



NSW Tidal Anomaly -A Tidal Epoch Review


NSW Department of Commerce - MHL

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SUPPORTING


CONNECTING


DELIVERING VALUE




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Background


- 1992 Mid-NSW Tide- Storm Surge Analysis by MHL, based on 3-5years of data for 8 sites
- 2008 analysis commissioned by DECC, can now incorporate up to 20 years of data for 18 sites.
- Early stage of the study, now presenting some preliminary results.
- Purpose
 - Improved Accuracy and Confidence in the guideline values
 - Guideline values for many more sites across the state
 - Improve the presentation of results
 - Assess the measurable changes in tidal climate
 - Determine drivers of storm surge and relative impact on the NSW coast

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Purpose

- Project Drivers
 - Support DECC Estuary, Coastal and Floodplain management programs
 - Design Water Level (planning & coastal structures)
 - Shoreline stability
 - Navigation and Port Operations
 - Event-based Environmental and Aquaculture impacts
- Data:
 - DECC Network maintained by MHL
 - 4 Offshore tide gauges (pressure transducer)
 - 14 Near-shore tide gauges
 - 7 Waverider buoys
 - 250+ Estuary Flood gauges
 - 100+ Rainfall gauges
 - Sydney Ports Authority – Fort Denison data from 1914
 - Bureau of Meteorology - BLUElink and wind data






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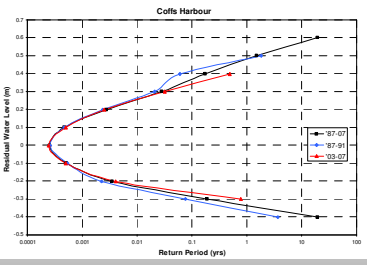
Known Anomaly Drivers

- Barometric Setup
- Coastally Trapped (Shelf) Waves
- Ocean Currents and Eddies
- Temperature and Salinity gradients
- Southern Oscillation Index (ENSO)
- Wind Setup
- Wave Setup
- Transient Response to drivers
- Bathymetric Effects
- Tsunami
- Others?

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1992 & 2008 results compared

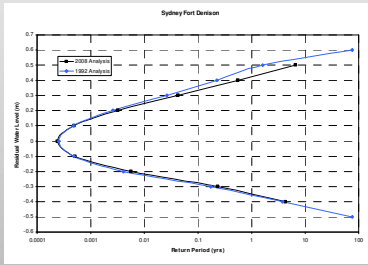


- A change in tidal residual over time would be an indicator of climate change
- Similar results for short return periods, but variation in return period for extreme events
- Important to provide an analysis of the uncertainty of the design levels

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Fort Denison Residual Return Period

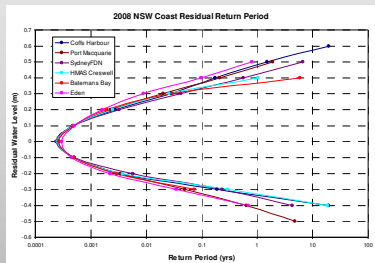


- Very similar results to the original analysis, as we would expect for long datasets

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Tidal Residual Return Period

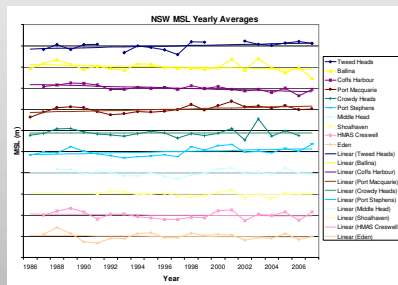


- Good correlation between sites along the coast
- Events are more common at north and south extents
- Joint probability analysis will provide design levels at many locations along the coast

