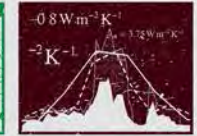




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Current and Future Climate Trends for Maui Nui

Global change, local impacts

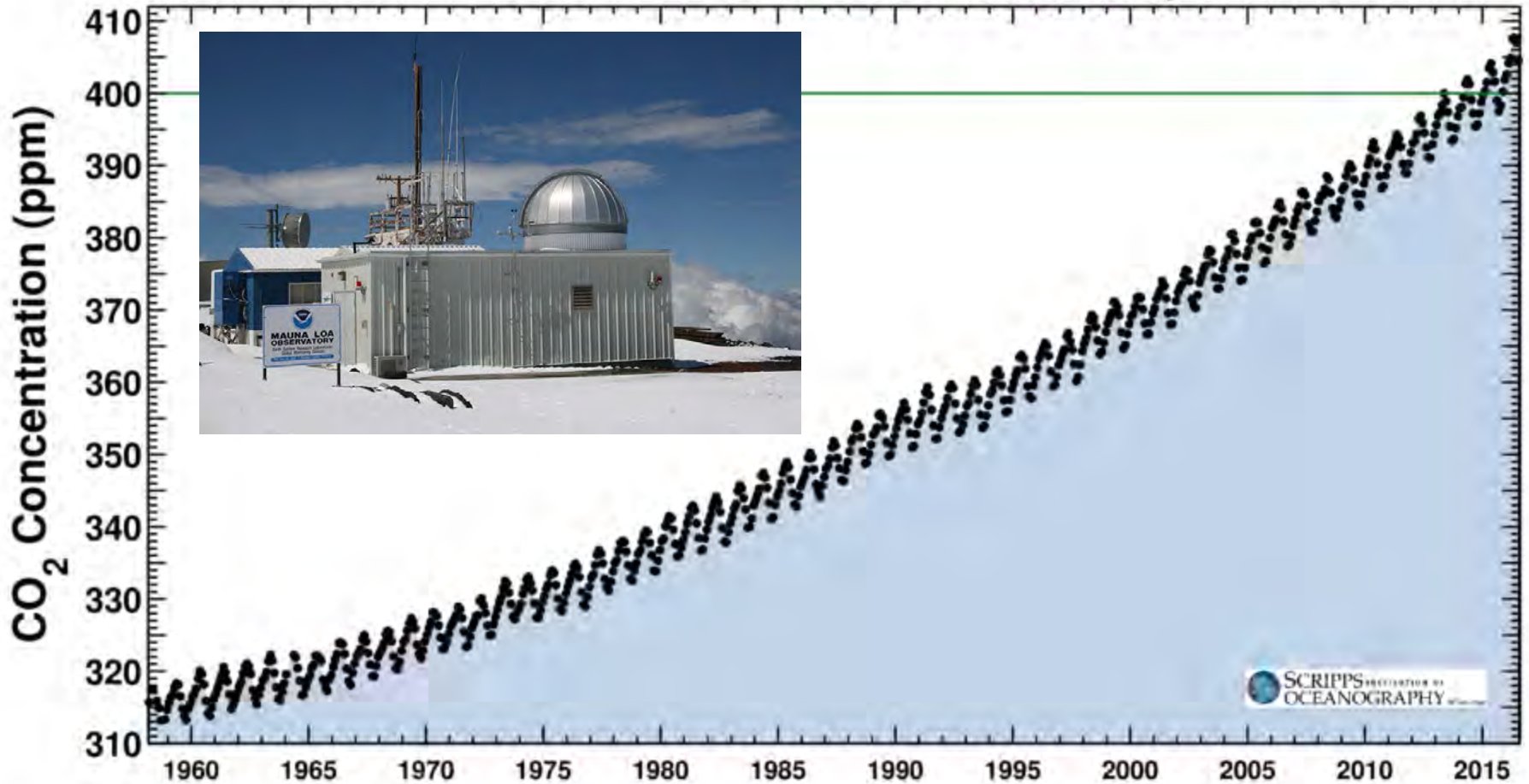
EcoAdapt Maui Workshop #1
August 16, 2016

Jeff Burgett
Science Coordinator, PICCC

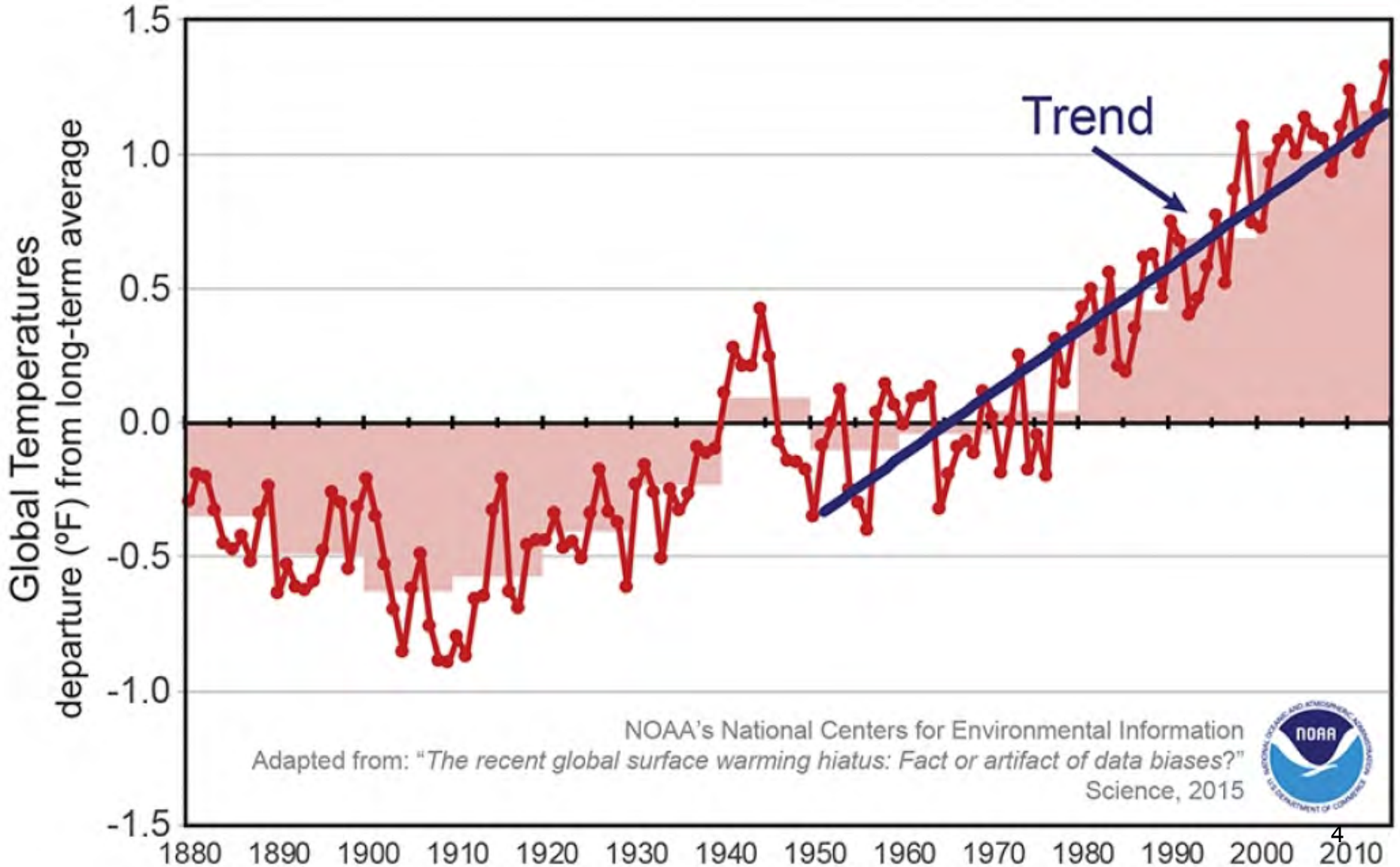


August 11, 2016

402.72 ppm
at Mauna Loa Observatory



Observed Global Warming

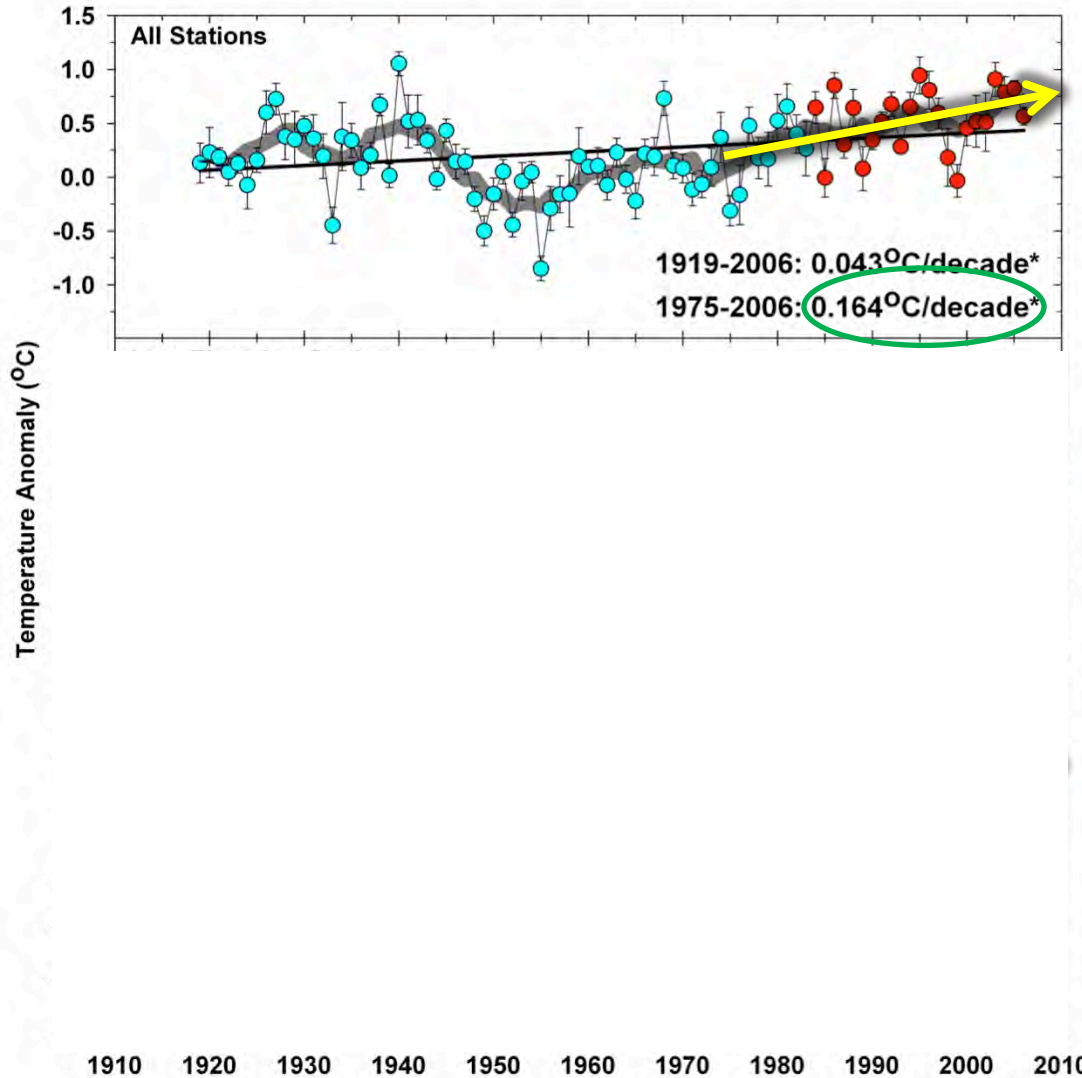


NOAA's National Centers for Environmental Information
Adapted from: "The recent global surface warming hiatus: Fact or artifact of data biases?"
Science, 2015



