

# Using carbonyl sulfide to explore coastal fog and coast redwood interdependence

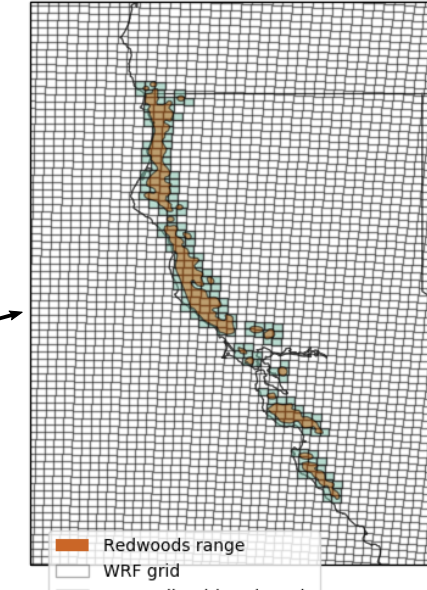
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Coast redwoods (sequoia sempervirens):

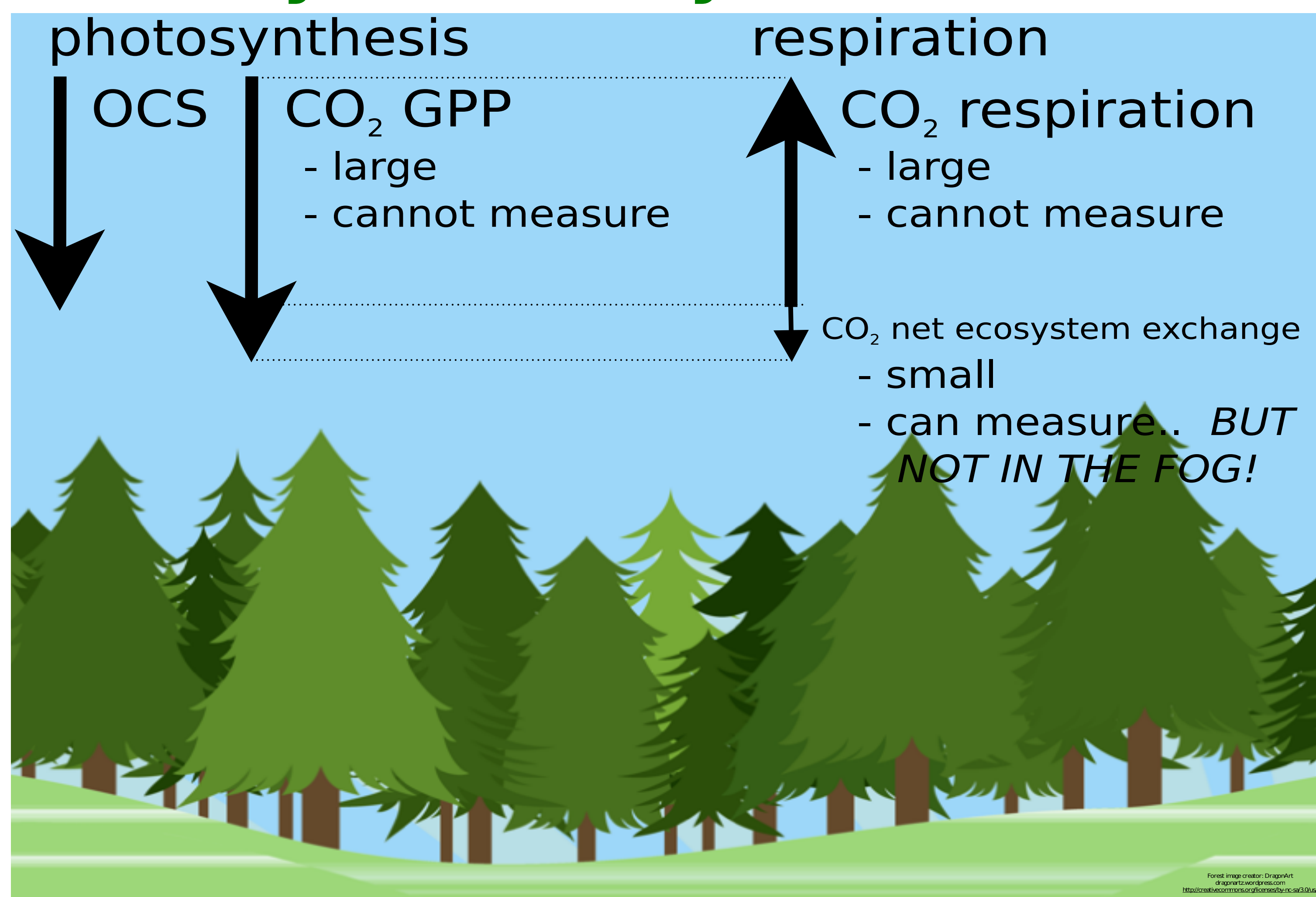
- are the tallest trees on Earth
- grow in a narrow fog-shrouded band along the U.S. West Coast.
- Little is known about coastal fog-redwood growth feedbacks. And coastal fog is declining with increasing temperature and coastal urbanization.



