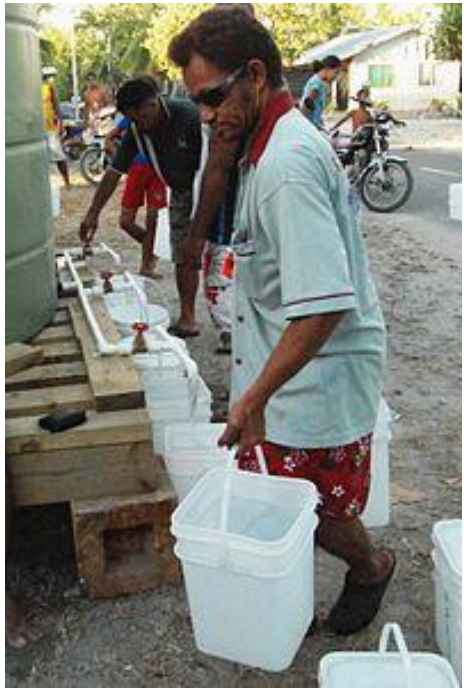
The Bureau of Meteorology

Session 4: Looking Back Long-Term: Status of key variables

Rainfall

Background - Rainfall



- Wide ranging impacts on humans and ecosystems across the Pacific Islands

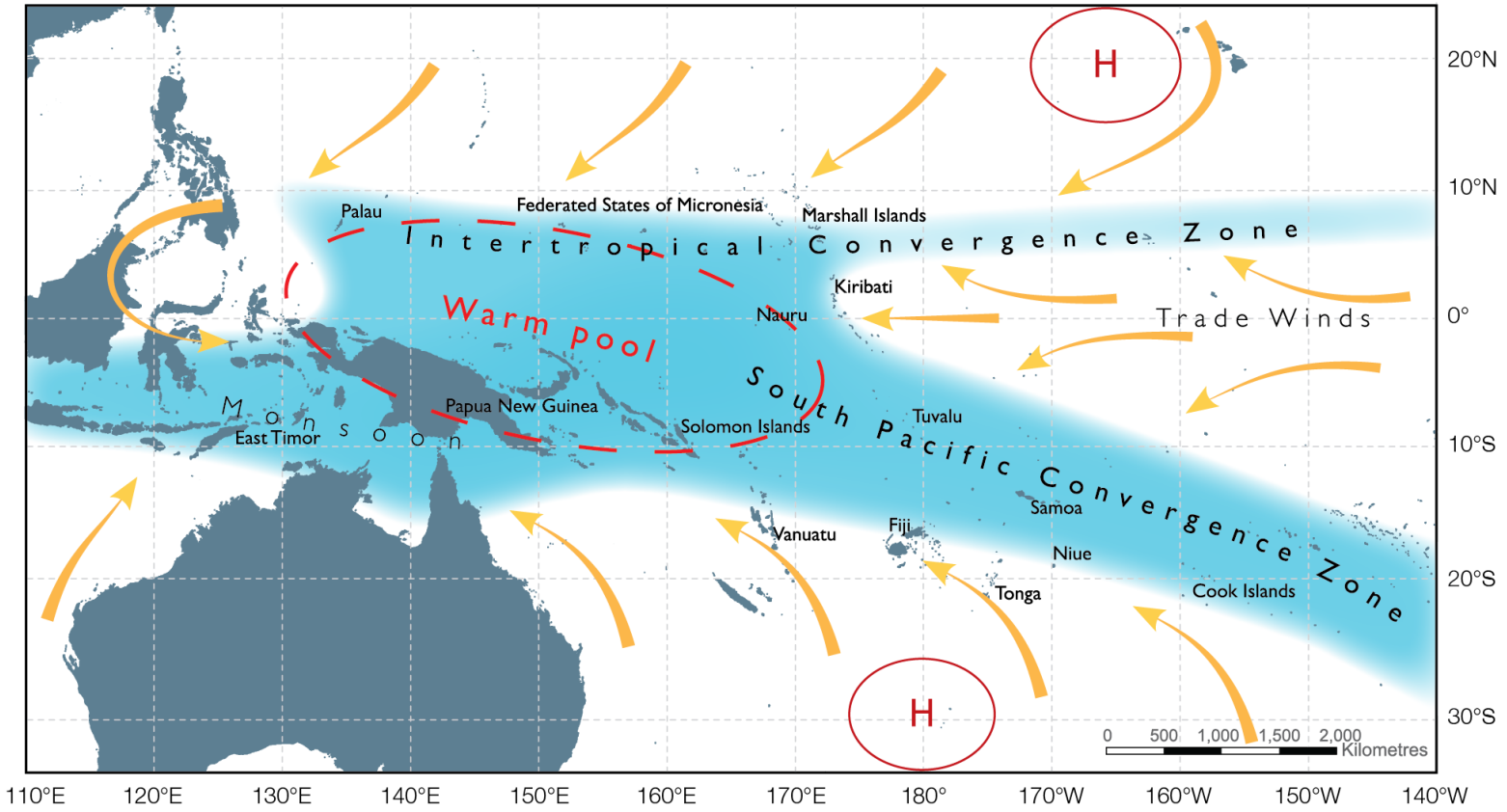
- Supplies drinking water on low-lying atolls
- Replenishes freshwater lens
- Supplies water for agriculture

