT-Austin), David Sailor (Arizona State), Ben Zaitchik (Johns Hopkins)

What are Urban IFLs?

- FY22 Budget Initiative → FY22 FOA Defined
- Large multi-disciplinary, multi-institutional projects that emphasize the basic sciences of climate, environmental, ecological, and urban change affecting heterogeneous urban regions, with a view towards informing sustainable, resilient, and equitable solutions.
- Integrate research across three focus areas: spatial variabilities leading to microclimates and micro-environments, atmospheric composition and biogeochemical cycling, and quantifying equitable climate solutions
- Research combines new observations with high resolution and highly detailed urban modeling, where data generated by observations and models are used for scientific analysis.
- Provides opportunities to inspire, train, and support leading scientists from a variety of institutions, including minority-serving institutions, who have an appreciation for the global climate and energy challenges of the 21st century.

Urban Landscapes. Urban integrated field laboratories focus on climate-sensitive and highly heterogeneous locations having uneven distribution of physical landforms and vegetation, environmental processes, the built environment and infrastructure, population density, and socioeconomic clustering in the urban landscape, particularly when that heterogeneity relates to impacts on disadvantaged communities.

Developing the Urban IFL Concept

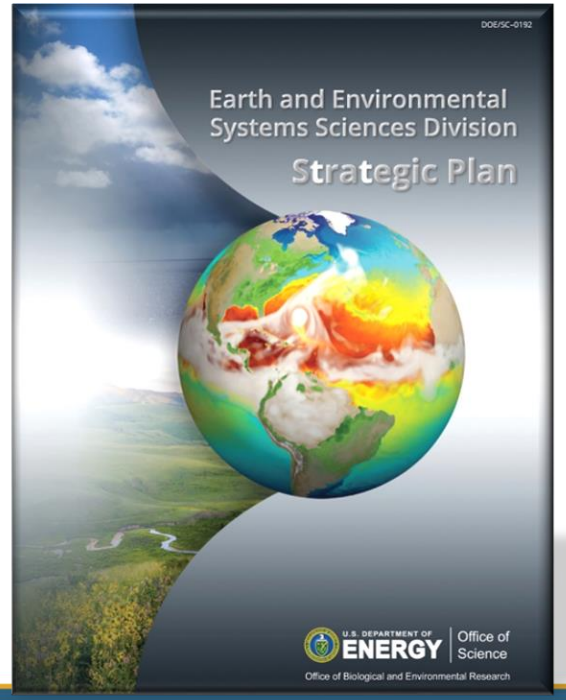


"Create **new integrated field laboratories** that target biogeochemical, energy, and water flows between urban areas and surrounding ecosystems." (EESS Action Item, p. 6)

Research Need and Knowledge Gap: **Improve Human-Earth System Modeling Capabilities**: "human-Earth interactions at fine scales such as processes in urban population centers …are not well represented in the current generation of models" (p.42)