the big Q: what do stomata do as fog dissipates?

H1: stomata close (redwoods are "heaters")      H2: stomata stay open (redwoods are "coolers")

## Q1: Why carbonyl sulfide (OCS)?

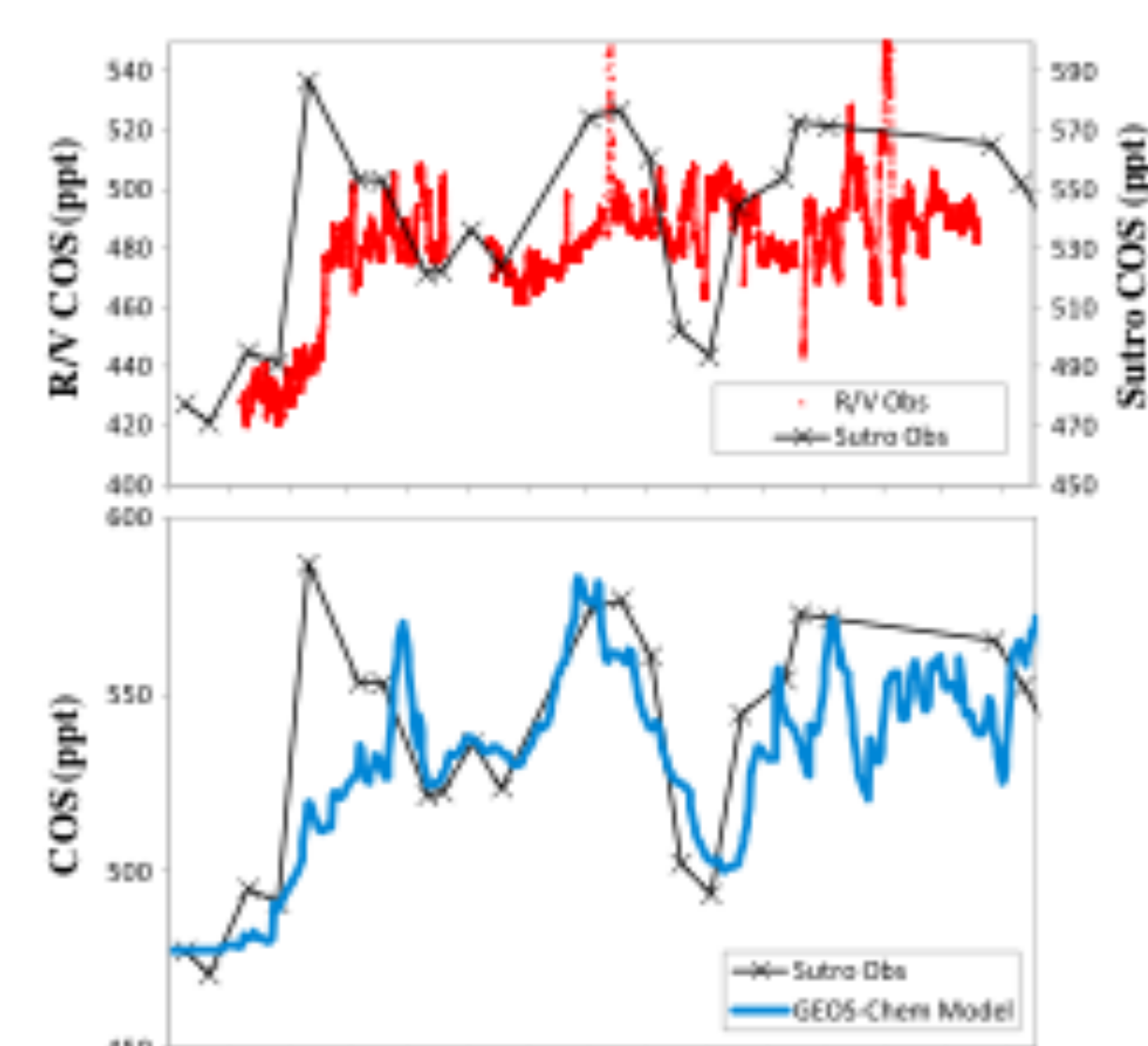
