Future Climate Change in Hawai‘i

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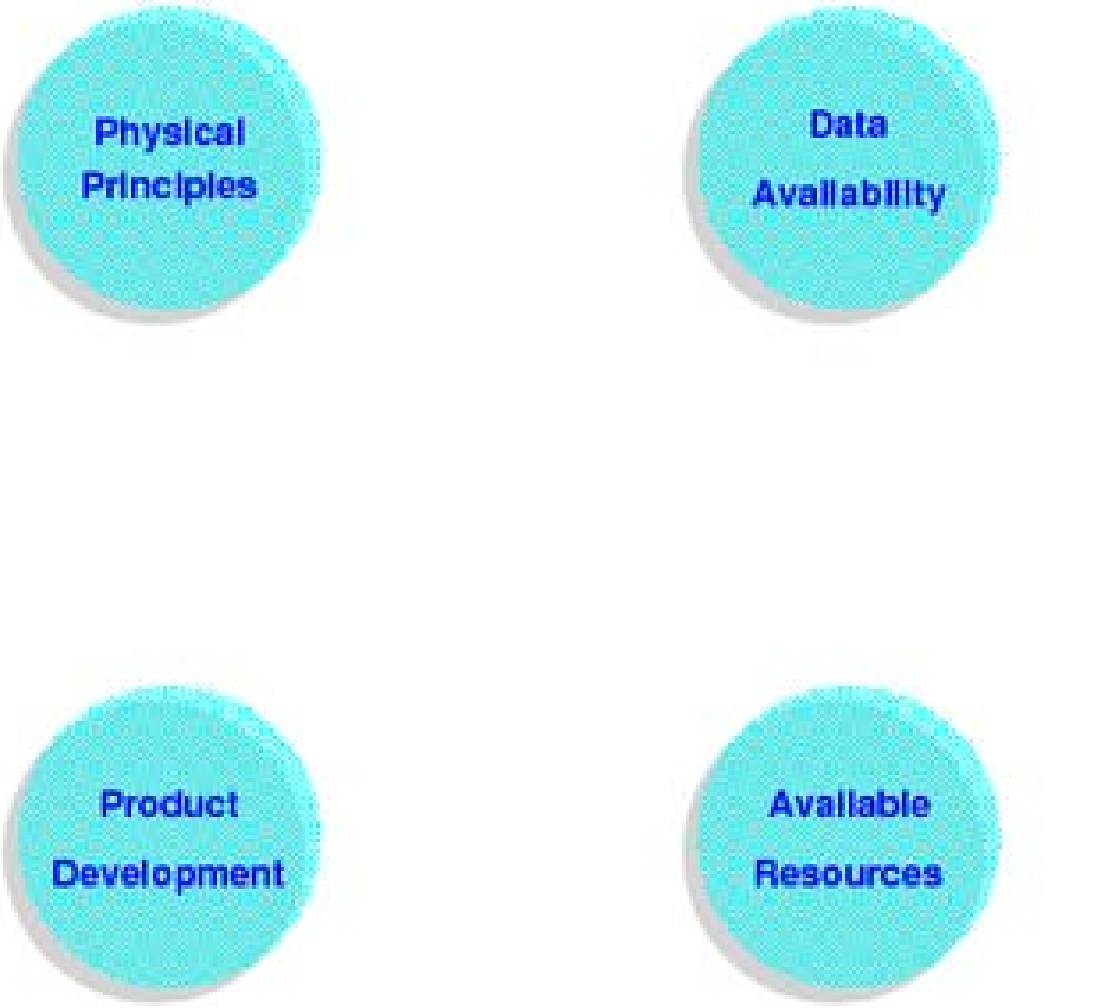
PACIFIC ISLANDS CLIMATE CHANGE COOPERATIVE

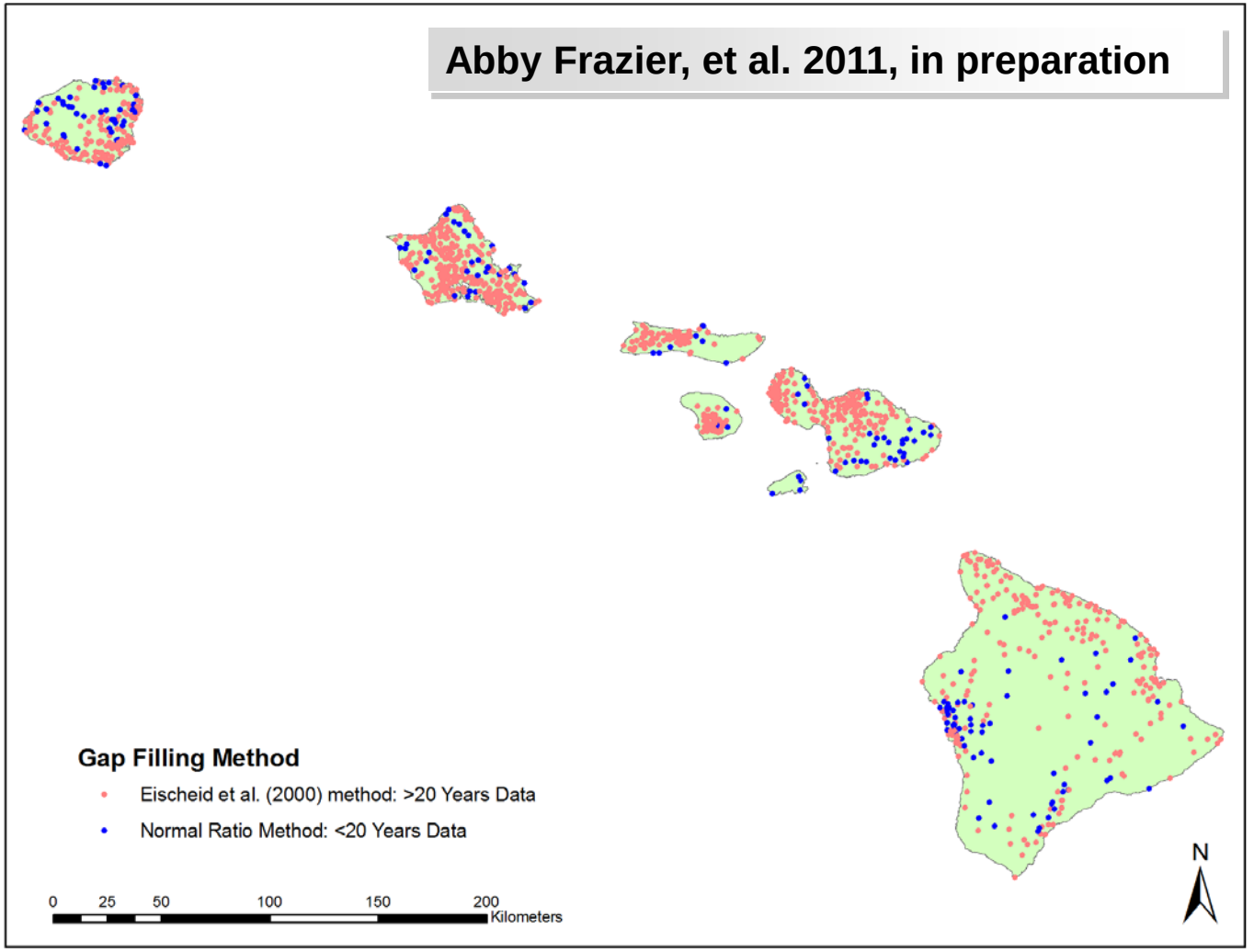
NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