- Changes in rainfall can disrupt these and other natural processes

- Heavy or extreme rainfall can increase of enhance crop damage, soil erosion and floods, reduce quality of drinking water

(Marra et al., 2022)

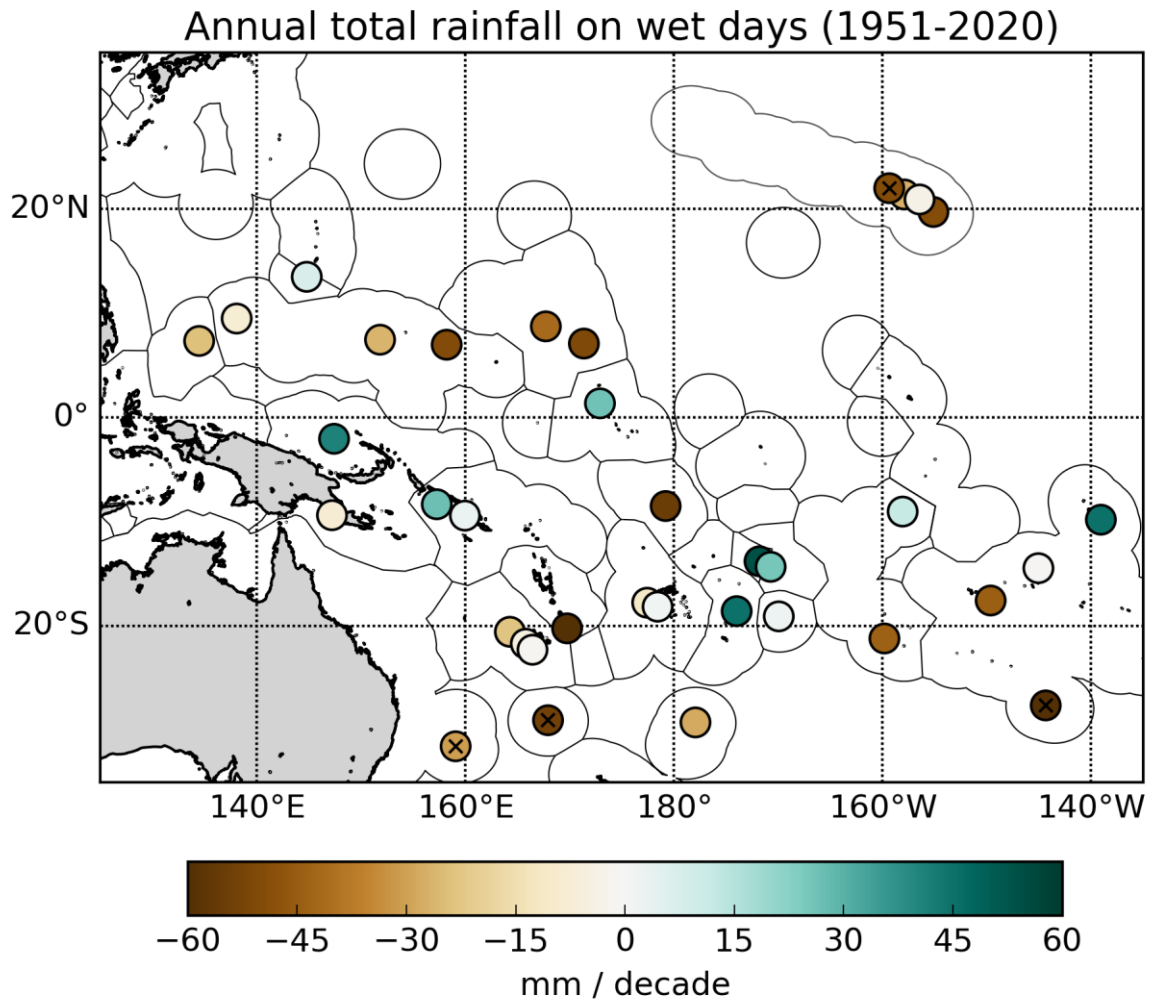
Drivers of western Pacific rainfall variability