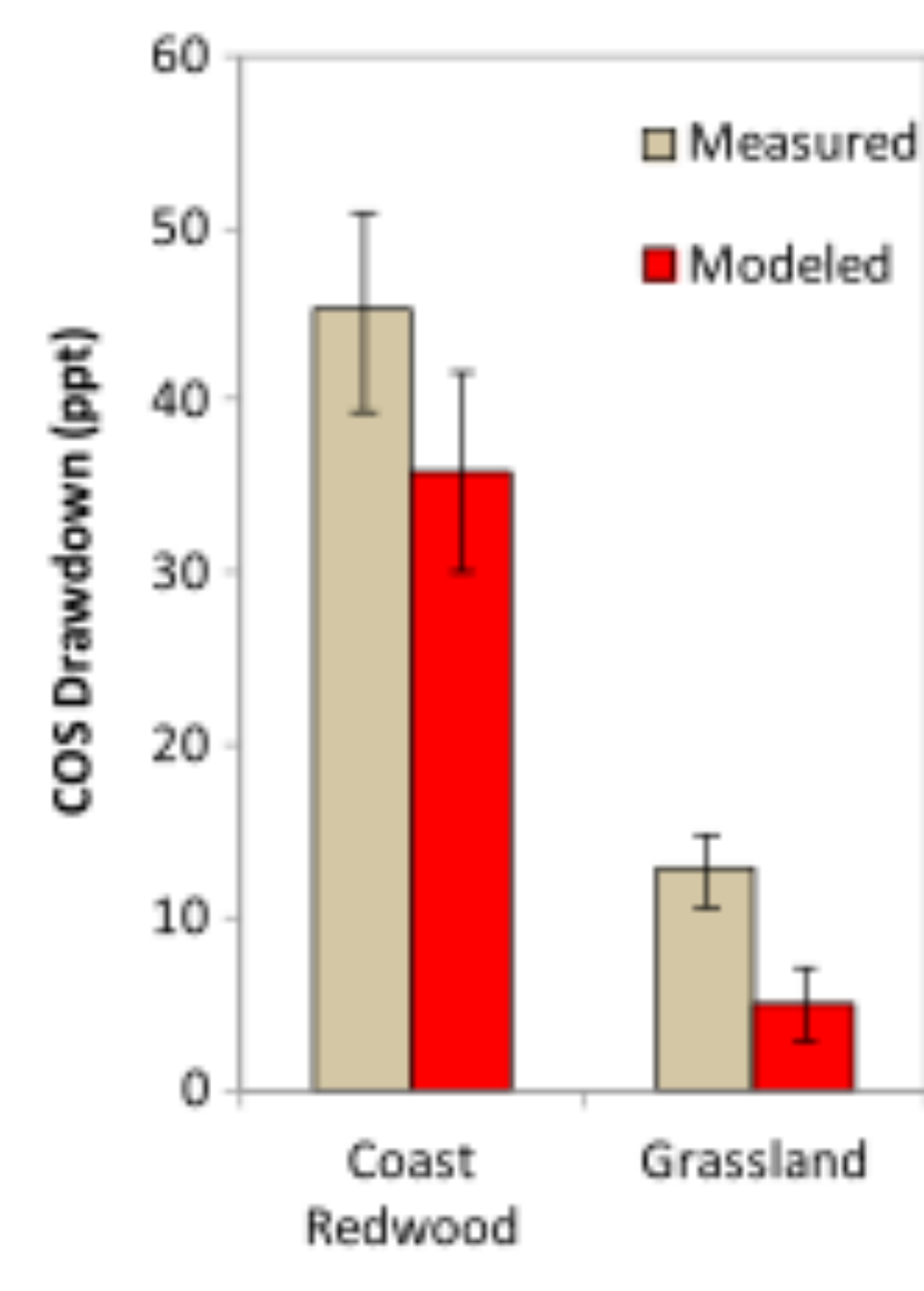
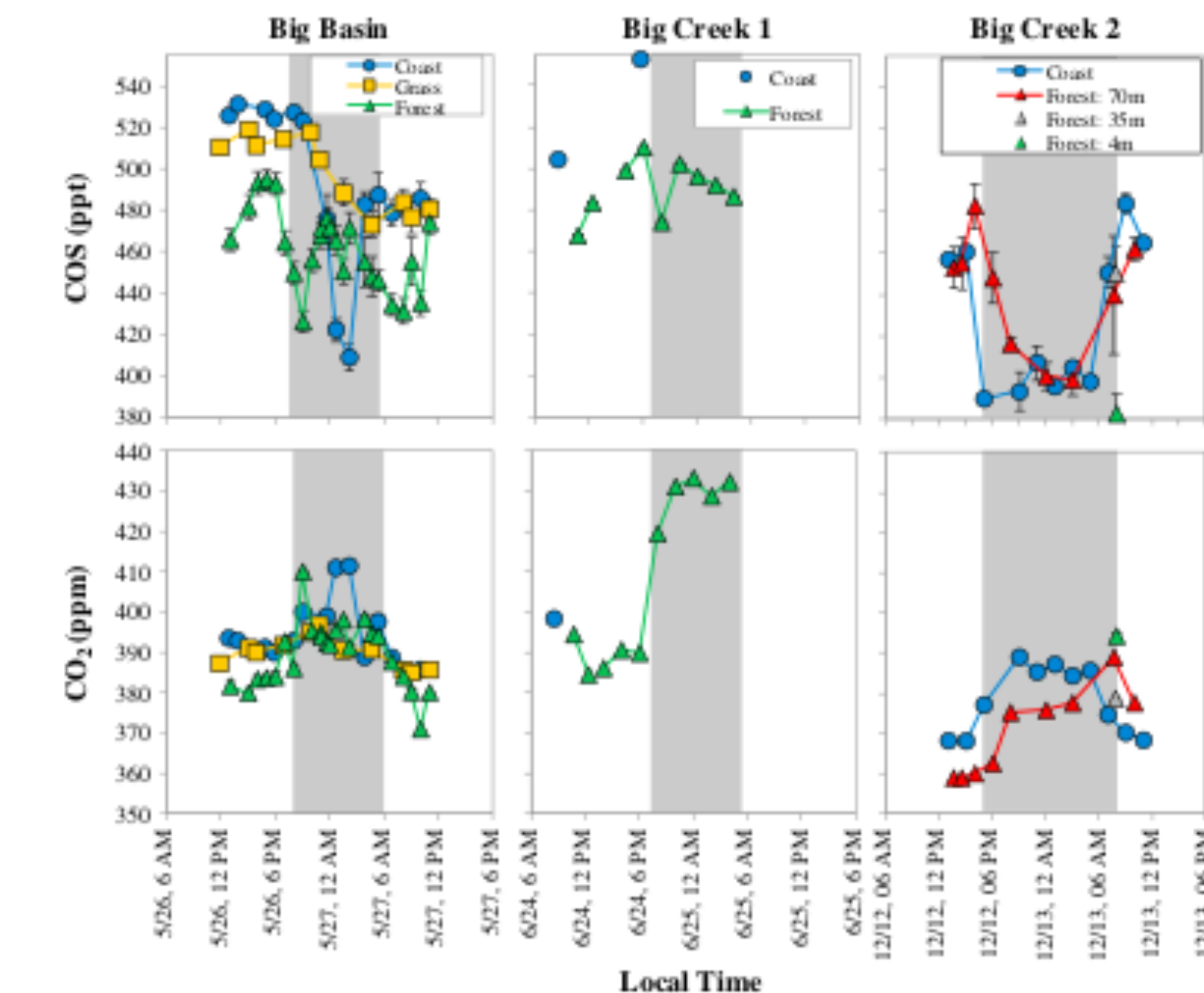