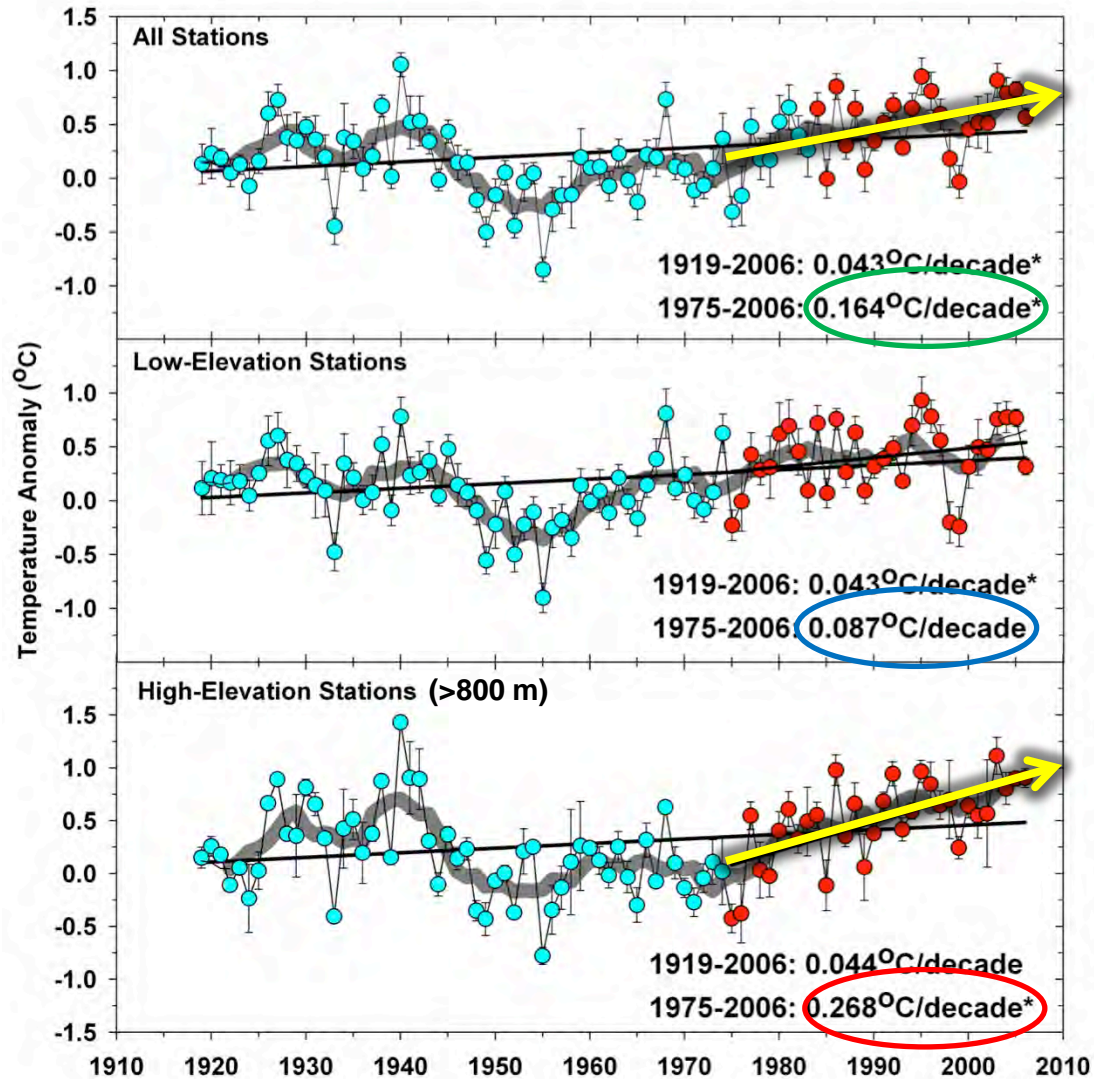


Observed trends: Temperature





Observed trends: Temperature



Trade wind inversion becoming more frequent



Photo: S. Crausbay

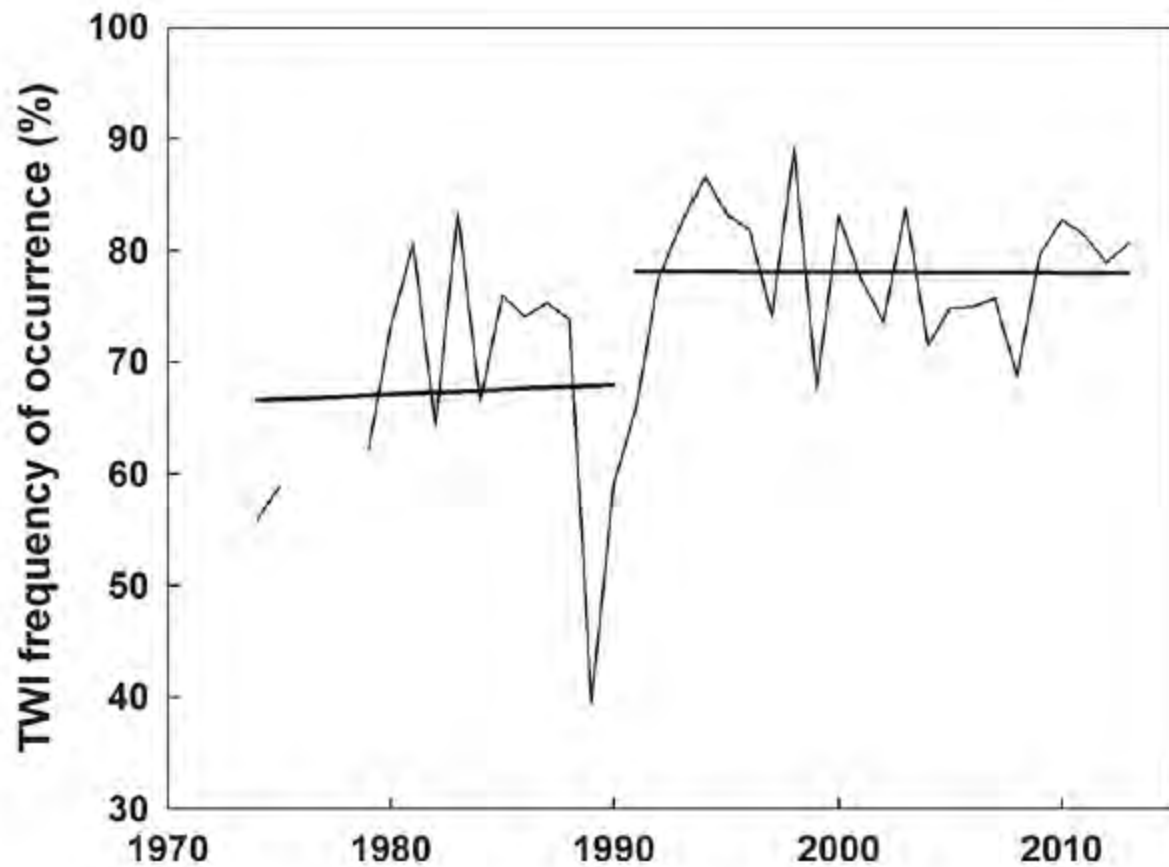


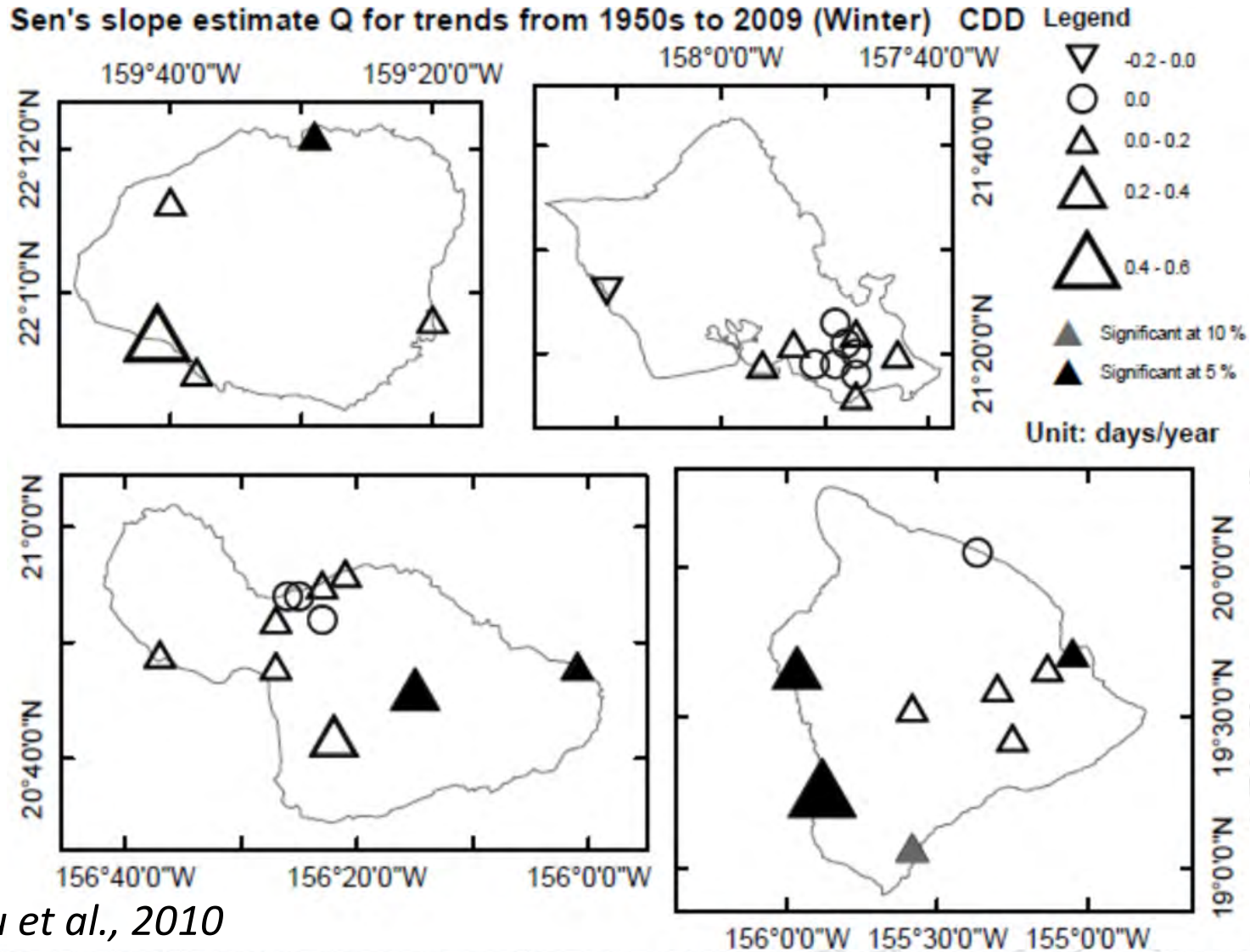
Fig. 1 TWI frequency of occurrence (percent of days).

