Southwest Urban Corridor Integrated Field Laboratory (SW-IFL)

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U.S. DEPARTMENT OF ENERGY | Office of Science

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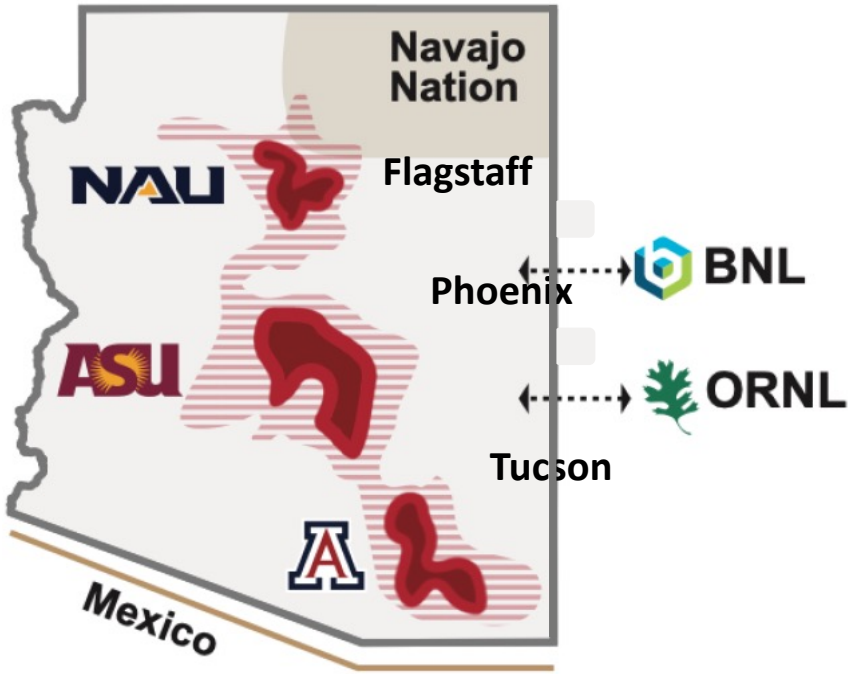
SW-IFL Southwest Integrated Field Laboratory

ASU Arizona State University | The University of Arizona | NAU Northern Arizona University | Brookhaven National Laboratory | Oak Ridge National Laboratory | IBM

Focus of SW-IFL

Extreme heat as a key driver of environmental and societal outcomes, ***particularly for the most at-risk communities*** *across Arizona*



One of four 5-year projects funded by the Department of Energy's Urban Integrated Field Laboratory initiative within the Biological and Environmental Research (BER) Program

Modeling

A next-generation predictive system – a Model of Models (MoM) – that transcends scales from individual buildings to the globe

Observations

New surface and vertical profile measurements of atmospheric composition and temperature

Resilient Solutions

Stakeholder engagement to drive environmental and social resilience solutions

Progress and Results in Year 1…

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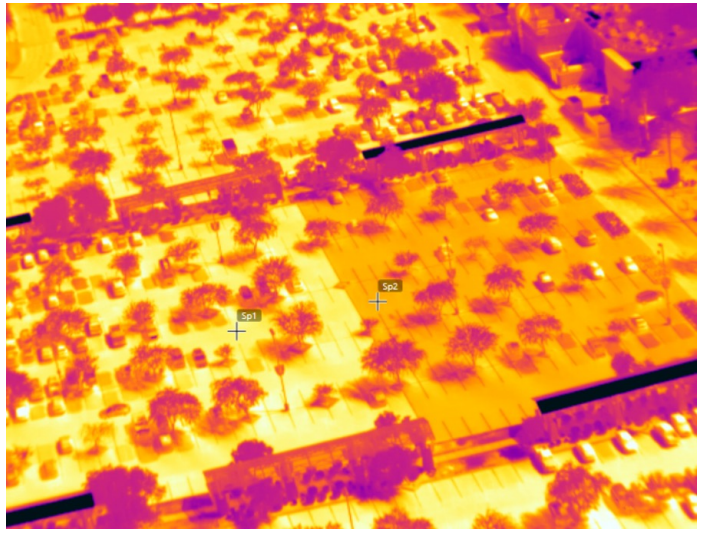
Technology testbeds – Cool Paving

