

# WG2

## Assessing seismic network configuration against TEW targets

Bill Fry, WG2 Chair

Contributors include:

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Tanja Pejic, Trevor Allen and Phil Cummins

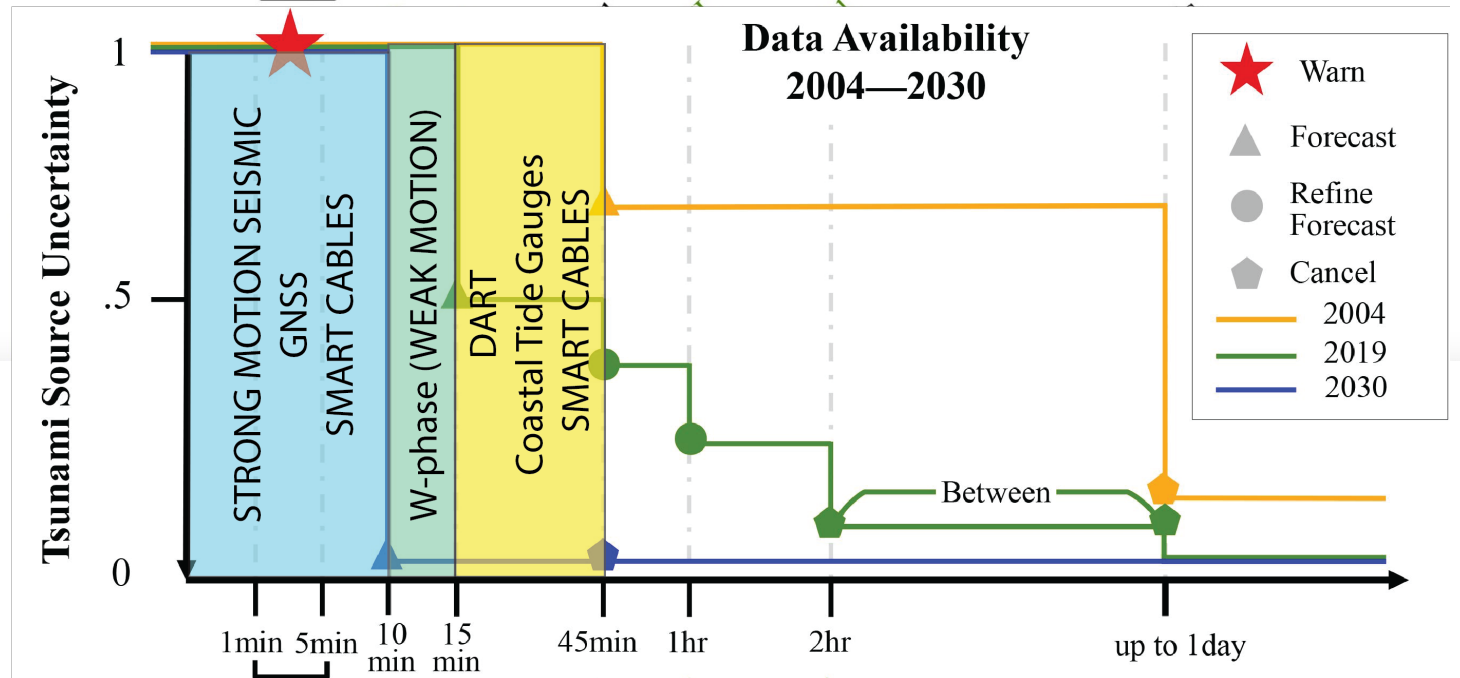
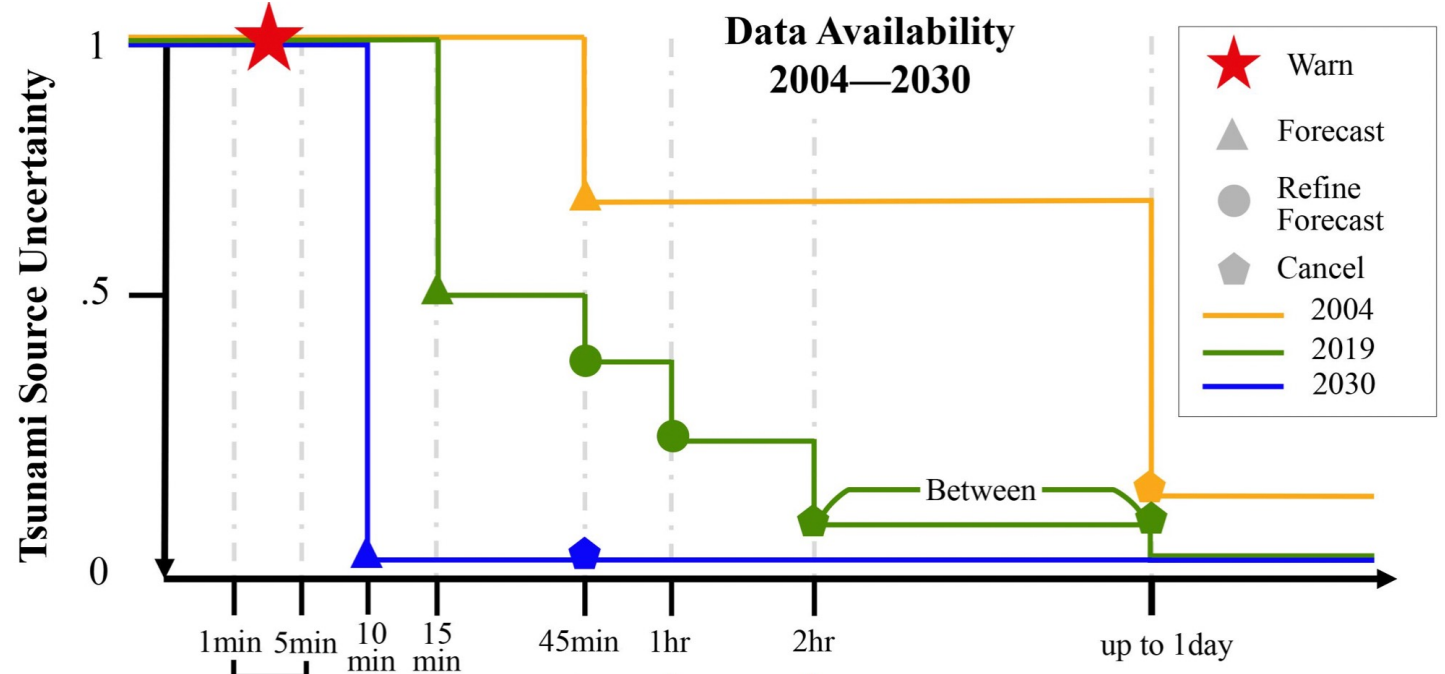


*Te Whakaahuatanga Tere o ngā Rū Whenua me ngā Parawhenua*  
**R-CET** *Rapid Characterisation of Earthquakes and Tsunamis*  
*A GNS Science Led Research Programme*