Krushelnycky et al. 2016

Dry Periods are Increasing

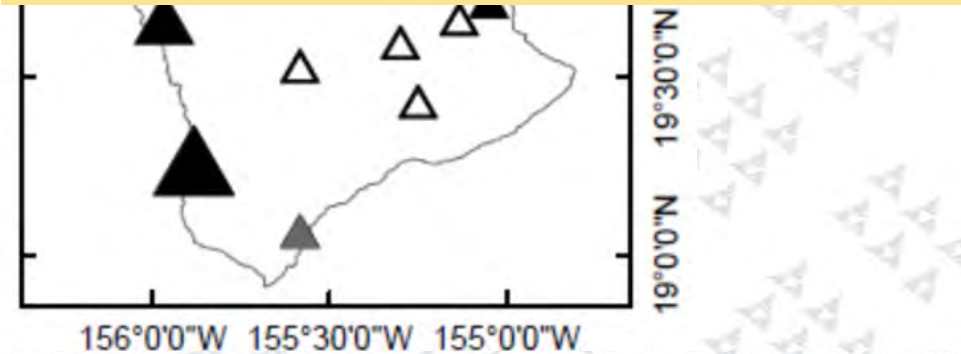
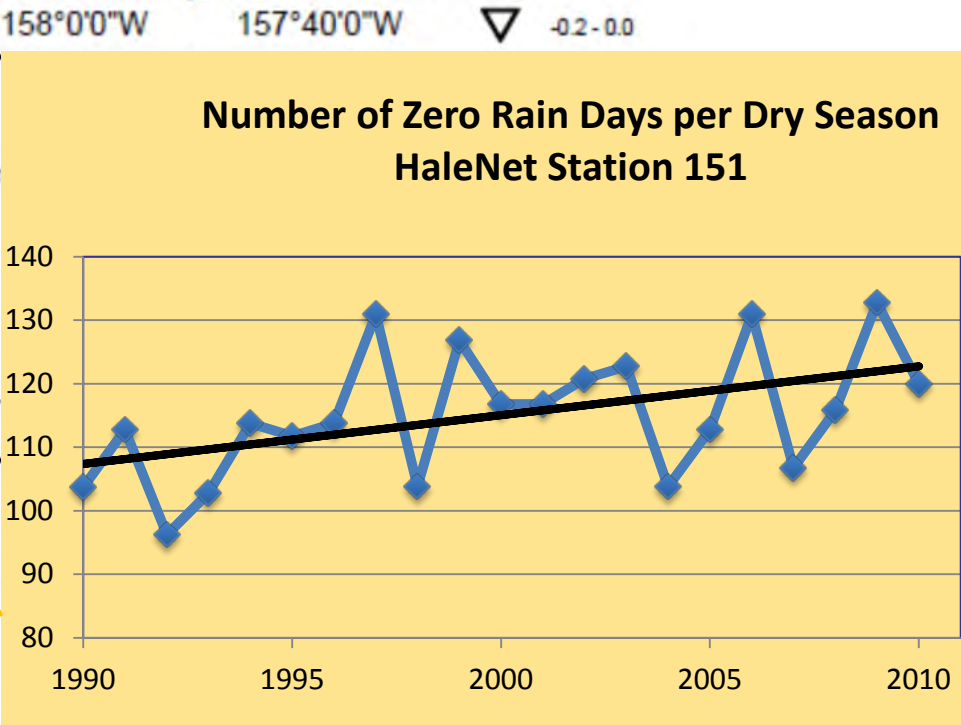
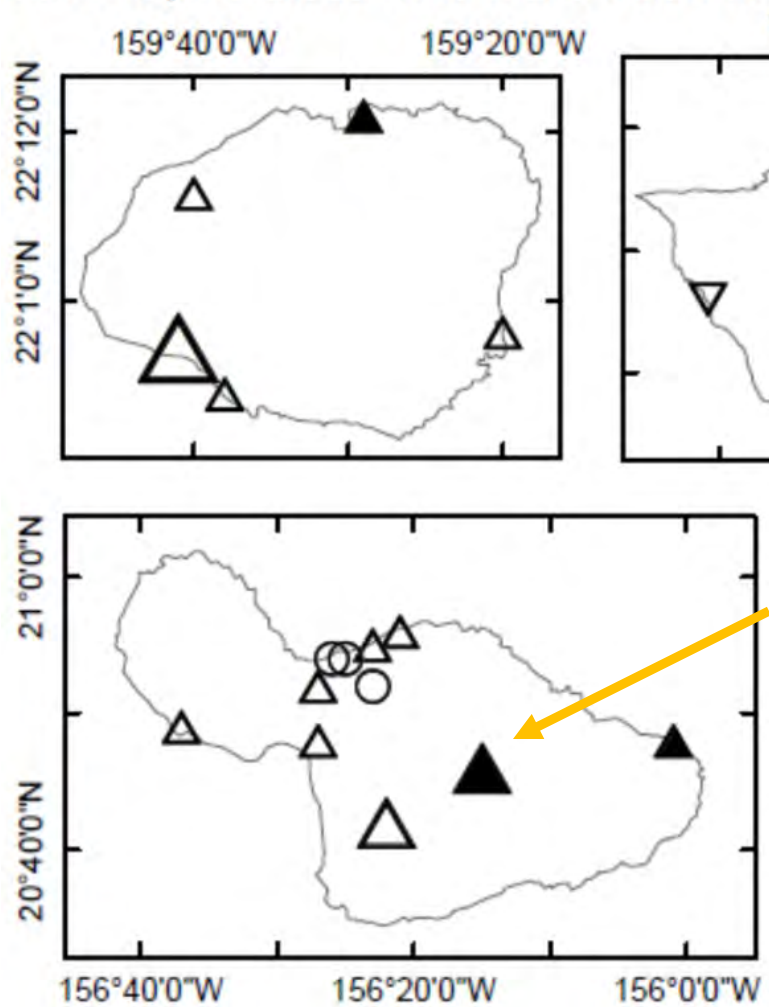