## Q2: Is there a redwood OCS signal?

Preliminary flask samples from the field say "yes". Note larger OCS decline from coast to redwoods vs. coast to grassland!

Our transport model (STEM) simulates the flask samples fairly well.

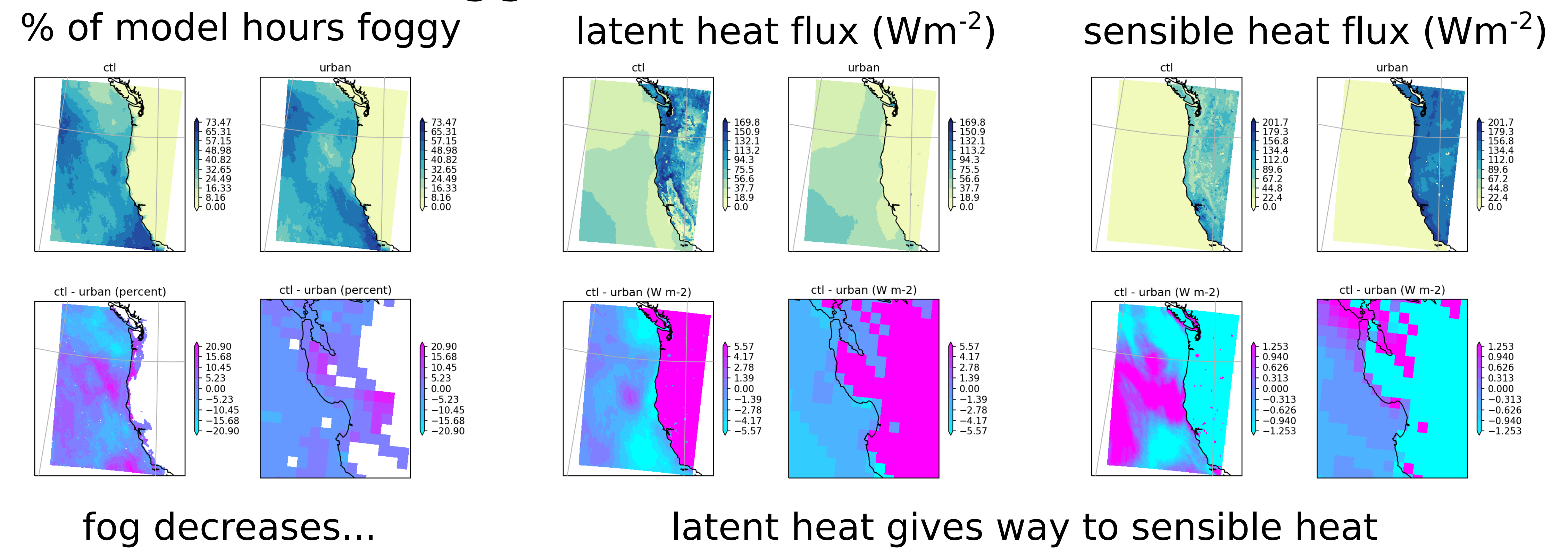
Our flask samples largely agree with NOAA/ESRL/GMD's nearby site (Mt. Sutro)