Future Climate Change in Hawai‘i: From Global Warming to Regional Change



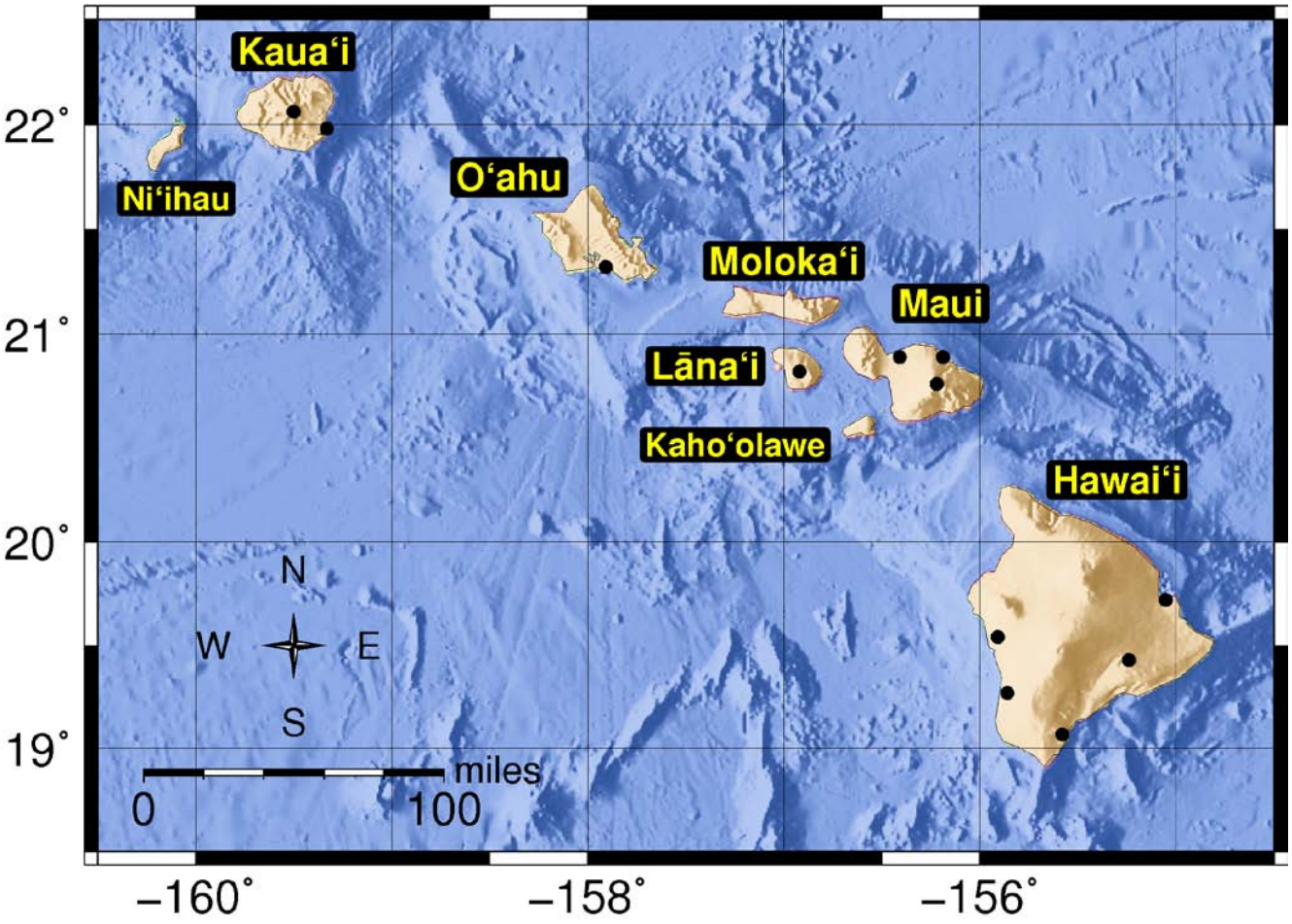
Data Availability

Hawaii has a dense rain-gauge station network with more than 1000 gap-filled stations (monthly rainfall data 1920-2008)



Data Availability

Only a small number of stations provide long records with few missing observations for the analysis of daily rainfall extremes.



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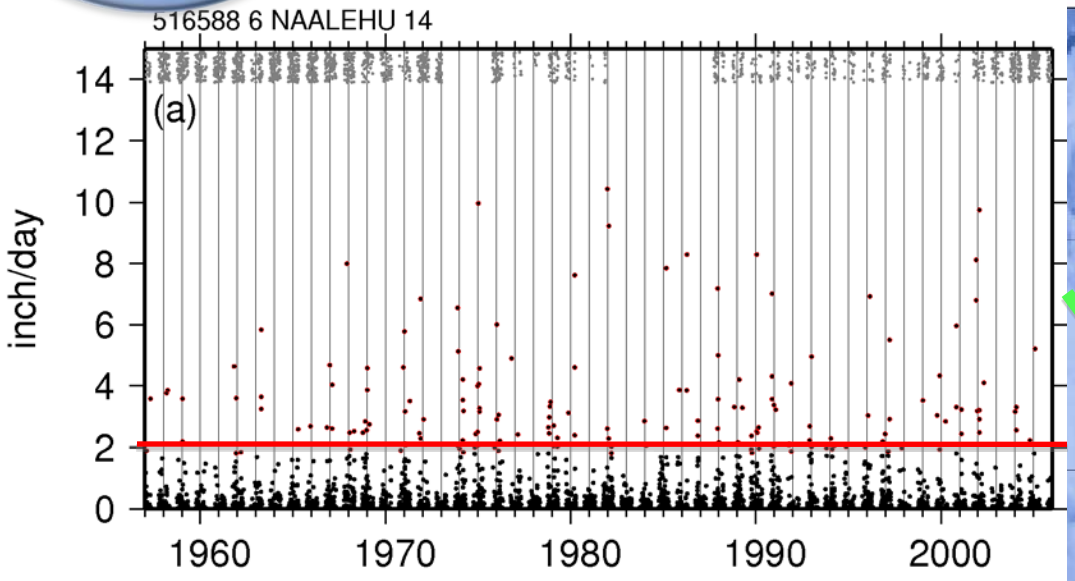
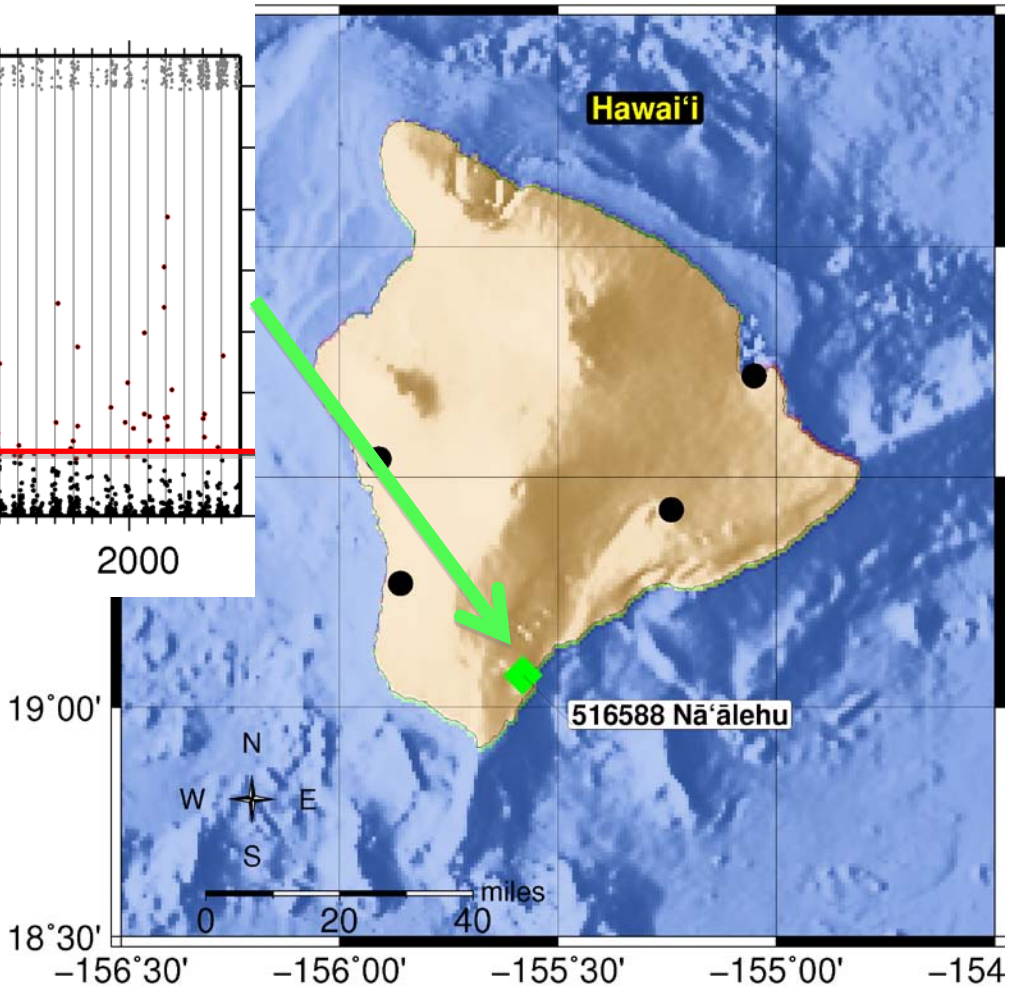
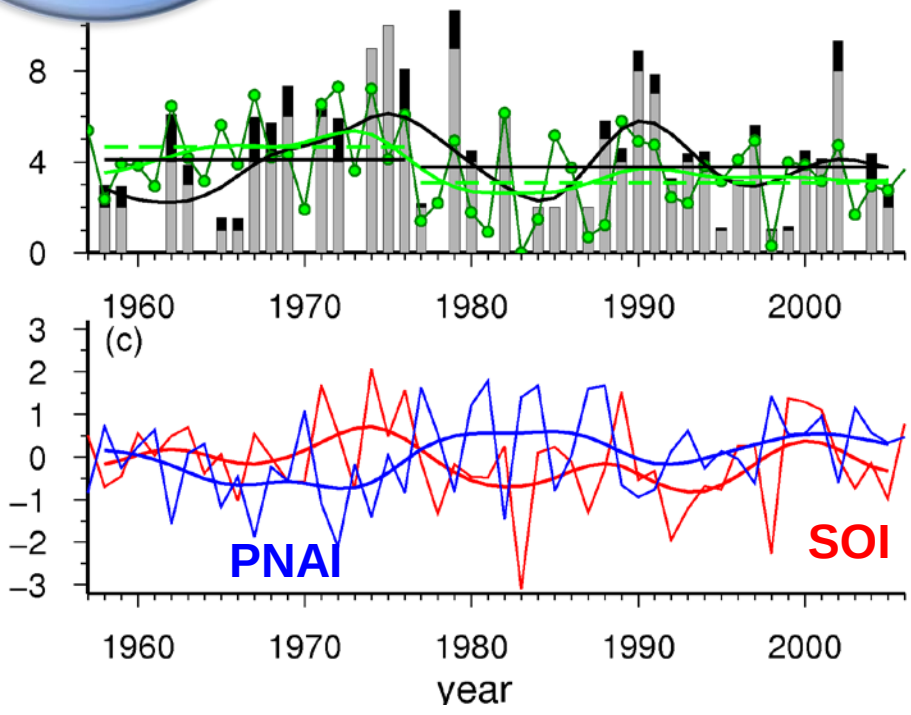