Dry Periods are Increasing

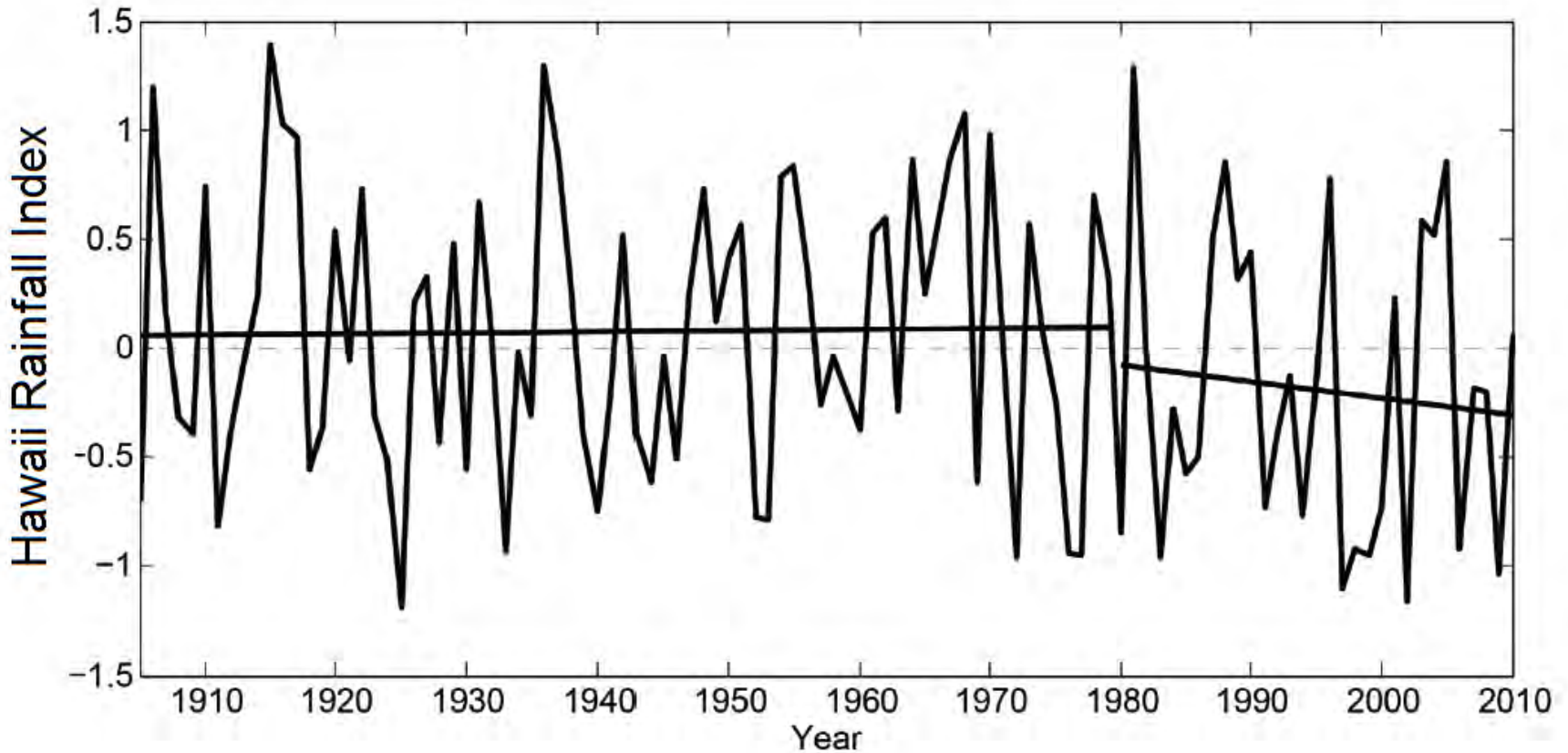


Dry Periods are Increasing

Sen's slope estimate Q for trends from 1950s to 2009 (Winter) CDD Legend

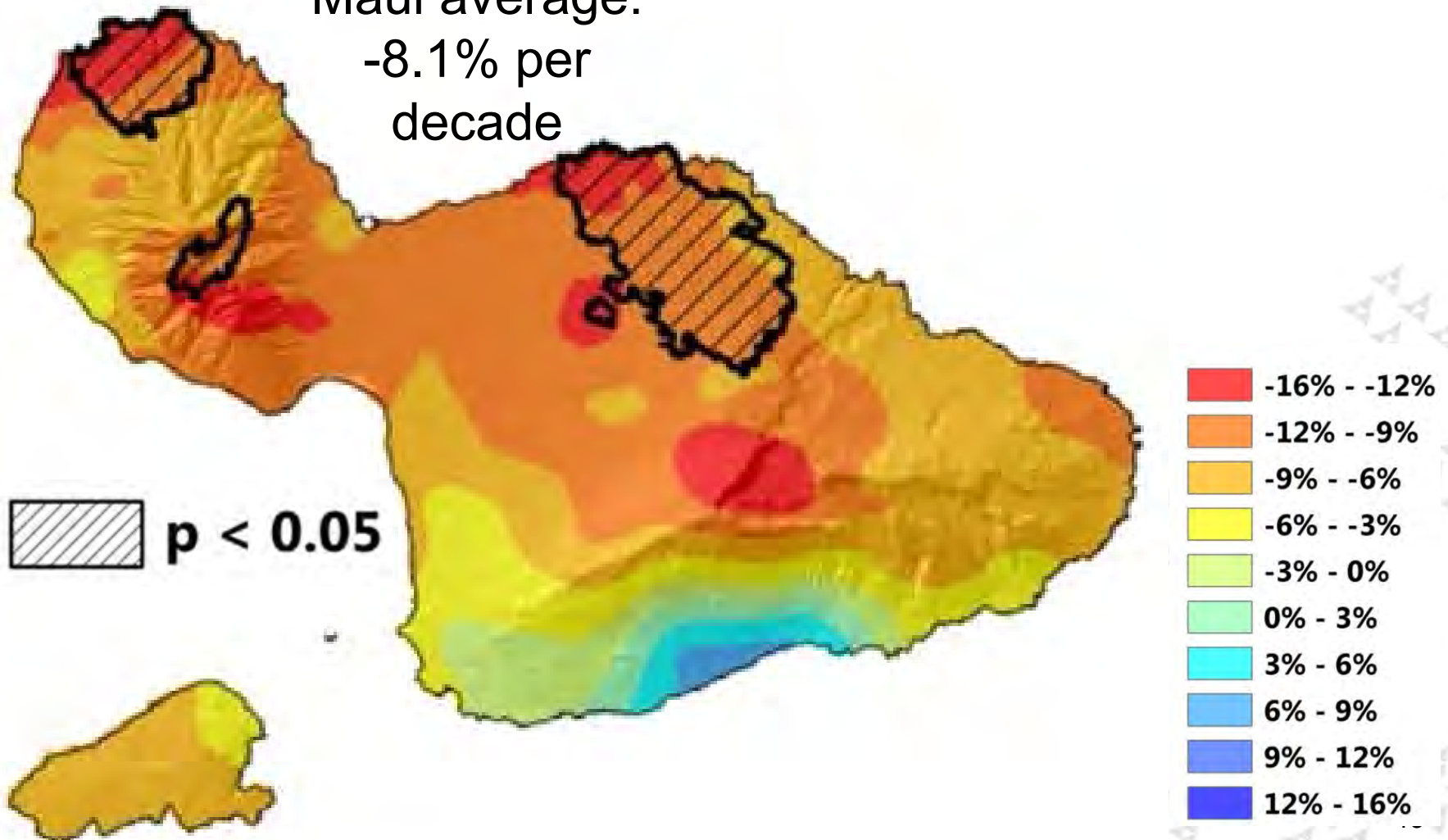


Statewide Rainfall is Decreasing



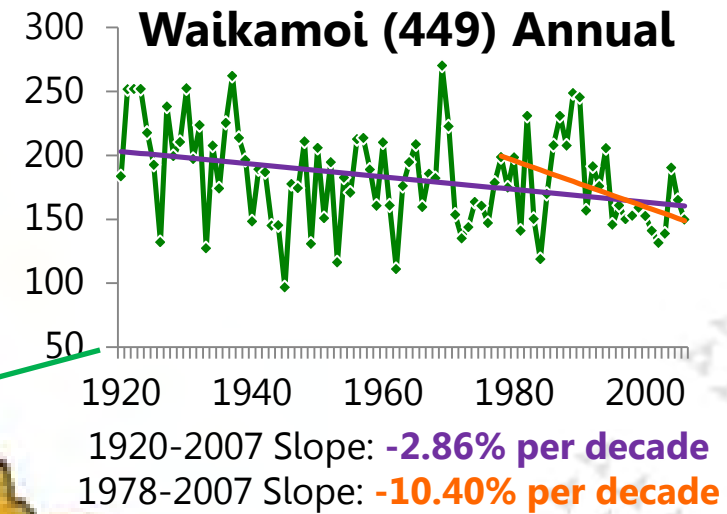
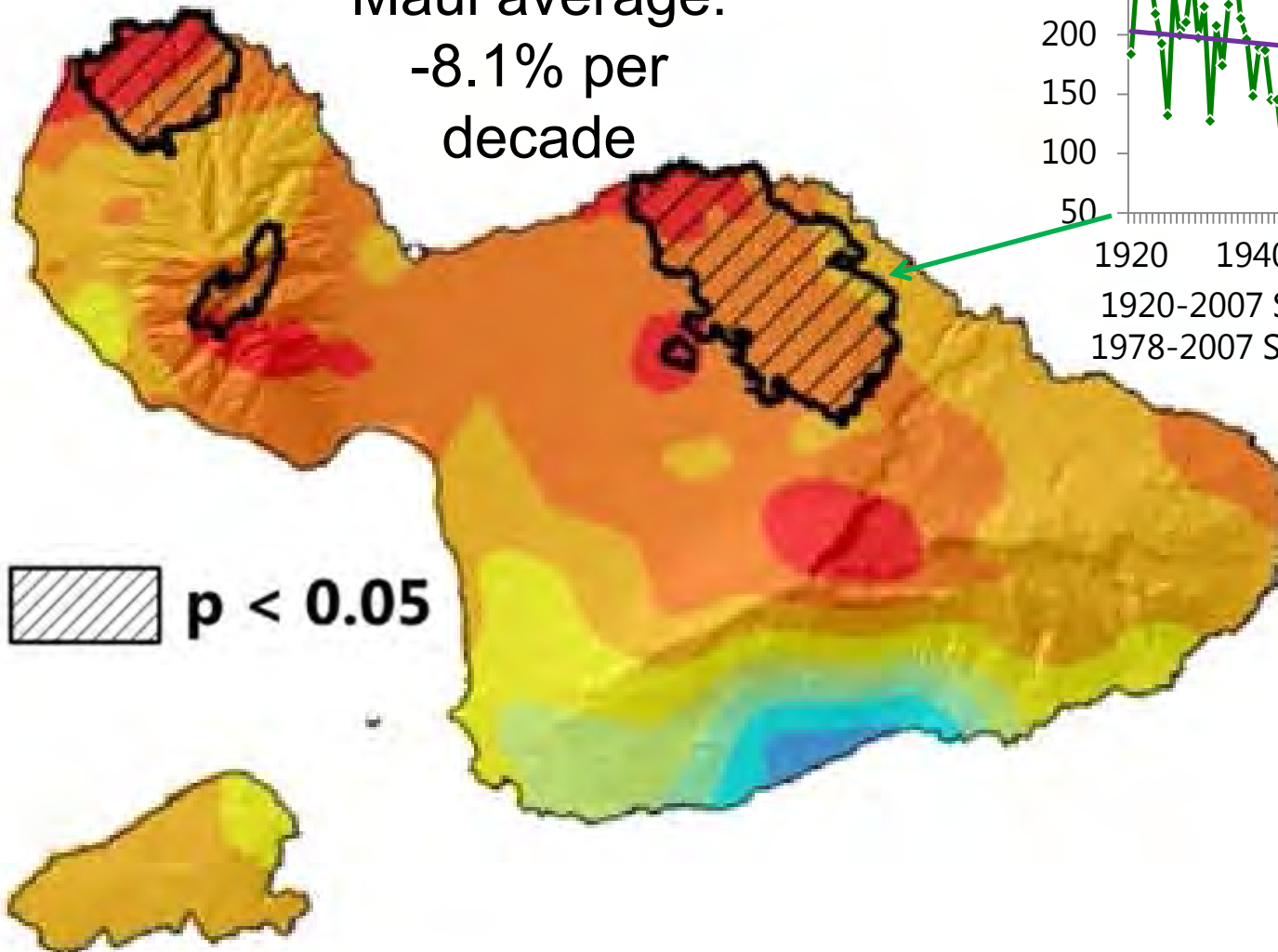
Change in annual rainfall per decade 1978-2007