**Australian Government**  
**Geoscience Australia**

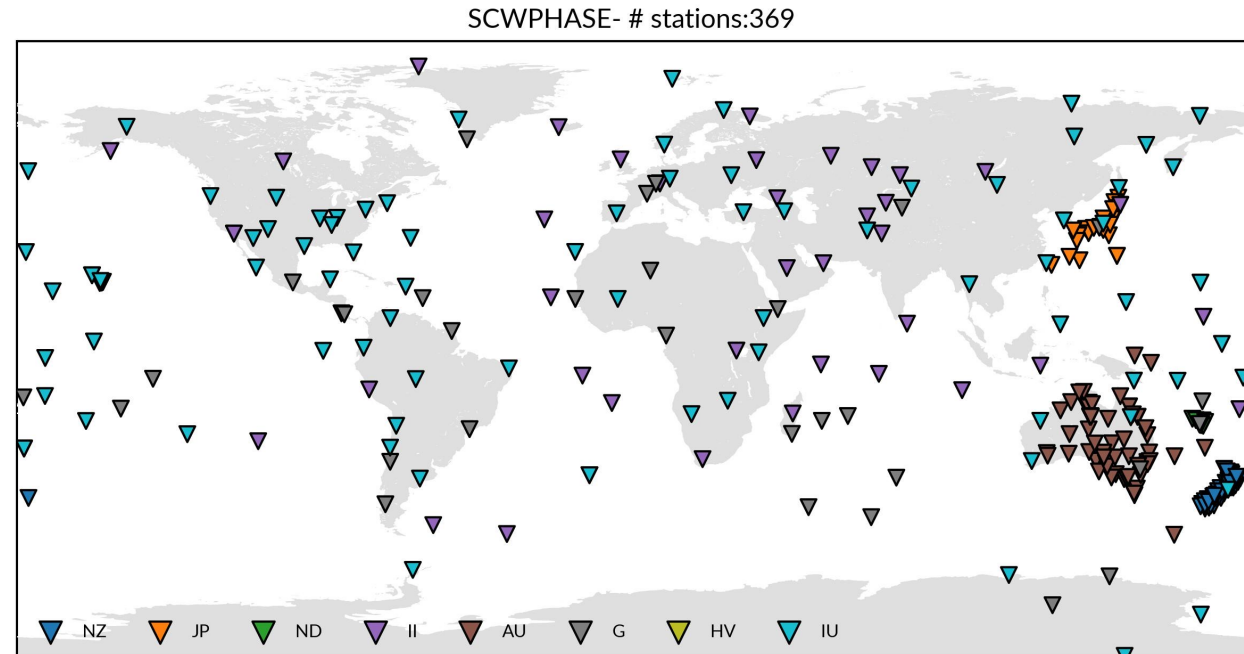
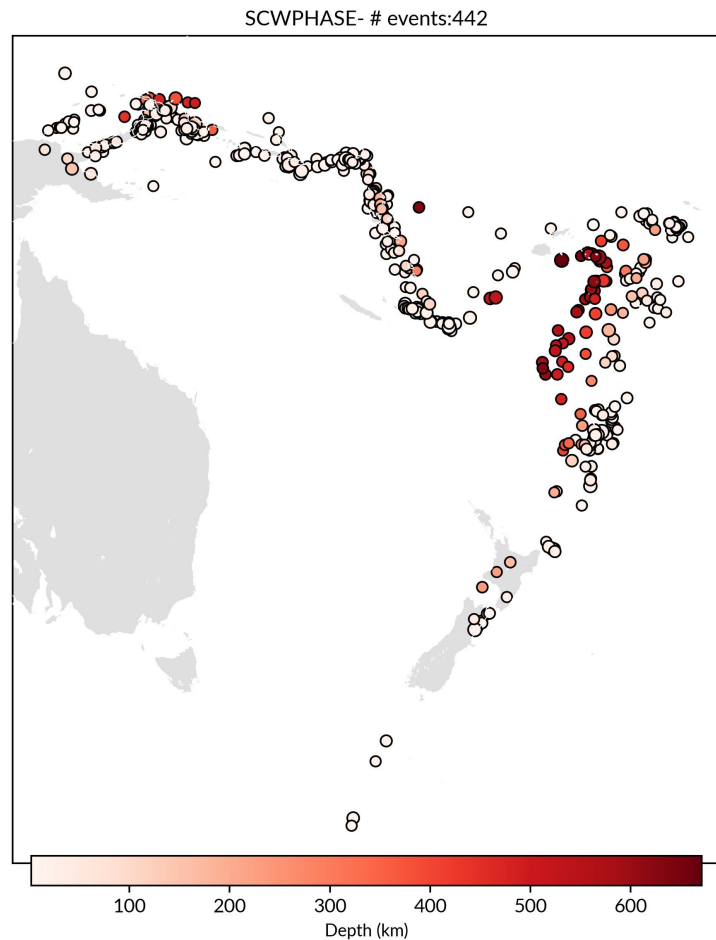
GOAL: assess network for ability to produce Decade TEW targets in SW Pacific – note the need for weak motion seismic data between 10-15 minutes.



# Mww – why and how?

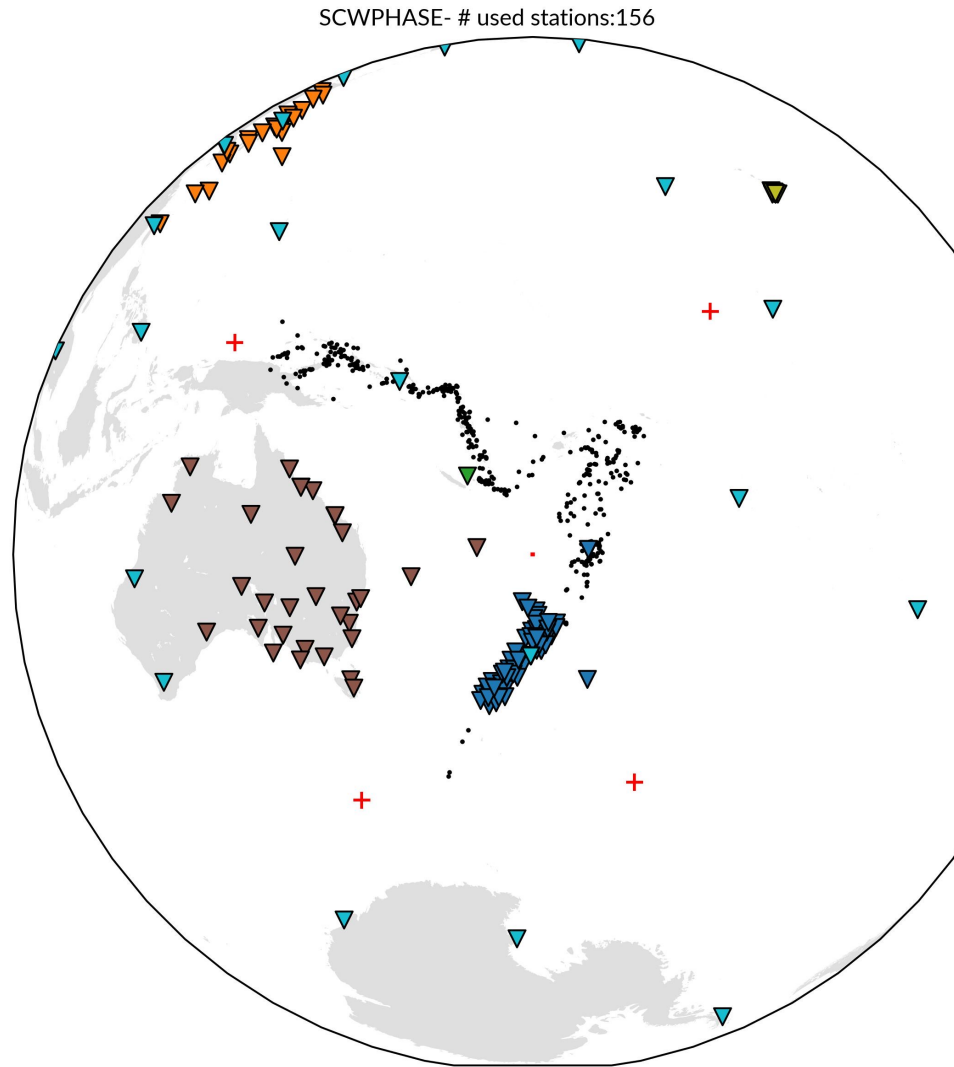
- Amplitude based magnitude estimates (think SC4 standard/summary M) SATURATE with large ( $M > 6.5$ ) earthquakes
- Mww does not saturate, so it is better for very large earthquakes (think all typical significant tsunamigenic earthquakes)
- Requires broad-band real-time data
- Improves with increasing data coverage – we need data across whole SW Pacific region