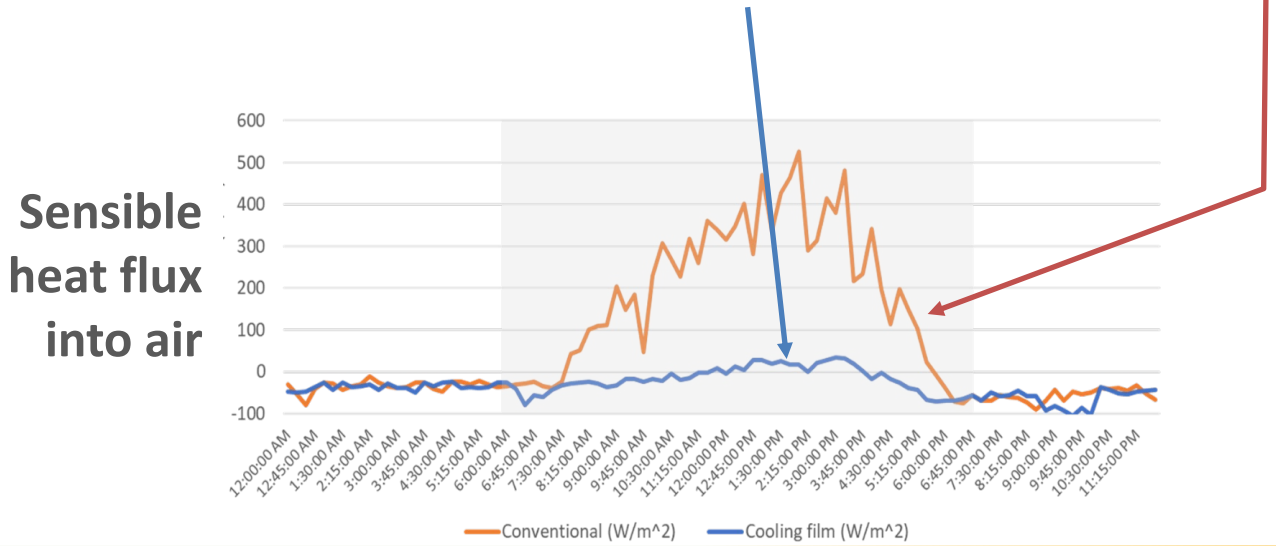
- Partnering with the City of Phoenix (roads) and local developers (parking lots) to measure efficacy of reflective, ***cool paving***

- **Results**: Summer temperature reductions up to
  - Surface $\Delta T \sim 8°C$
  - Subsurface $\Delta T \sim 4°C$
  - 2m Air $\Delta T \sim 1\text{-}2°C$



Technology testbeds – Radiant Cooling Films

- Artificial shade can be more effective if coated with highly reflective and highly emissive materials
- Summer daytime <u>average</u> sensible flux:
  - Conventional surface warms the airshed by 185 W/m^2
  - Radiative cooling surface cools the airshed by 18 W/m^2



Community Testbeds

- Community testbed sites selected:
  - **Jackson Street Site, Phoenix**
  - **Oracle Road Corridor, Tucson**
  - Desert Wells, Mesa
  - Flagstaff
- Meeting with community stakeholders to define challenges and co-design solutions