Maui average:
-8.1% per
decade



Change in annual rainfall per decade 1978-2007

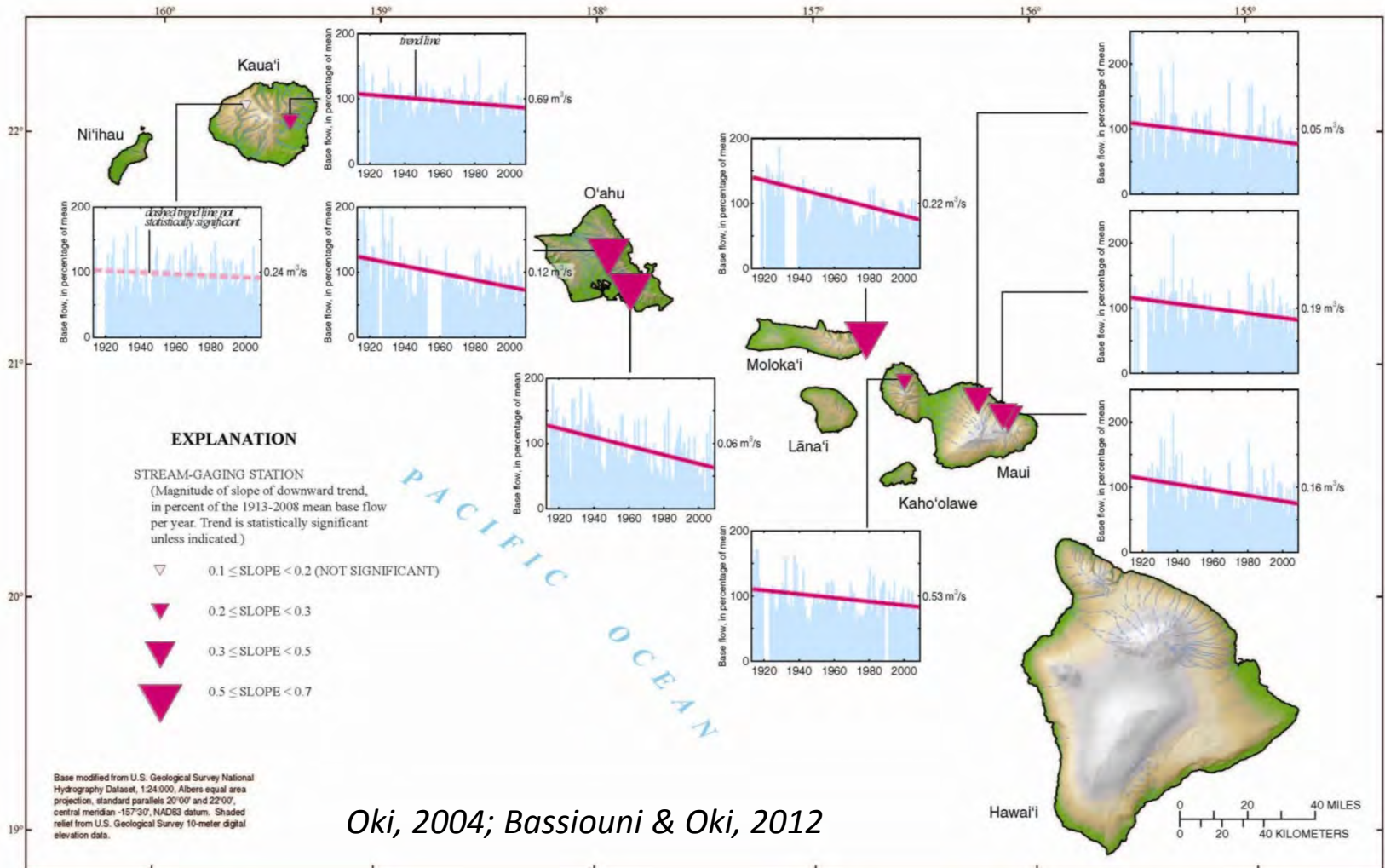
Maui average:
-8.1% per
decade



Base Flow in Streams is Decreasing

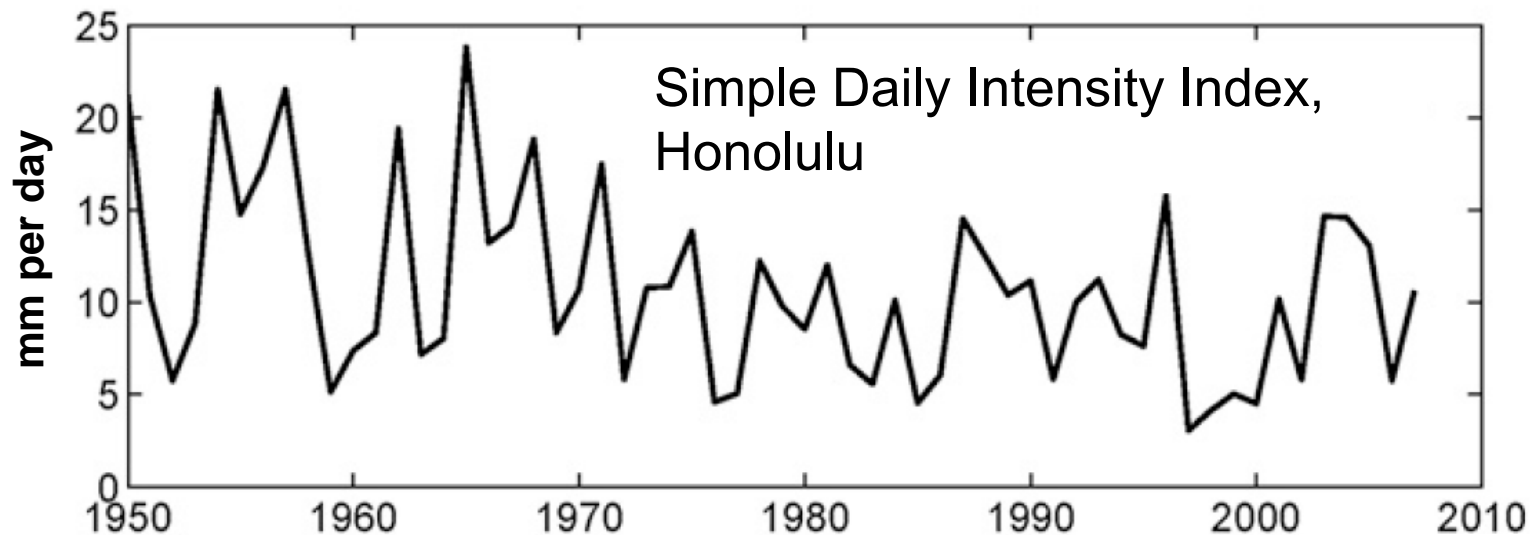


Base Flow in Streams is Decreasing



Storms and Floods

- **Global trends toward more intense rainfall events**

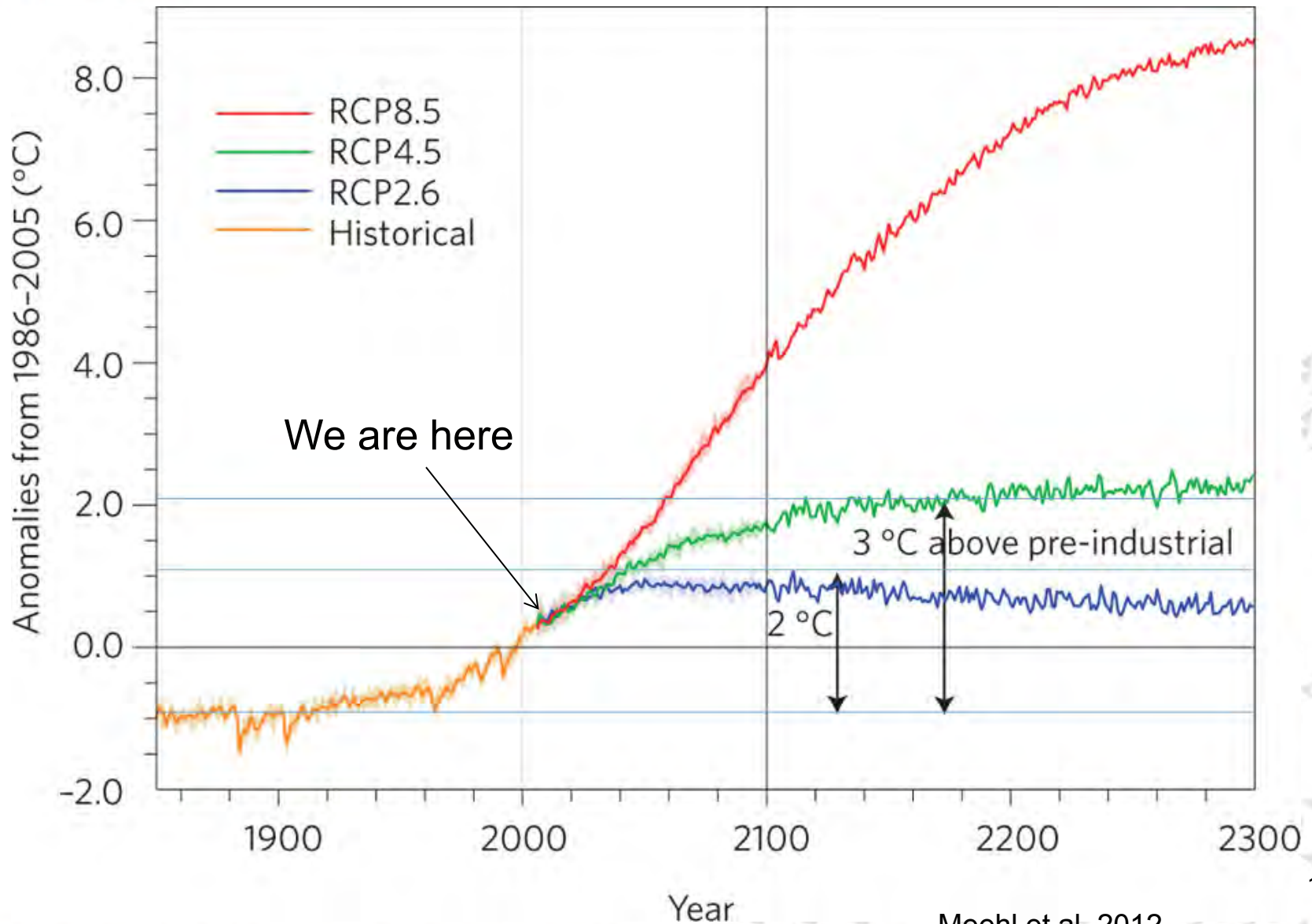


Chu et al, 2010

- **Decrease in intensity observed in Hawai'i**

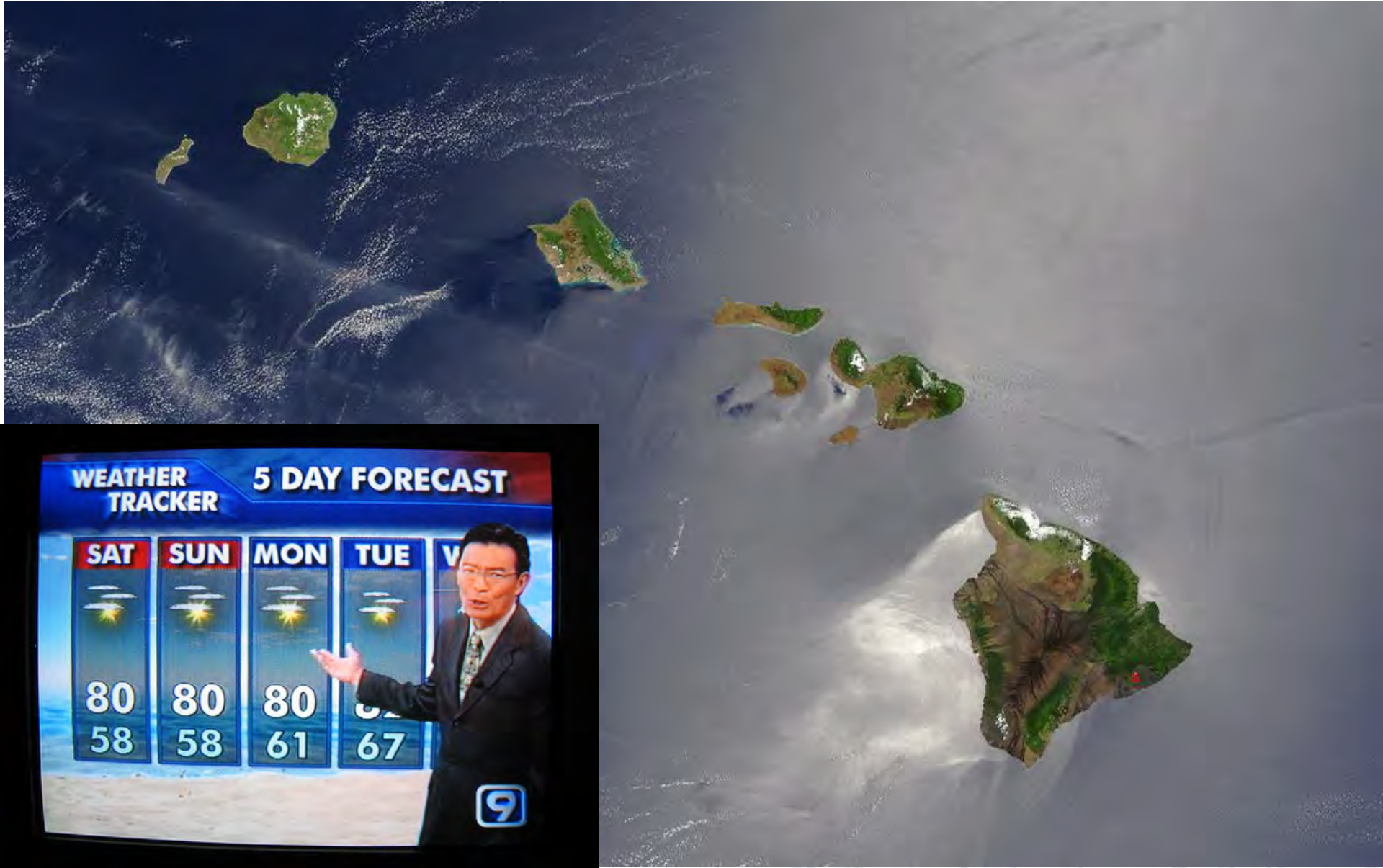


Multiple possible futures