# Test Case Setup



- We reprocessed 442 gCMT events  $M_w > 6.5$  in SW Pacific over the last 10 years as if they were happening in real-time
- We used data easily available from IRIS
- We used a module optimized for the SW Pacific and plugged into SC4 – CPPT/GNS RCET collaboration. Thanks Anthony!

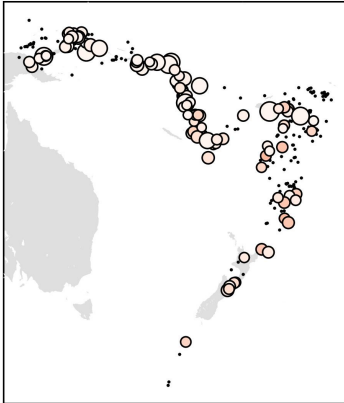
# In practice..



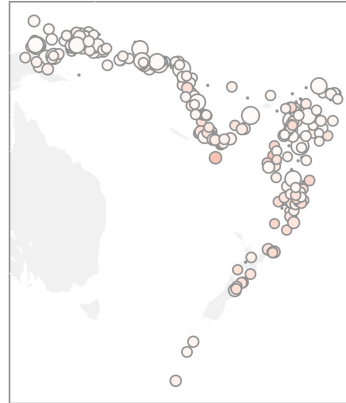
- Global network is not necessary and cannot be used to reach our Decade targets
- 366 / 442 inversion successful

# Network usage (15min solution)

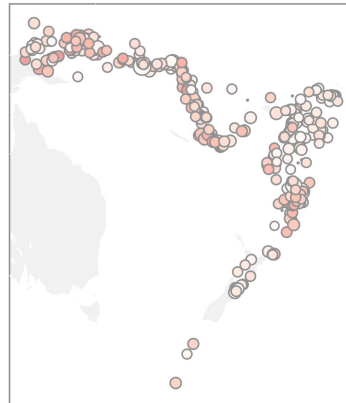
SCWPHASE- 15min - N=111



SCWPHASE- 18min - N=277

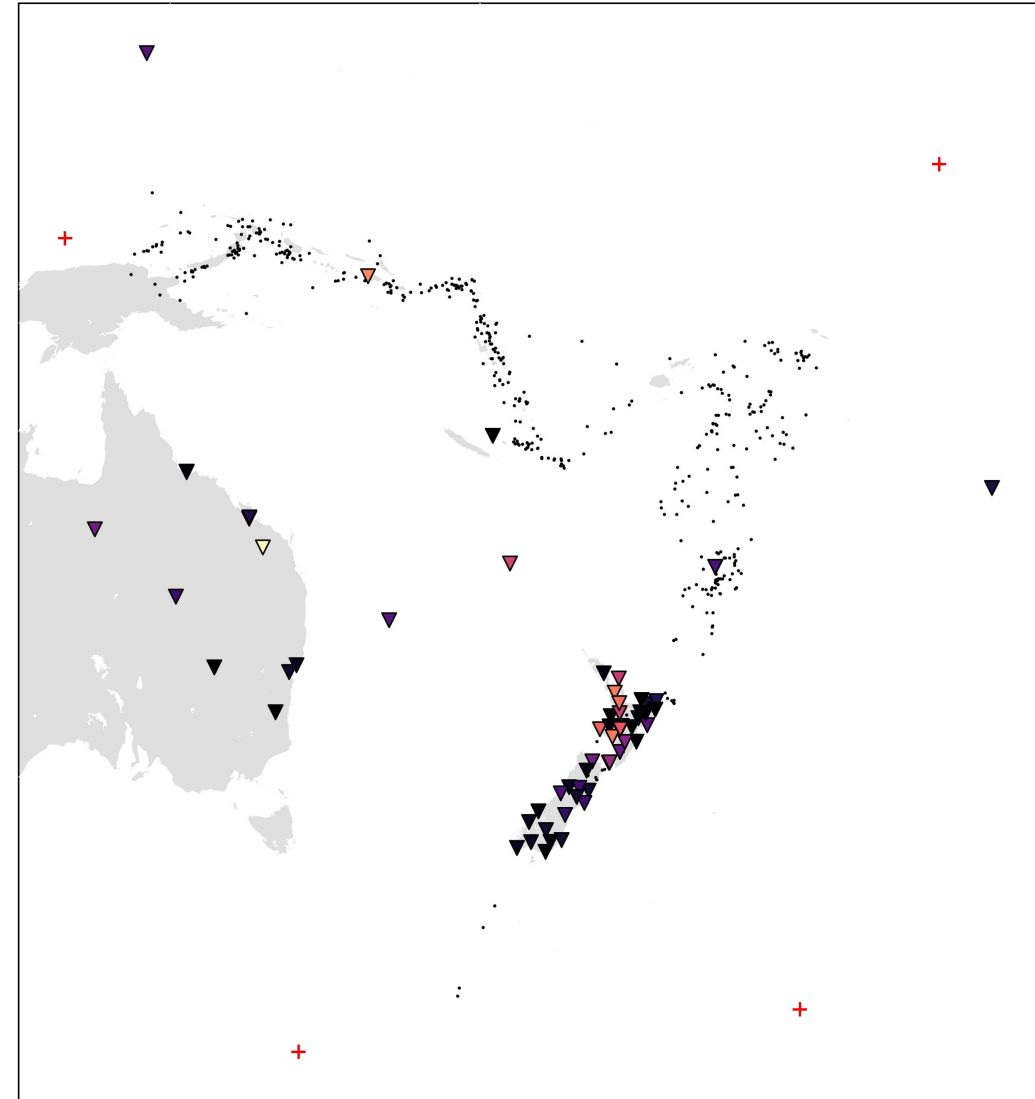


SCWPHASE- 30min - N=366



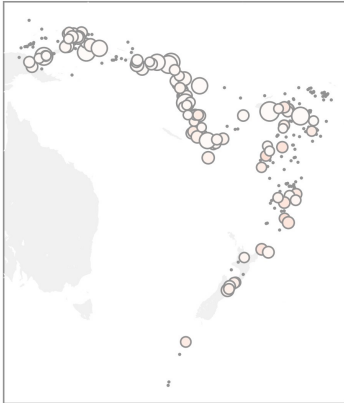
- Stations mostly contained inside regional boundaries
- Regional defined by the speed at which shear waves travel away from the earthquake.

