A 1300-year reconstruction of the South Pacific Convergence Zone (SPCZ)

Never Stand Still | Faculty of Engineering | School of Civil and Environmental Engineering

Philippa Higgins, Jonathan Palmer, Chris Turney

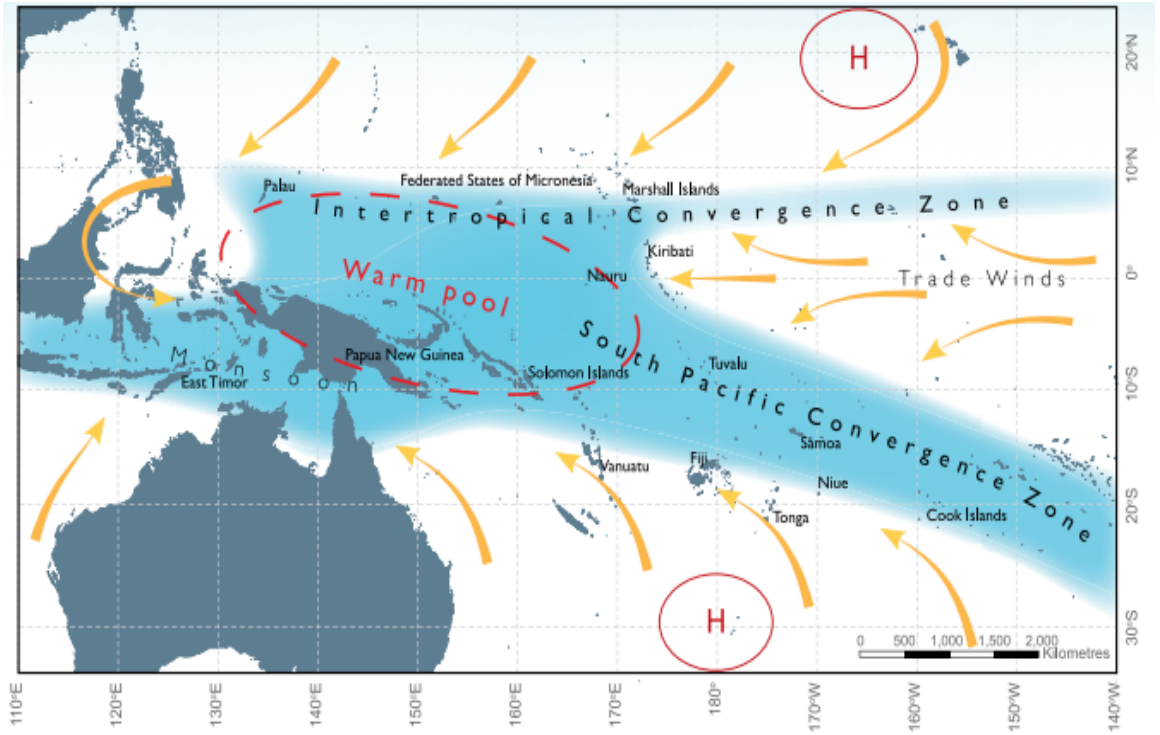
Martin Andersen, Edward Cook

All Rights Reserved

Why reconstruct the SPCZ?

