



Changing Waves and Coasts in the Pacific

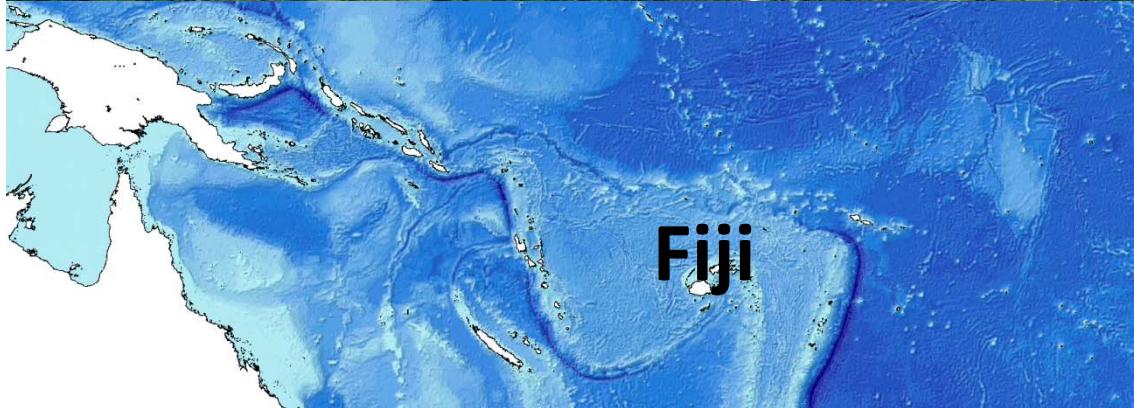
Wave inundation hindcasting and forecasting on fringing reefs – The Coral Coast of Fiji

