WAMSI Conference 2011

6.1 Storm surge climatology and sea level variability for WA

Ivan Haigh, Matthew Eliot and Chari Pattiaratchi

The University of Western Australia

western australian marine science institution

1. Introduction (Aim)

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What will this beach look like in 2100?

1. Introduction (Scales)

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TEMPORAL SCALE

MEGA decades - centuries

wave/surge climate change

mean sea level variability and rise

tidal modulations 18.6 yr

MACRO months - years

seasons
summer
winter

atmospheric variability
ENSO
SAMI

Leeuwin current

MESO hours - days

swell

tides

storms

sea breezes

BEACH VARIABILITY

SPATIAL SCALE

MEGA > 100 km

MACRO km - 10 km

MESO m - km

2. Sea Level (past)

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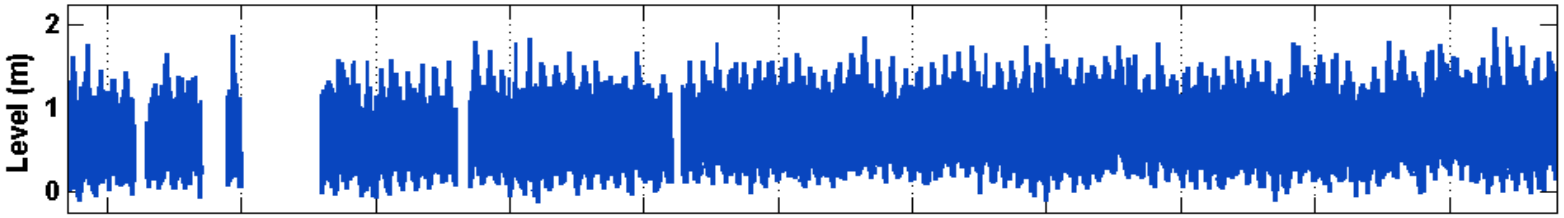
Fremantle tide gauge record (1897-2008;112 yrs);



Observed Water level

2. Sea Level (past)

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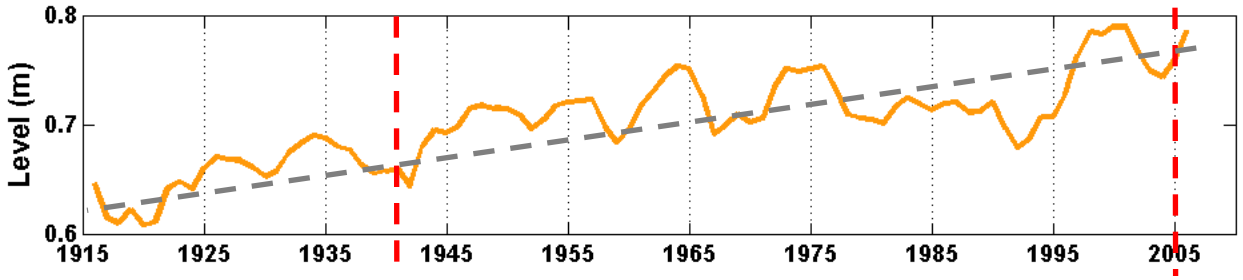
Fremantle (5 yr running means)