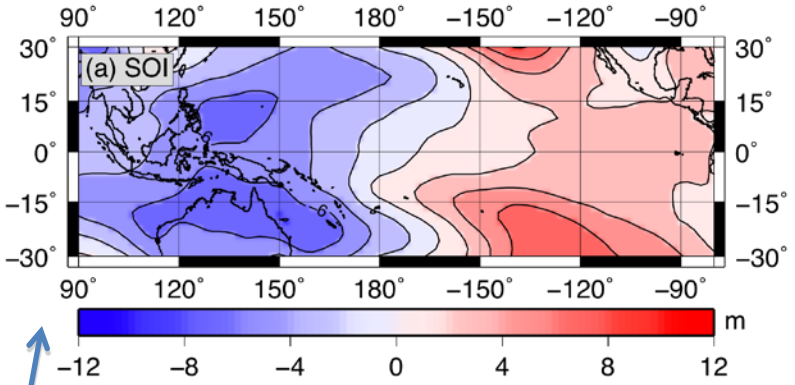


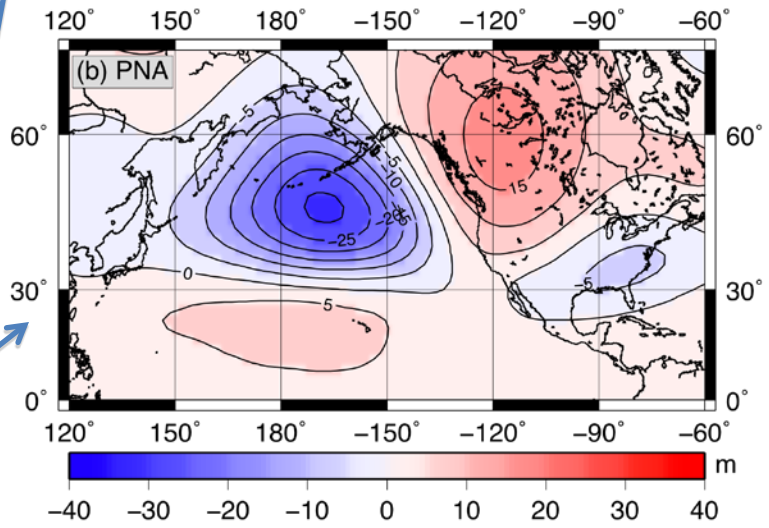
Data source NOAA NCDC

Large-scale climate & heavy rain frequency

Number of heavy rain events during wet seasons (Nov-Apr) and its dependence on large-scale circulation modes.







NCEP reanalysis 1000 and 500 hPa geopot. height anomalies associated with SOI and PNA index, respectively

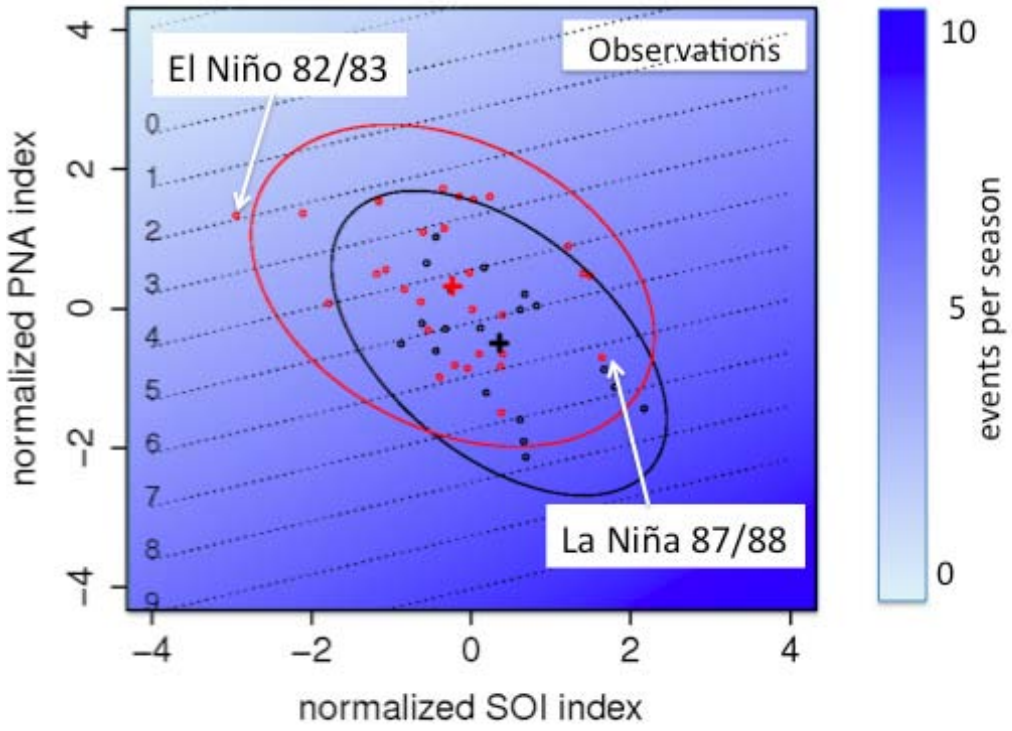
Large-scale climate & heavy rain frequency