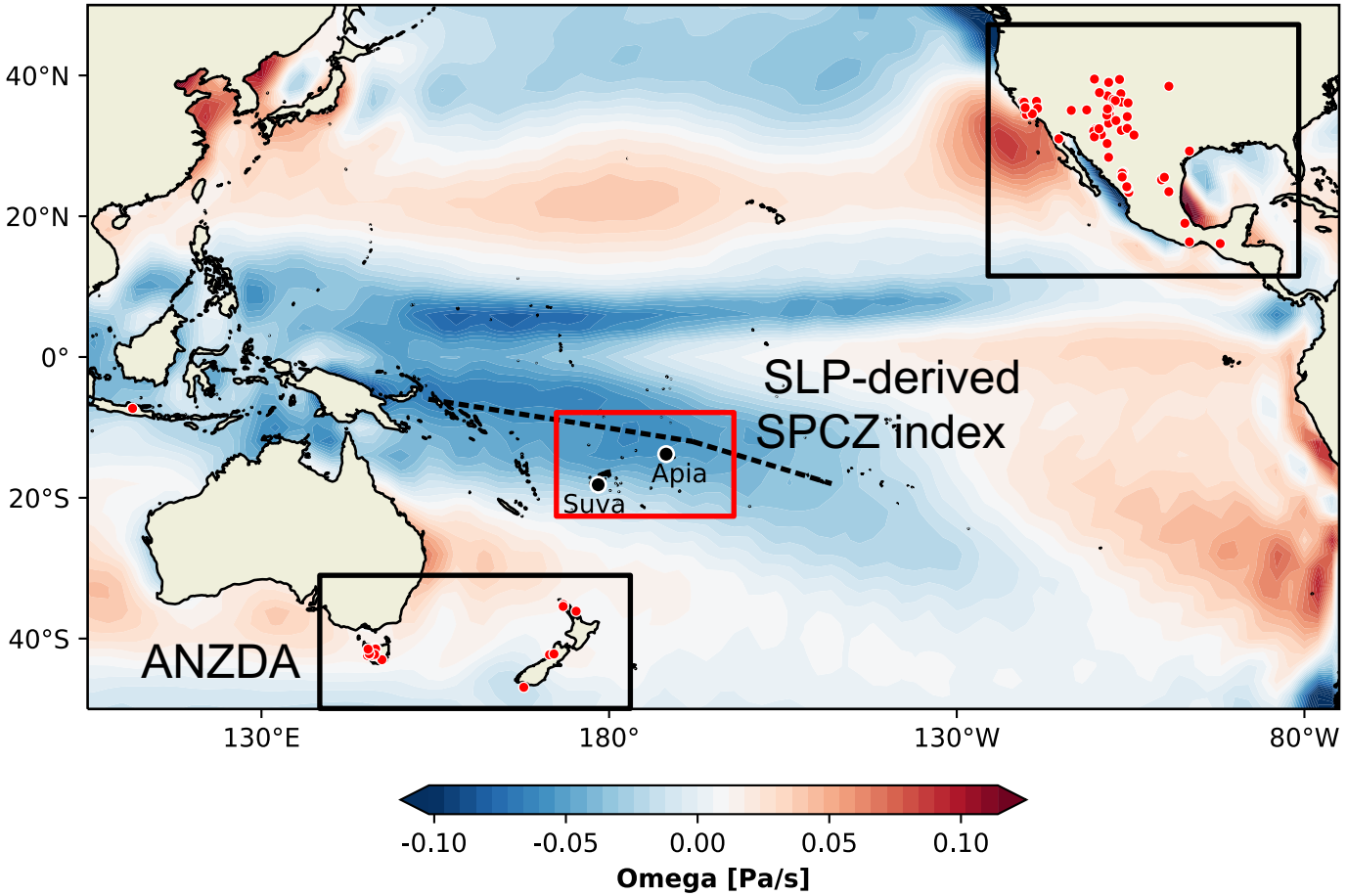
- Huge impact on South Pacific communities
  - Floods, droughts, cyclones
- Multi-decadal variability
- Short data record
- Poorly represented in CMIP5 models

Average positions of major climate features Nov-Apr



Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation (CSIRO) 2011

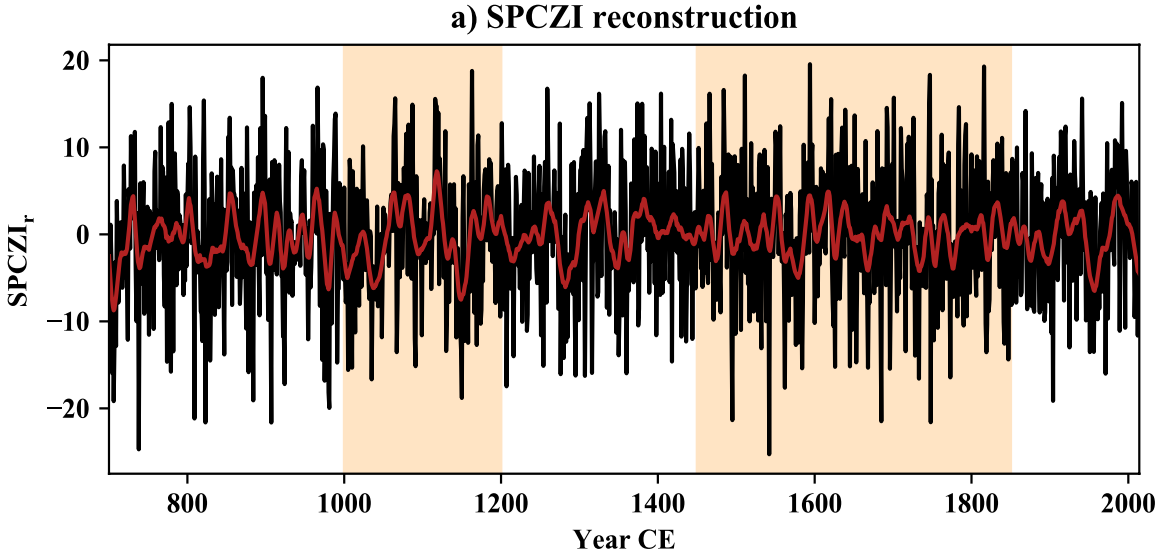
Tree-ring chronologies with teleconnections to the South Pacific