Figures: Campbell et al. (2017), JGR Biogeosci. 10.1002/2016JG003703

## Q3: Can WRF-NOAH simulate land surface-fog interactions?

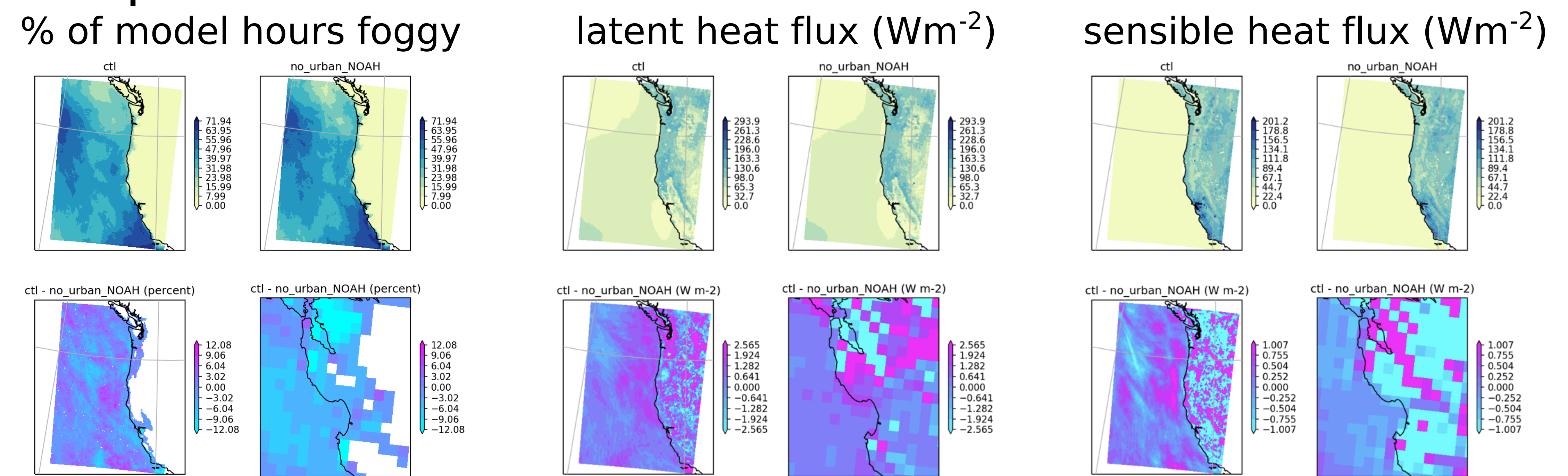
Experiment 1: make a vast swathe of North America urban: "the biggest hammer we can find"



fog decreases...