SCWPHASE- 15min - # unique station:67

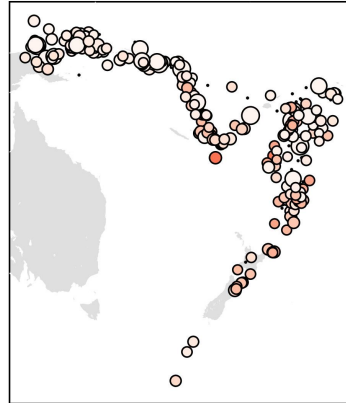


# Network usage (18min solution)

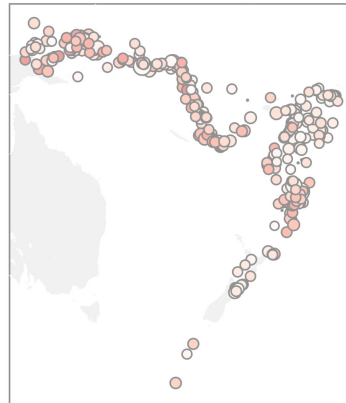
SCWPHASE- 15min - N=111



SCWPHASE- 18min - N=277

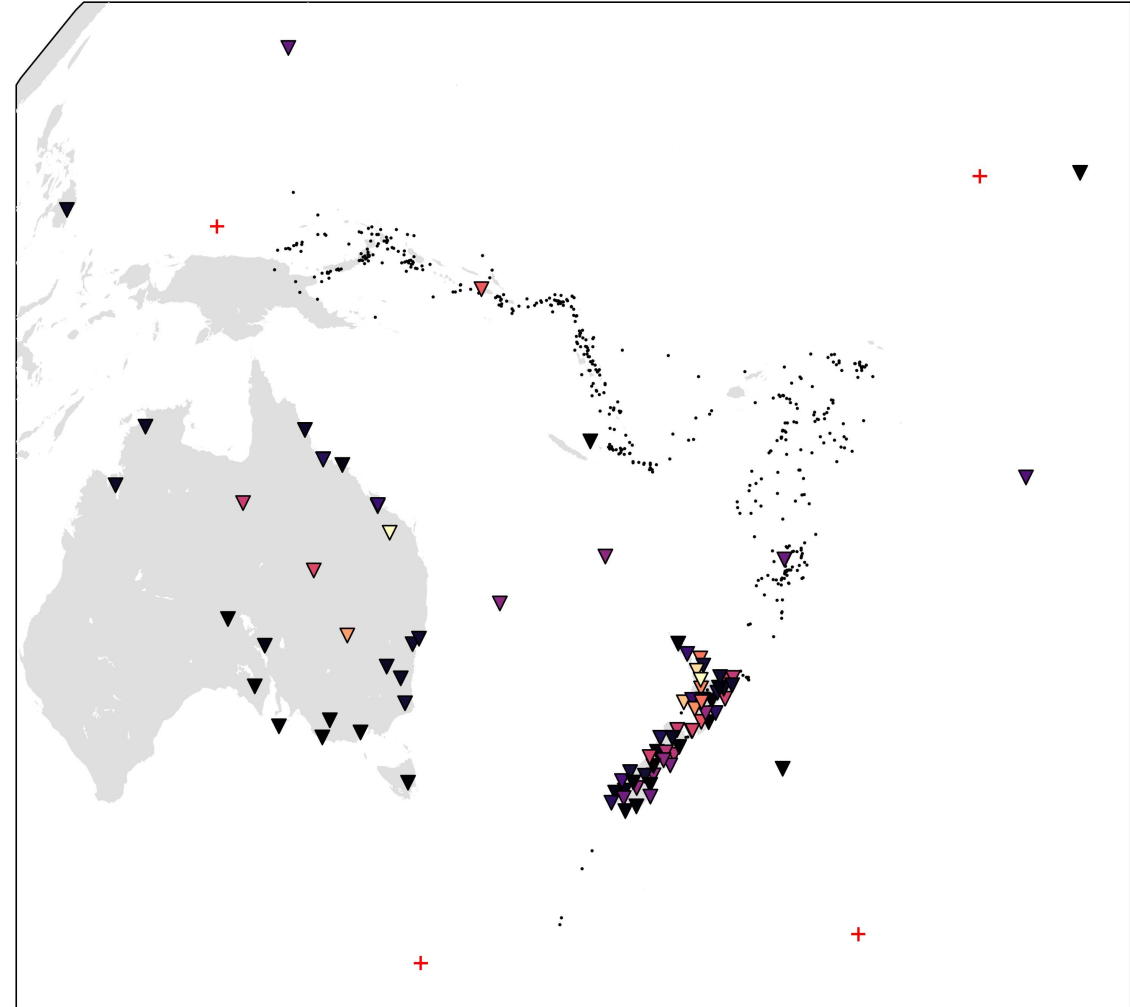


SCWPHASE- 30min - N=366



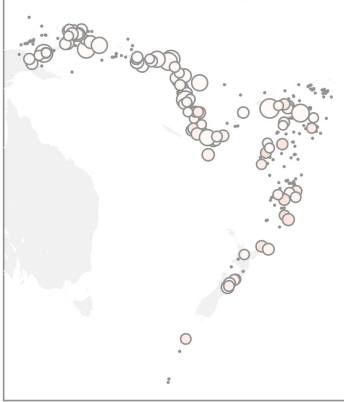
- Stations mostly contained inside regional boundaries
- Regional defined by the speed at which shear waves travel away from the earthquake.