- Pacific rainfall highly variable from decade-to-decade and year-to-year.
- Rainfall strongly influenced by ENSO, position/strength of ITCZ, SPCZ and West Pacific Monsoon
- Frequency of tropical cyclones/depressions and subtropical fronts also important

(BoM and CSIRO, 2011)

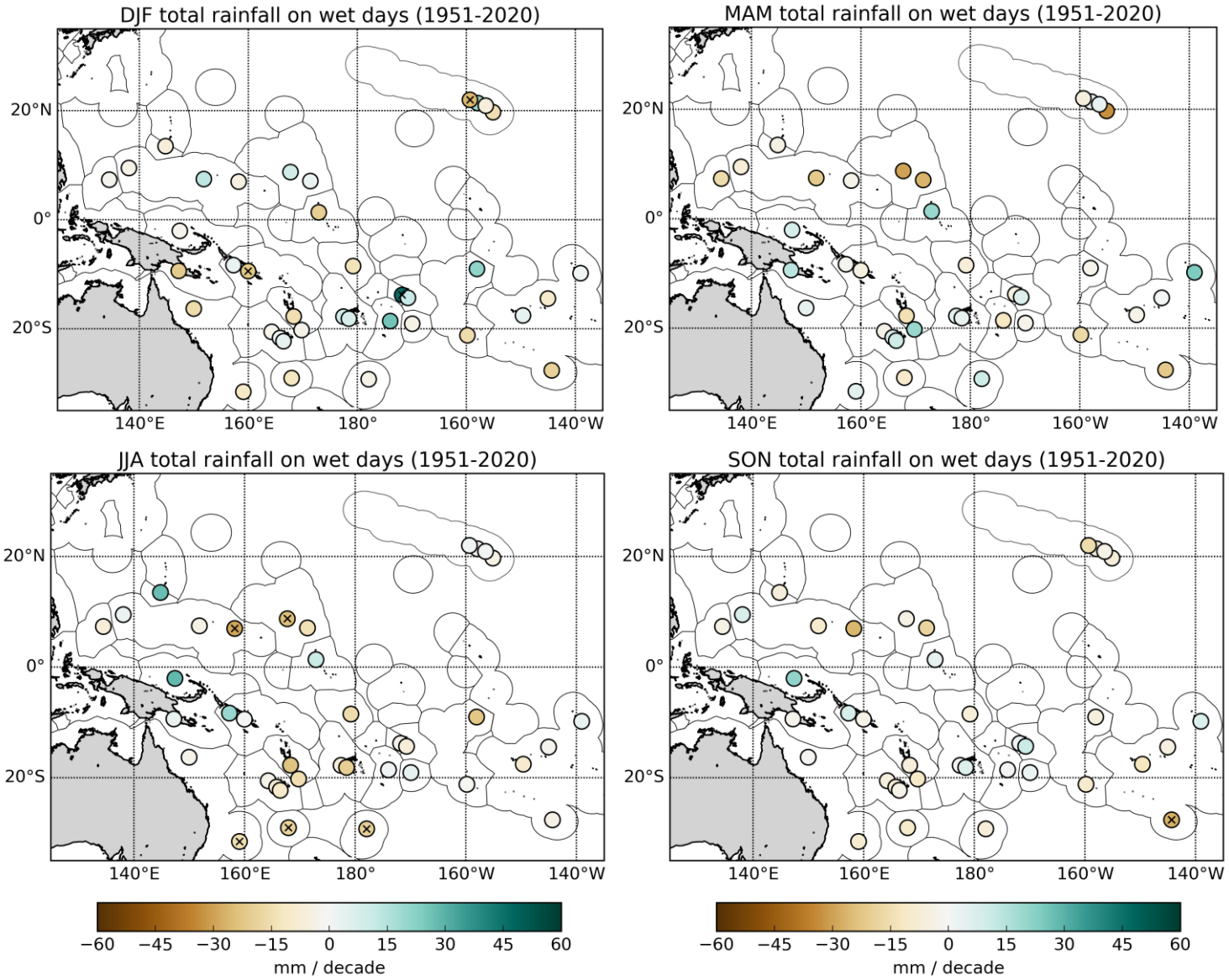
Trends in annual total rainfall (≥ 1mm)