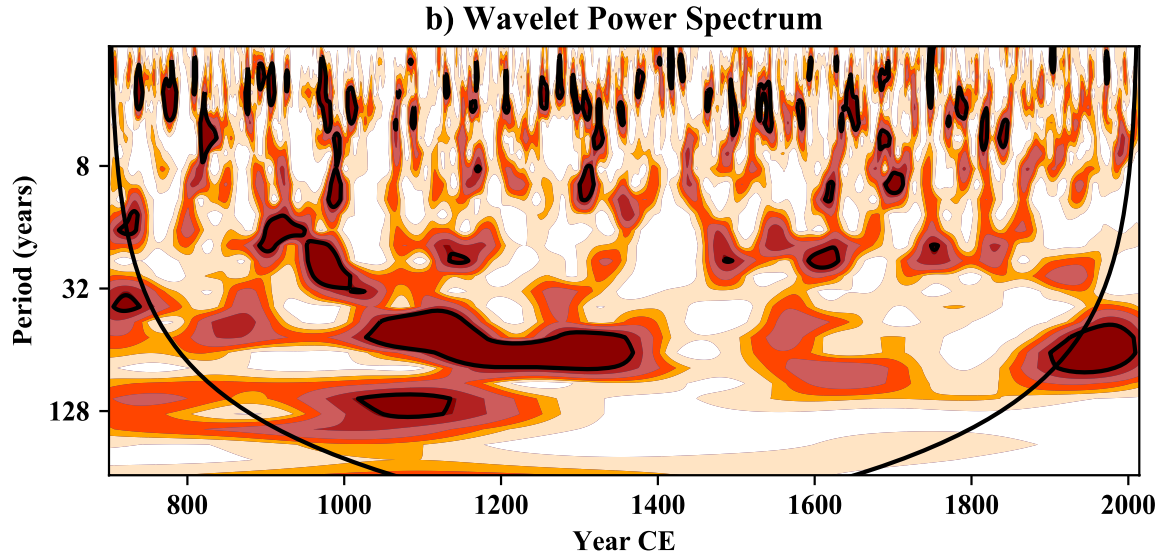


Mexican drought atlas

Applying PPR to the SPCZ

1. Many predictors with one predictand (point index)
2. Search-radius set to infinity
3. 90% 2-tailed screening of potential predictors to prevent overfitting
4. Split period calibration and validation: calibration 1955-1998, verification 1911-1954
5. Despite remoteness of tree-ring chronologies from SPCZ region, reconstruction captures ~60% of instrumental variability



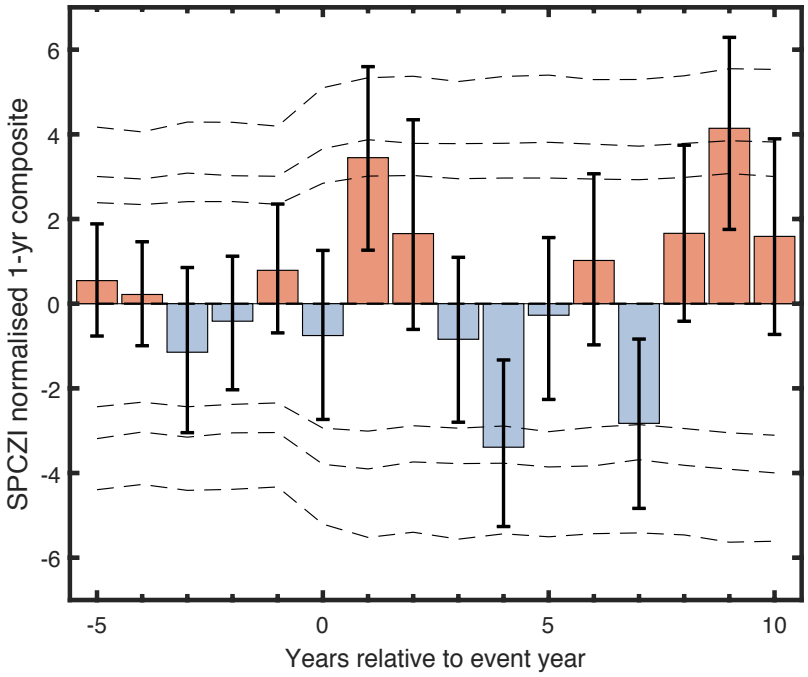


- Sustained eastward shift in the SPCZ during the Medieval Climate Anomaly (El Niño-like)
- No significant shifts during the Little Ice Age

Pervasive ENSO periodicities

Decadal and multi-decadal periodicities wax and wane

Climate drivers during the Little Ice Age



Superposed Epoch Analysis results for normalized SPCZI

- Increased likelihood of an eastward shift in the SPCZ following a large volcanic eruption (90% significance level)
- Lack of solar fingerprinting on the reconstruction
  - Schwabe cycle and Maunder Minimum not distinguished

Conclusions and implications

1. 1300-year reconstruction of the SPCZ can be used to assess general circulation model projections for the region
2. Eastward shift in the SPCZ during the MCA contributes to the ‘ENSO hypothesis’ of maritime migration between the Pacific Islands
3. Discrepancies between different paleoclimate reconstructions: need additional high-resolution proxy records from the Southern Hemisphere

Thank you