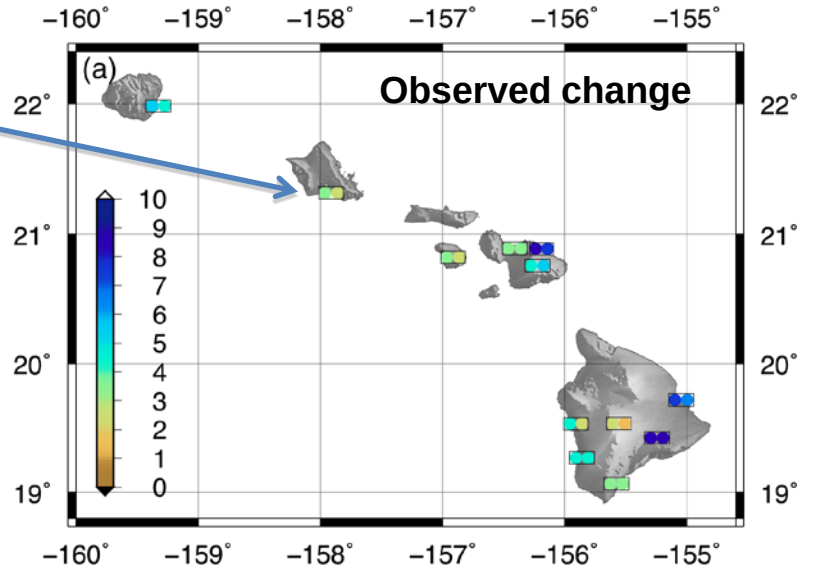
1958-1976 1977-2008

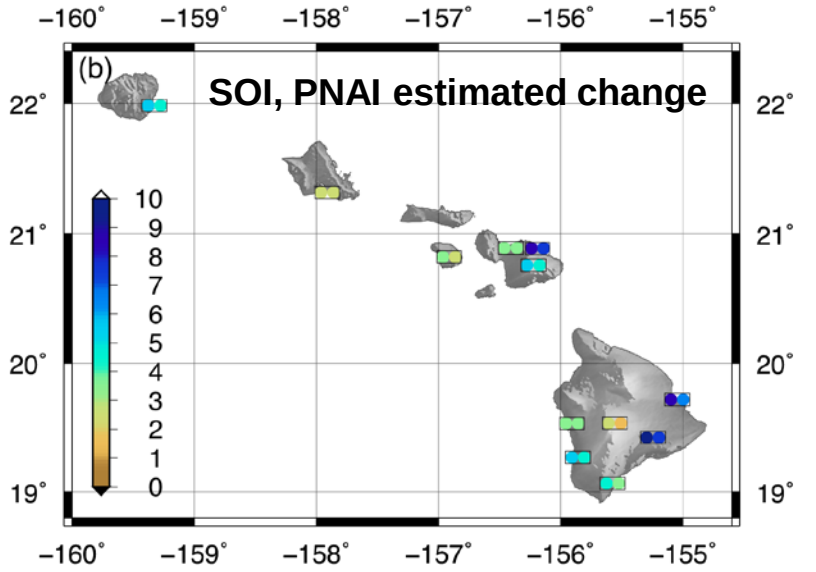
black: years 1958-1976

red: years 1977-2005

Mean changes for the 12 stations



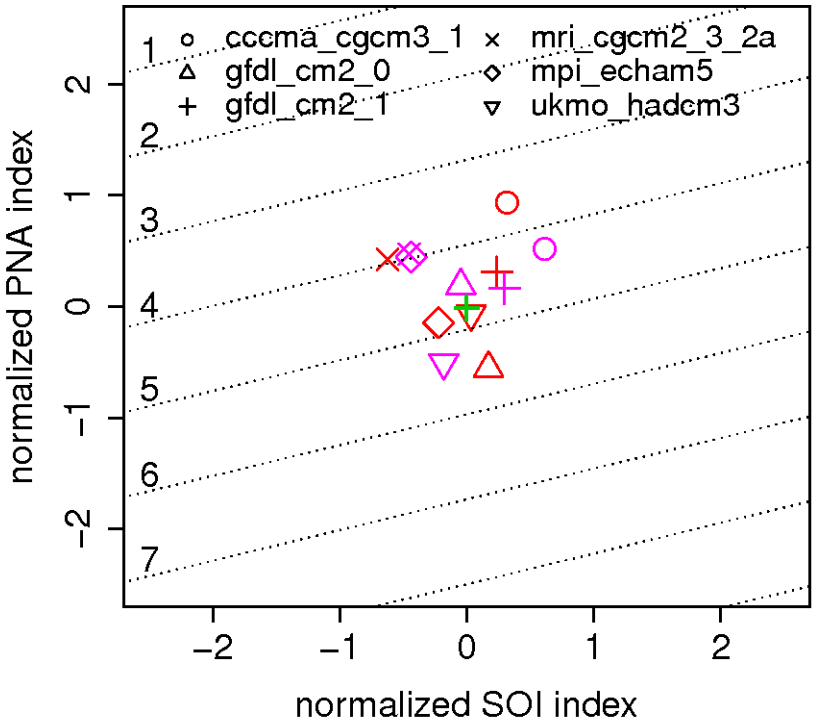




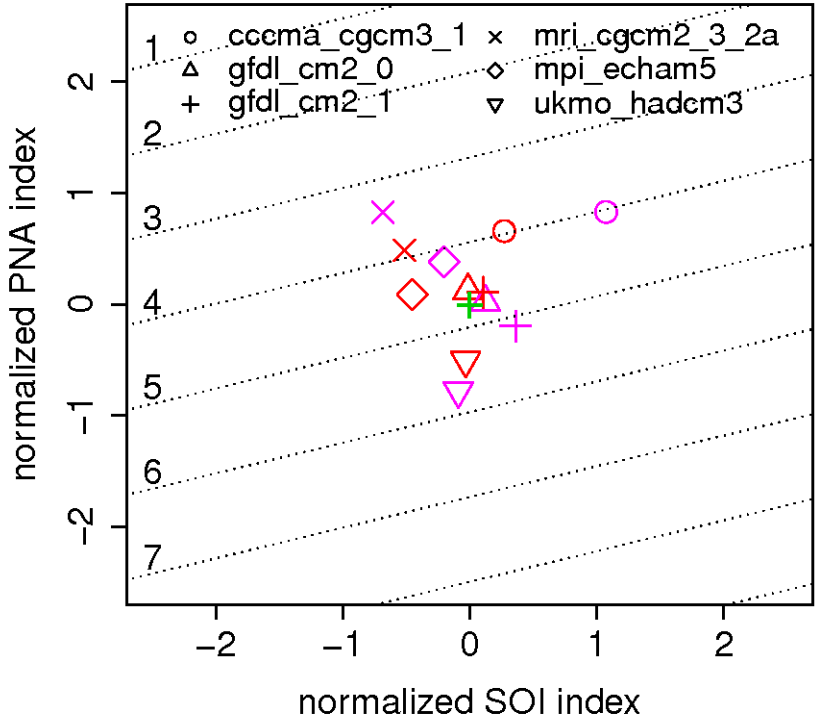
Future projection heavy rain frequency

Green: present day
Red: 2046-2065
Purple: 2081-2100

Six-model ensemble scenario A1B



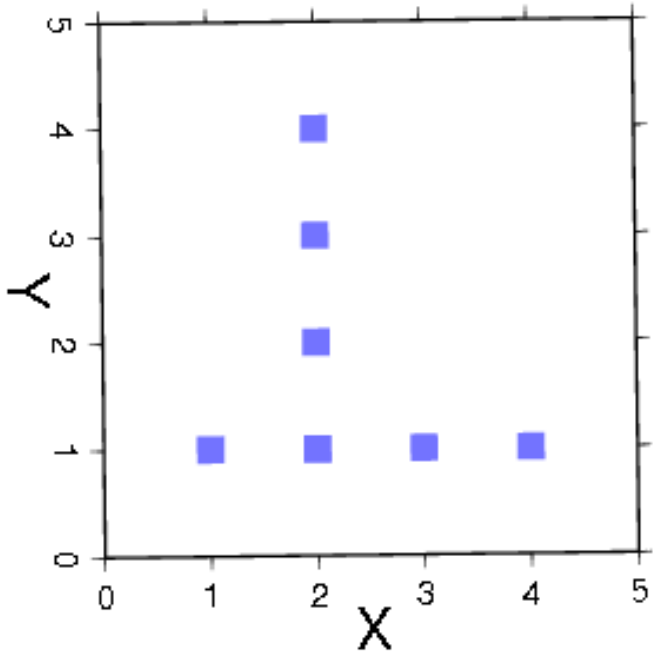
Six-model ensemble scenario A2