Mean Sea Level

2. Sea level (Future)

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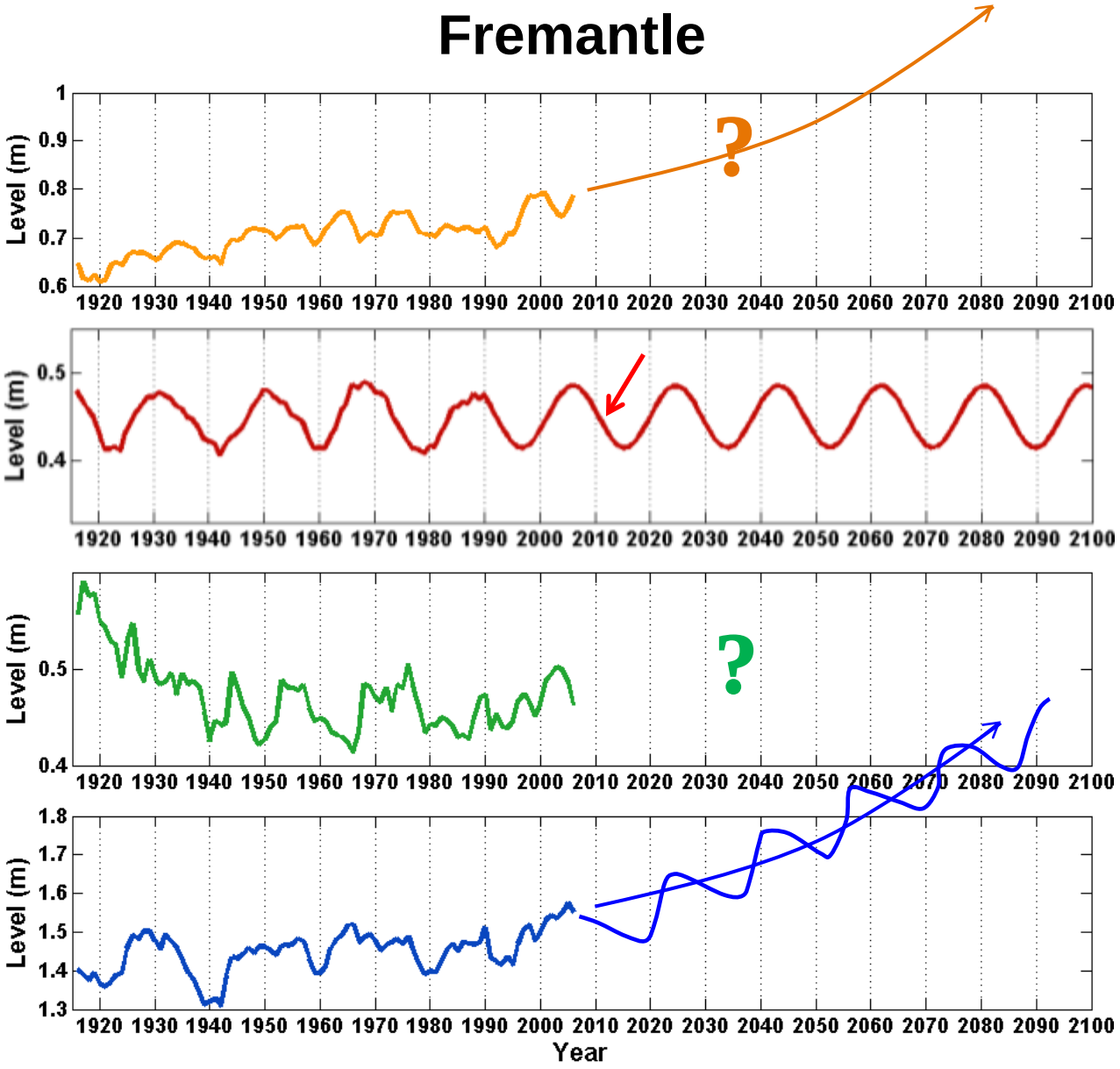