- Mixed rainfall pattern, little change in annual total rainfall at most tropical locations over last 70 years
- Drying trends in Hawai'i and South Pacific subtropics. Consistent with model projections – Kevin may talk about this later

(Marra et al., 2022)

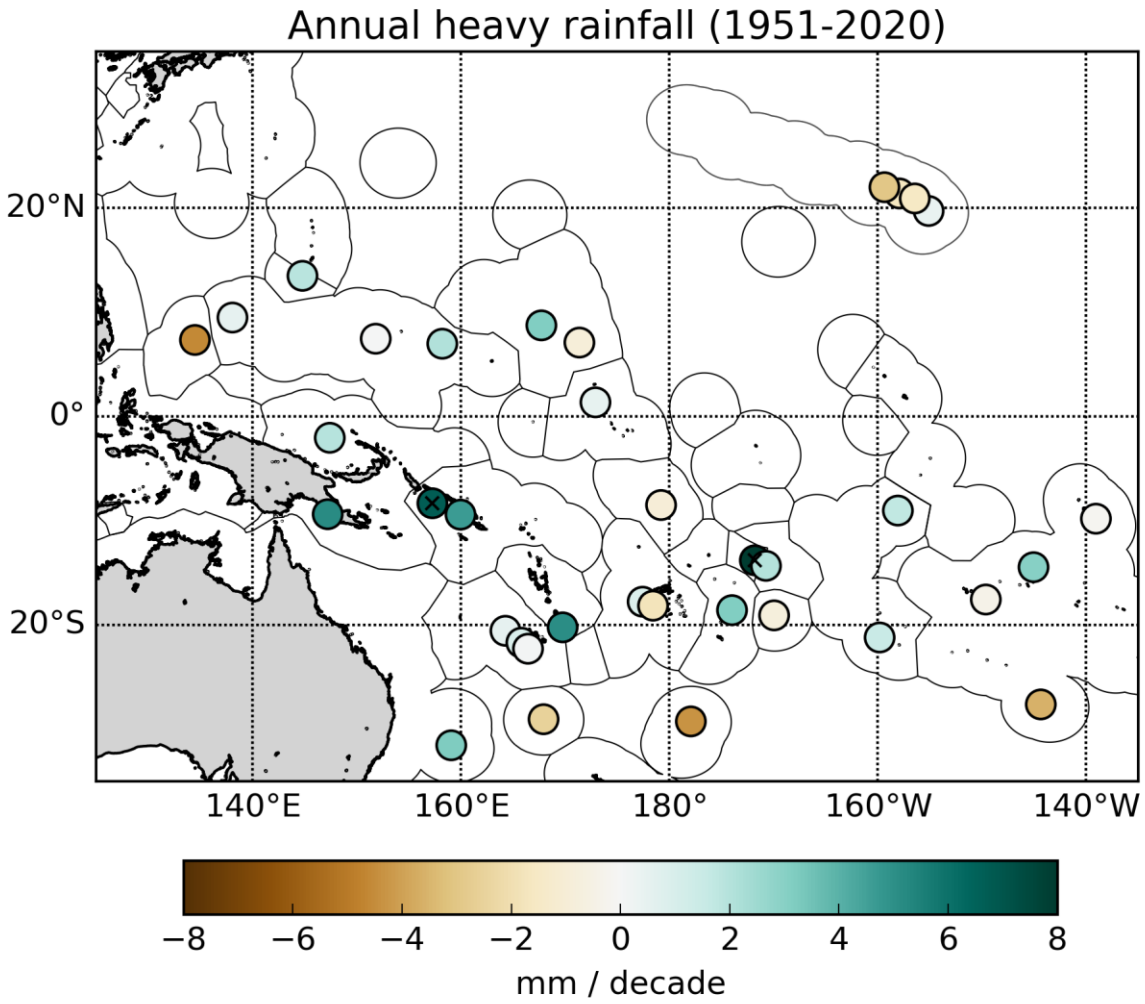
Trends in seasonal total rainfall (≥ 1mm)



- Drying trends in Hawai'i strongest in DJF.
- Drying trends in eastern FSM and RMI in JJA
- South Pacific subtropics drying trends over Jul-Aug in the western Pacific (consistent southeast Australia), Sep-Nov in the east

(Marra et al.,2022)