SCWPHASE- 18min - # unique station:95

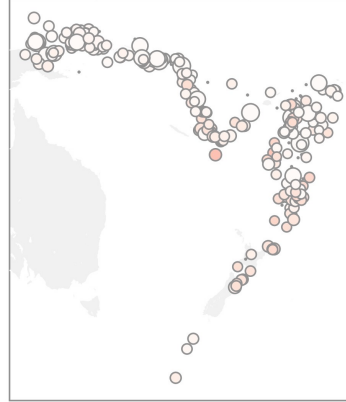


# Network usage (30min solution)

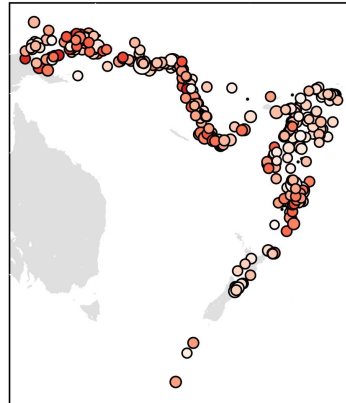
SCWPHASE- 15min - N=111



SCWPHASE- 18min - N=277

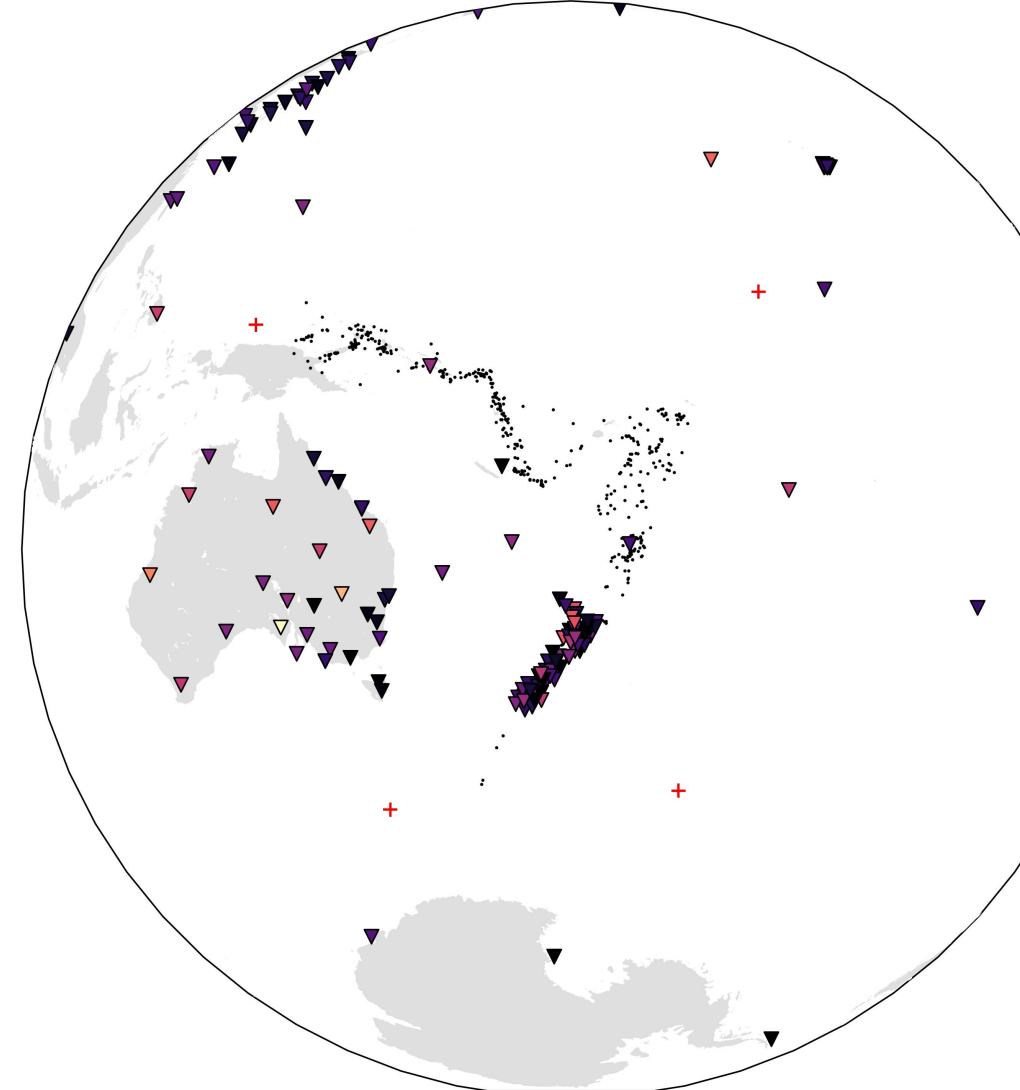


SCWPHASE- 30min - N=366



- SW-Pacific stations + Japan, Hawaii and Antarctica

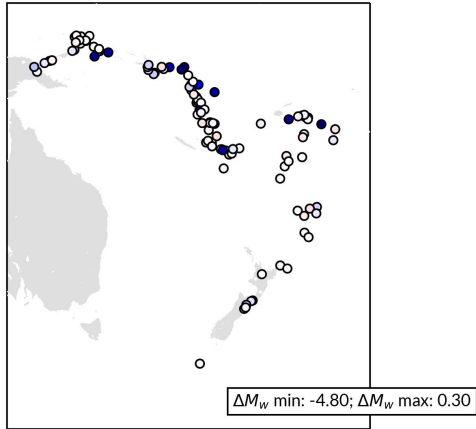
SCWPHASE- 30min - # unique station:155



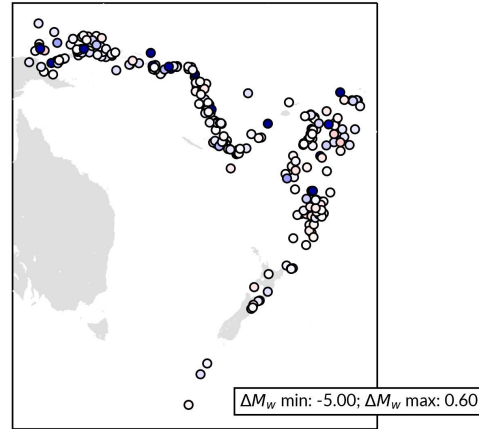


# Magnitude difference

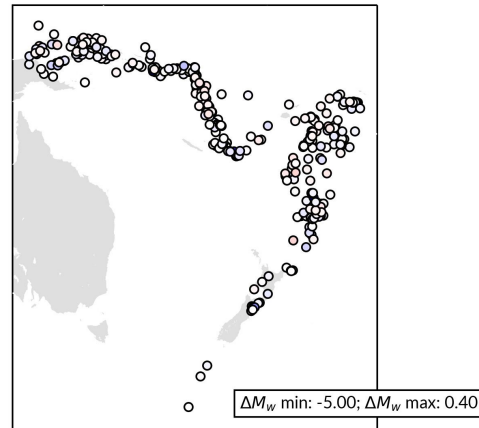
SCWPHASE- 15min - N=111/442 - rms=1.333



SCWPHASE- 18min - N=277/442 - rms=1.064

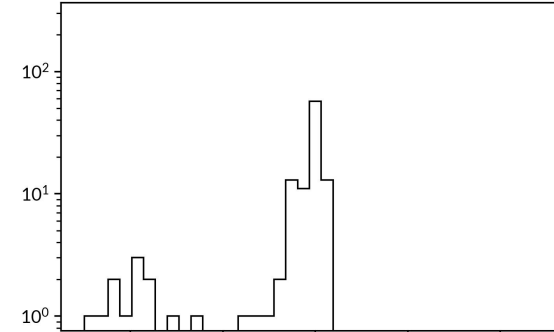


SCWPHASE- 30min - N=366/442 - rms=0.503

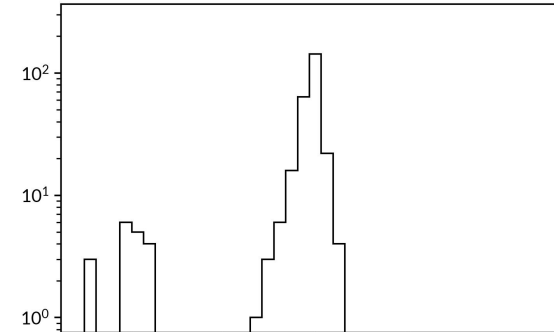


- Clear over-estimation of the magnitude for a very few events in early inversion ( $M_{ww} > 9.5$ )
- 30min tends to correct that