**References and links to these (and other) reports available in the FOA text*

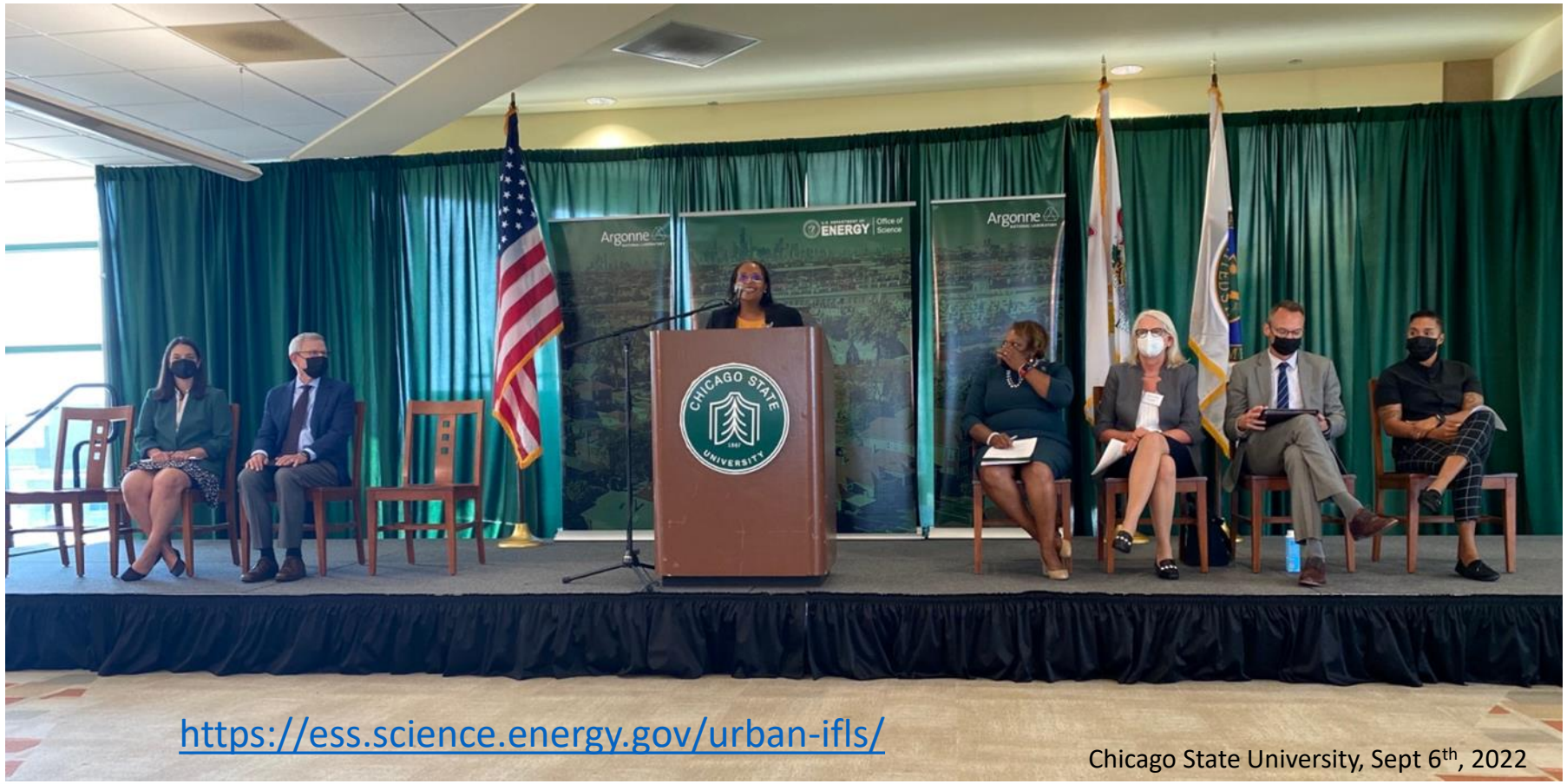
"the intellectual home for fundamental research [on] the **interactions** and **interdependencies** of the atmospheric, terrestrial, subsurface, cryospheric, oceanic, and human-energy components of the Earth system." (exec summary, p.iv)



FY22 EESSD Division-Wide Solicitation: DE-FOA-0002581

To improve our understanding of climate and environmental predictability across complex and variable U.S. urban regions in highly heterogenous, climate-sensitive locations with significant disadvantaged populations/neighborhoods (Justice40 communities)

- Released March 23, 2022
- Closed June 16, 2022
- FY22 selections announced Sept. 6, 2022
- FY23 selection announced Nov. 7, 2022



https://ess.science.energy.gov/urban-ifls/

Chicago State University, Sept 6th, 2022

The Urban IFLs

- Three FY22 selections and one FY23 selection – totaling $94M in awards over the projects' lifetimes (5 years), with 25 funded institutions across the four projects.
- Projects encompass interdependent environmental, ecological, infrastructure, and human components of their selected urban region.
- Each Urban IFL represents different aspects of understanding urban systems, including diverse demographic characteristics, differing climate-induced pressures on people and infrastructures, and unique geographic and climatic settings.
- Each project will develop specific innovations in observing and modeling urban systems and will leverage DOE capabilities as well as those from other agencies.
- Each project is strongly connected to their city through local and Minority Serving Institutions, community organizations, and previous history working with the communities involved.

Chicago, IL: led by Argonne National Lab with 13 (6 MSI) collaborators.

Baltimore, MD: led by JHU with 10 (3 MSI) collaborators

Tucson-Phoenix-Flagstaff, AZ: led by ASU with 4 (2 MSI) collaborators.