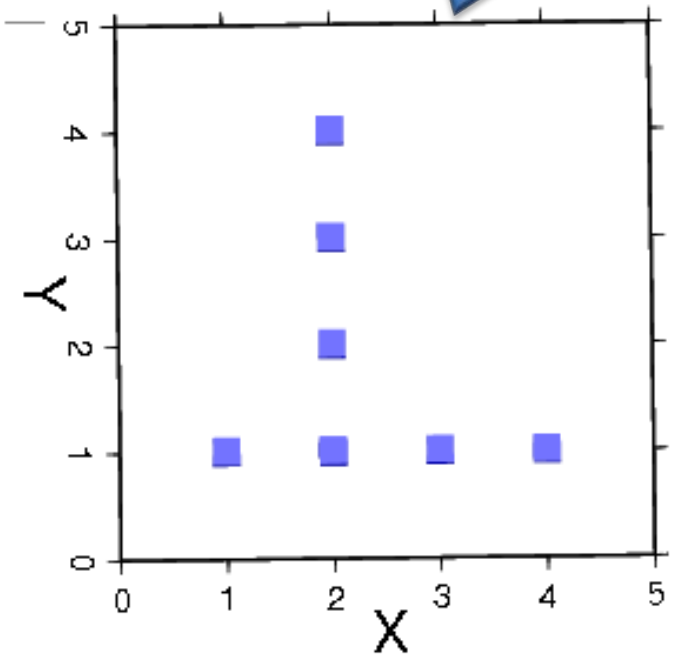


Elison Timm, O., H. F. Diaz, T. W. Giambelluca, and M. Takahashi,, J. Geophys. Res., 116, D04109, 2011.

and our chances to detect changes

How dimension reduction changes our perception of objects

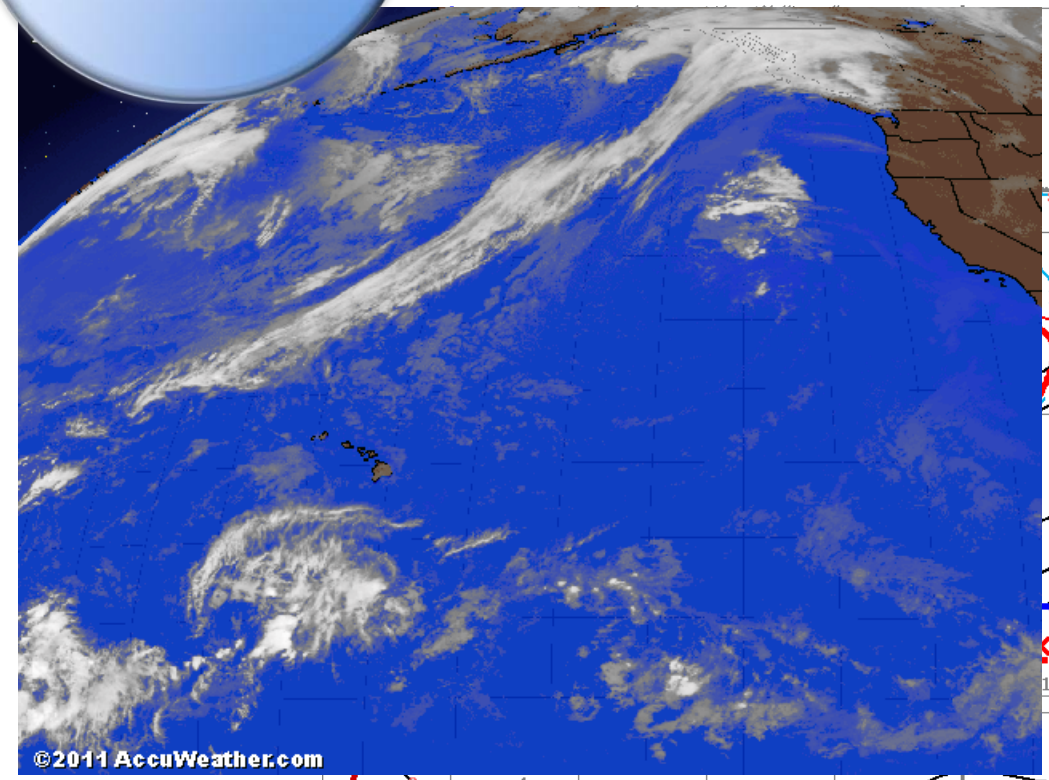


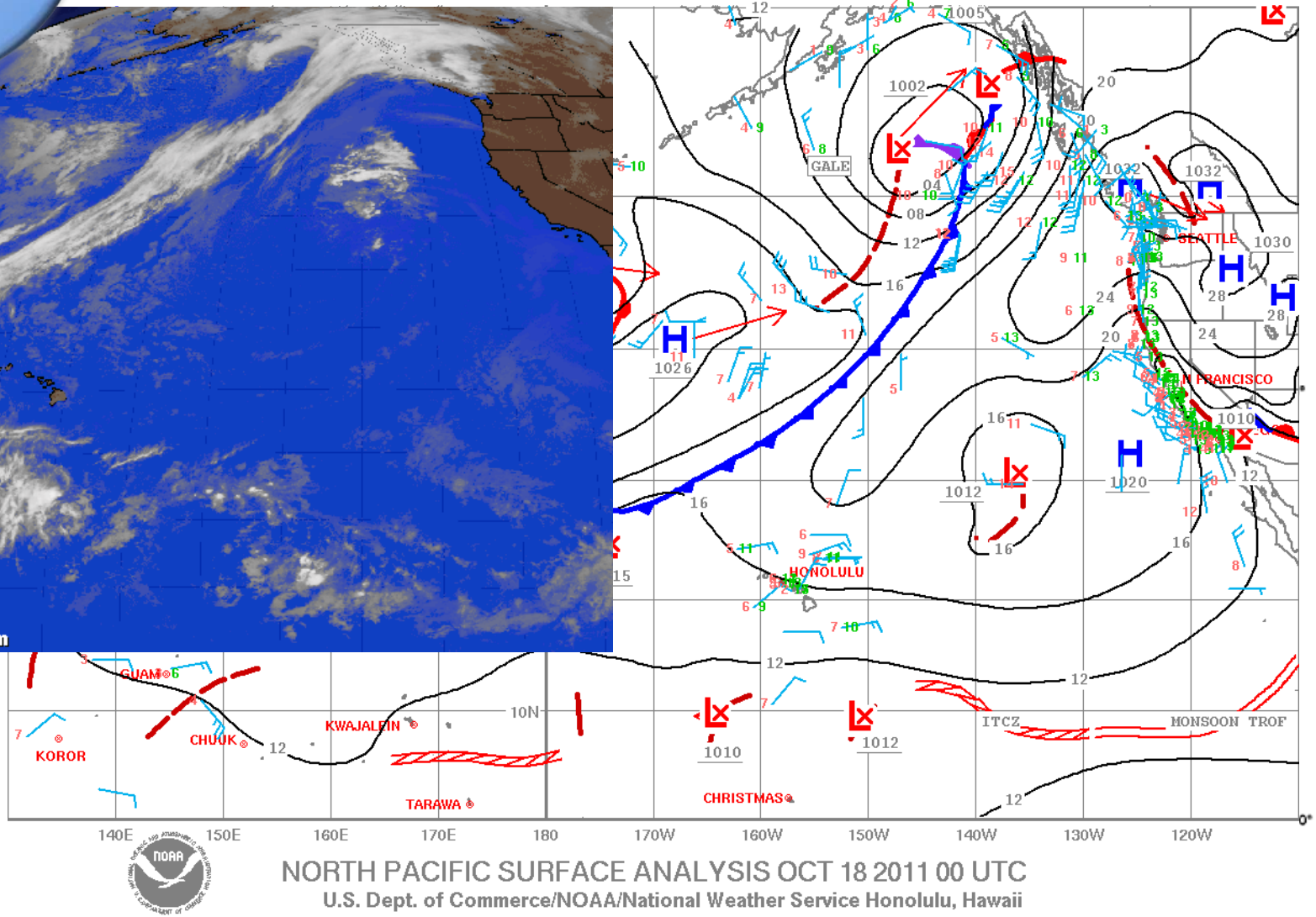


From weather to climate statistics

Rain-producing synoptic weather types during winter months

(e.g. Chu, Nash and Porter, J. Climate, Vol. 6, 1457-1462, 1993.)