Mean Sea Level

Astronomical Tide

Storm Surge

Observed Tide

3. Models (past/future)

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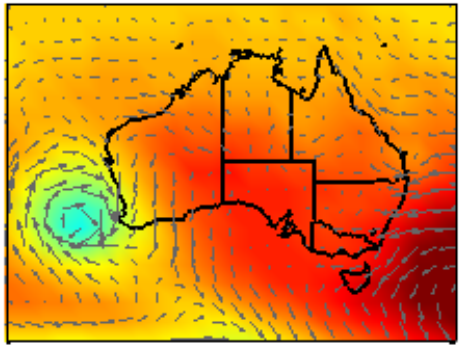
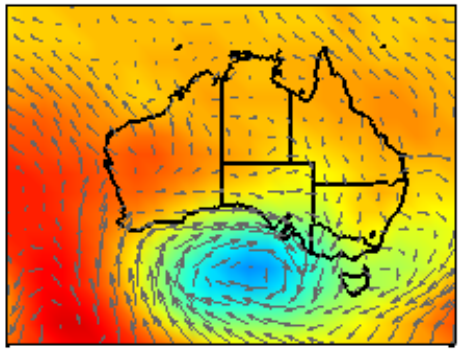
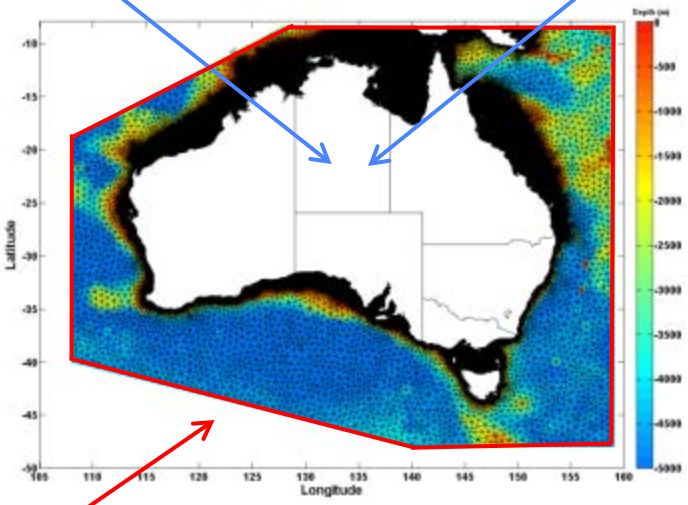
NCEP: 1949-2009