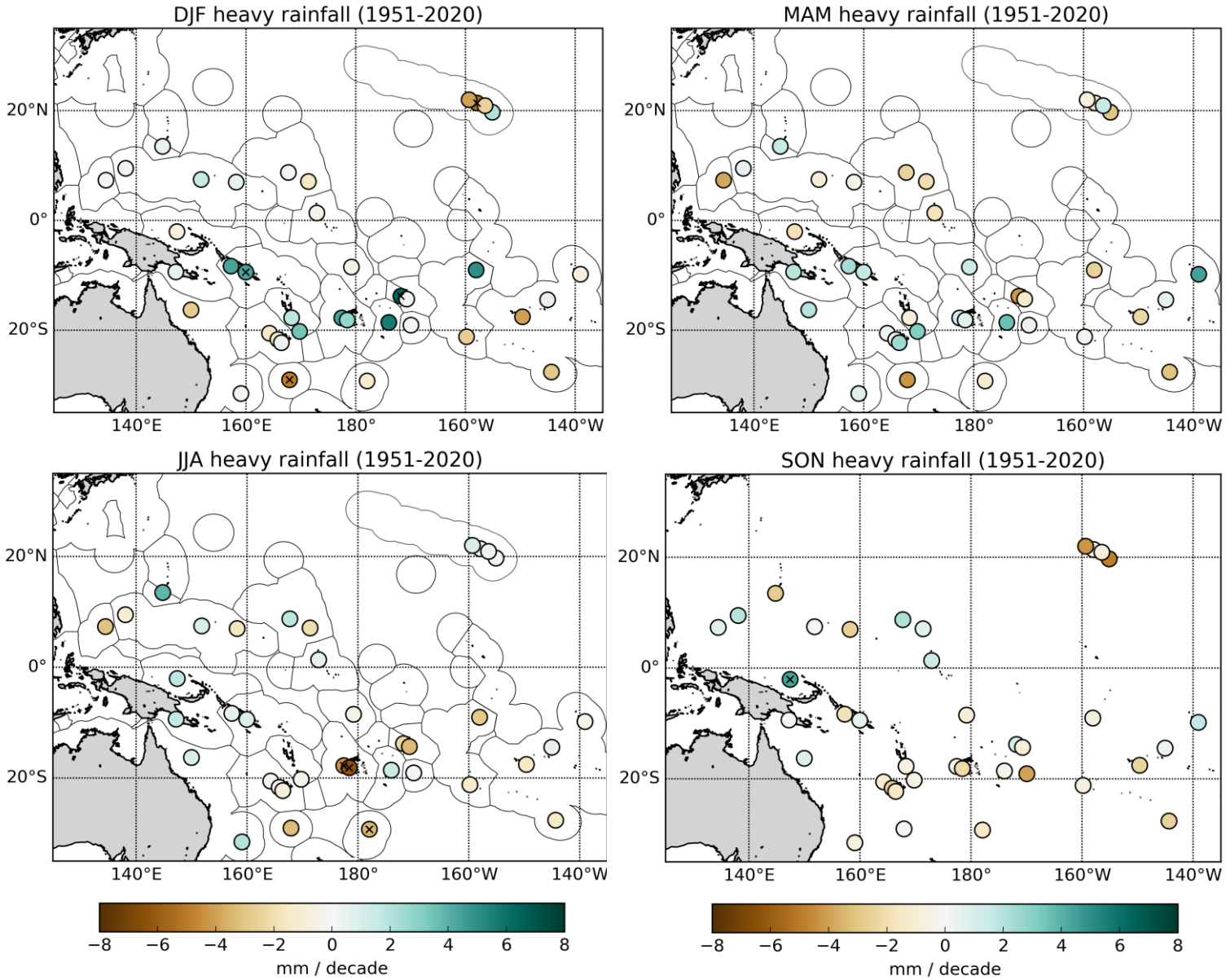
Trends in annual maximum 1-day rainfall



- Little change in annual maximum 1-day rainfall at most locations over the last 70 years
- Projections favour increasing trends in the equatorial region – very few stations here

(Marra et al., 2022)