Harmonic Analysis

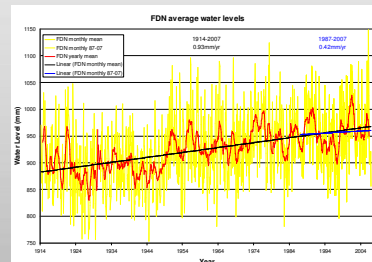
- Harmonic components:
 - 24.8hr (lunar day)
 - 27day (longitude of the moon)
 - 1yr (longitude of the Sun)
 - 8.8yr (lunar perigee)
 - 18.6yr (moons ascending node)
 - 21000yr (solar perigee)
- Gives us constituents: M2, S2, K1, O1, etc
- Tidal planes derived from constituents, eg MHWS = Z0 + M2 + S2
- Forecast tides based on constituents
- Residual (Anomaly) WL = Measured WL - Predicted WL
- Tide climate varies on very long cycles

MSL trends



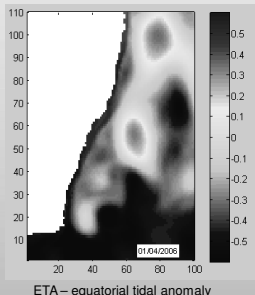
- No consistent trend in MSL for various sites across the state
- Highlights the importance of local effects within global trends

Long Term Fort Denison



- Trend for monthly mean: 0.93mm/yr
- Trend for last 20 years 0.42mm/yr
- Global rise: 3.3mm/yr for 15yrs
- IPCC forecast SLR: up to 0.91m for 100yrs

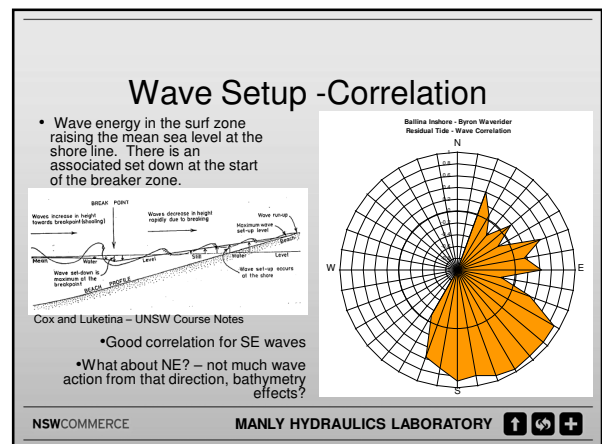
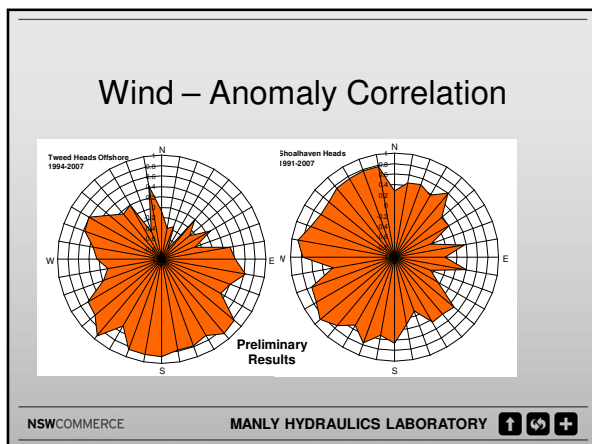
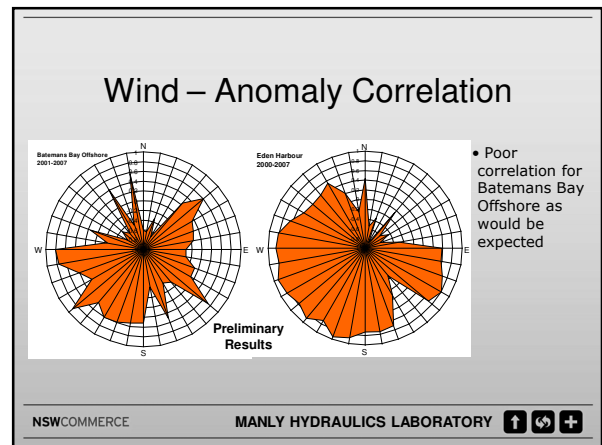
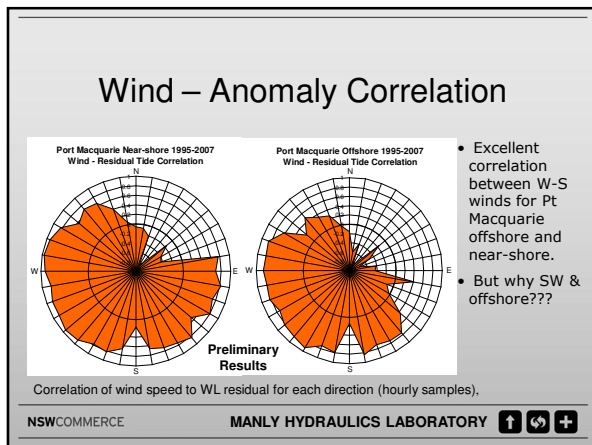
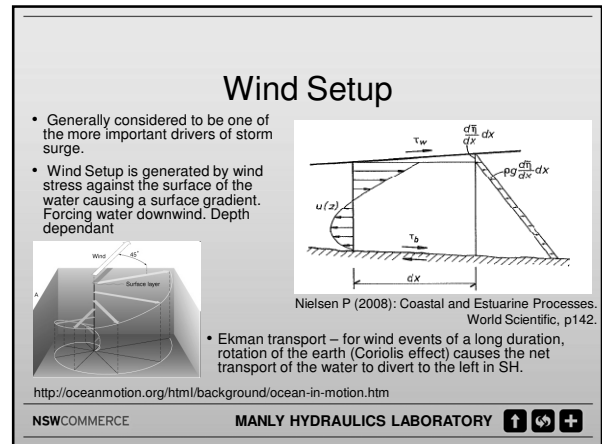
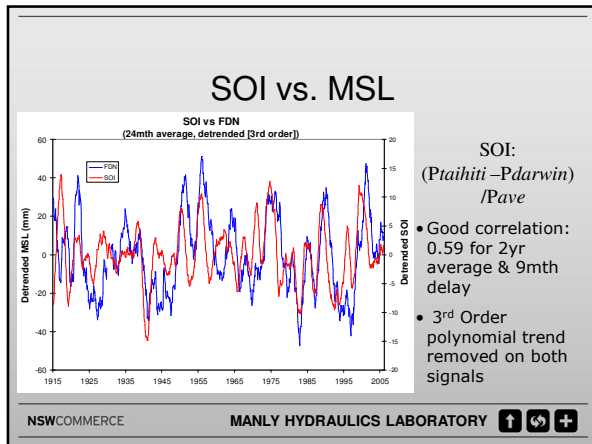
BLUElink