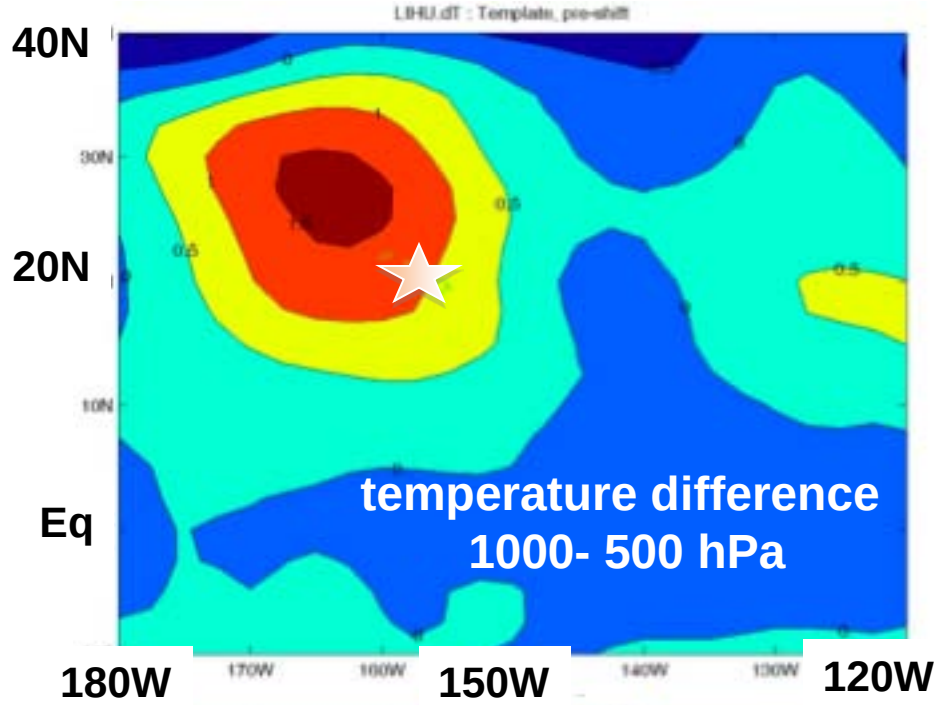


NORTH PACIFIC SURFACE ANALYSIS OCT 18 2011 00 UTC

U.S. Dept. of Commerce/NOAA/National Weather Service Honolulu, Hawaii

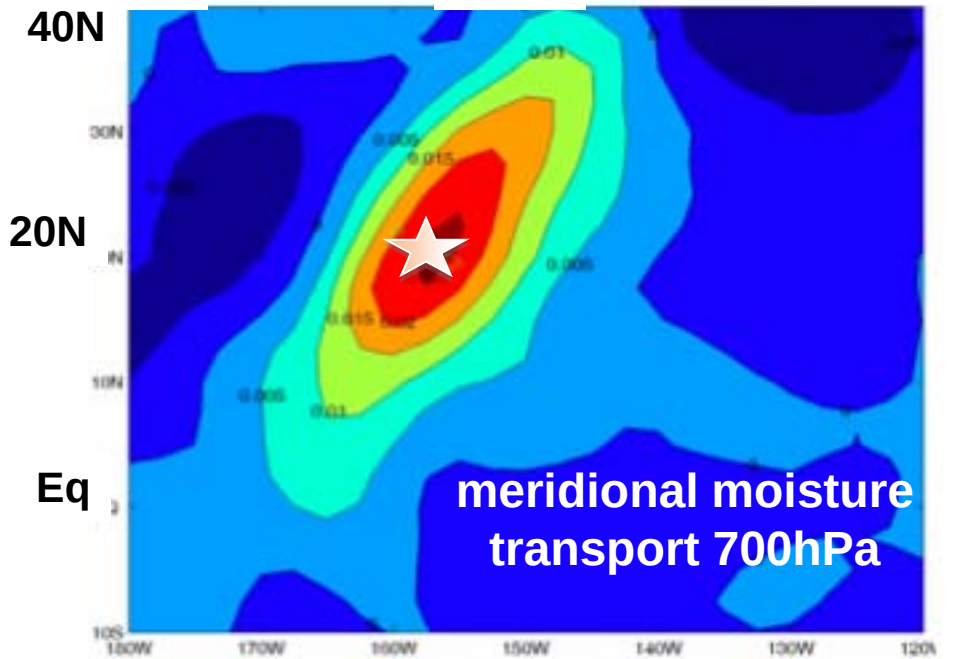
Composite Analysis

Composite analysis of the circulation anomalies using NCEP reanalysis data. Anomalies for days with precipitation greater than 90% percentile



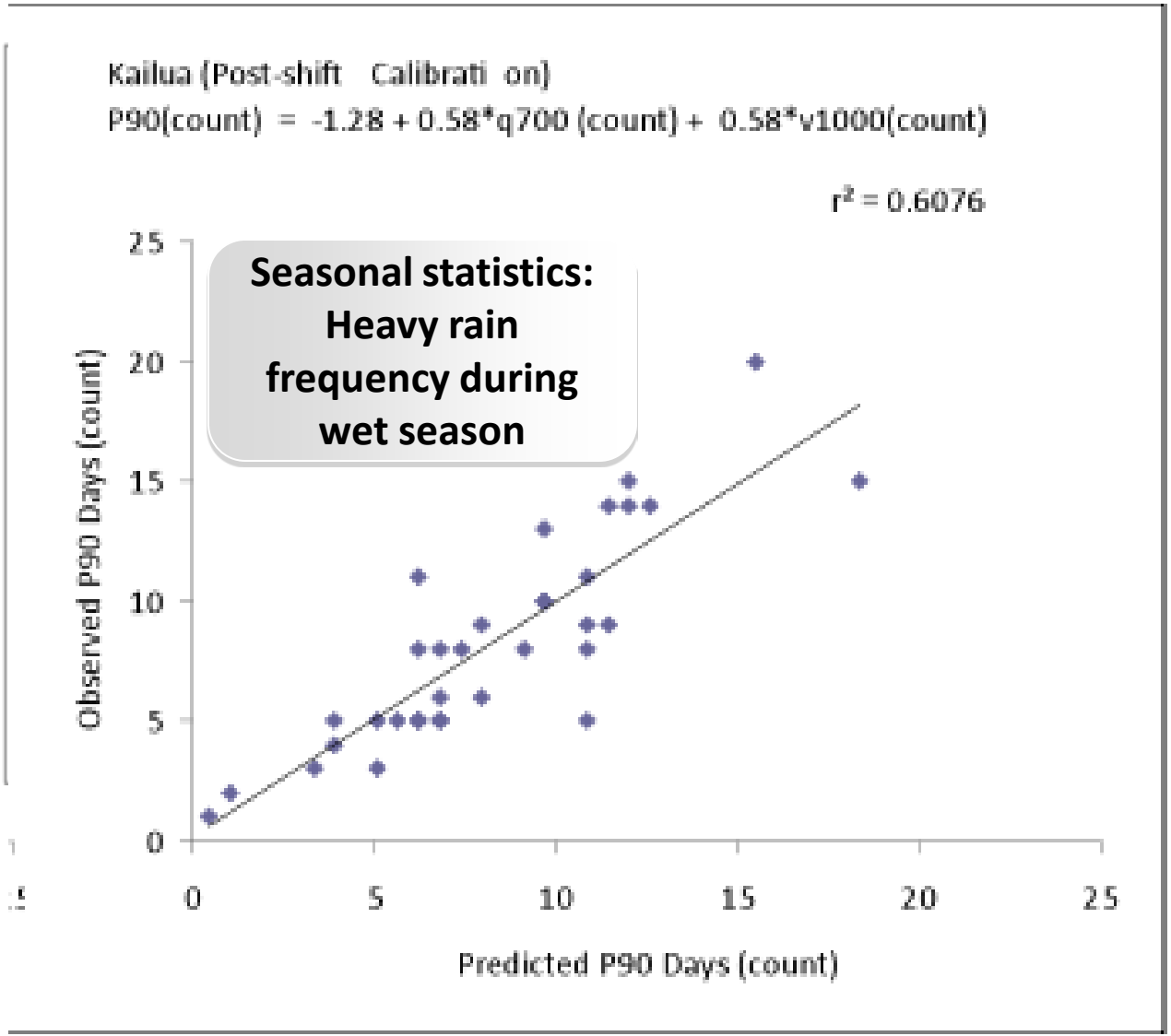
Rainfall at station Nā‘alehu: Anomalous moisture advection from equatorial Pacific + upper level trough.