Cyprien Bosserelle, Herve Damlamian, Jens Kruger

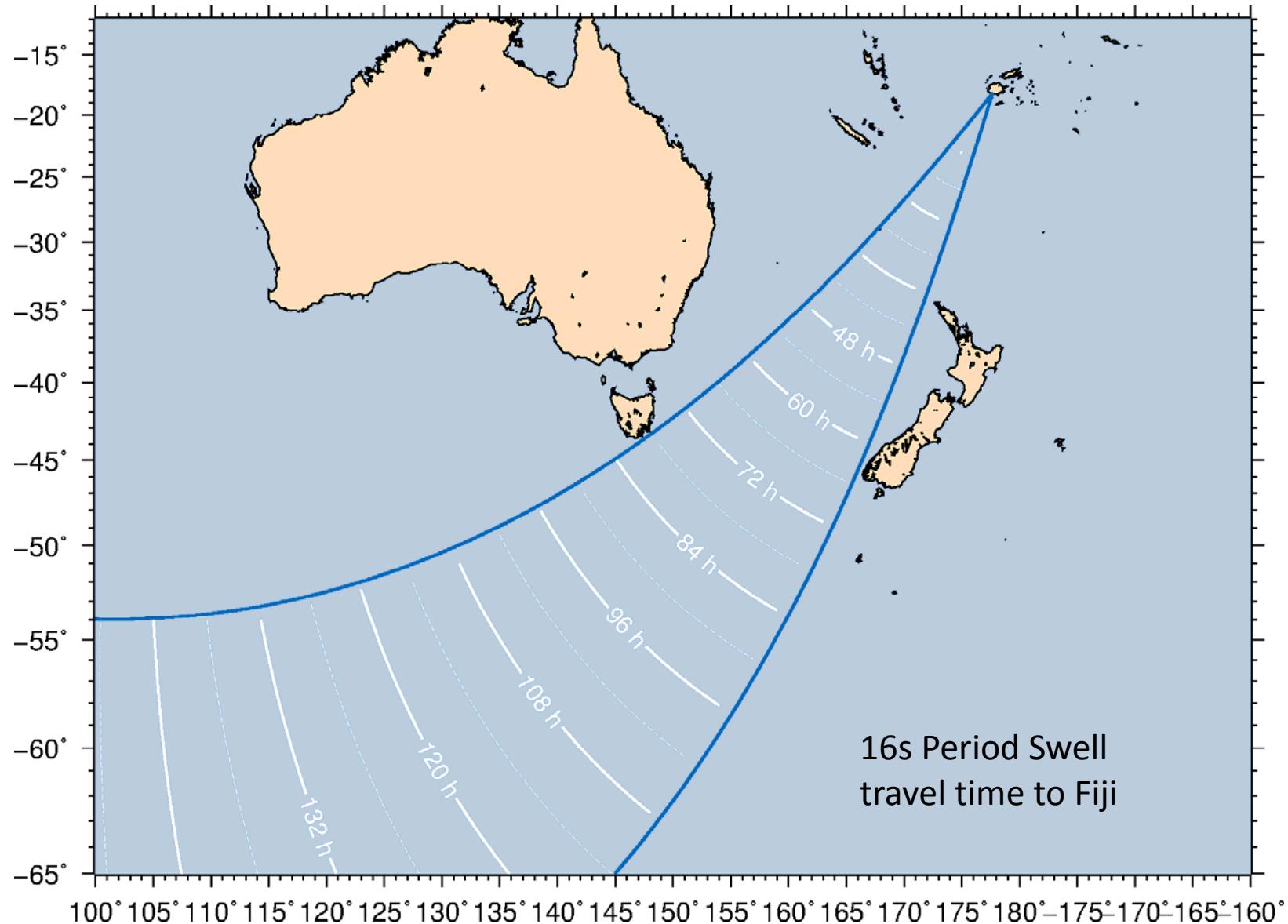


14th International Workshop on Wave Hindcasting and