- Developed by BoM, CSIRO & RAN
- 10km grid with twice per week forecasts
- Inputs:
 - Satellite, Drifters (surface and sub-surface), buoys, tide gauges, ship data, weather stations
- It models:
 - Currents, SST, MSL, Salinity
- More information: <http://www.bom.gov.au/bluelink/>

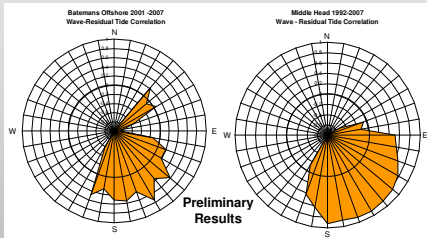
BoM BLUElink

- Includes the effects of wind & wave setup, barometric effects, rainfall, ocean currents, temp & salinity, shelf waves, etc
- Understanding of drivers
- Prediction of anomaly events
- Improve extrapolation between locations
- But is a model, and strongly reliant on actual measurements. Future design levels reliant on data and models of long term changes.



Wave Setup -Correlation

- Poor correlation for Batemans offshore tide gauge. We would not expect wave setup at a station outside the breaker zone
- But, Middle Head also shows a correlation, even though its not expected to have wave setup... some cross correlation?



Preliminary Results

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Conclusions

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