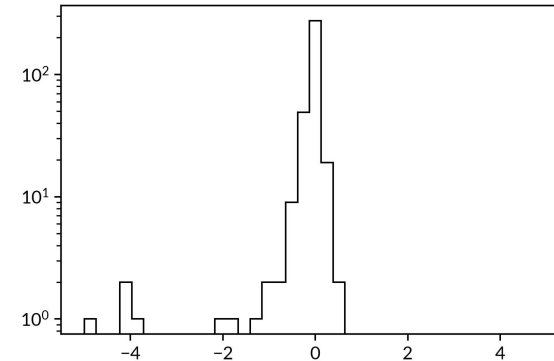
SCWPHASE- 15min - rms=1.333 - max M: 12.0



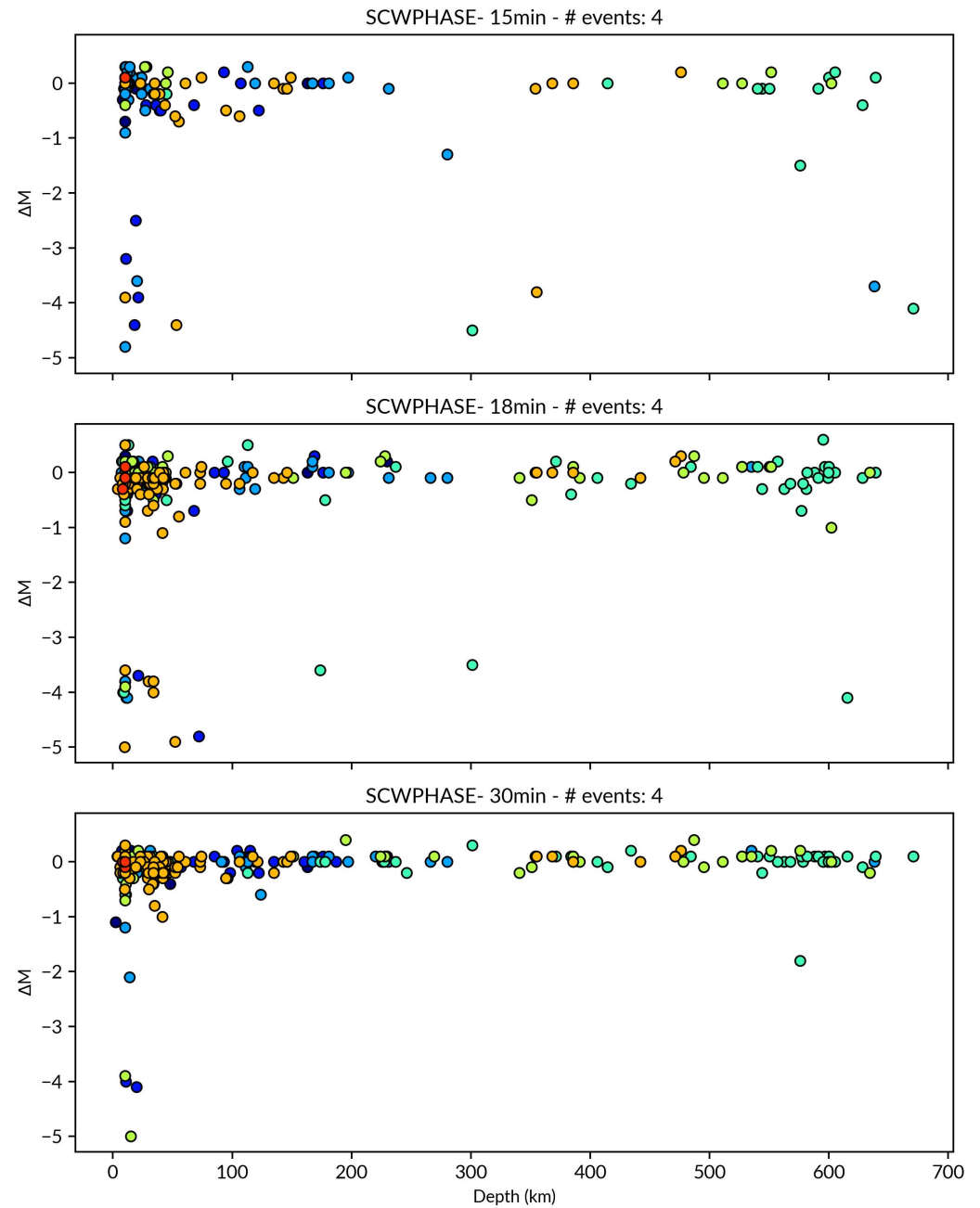
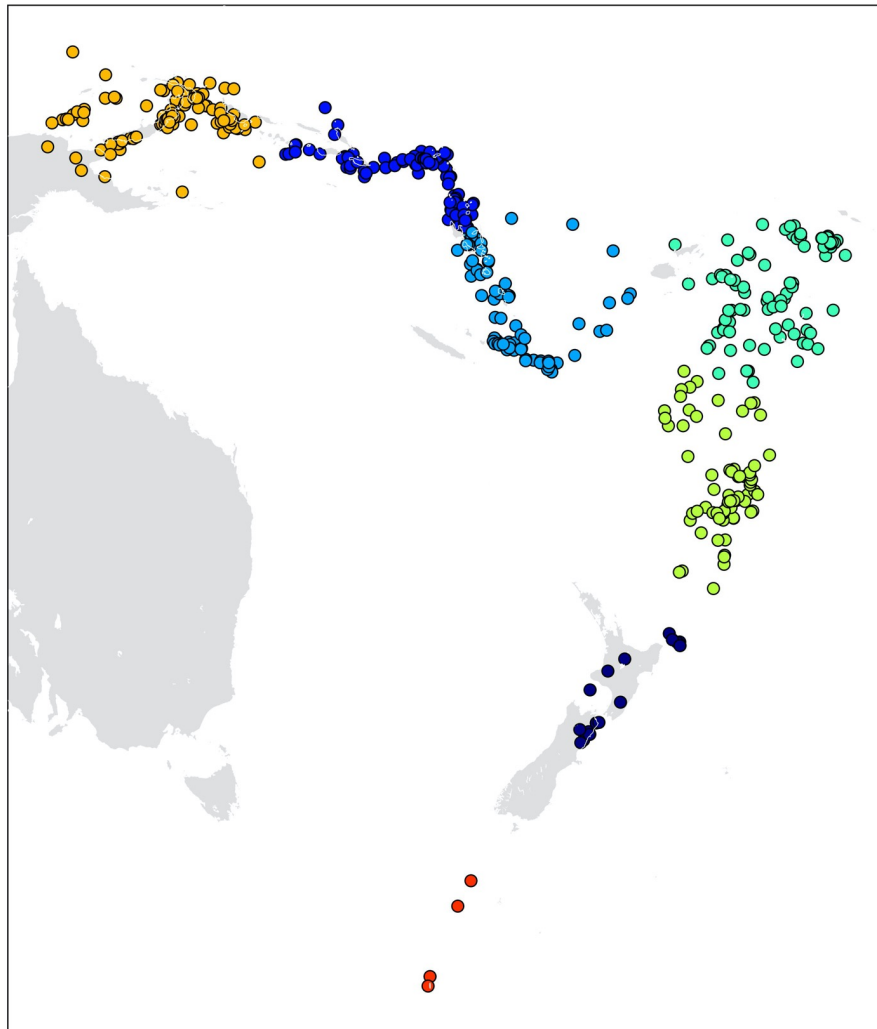
SCWPHASE- 18min - rms=1.064 - max M: 11.0