‘Kona-low’ weather pattern



Composite Analysis + Regression model

Example illustration: Conditional dependence of rainfall on the spatial correlation between composite and daily circulation anomalies.

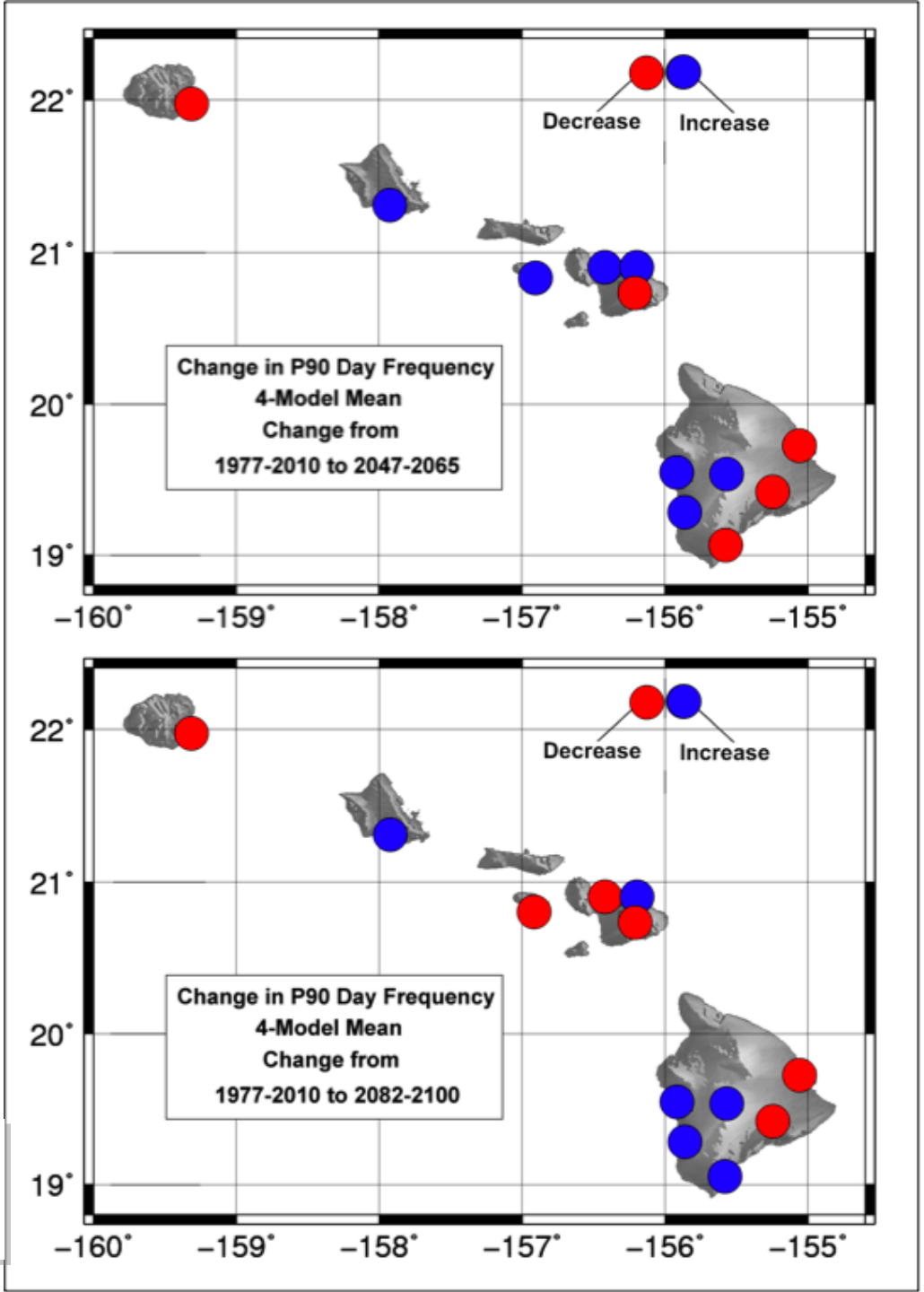


Future projection heavy rain frequency

Summary:

- **So far, no indicator for dramatic increase in the frequency of heavy rain events**
- **The limited number of stations available show equal number with positive and negative trends.**
- **Downscaling results vary considerably among the GCM models.**

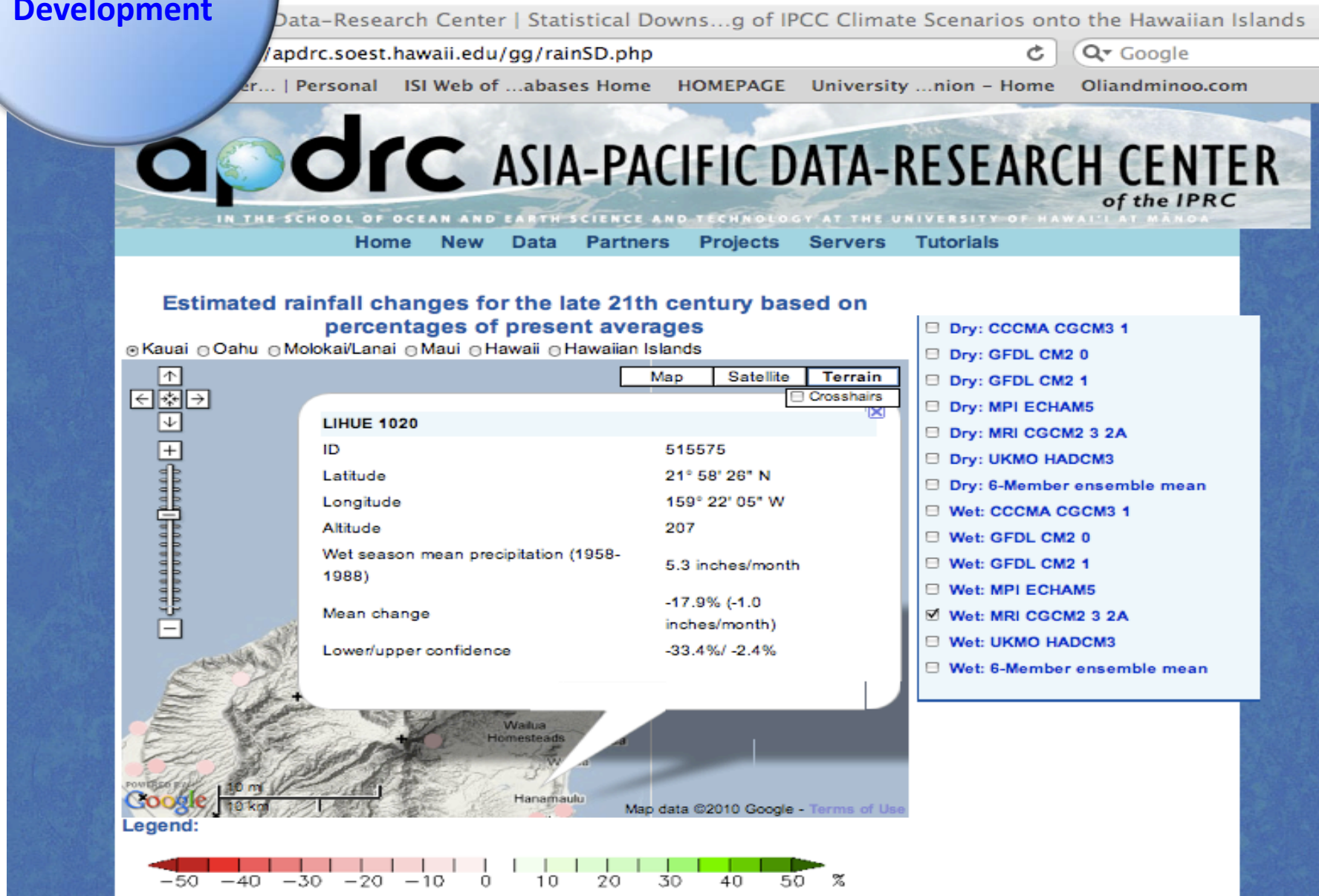
Elison Timm, O., M. Takahashi, H. F. Diaz, T. W. Giambelluca, in preparation.