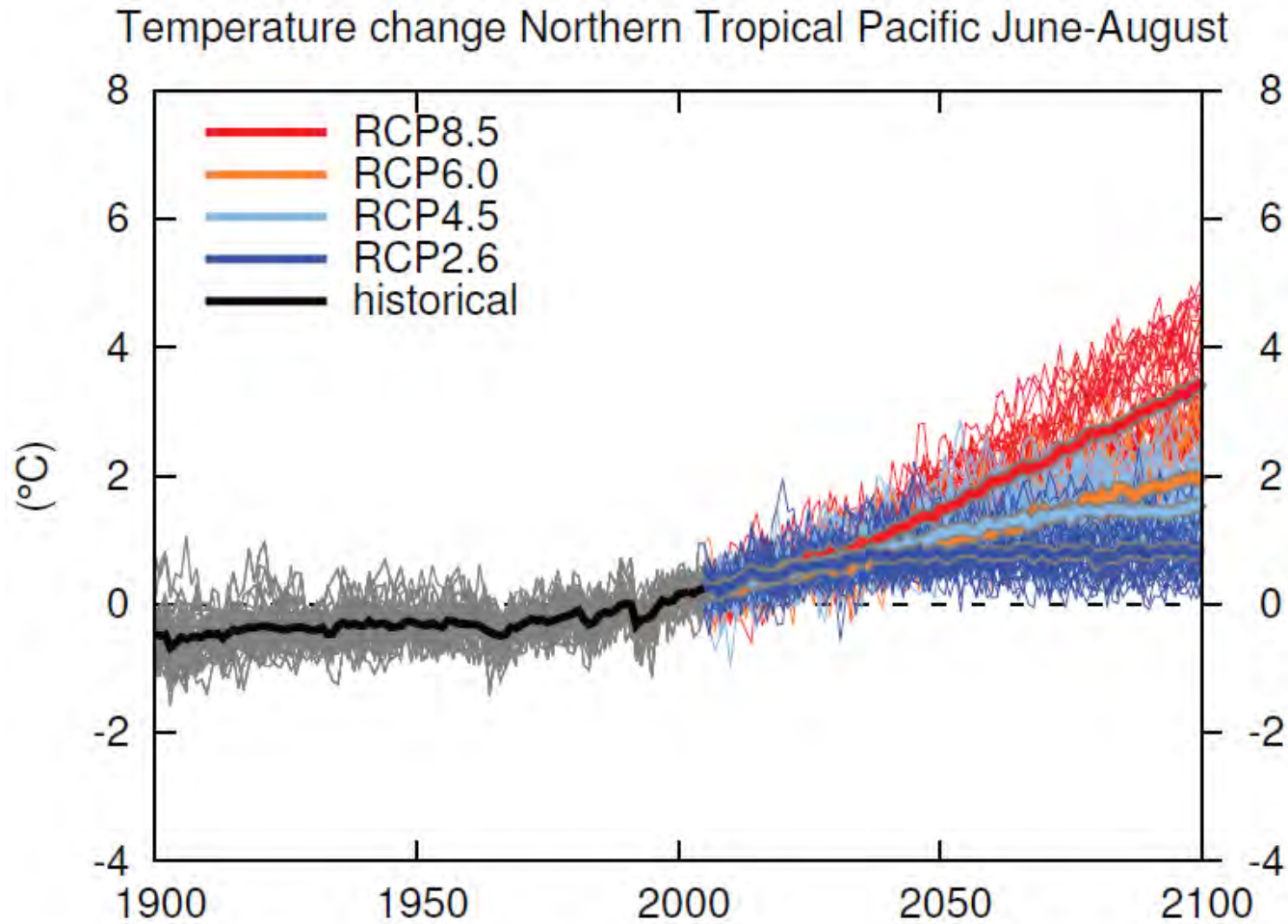




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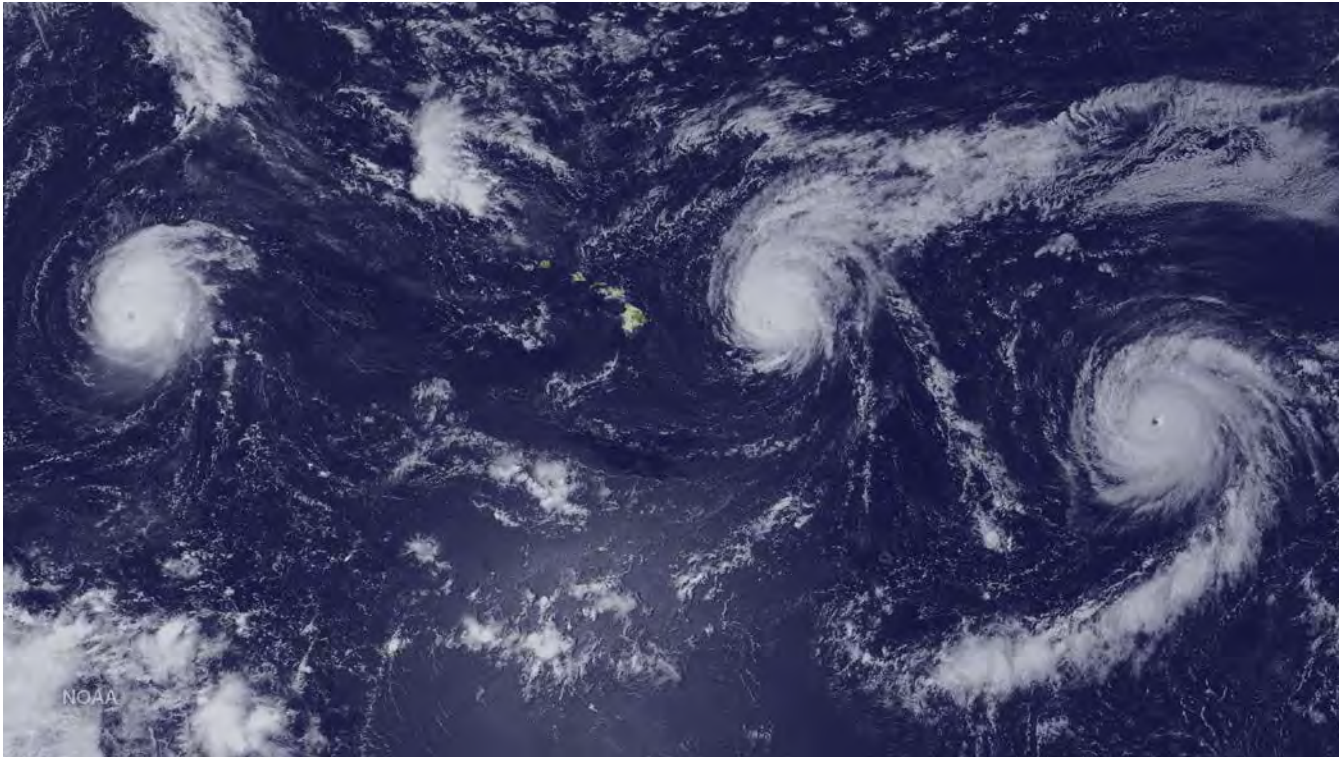


Projected Temperature Increases



Storms and Floods

- Stronger tropical storms in the future globally



- Potential higher intensity and frequency near Hawaii (Murakami et al., 2013)

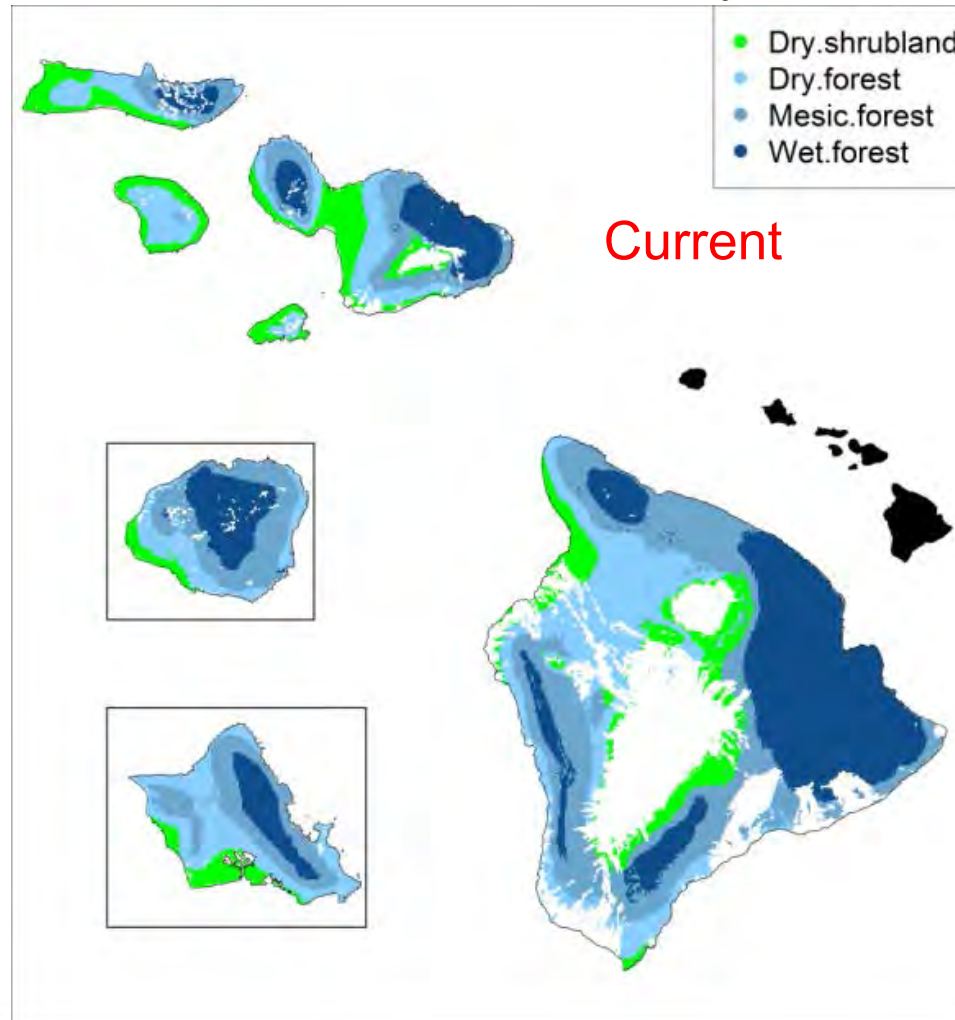
Projecting Precipitation is Really Difficult



- Island scale pushes the limit of climate modeling.
- Wetter windward, drier leeward?
- Drier overall, parched leeward?