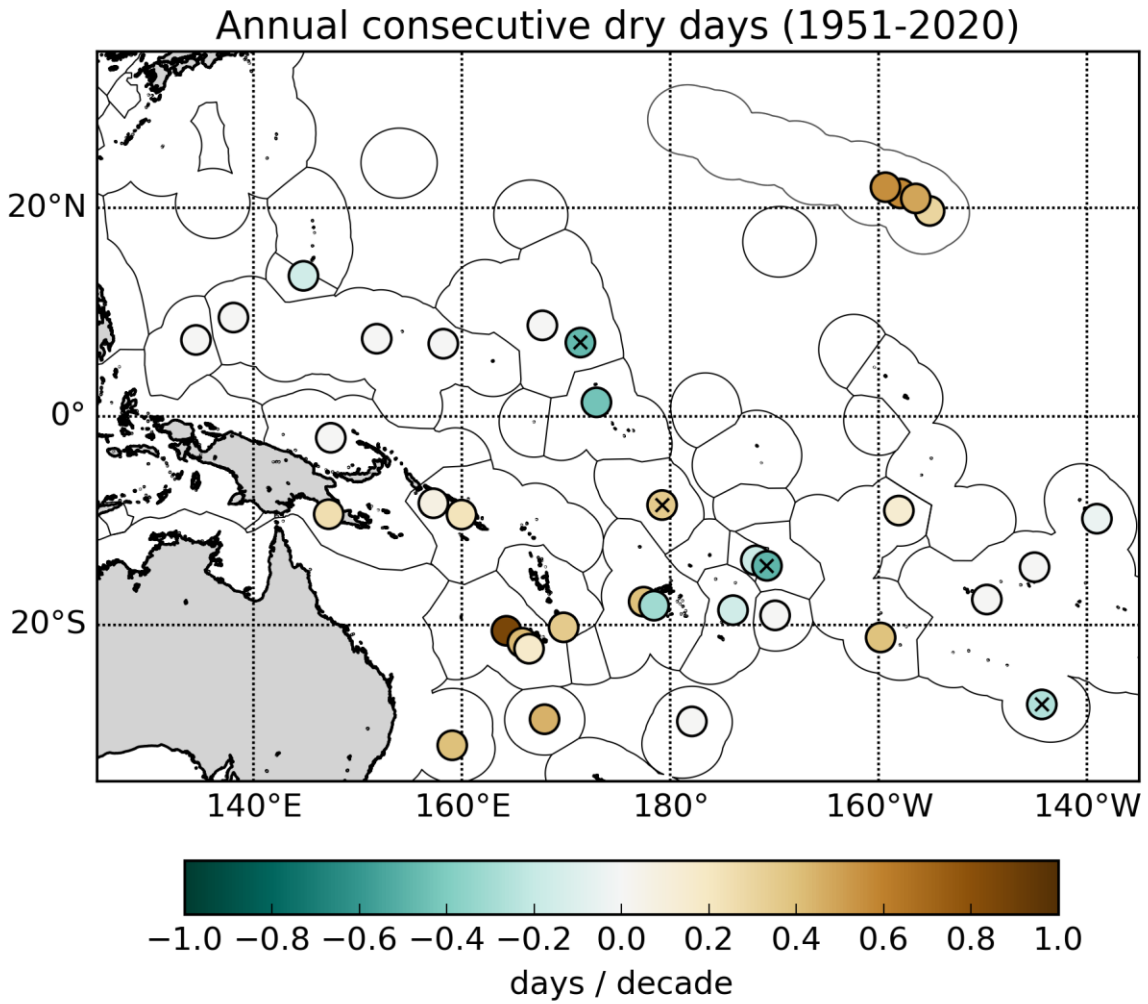
Trends in seasonal maximum 1-day rainfall



- On a seasonal basis, proportion of statistically significant trends 10% or less
- Trend pattern mixed

(Marra et al., 2022)