Forecasting/ 2nd International Storm Surge Symposium

Fiji Coral Coast

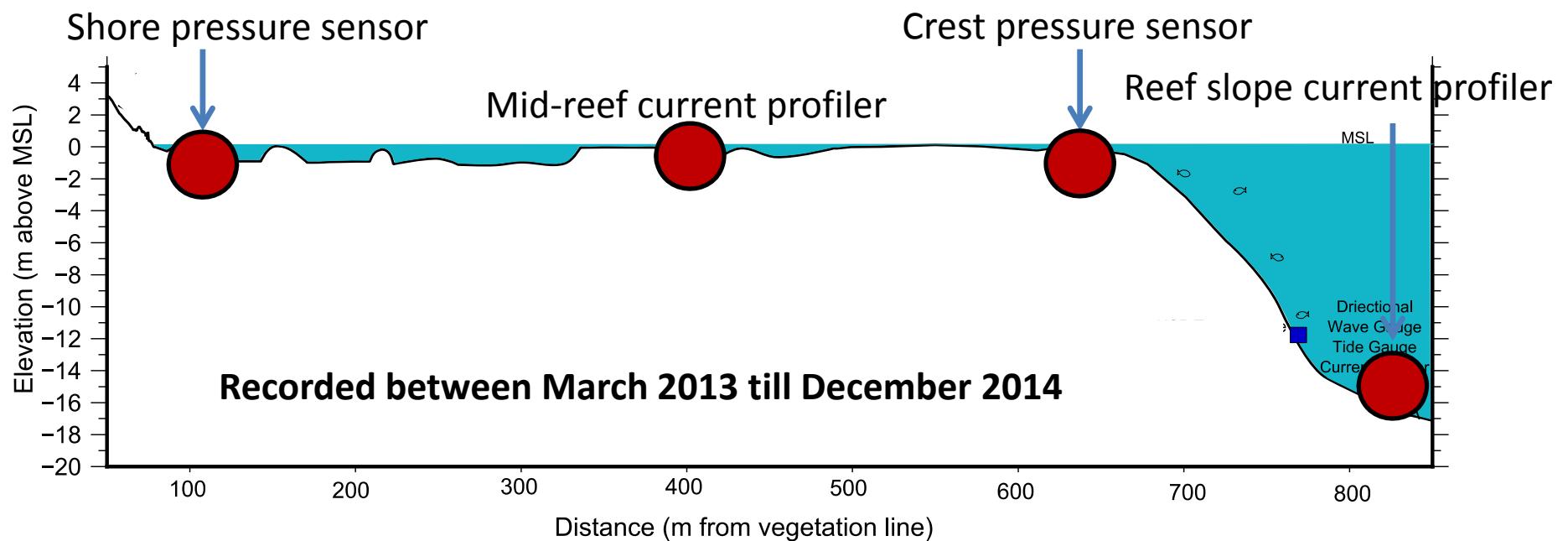
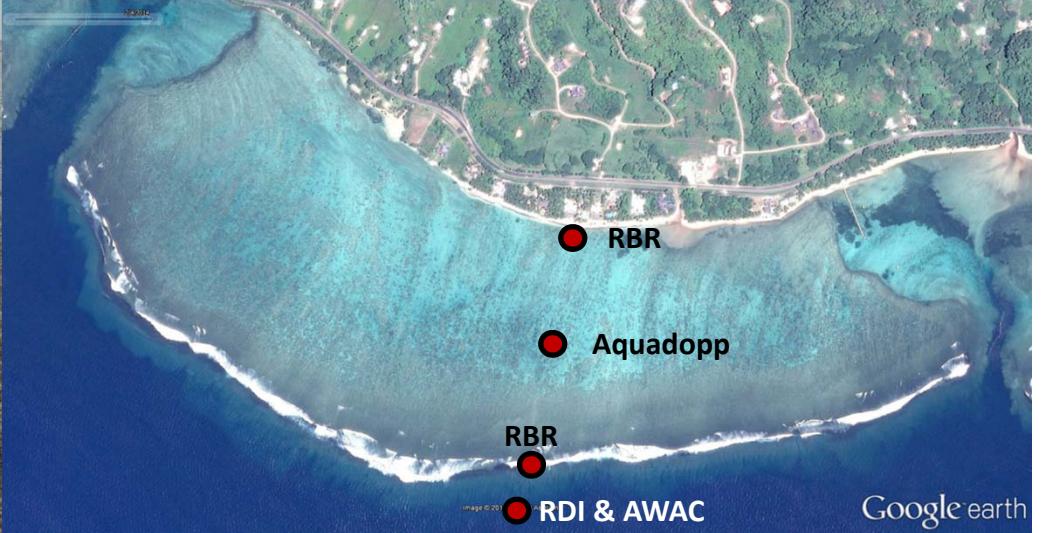