TX Gulf Coast: led by UT-Austin (MSI) with 4 (1 MSI) collaborators.

CROCUS
Community Research on Climate & Urban Science

Argonne NATIONAL LABORATORY · University of Illinois Chicago · University of Illinois Urbana-Champaign · Chicago State University · City Colleges of Chicago · Northeastern · University of Notre Dame · Northwestern University · Washington University in St. Louis · North Carolina Agricultural and Technical State University · Wisconsin · The University of Chicago · Texas · Ciemat · BIG · Greater Chatham Initiative · Puerto Rican Agenda · Metropolitan Mayors Caucus

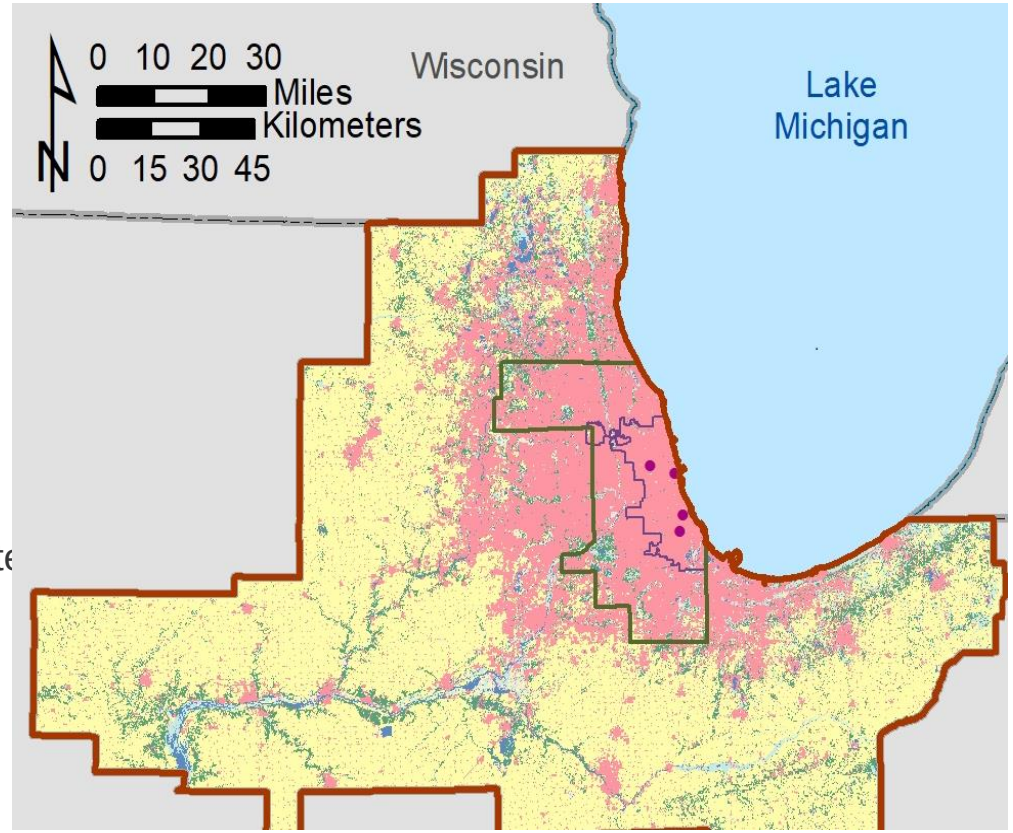
CROCUS is a collaborative study to deliver a reliable representation of the complex urban Chicago Metro environment and its feedbacks with climate.