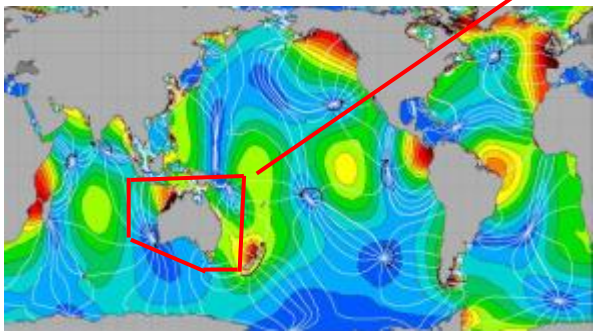


GCM (A2): 2081-2100

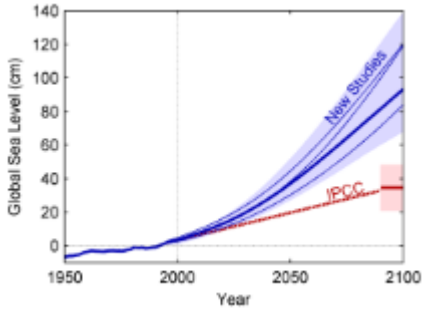




Global tidal model



MSL Projections



Past/present conditions

Future conditions

3. Models (present)

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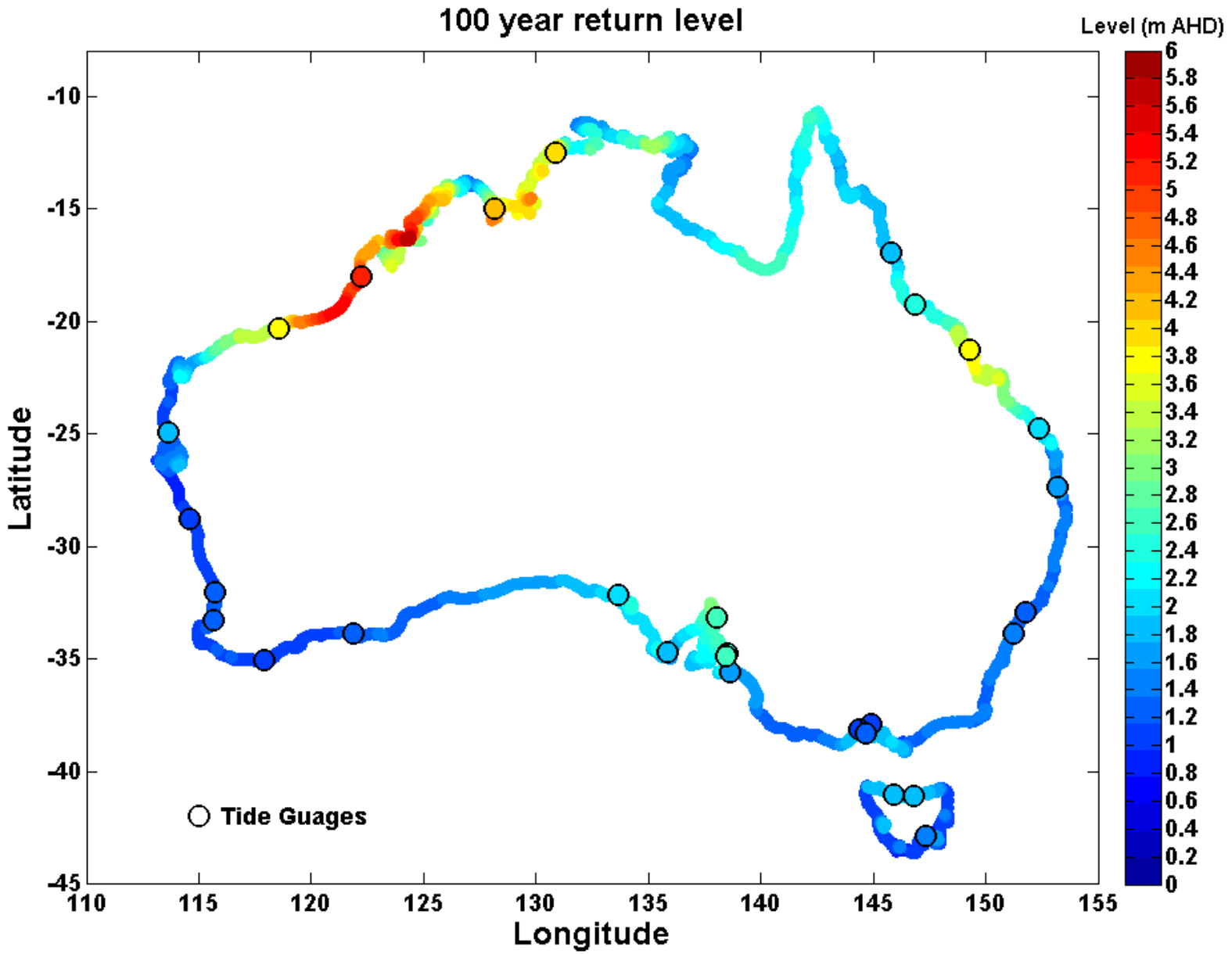
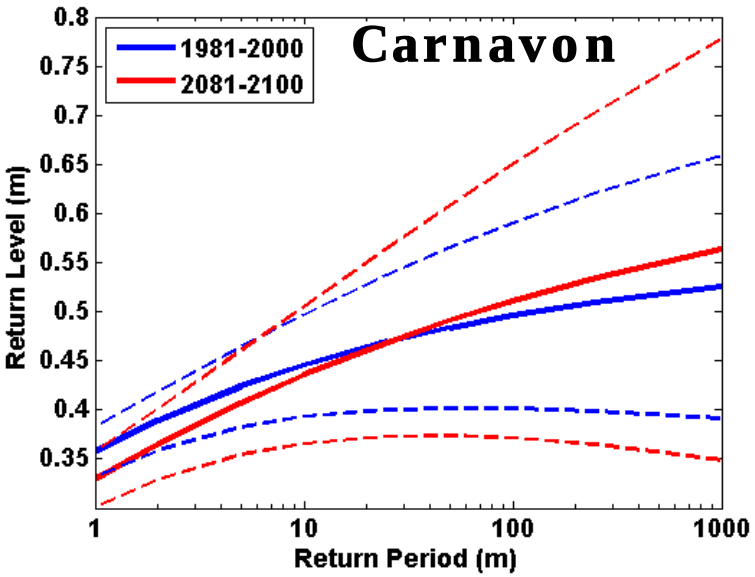


