6.1 Storm surge climatology and sea level variability for WA

Ivan Haigh, Matthew Eliot and Chari Pattiaratchi
1. Introduction (Aim)

What will this beach look like in 2100?
1. Introduction (Scales)

- Wave/surge
- Climate change
- Mean sea level variability and rise
- Tidal modulations 18.6 yr
- Seasons
  - Summer
  - Winter
- Atmospheric variability
  - ENSO
  - SAMI
- Leeuwin current
- Swell
- Tides
- Storms
- Sea breezes

Temporal Scale:
- MEGA: decades - centuries
- MACRO: months - years
- MESO: hours - days

Spatial Scale:
- MEGA: > 100 km
- MACRO: km - 10 km
- MESO: m - km
2. Sea Level (past)

Fremantle tide gauge record (1897-2008; 112 yrs);
2. Sea Level (past)

Fremantle (5 yr running means)

Mean Sea Level
2. Sea level (Future)

Fremantle

Mean Sea Level

Astronomical Tide

Storm Surge

Observed Tide
3. Models (past/future)

NCEP: 1949-2009

GCM (A2): 2081-2100

Global tidal model

Past/present conditions

Future conditions

MSL Projections
3. Models (present)
3. Models (future – Prelim.)

![Graph showing return levels for Carnavon with data for different periods: 1981-2000 and 2031-2100.](image)

- **Return Level (m)** on the y-axis.
- **Return Period (m)** on the x-axis.

The graph compares return levels for Carnavon with data from two different periods: 1981-2000 (solid blue line) and 2031-2100 (red dashed line).
3. Models (future)
3. Models (Future)

Present day

1.0m sea level rise
4. Conclusions

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 20\textsuperscript{th} 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


15 presentations at conferences, workshops, symposiums and invited seminars.
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