Jackson St. Site Phoenix – Unhoused populations

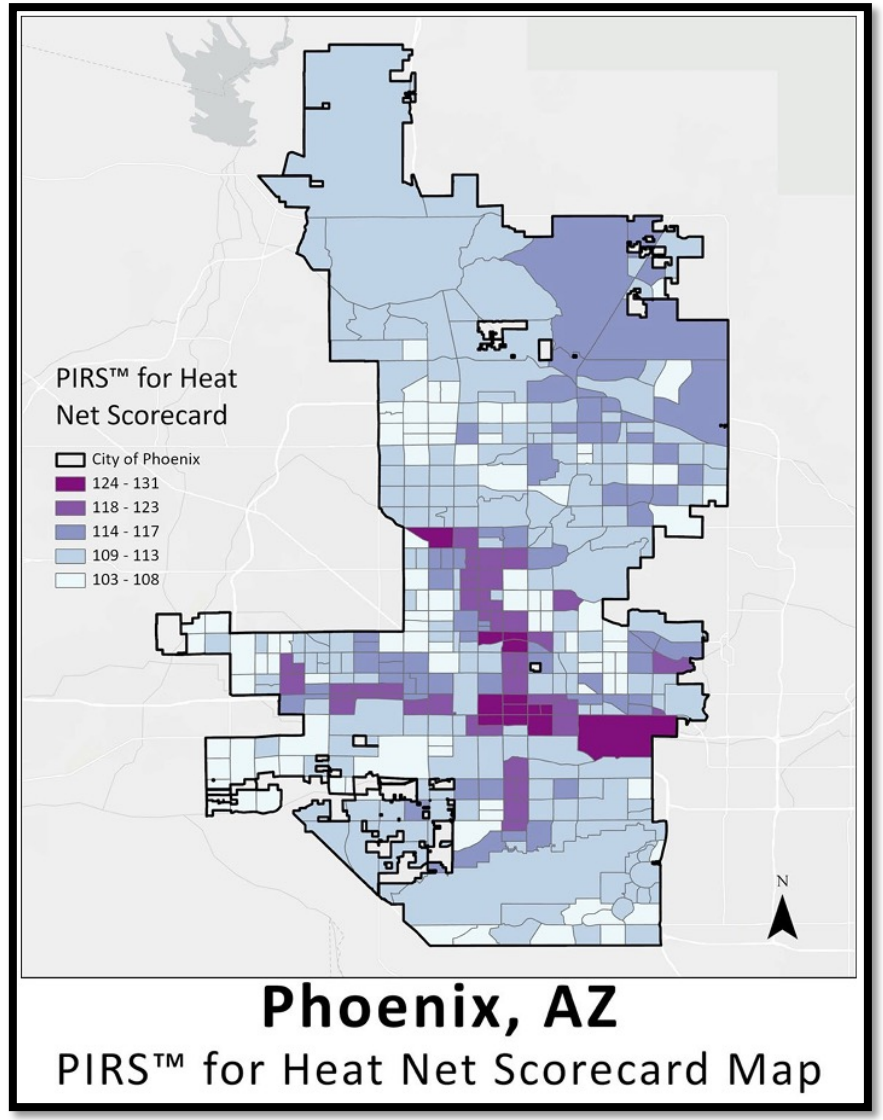
Oracle Road Corridor, Tucson – Manufactured & public housing

Plan Integration for Resilience Scorecards (PIRS™)

Resilient Solutions

Discovery with Stakeholders
Engagement Mechanisms
Solutions Testbeds

- Spatial evaluation of the extent to which city plans incorporate heat resilience
- Reports delivered to Tucson, Tempe, and Phoenix in 2023
- Reports being finalized for Flagstaff, Mesa, Casa Grande, and Nogales
- Initiated assessment protocol to determine how reports are being used



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Developing Observational Framework

Established Urban Flux Towers

Maryvale – low-rise residential neighborhood

Encanto – urban park (to be re-established)