Swell window for Fiji Coral Coast





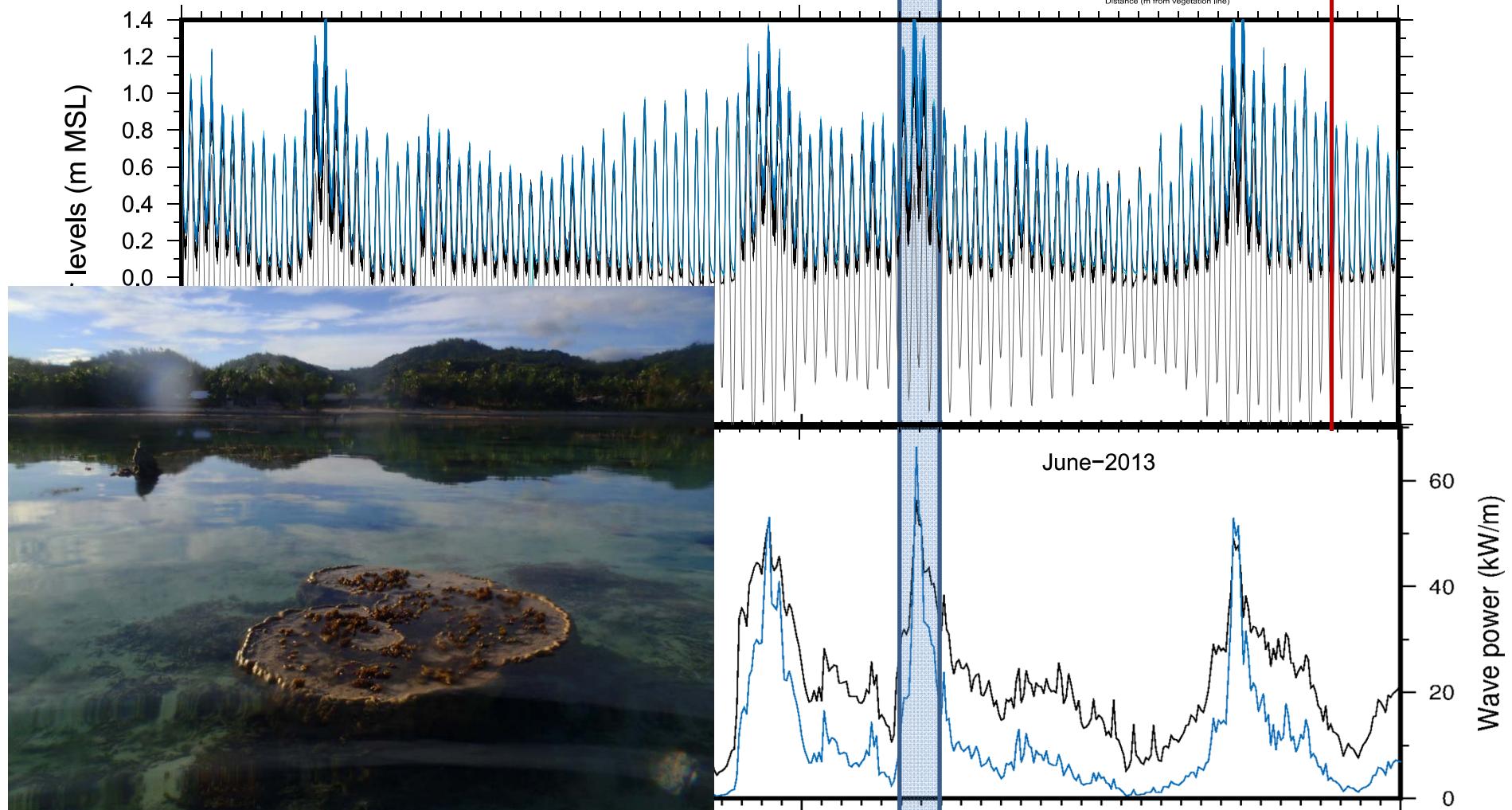
Methods – Field data collection



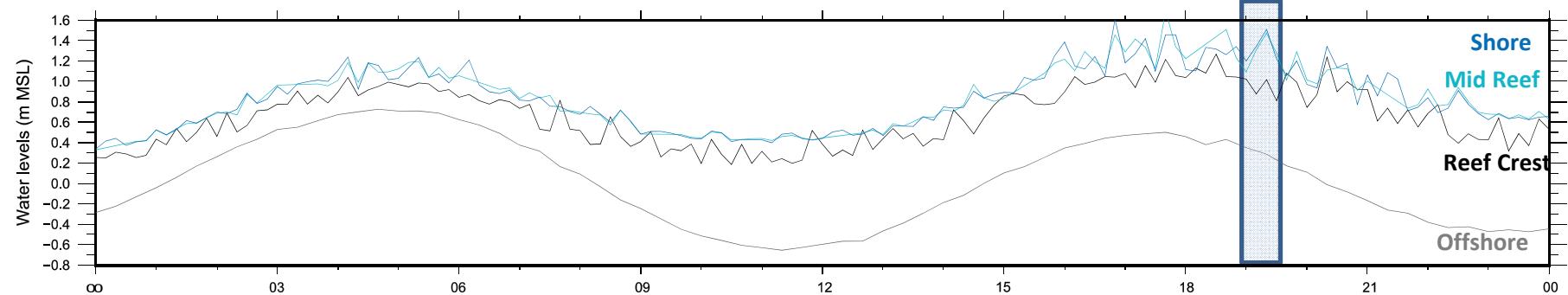
Results – Water levels data summary



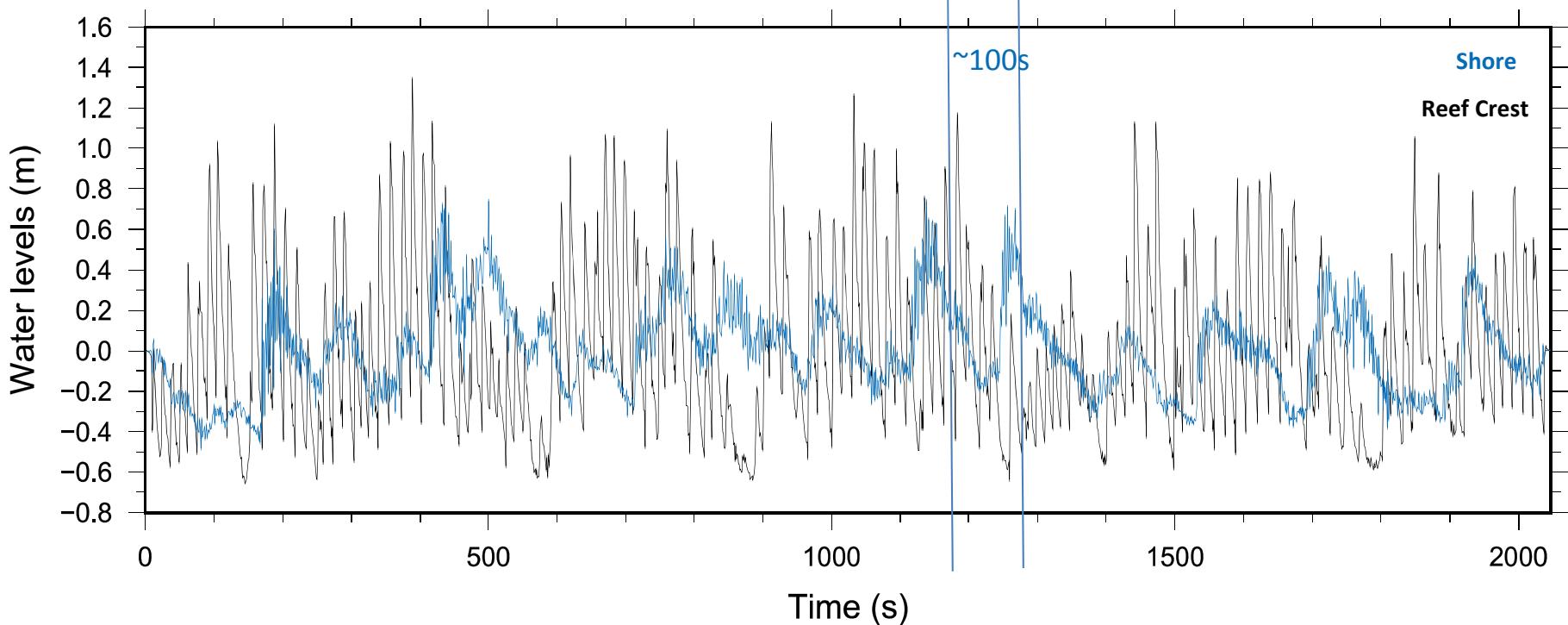
- No low tide inside the reef flat
- Wave set-up uniform across the reef flat