Product Development

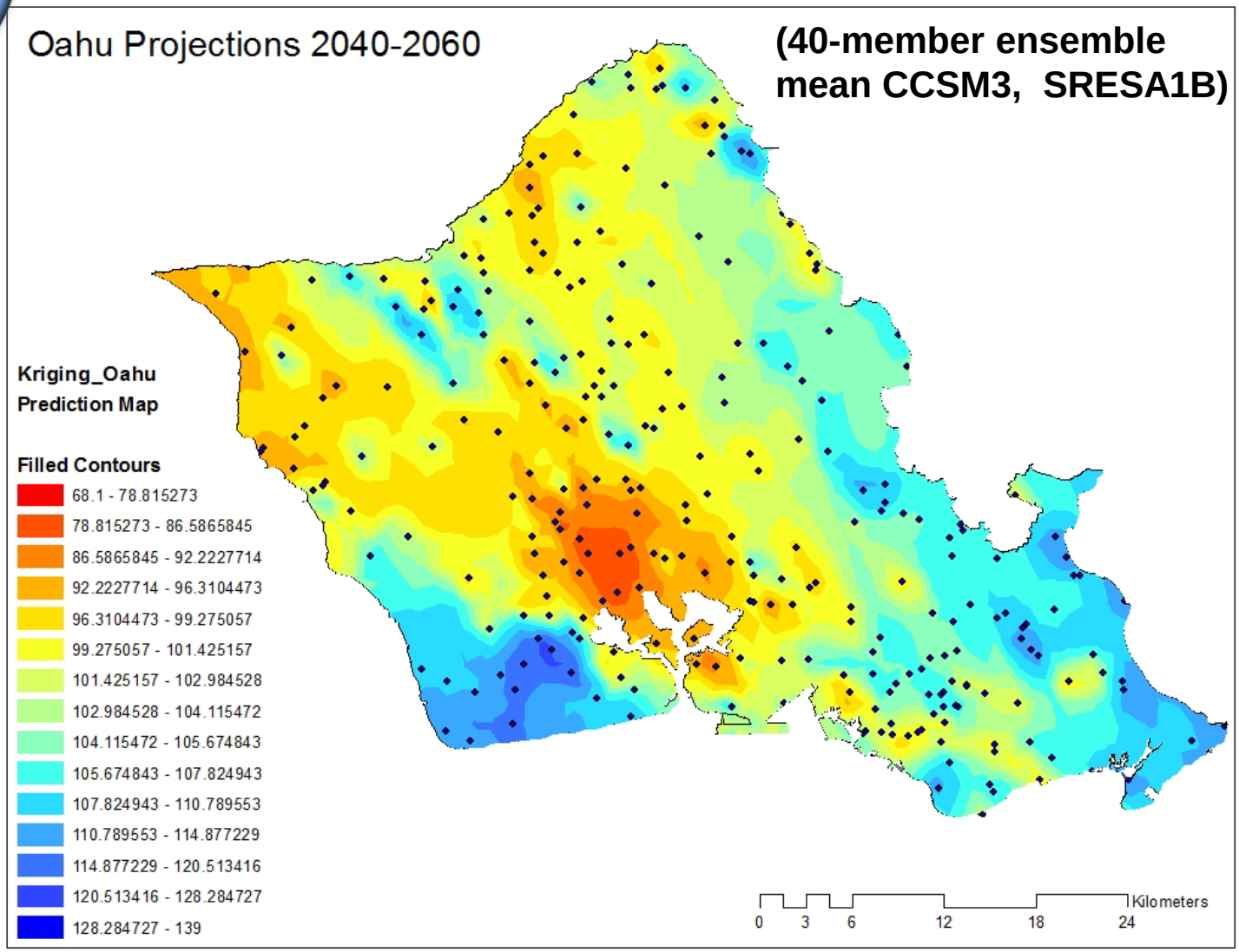
Online access through interactive maps.

http://apdrc.soest.hawaii.edu/projects/SD/



Product Development

Spatial statistics for GIS Map productions: Example showing downscaled wet season precipitation changes for 2040-2060



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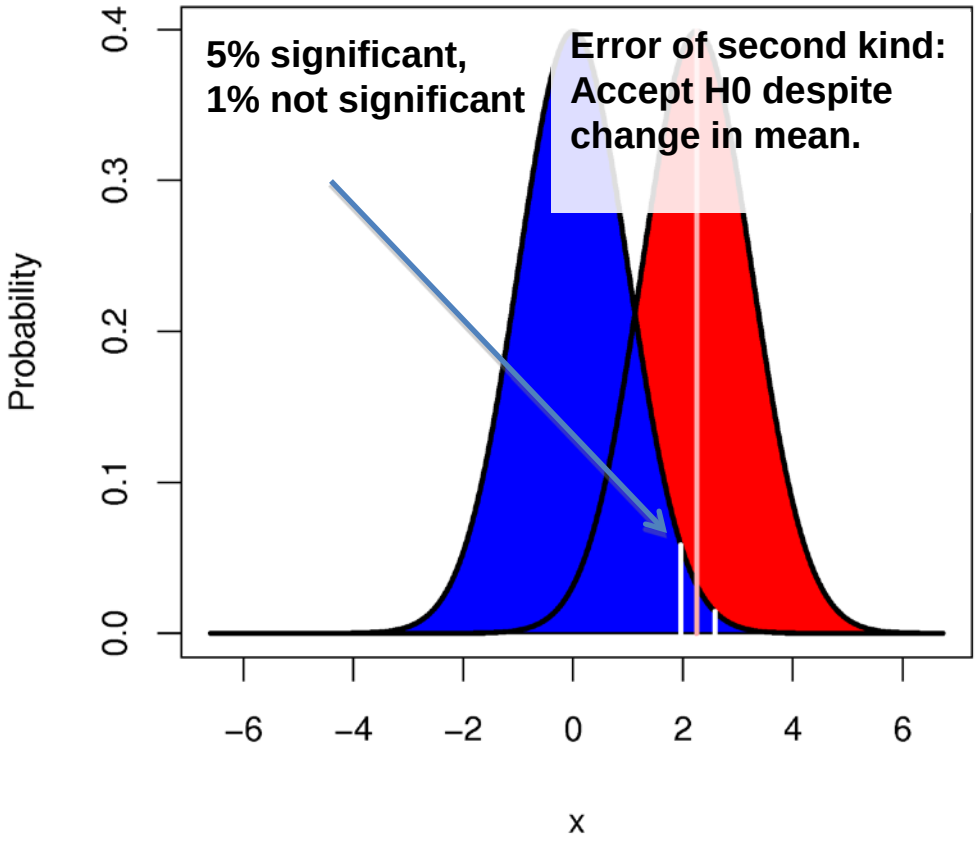
Product Development

Null Hypothesis: No change in mean



Product Development

Null Hypothesis: All edible!

Product development must include confidence /significance estimates!

Scientists must take the risk into account!

Hypholoma fasciculare *Hypholoma capnoide*