Desert Botanical Gardens – open desert within city

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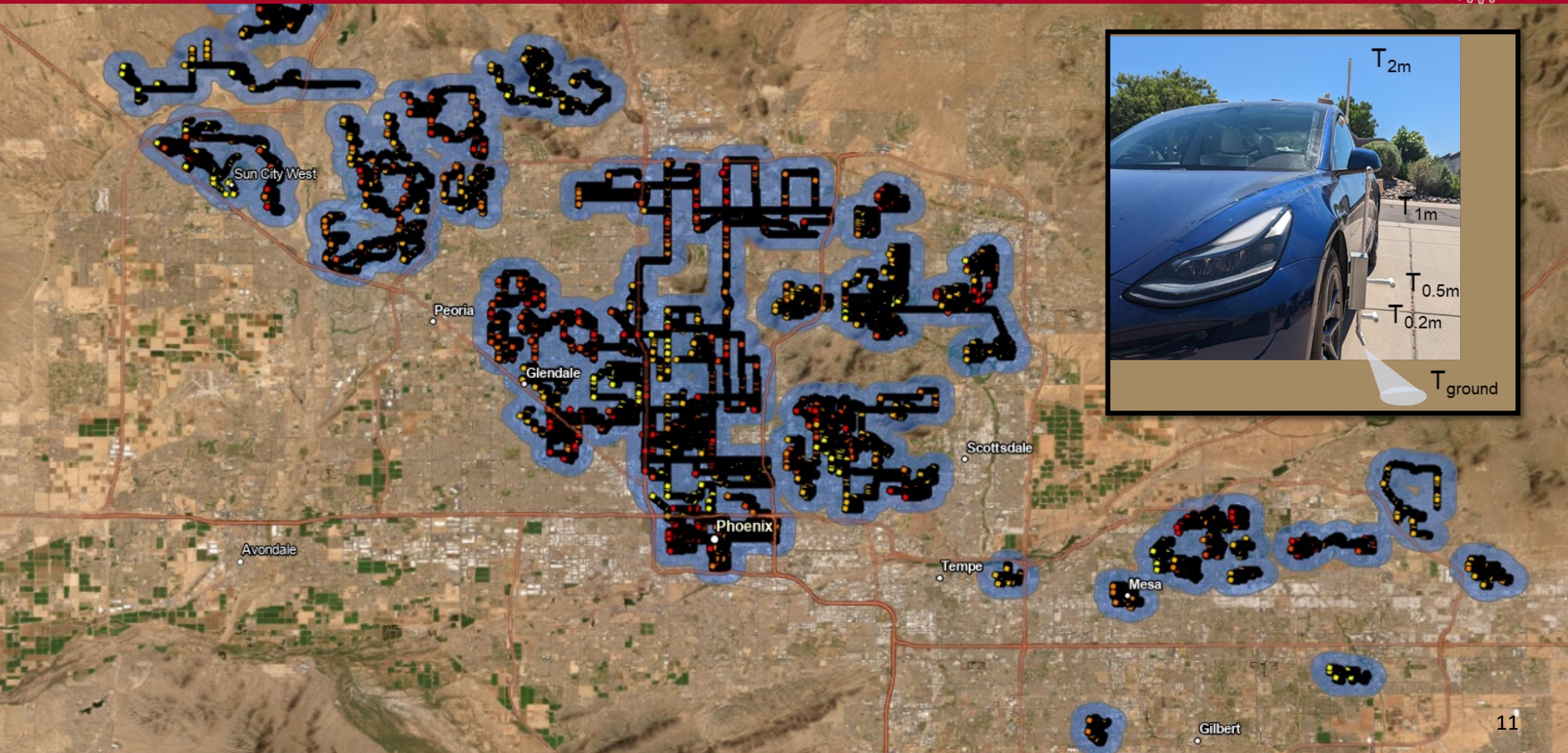
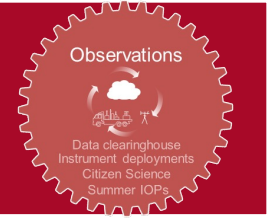
Pilot Urban Temperature Traverse Campaign (2023)



Developed 2nd-gen BNL Mobile Observatory



- Deployable on a truck, rooftop or on the ground
- Easier to ship
- Can be deployed on rental vehicles