Projections yield multiple possible futures for habitats

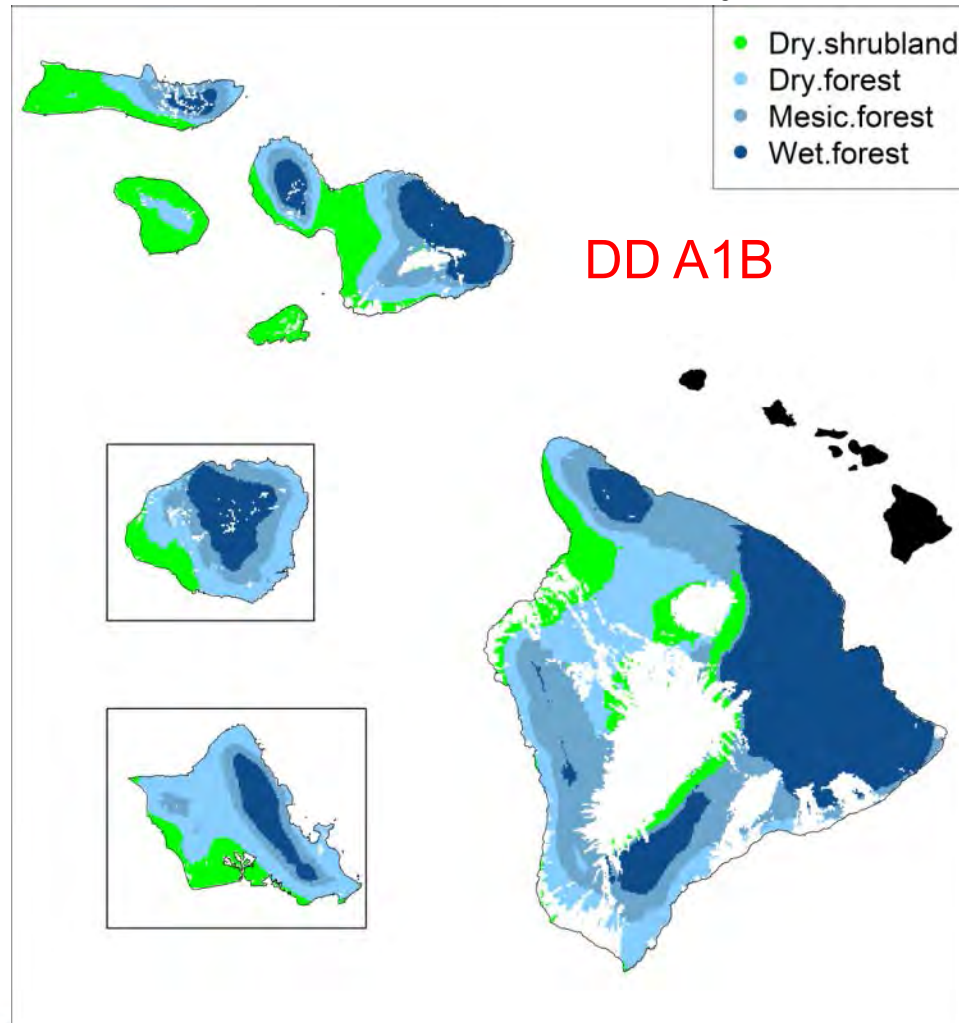
2100 native biome affinity



Fortini et al. in review

Projections yield multiple possible futures for habitats

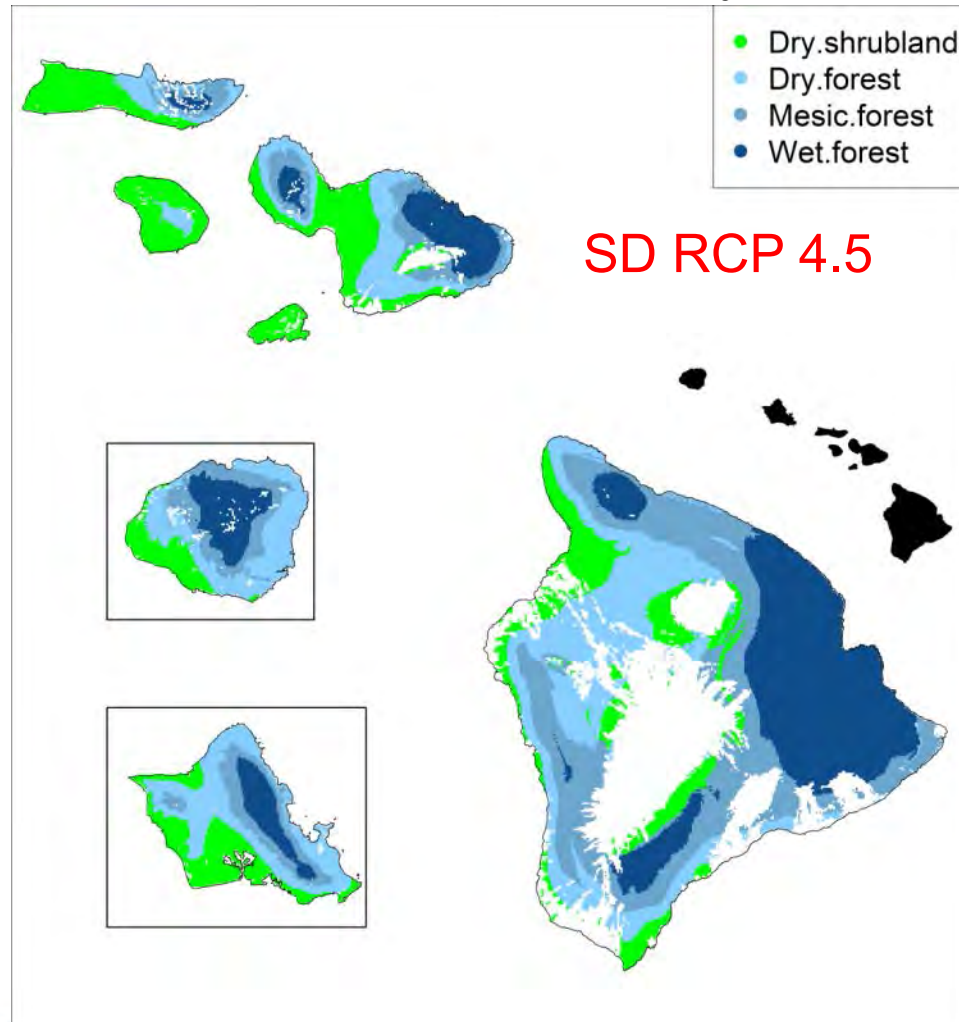
2100 native biome affinity



Fortini et al. in review

Projections yield multiple possible futures for habitats

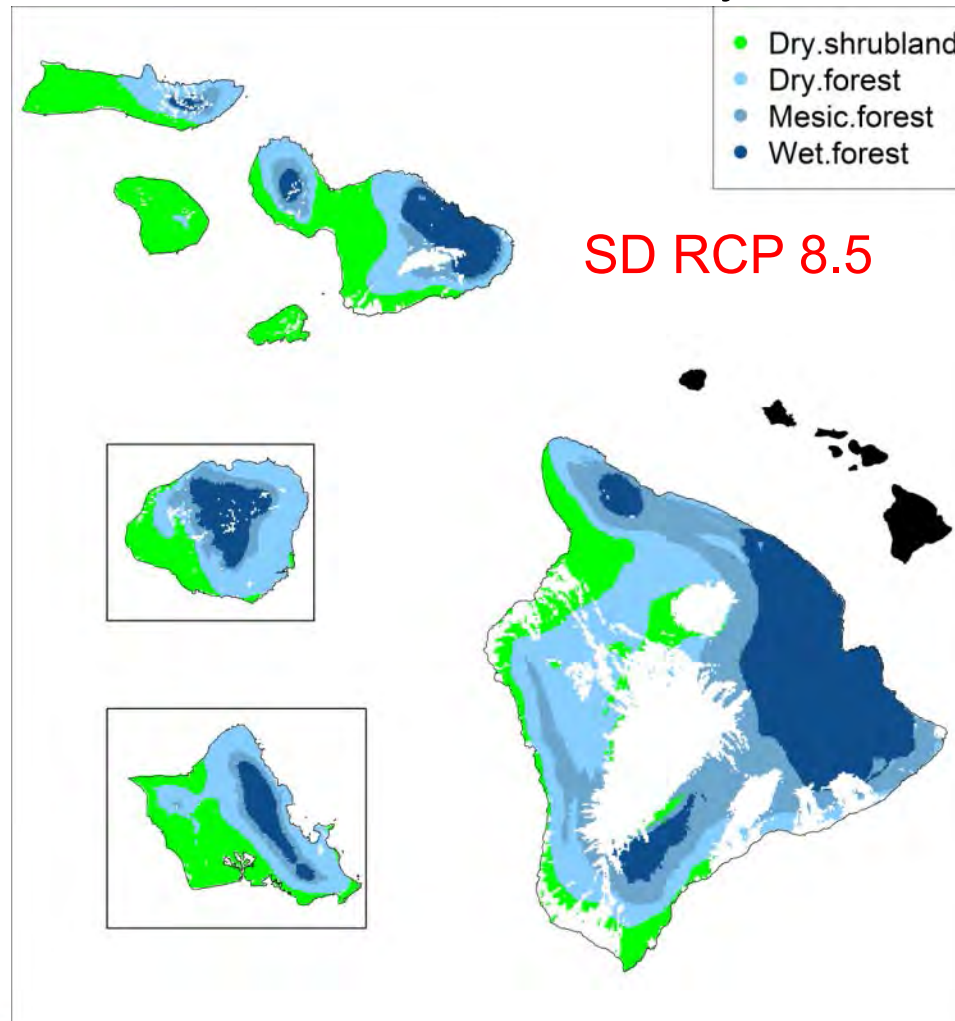
2100 native biome affinity



Fortini et al. in review

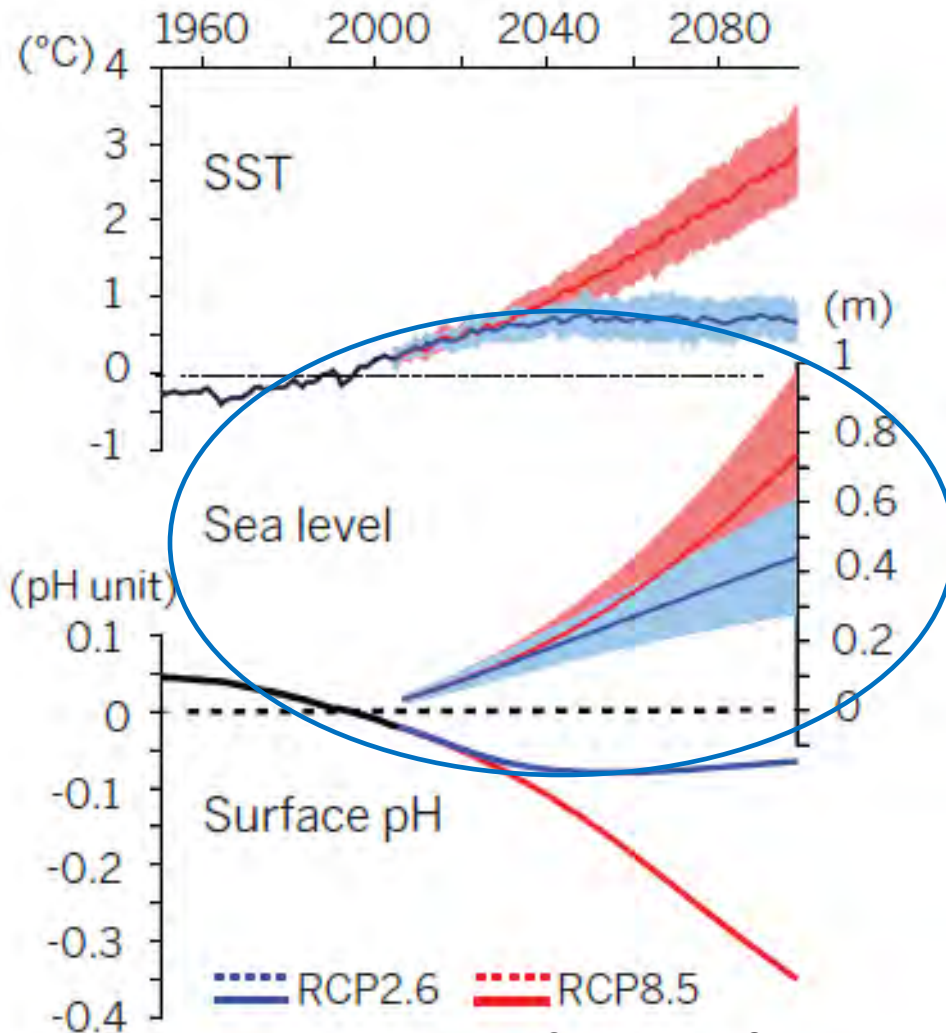
Projections yield multiple possible futures for habitats