Trends in annual consecutive dry days

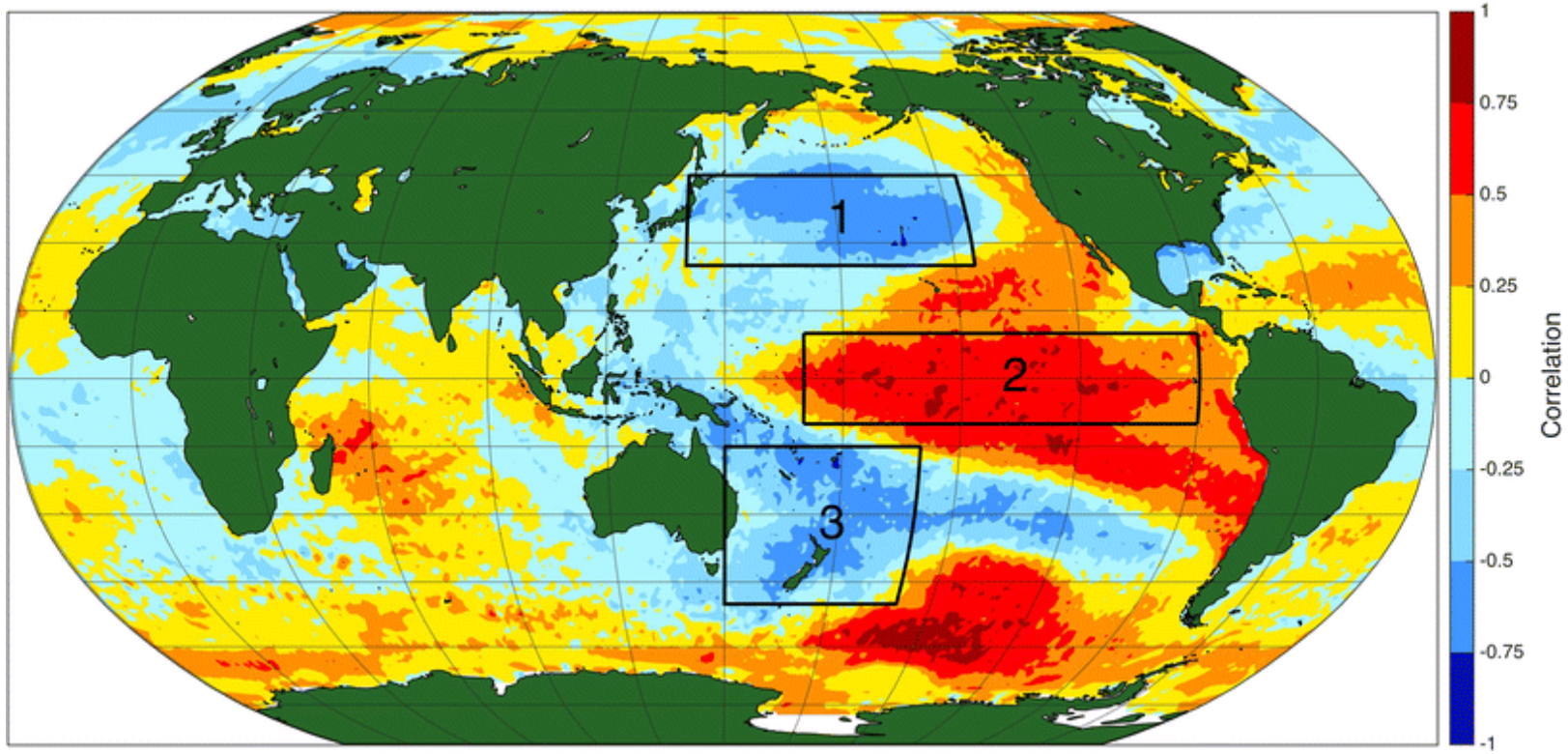


- Change in the longest no. of days in year where rainfall is less than 1 mm (0.04 inches)
- + values = longer periods of low rainfall in recent years
- - values = shorter periods of low rainfall in recent years

- Little change in annual CDD at most locations over the last 70 years

(Marra et al., 2022)