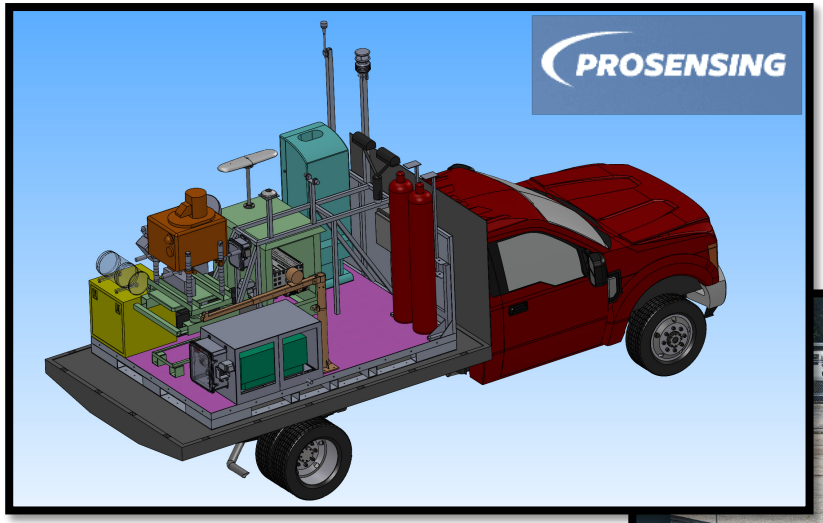


Photo of second mobile lab from BNL

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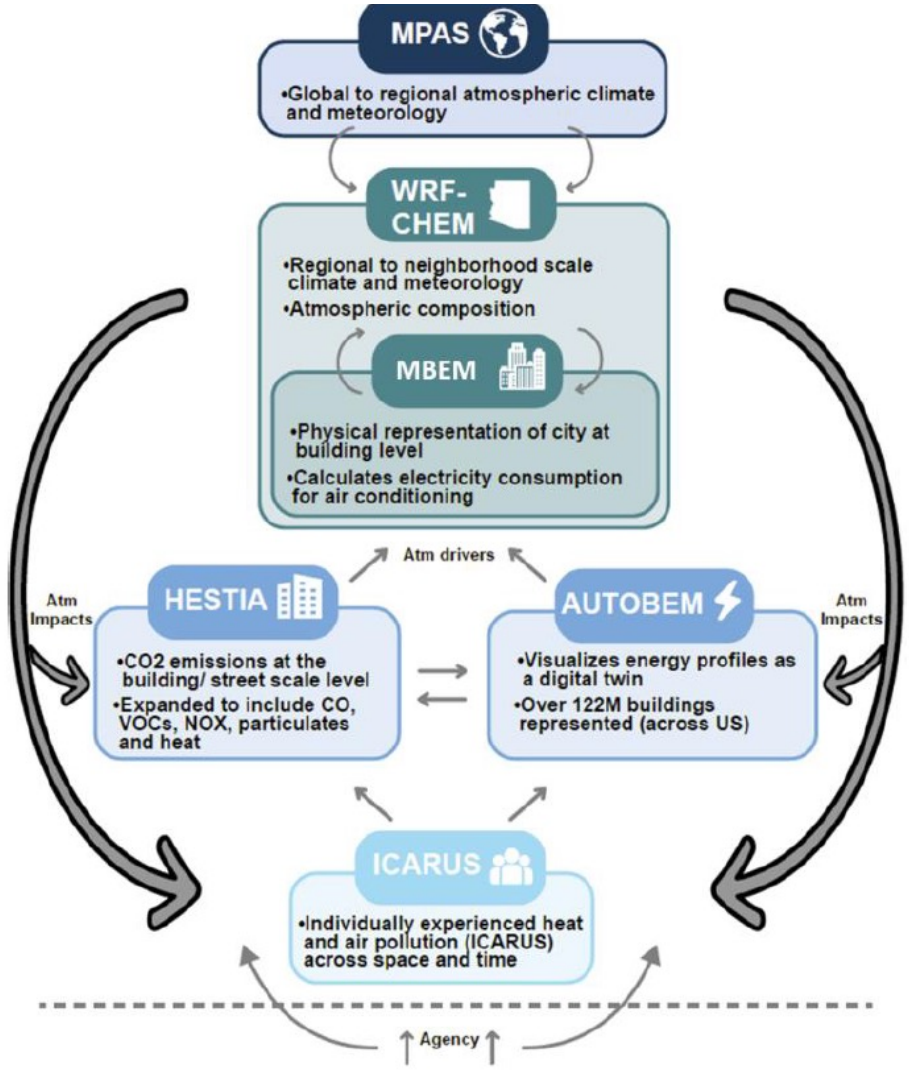
Developed Model of Models (MoM) Framework

Modeling
WRF-Chem/MBEM/ MPAS
Building Energy (AUTOBEM)
Exposure (Icarus)
Emissions (HESTIA)

- Evaluation of MPAS to WRF versus traditional approach
- Data assimilation work to optimize siting of instruments
- Incorporation of building morphology