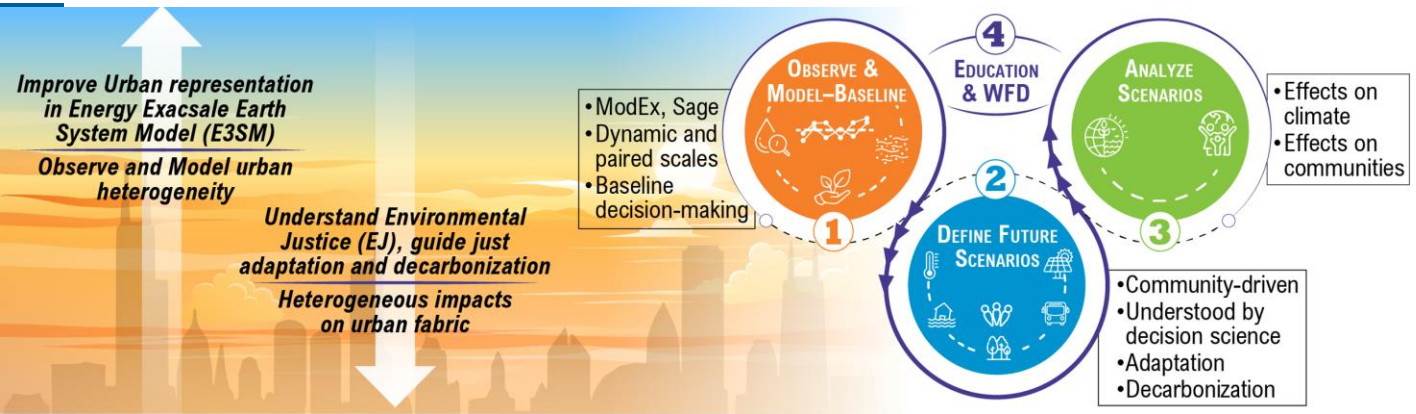
It will provide blueprints for other cities:

- A systems-based approach for integrating physical, biological and human dimensions of climate change
- A framework to simulate, evaluate and project the impacts and feedbacks between climate and urban systems
- An integrated approach to observation and modeling bridging street to regional scales essential to reveal social justice implications related to climate change.

Status:

- All thematic research groups started work, preliminary model output generated
- Instruments calibrated and tested, first Micronet deployment April 7, 2023
- Expanding community reach – Woodlawn Summit participation





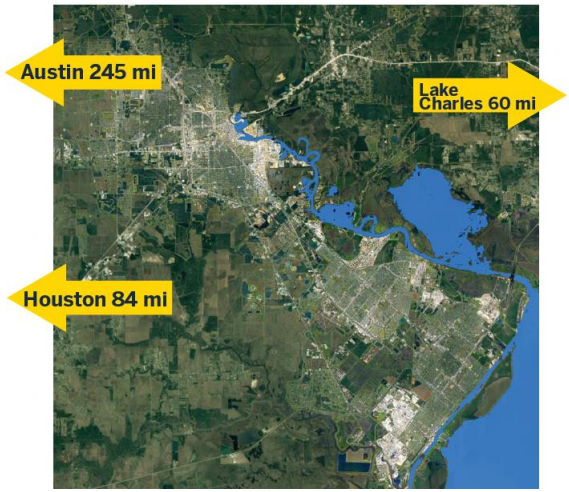
Urban heat and flooding
Nature based solutions
Energy transitions
Regional Resilience & Sustainability
Sustainable Square Mile
Community Self Determination
Community of Opportunity and Choice