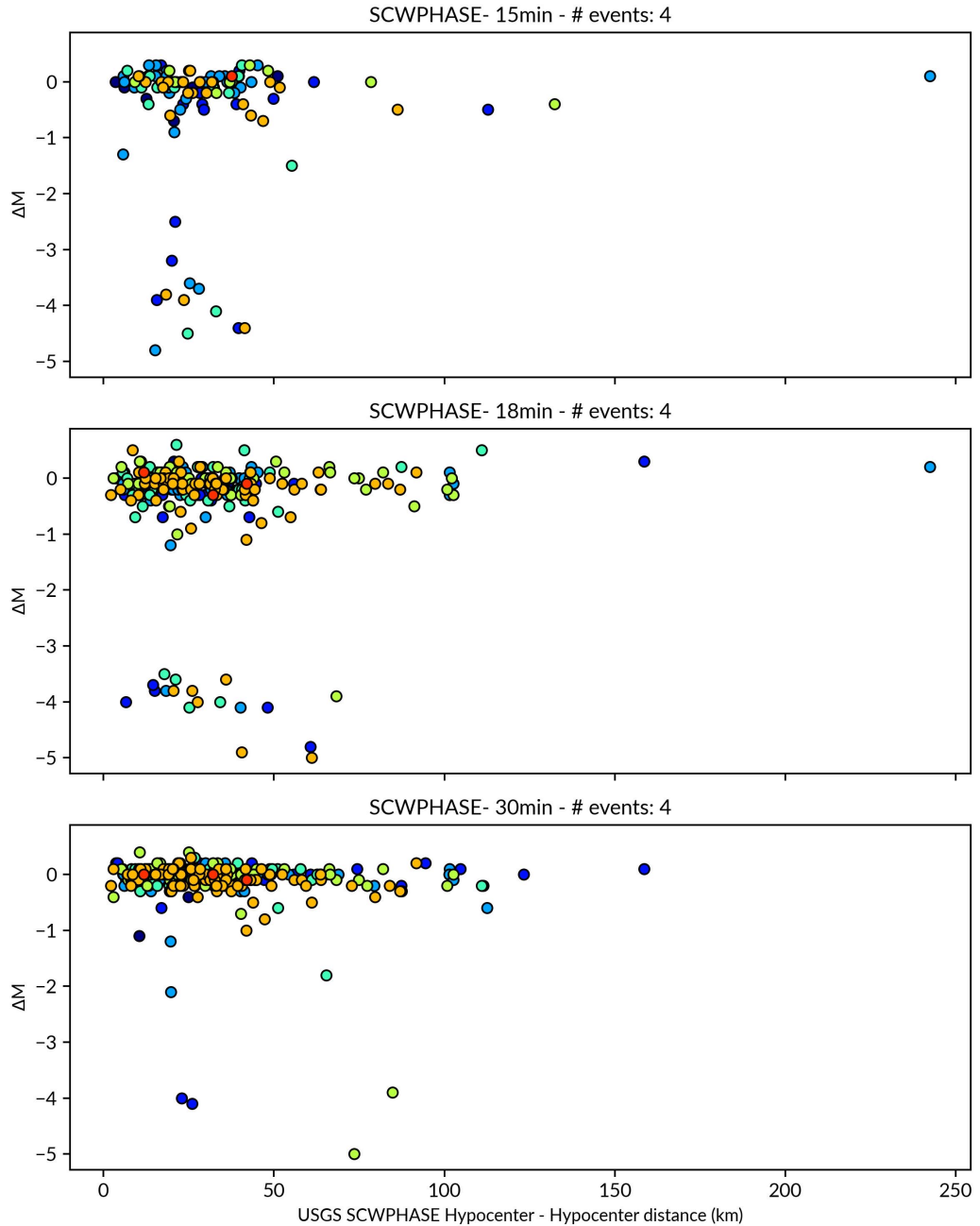
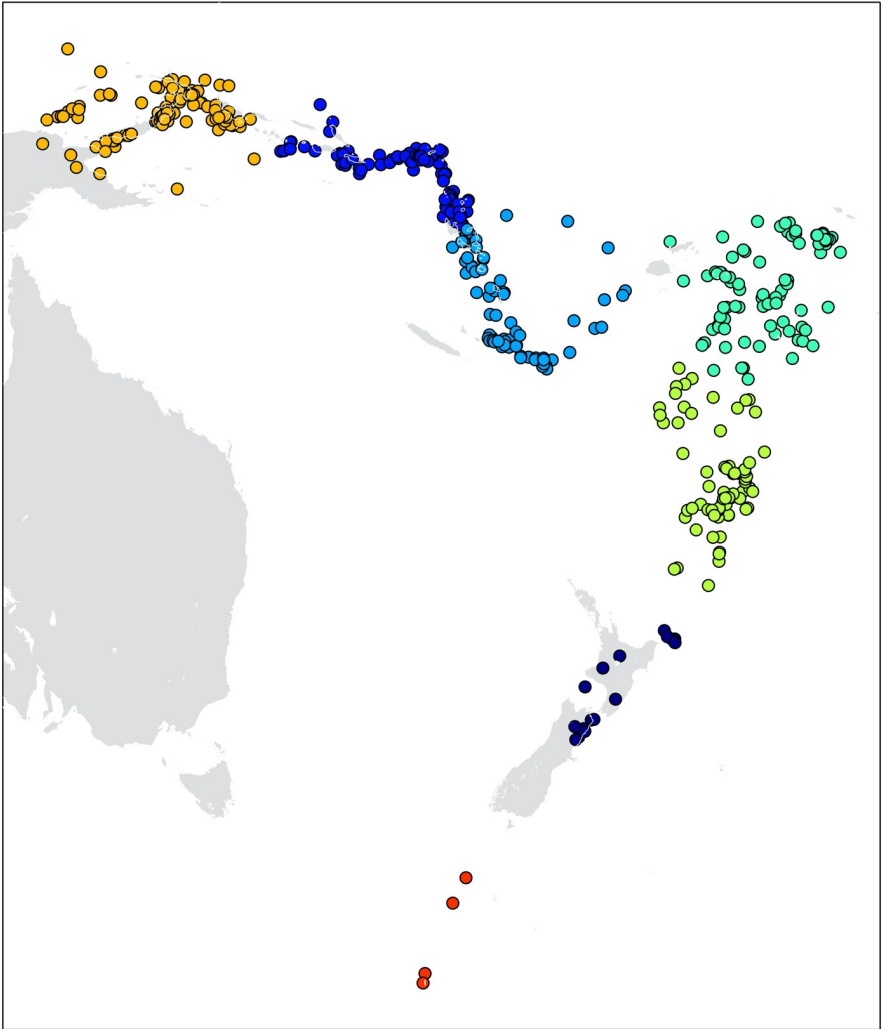
SCWPHASE- 30min - rms=0.503 - max M: 11.0