latent heat gives way to sensible heat

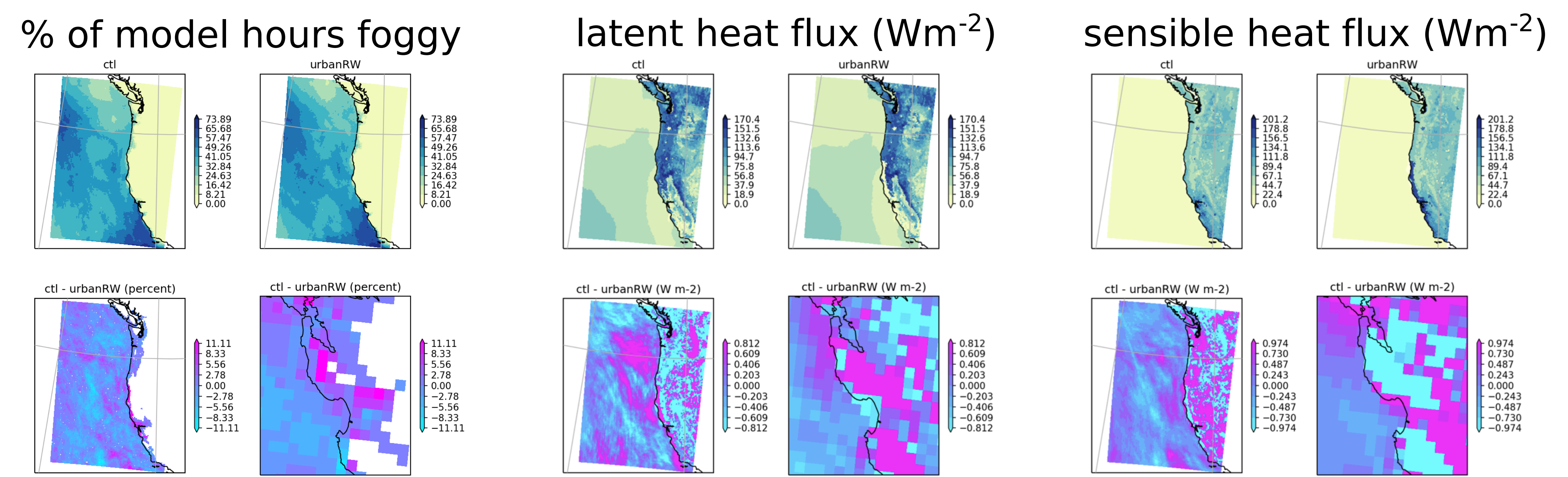
Experiment 2: remove all urbanization



fog increases...

sensible heat gives way to latent heat (at least near cities)

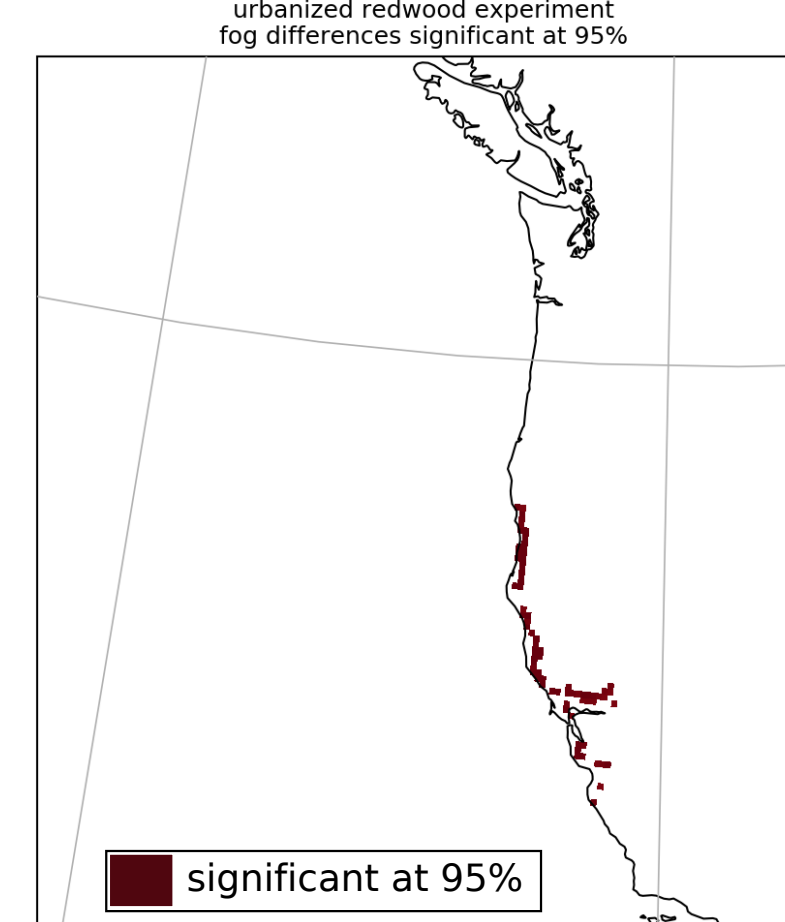
Experiment 3: urbanize the redwood groves:



fog decreases...

latent heat gives way to sensible heat (at least near redwoods)

## Q4: are these widespread changes meaningful?



Offshore fog changes are not significant. Fog changes near redwood range are less likely noise but more work is needed!

coming up:

- continuous redwood canopy [OCS] obs
- implement redwood stomatal behavior in WRF-NOAH (or WRF-CLM?)



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