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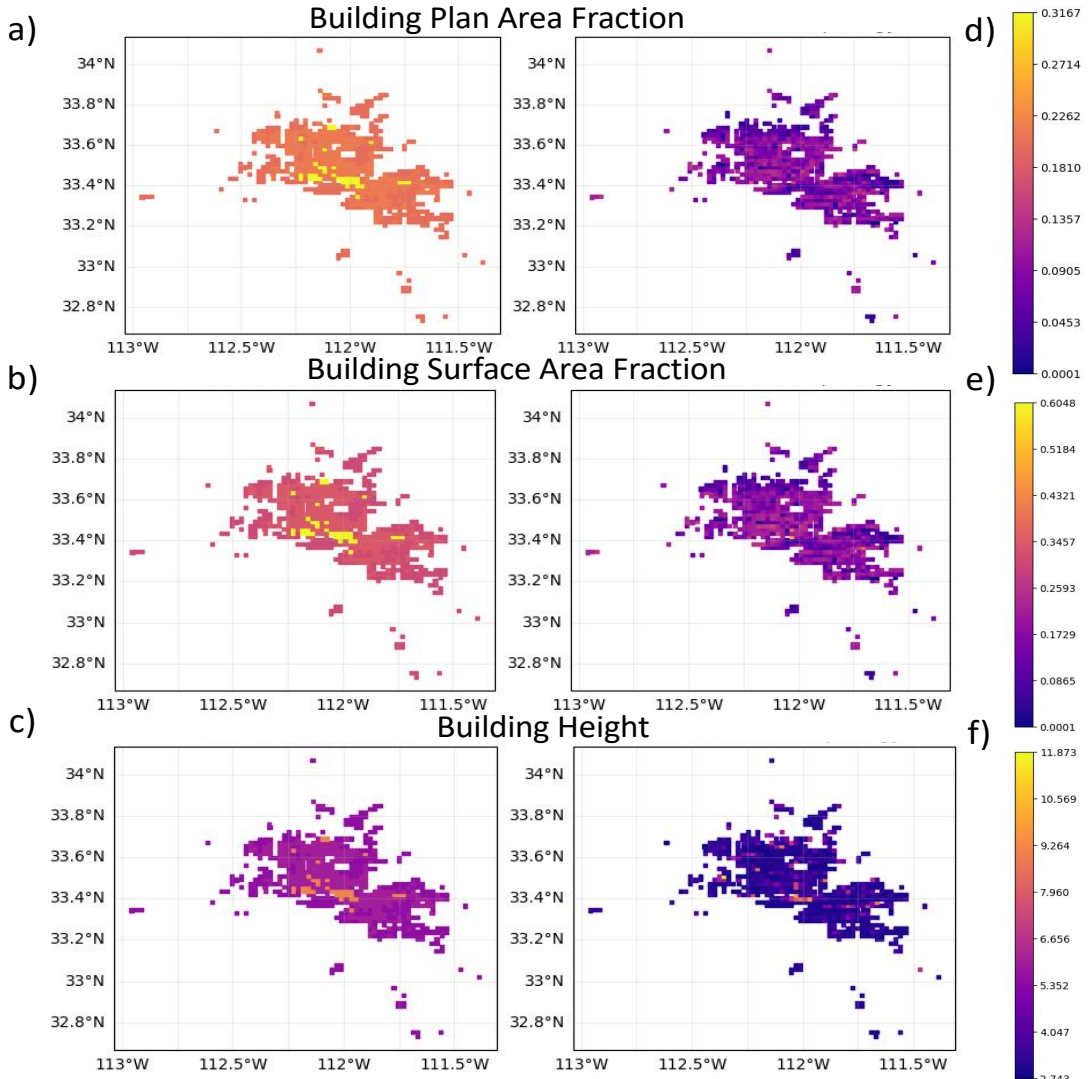
Incorporating Building Morphology

Modeling

WRF-Chem/MBEM/ MPAS
Building Energy (AUTOBEM)
Exposure (Icarus)
Emissions (HESTIA)

Morphological Characteristics



Building Data

UBID	8559CWXG+F5X-19-18-14-14
Building Type	GOVERNMENTAL/PUBLIC USE (GENERAL)
Year Built	1971
Num Floors	14
Square Footage	1,324,440
Height (ft)	185
Energy Use Intensity (kBTU/sf)	59.6

Total Energy Projections

Percent changes are calculated from 2020-2040

	Annual Energy	Annual Cost	Annual Emissions
fTMY 2020-2040	79,600,092 kBTU	1,535,443 $	8,540.8 Tons CO2
fTMY 2040-2060	2.7 %	3.6 %	2.7 %
fTMY 2060-2080	3.4 %	5 %	3.4 %
fTMY 2080-2100	7.5 %	10.6 %	7.5 %

Electricity Projections

Percent changes are calculated from 2020-2040

	Annual	Annual	Annual

Thank you!

Interested in learning more about SW-IFL?

sw-ifl.asu.edu

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