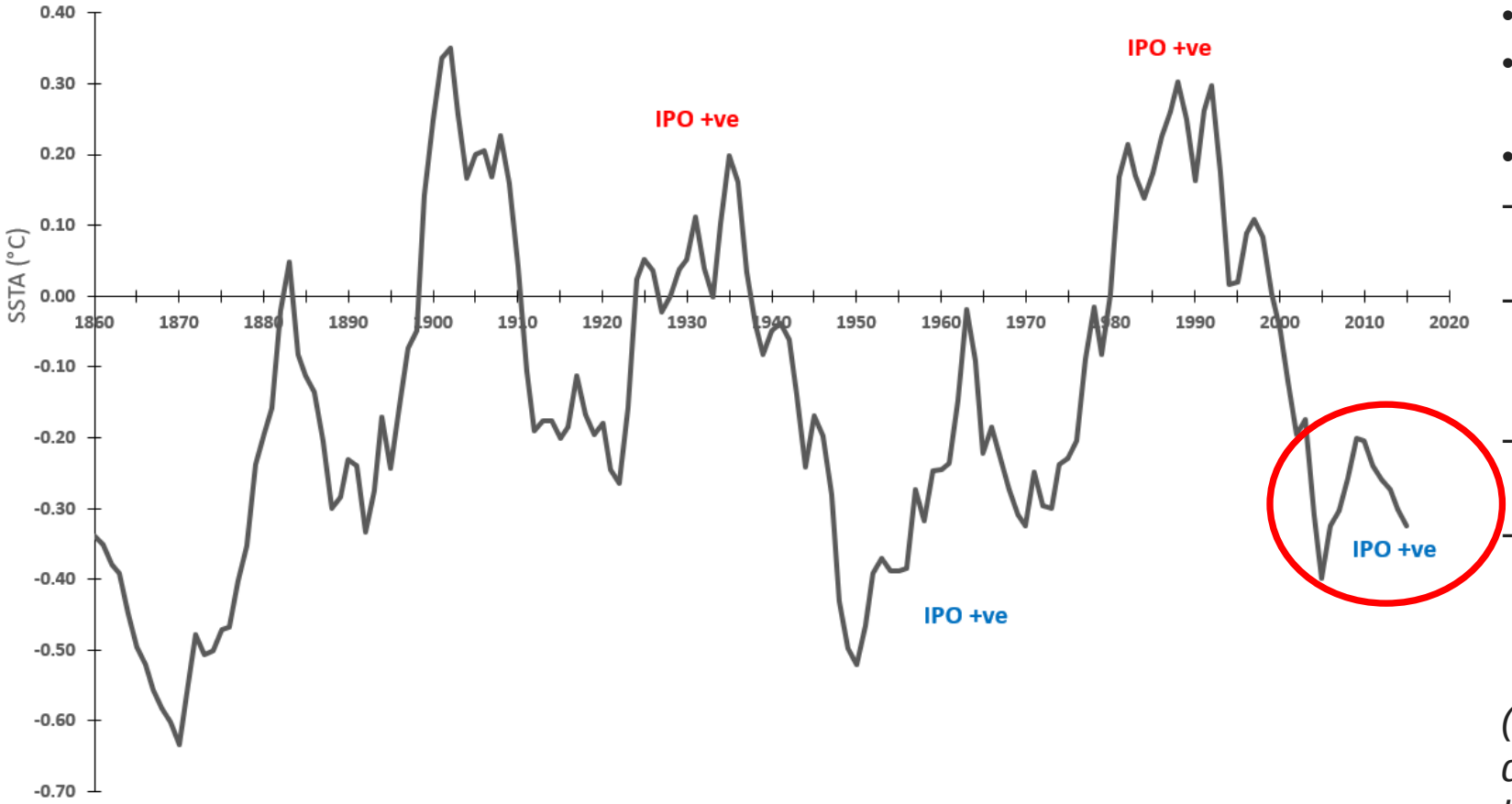
Interdecadal Pacific Oscillation



- Tripole Index for the Interdecadal Pacific Oscillation
- Index is based on the difference between the SSTA averaged over the central equatorial Pacific and the average of the SSTA in the Northwest and Southwest Pacific.
- Measure of interdecadal variability in the Pacific
- Phases can last 20 to 30 years
- Positive and negative phases affect the strength and frequency of El Niño and La Niña

(Henley et al., 2015), NOAA ERSST V5 data from https://psl.noaa.gov/data/timeseries/IPOTPI/

Interdecadal Pacific Oscillation



- Positive phases 1913-44, 1977-98
- Negative phases 1945-76, 1999-

- During a negative phase
- SPCZ displaced further southwest during La Niña
- Rainfall generally lower than normal northeast of the SPCZ and in the central equatorial Pacific
- Higher than normal southwest of the SPCZ
- MSLP higher than normal to the west of the dateline and lower than normal to the east of the dateline

(Henley et al., 2015), NOAA ERSST V5 data from https://psl.noaa.gov/data/timeseries/IPOTPI/

Summary slide

- Rainfall has wide ranging impacts on humans and ecosystems across the Pacific Islands. Rainfall supplies drinking water on low-lying atolls, replenishes freshwater lens and provides water for agriculture. Changes in rainfall can disrupt these and other natural processes. Heavy or extreme rainfall can increase of enhance crop damage, soil erosion and floods, reduce quality of drinking water.
- Little change in annual total rainfall at most tropical locations over last 70 years. Drying trends exist in Hawai'i and in the South Pacific subtropics. Consistent with climate change projections.
- Little change in annual and seasonal maximum 1-day rainfall at most locations over the last 70 years.
- The annual consecutive dry days (CDD) index represents change in the longest number of days in year where rainfall is less than 1 mm (0.04 inches). Positive values represent longer periods of low rainfall in recent years. Negative values shorter periods of low rainfall in recent years. There has been little change in annual CDD at most locations over the last 70 years.
- The Interdecadal Pacific Oscillation (IPO) is a measure of decadal variability in the Pacific. Phases can last 20 to 30 years. Positive and negative phases affect the strength and frequency of El Niño and La Niña.
- Currently in a negative IPO phase which is associated with the SPCZ being displaced further southwest during La Niña. Rainfall generally lower than normal northeast of the SPCZ and in the central equatorial Pacific (Northern Cook Is. Tokelau, Kiribati and Tuvalu). Rainfall higher than normal southwest of the SPCZ (Solomon Is., Vanuatu, Fiji, Tonga).

The Bureau of Meteorology

Thank you