3. Models (future – Prelim.)



3. Models (future)

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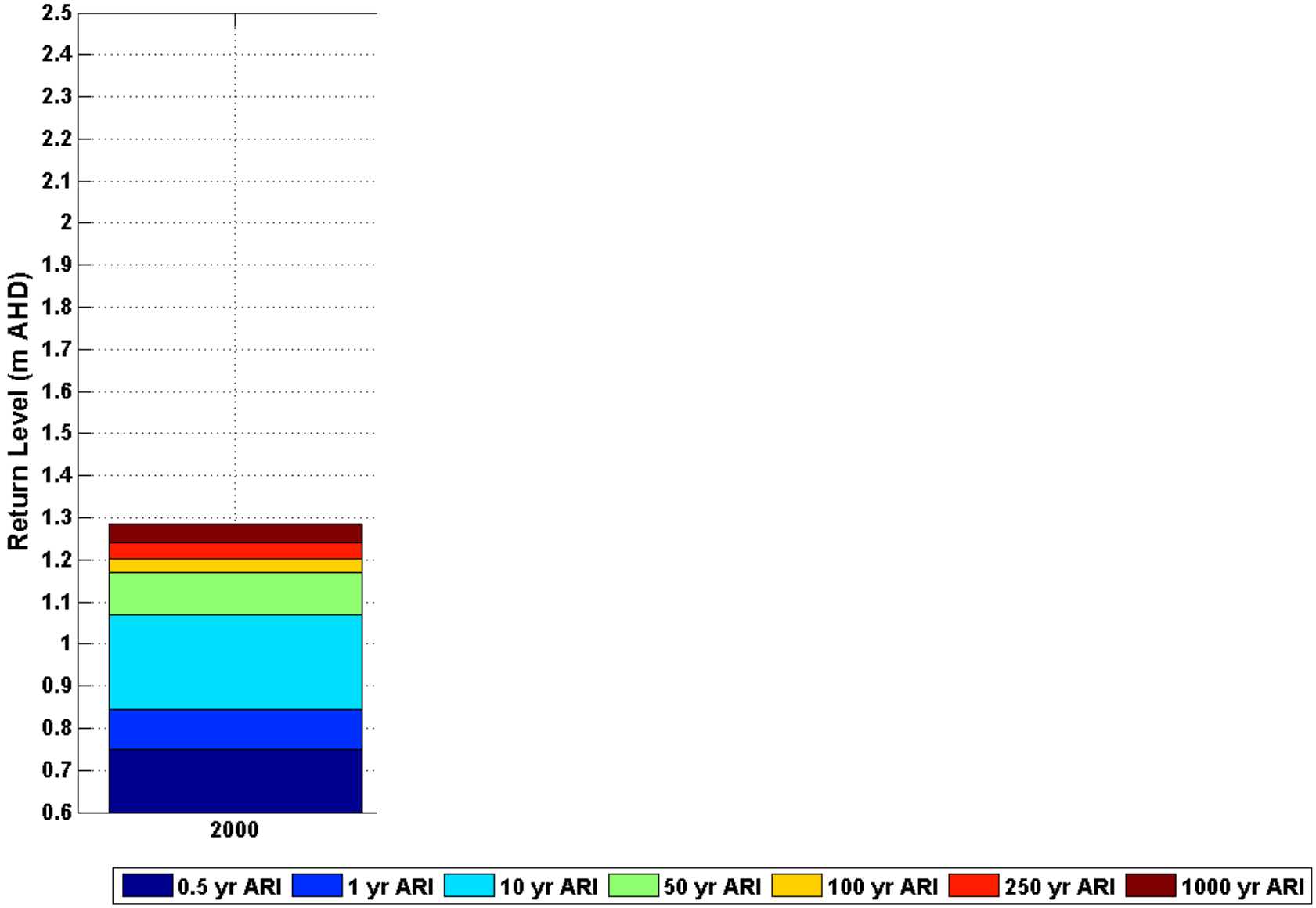