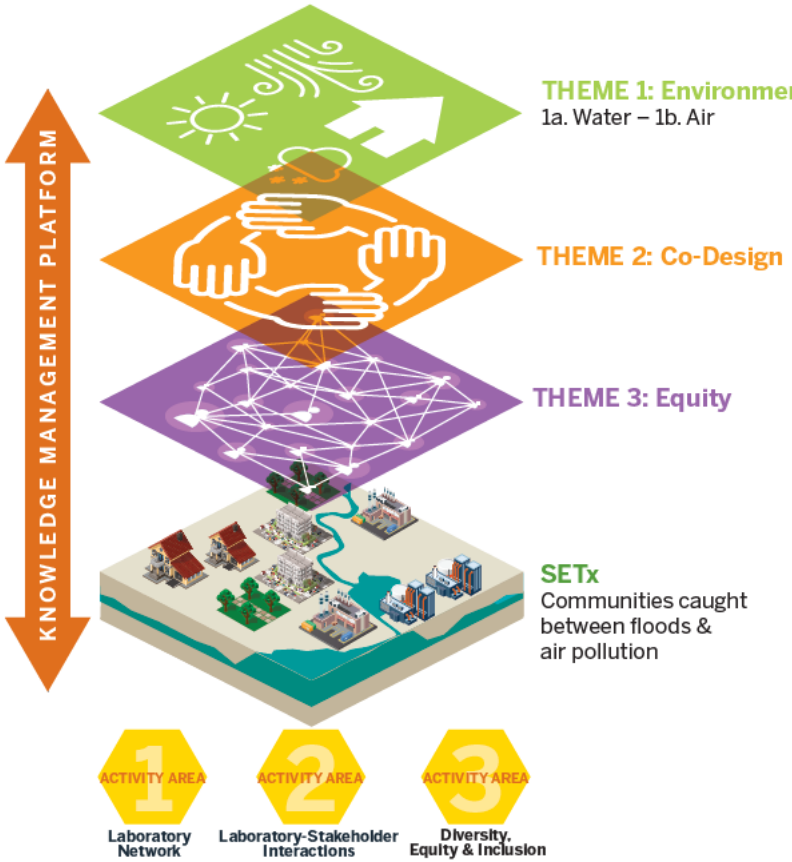
SETx-UIFL

Better data, modeling, & planning to support climate adaptation in Southeast Texas and the Gulf Region

TEXAS The University of Texas at Austin · Center for Resiliency LAMAR UNIVERSITY · Prairie View A&M University · Texas A&M University · Oak Ridge National Laboratory

Beaumont-Port Arthur Metropolitan Statistical Area





Top-down

High res climate projections sub-selected & bias-corrected for SETx
Status: selecting projections

Deliverable 1:
Hi-res bias-corrected climate projection data

Water and air sensing & modeling
Status: 1st field campaign completed; models running

Deliverable 2:
Current & future flooding & air pollution and exposure assessments

Deliverable 4
Equitable co-designed adaptation strategies
Status: March 2023 1st meeting with technical stakeholders; Feb 2023 drone flights for visualization pilot

Community input on flood & air quality performance criteria
Status: Creating residents task force

ID conditions where performance criteria are violated & likelihood under climate change

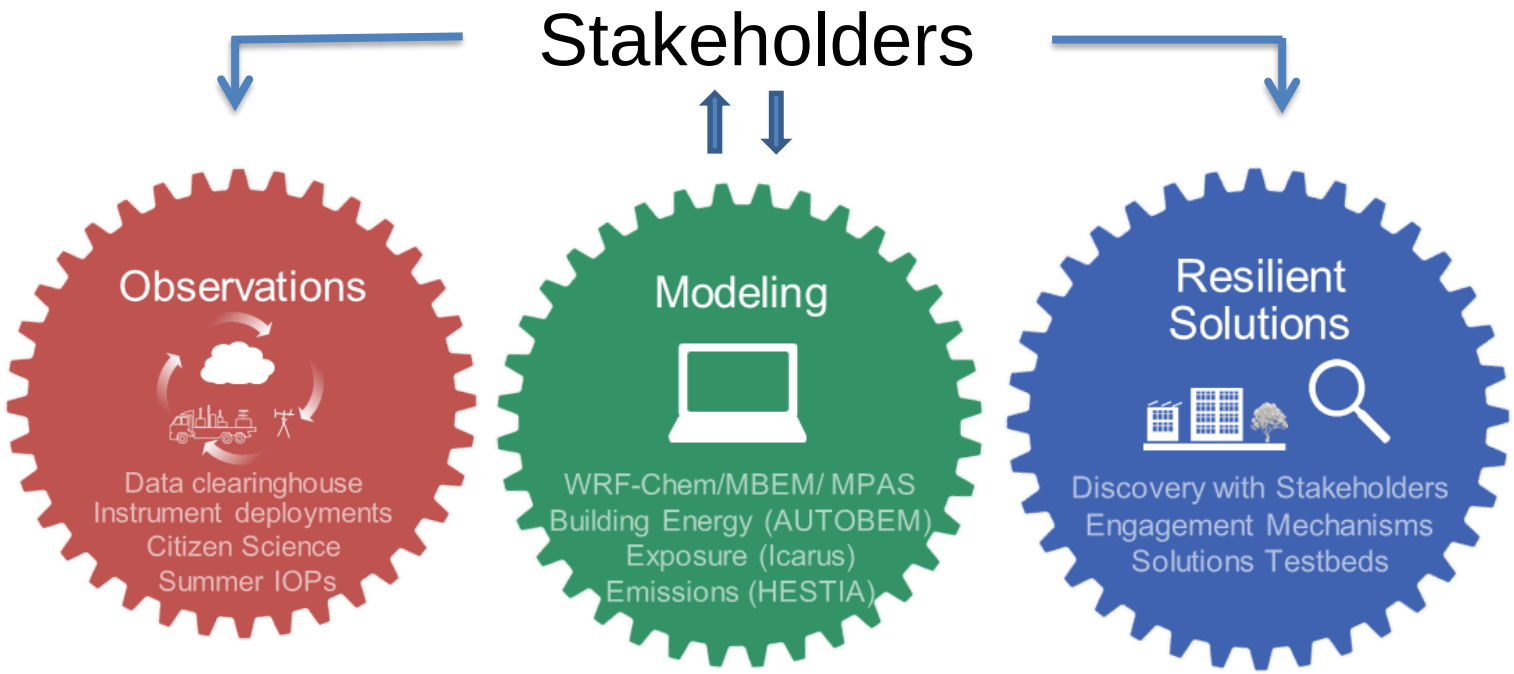
Deliverable 3:
Current & future vulnerability mapping for SETX
Status: Preliminary results of current social vulnerability indicators completed