2100 native biome affinity



Fortini et al. in review

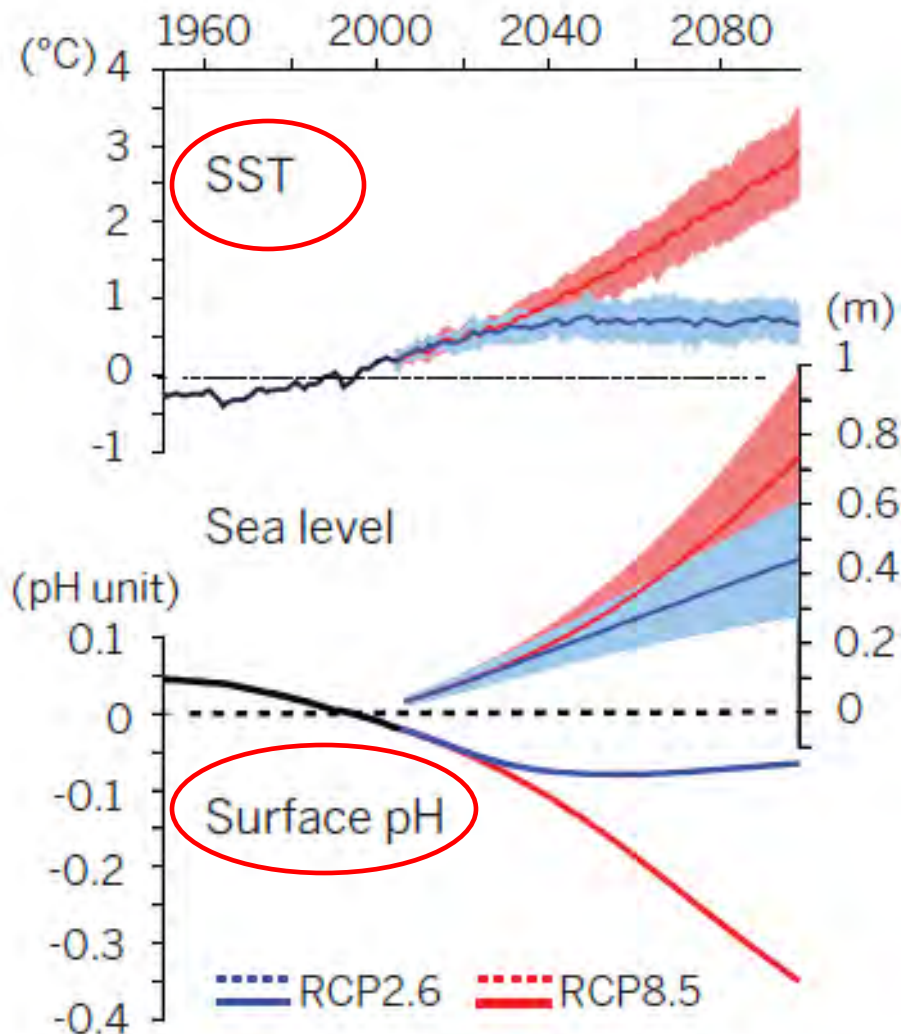
Ocean changes affect terrestrial and aquatic habitats



Gattuso et al. *Science* 2015



Ocean changes affect terrestrial and aquatic habitats

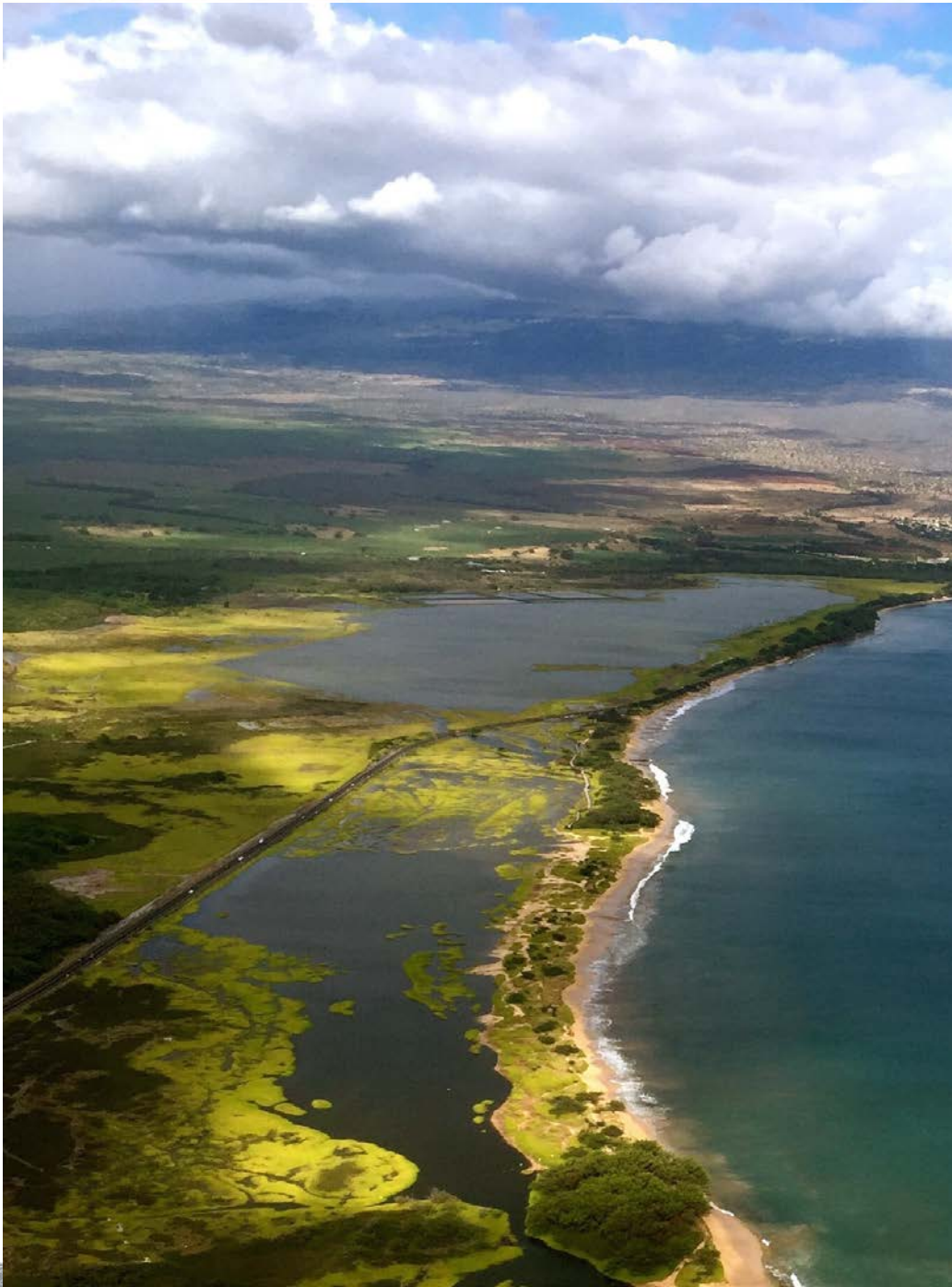


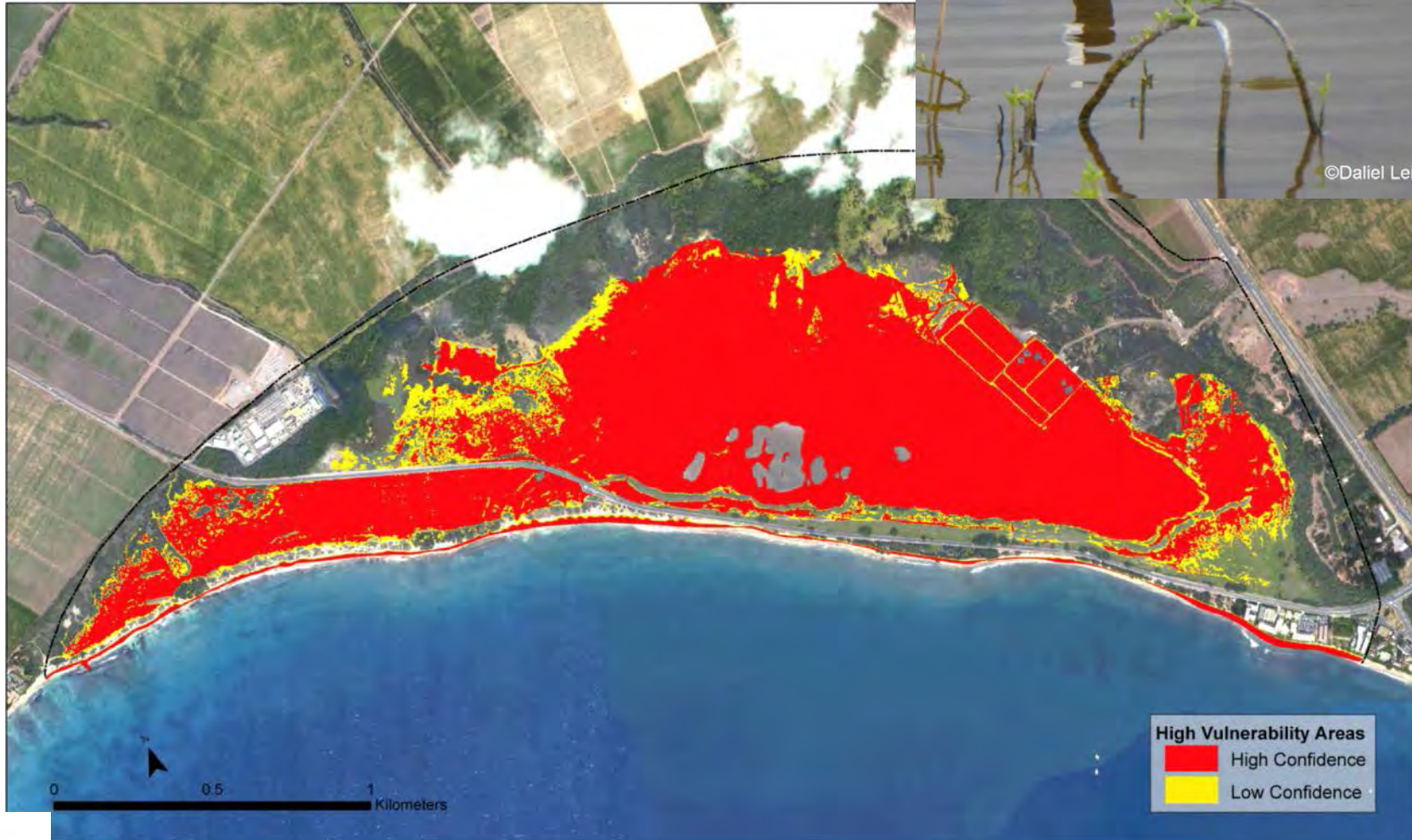
Gattuso et al. *Science* 2015





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Sea level rise projection for Keālia Pond National Wildlife Refuge, Maui
Image courtesy of H. Kane and C. Fletcher

Future Changes in Hawai'i's Climate: Warmer and Drier

- **High Confidence:**
 - Increasing temperatures
 - Increasing sea level
- **More questions:**
 - Lower mean rainfall?
 - Fewer heavy rainfall events?
 - More frequent drought events?
 - Higher rates of evaporation?
 - Reduced streamflow?
 - Reduced groundwater recharge?