3. Models (Future)

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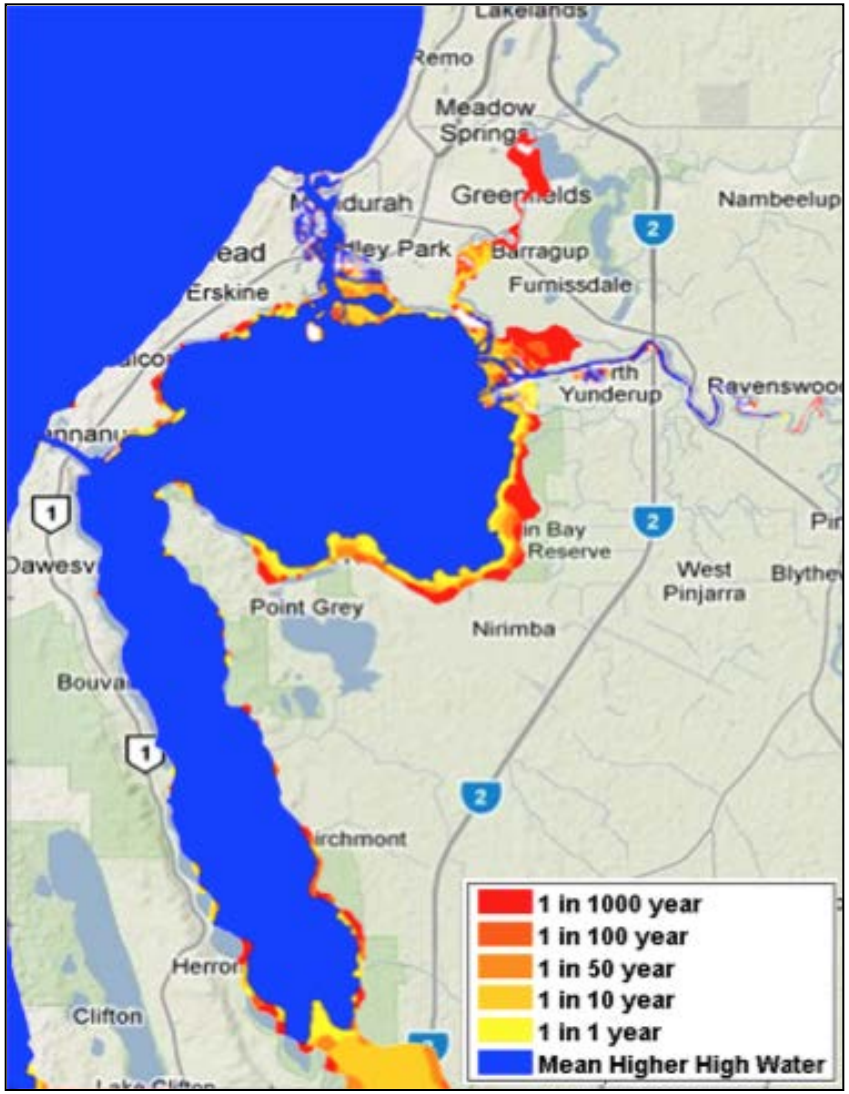
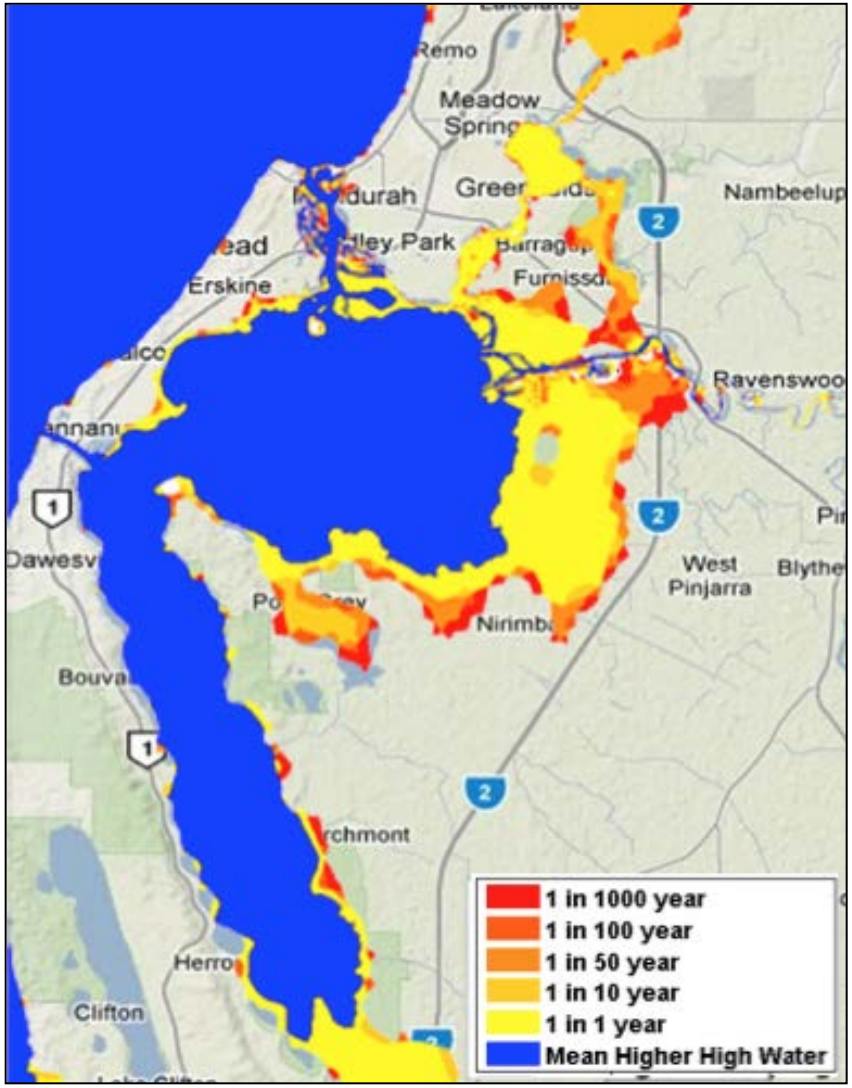
Present day