Bottom-up

SETx URBAN IFL

Southwest Urban Corridor IFL (SW-IFL)

SW-IFL's goal is the creation of new tools that will empower the public to respond to extreme heat, while informing the development and deployment of policies and solutions that are effective, equitable and generalizable.



SW-IFL Director: David Sailor (dsailor@asu.edu)

The Baltimore Social-Environmental Collaborative U-IFL

Mission: to produce the urban climate science needed to inform community-guided *potential equitable pathways* for climate action

Status:
- Issue identification sessions held in January
- Deliberations on *heat* and *climate action* scheduled for April

Status:
- Model coupling and calibration underway
- Most equipment deployments planned for spring/summer 2023

Themes:
- Atmos. Dynamics
- Air quality
- Water and Water Quality
- Greenhouse Gas Emissions
- Health
- Buildings & Energy
- Transportation
- Vegetation and Soils
- Decision Science and co-design

COLLABORATION

- Lead PIs meet regularly
- Virtual Kick-off November 2022
- Sept 2023 PI Meeting

COMMUNICATION

- AGU Town Hall Dec 2022
- Planning for 2024 AMS
- BER and Project websites

Chicago, IL: led by Argonne National Lab with 17 (6 MSI, 4 community org) collaborators.

Chicago Tribune

ENVIRONMENT

Argonne to deploy sensors to track climate change on a neighborhood level in Chicago

Sep 22, 2022 at 7:12 am

Baltimore, MD: led by JHU with 10 (3 MSI) collaborators

GCN The Technology Transforming State and Local Government

EMERGING TECH | DATA & ANALYTICS | CLOUD & INFRASTRUCTURE | CYBERSECURITY

TRENDING // ZERO TRUST // PUBLIC HEALTH // ELECTION SECURITY // AUTHENTICATION // DIGITAL EQUITY

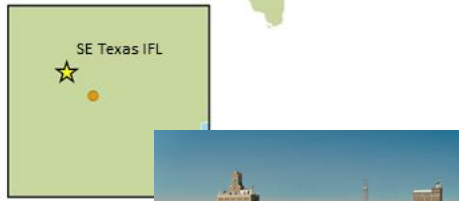
Urban climate lab makes holistic appraisal of resilience

How America's Hottest City is Handling the Heat | American Innovators

US Consensus Digital Media

5.63K subscribers

Tucson-Phoenix-Flagstaff, AZ: led by ASU with 4 (2 MSI) collaborators.



TX Gulf Coast: led by UT-Austin (MSI) with 4 (1 MSI) collaborators.

Inside Climate News

Justice

In Texas, a New Study Will Determine Where Extreme Weather Hazards and Environmental Justice Collide

EXAMPLE RESEARCH CONNECTIONS

- NOAA RISAs and CAPP (BSEC, SeTX, SW-IFL)
- EPA water and air quality monitoring and networks (BSEC, SeTX, CROCUS)
- DHS flood monitoring (SeTX)
- NOAA/ NASA AGES Air Quality flights (CROCUS)
- NIST Northeast Corridor Urban Test Bed (BESC)
- Western Alliance to Expand Student Opportunities (WAESO) (NSF-funded) (SW-IFL)

Urban Integrated Field Laboratories

https://ess.science.energy.gov/urban-ifls/

Thank You