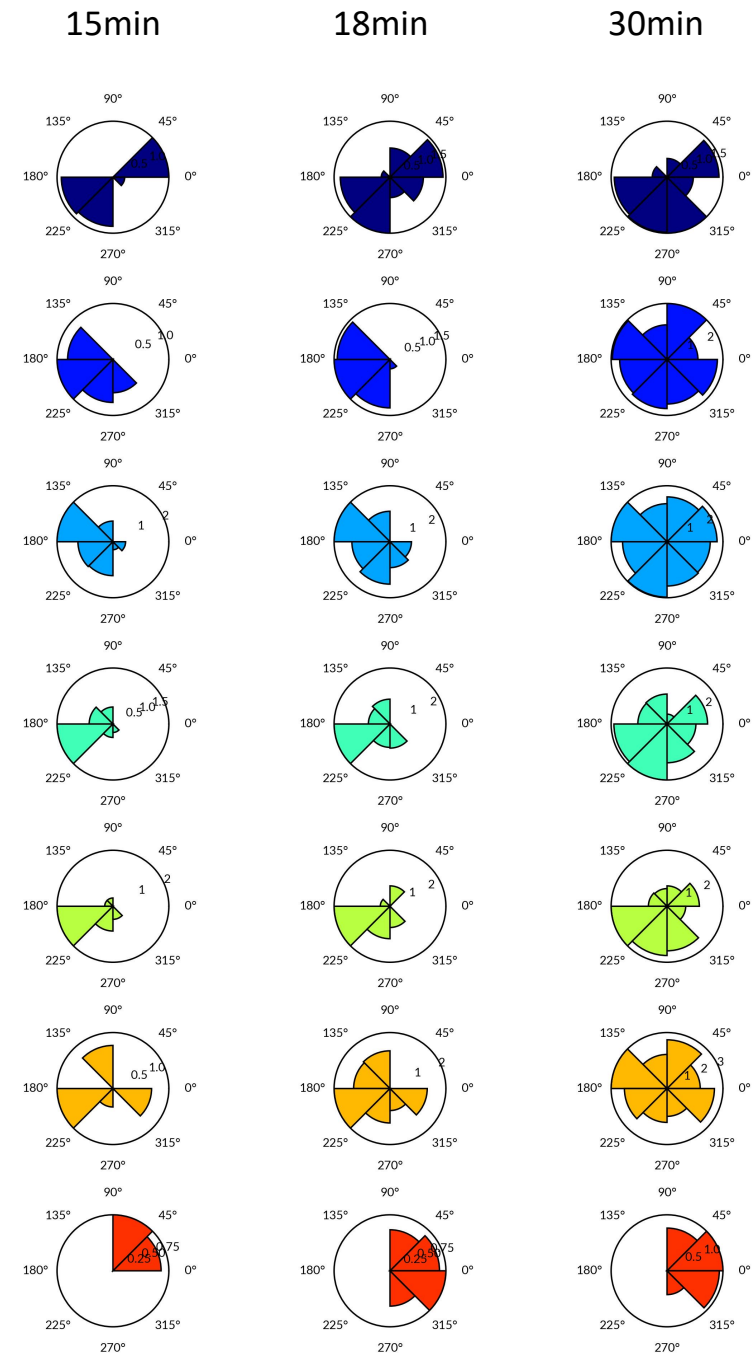
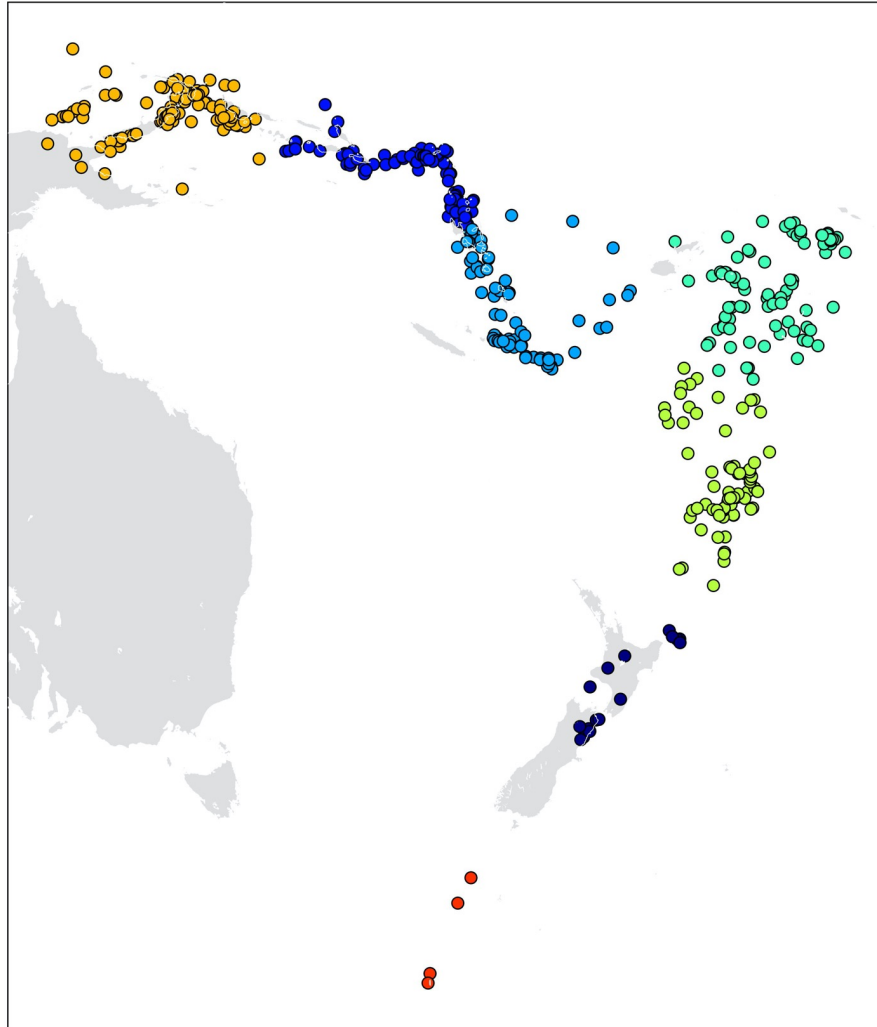
# Regional Magnitude estimation vs. depth



# Regional Magnitude estimation vs. Distance (USGS – SCWPHASE)



# Regional Azimuthal gap



Log scale!

# Summary

- We are close to having ability to generate 18-minute Mww sufficient for robust regional TEW in SW Pacific but the major limitation is data availability.
- IRIS data is currently insufficient. Main limitation is azimuthal coverage gap - we need broader coverage in PICs to deliver 18 (or possibly 15!) minute w-phase earthquake magnitudes.
- Patchy network around SW-Pacific
- Overall good estimation of magnitude within target times

# Recommendations

It is recommended that the WG2 SW Pacific seismic data sharing task team:

- **Considers** supporting full real-time release of all available continuous seismic data recorded in the region to support DECADE of OCEANS goal #2, leading to key outcomes “safe and transparent” oceans.
- **Note** the ability of regional Mww to deliver robust magnitude and centroid estimations within 20 minutes of the event.
- **Encourage** the development of TEW initiatives based on the use of regional Mww.
- **Consider** opportunities to support collaboration between the PIC to enhance local ability to generate Mww.