1.0m sea level rise



4. Conclusions

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1. **Extreme events happen and have always happened, but we are becoming increasingly vulnerable;**
2. **Extreme events arise as a combination of several different physical processes (not just storm surges);**
3. **Extremes have increased over 20th century due to rises in mean sea level (considerable inter-annual variability), no increase in storminess;**
4. **Extreme events will increase in the future, primarily due to rises in mean sea level. Decrease in next 10 years due to nodal cycle. Not the time to complacent.**

5. Outcomes

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1. Haigh, I.D., Pattiaratchi, C., 2010. 21st century changes in extreme sea levels around Western Australia. Proceedings of the 17th National Australian Meteorological & Oceanographic Society Conference, Canberra, Australia.;
2. Haigh, I.D., Eliot, M., Pattiaratchi, C., 2011. Global influences of the 18.61 year nodal cycle and 8.85 year cycle of lunar perigee on high tidal levels, J. Geophys. Res., 116, C06025, doi:10.1029/2010JC006645;
3. Haigh, I.D., Eliot, M., Pattiaratchi, C., 2011. Regional changes in mean sea level around Western Australia between 1897 and 2008. Proceedings of Australasian Coasts and Ports Conference, Perth, Australia (28-30 Sep 2010).
4. Haigh, I.D., Eliot, M., Pattiaratchi, C., in prep. Changes in the storm surge climate of southwest Australia. Plan to submit to Ocean Dynamics;
5. Pattiaratchi, C., Eliot, M., Haigh, I.D., Wijeratne, E.M.S., in prep. Physical Processes controlling tidal and non-tidal sea level variability in Western Australia. Plan to submit to Progress in Oceanography or Continental Shelf Research.

15 presentations at conferences, workshops, symposiums and invited seminars

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