Results – Wave transformation 06-06-2013



$H_{rms, \text{Crest}} = 0.76$; $H_{rms, \text{Shore}} = 0.20$; $H_{\text{Crest}} = 1.1 \text{m}$; $H_{\text{Shore}} = 0.82 \text{m}$



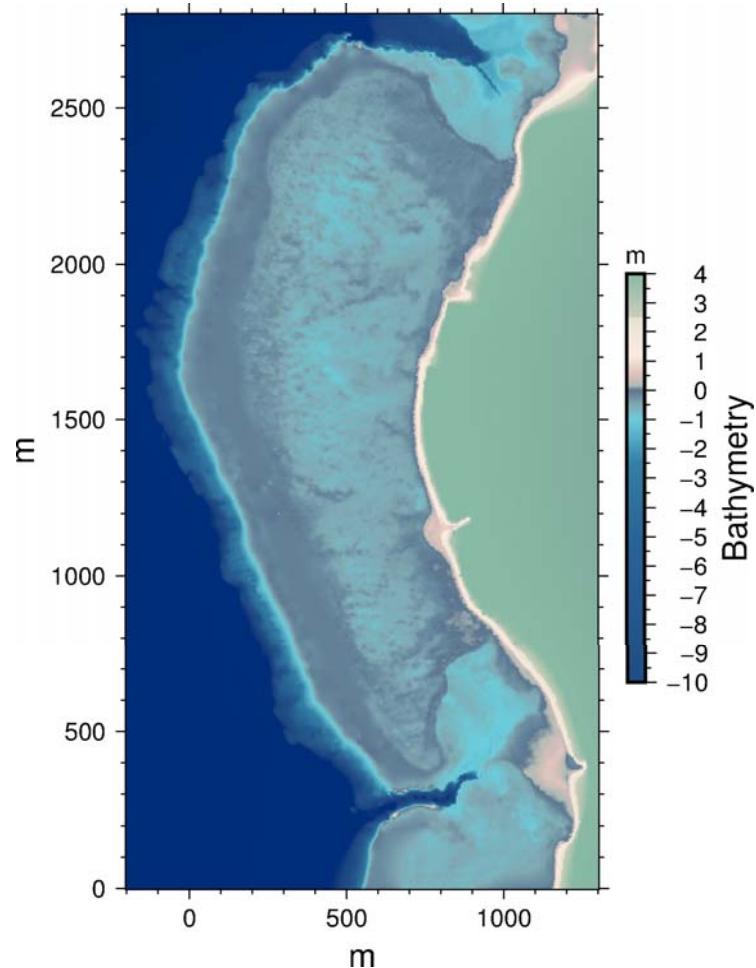
Methods: Numerical model description



XBeach GPU: Lightweight CUDA C version for NVIDIA GPU

Source code available at:

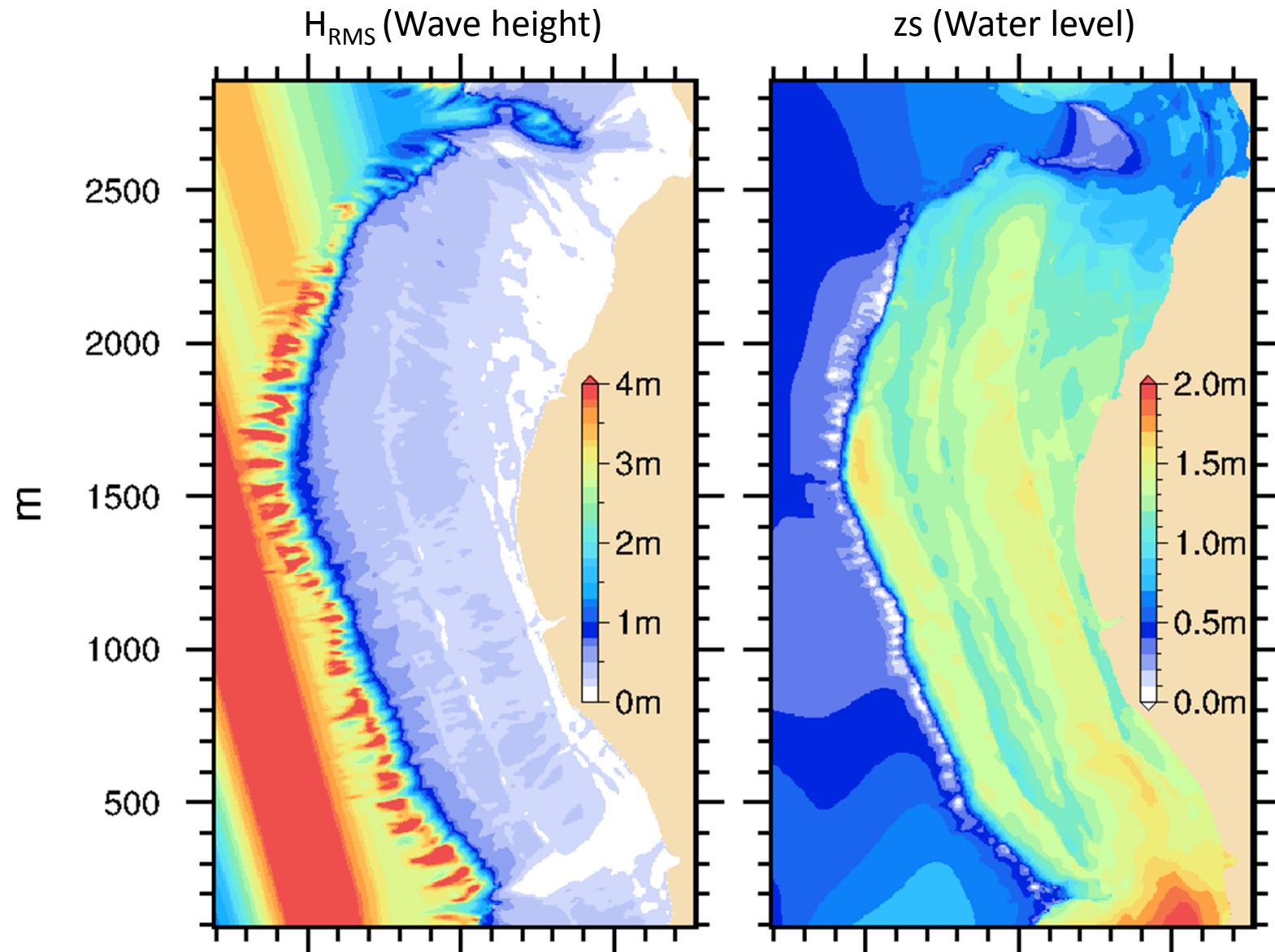
https://github.com/CyprienBosserelle/xbeach_gpu/



- Merged bathy/topo datasets
Multi beam, single beam, RTK, Photogrammetry, Satellite derived bathymetry
- 5m resolution
352x576
- Uniform bottom roughness
 $C_f=0.025$; $f_w=0.15$

Input : measured waves and water level on the reef slope.

Results – 06-06-2013 Simulation



Results – Summary for 06-06-2013 event



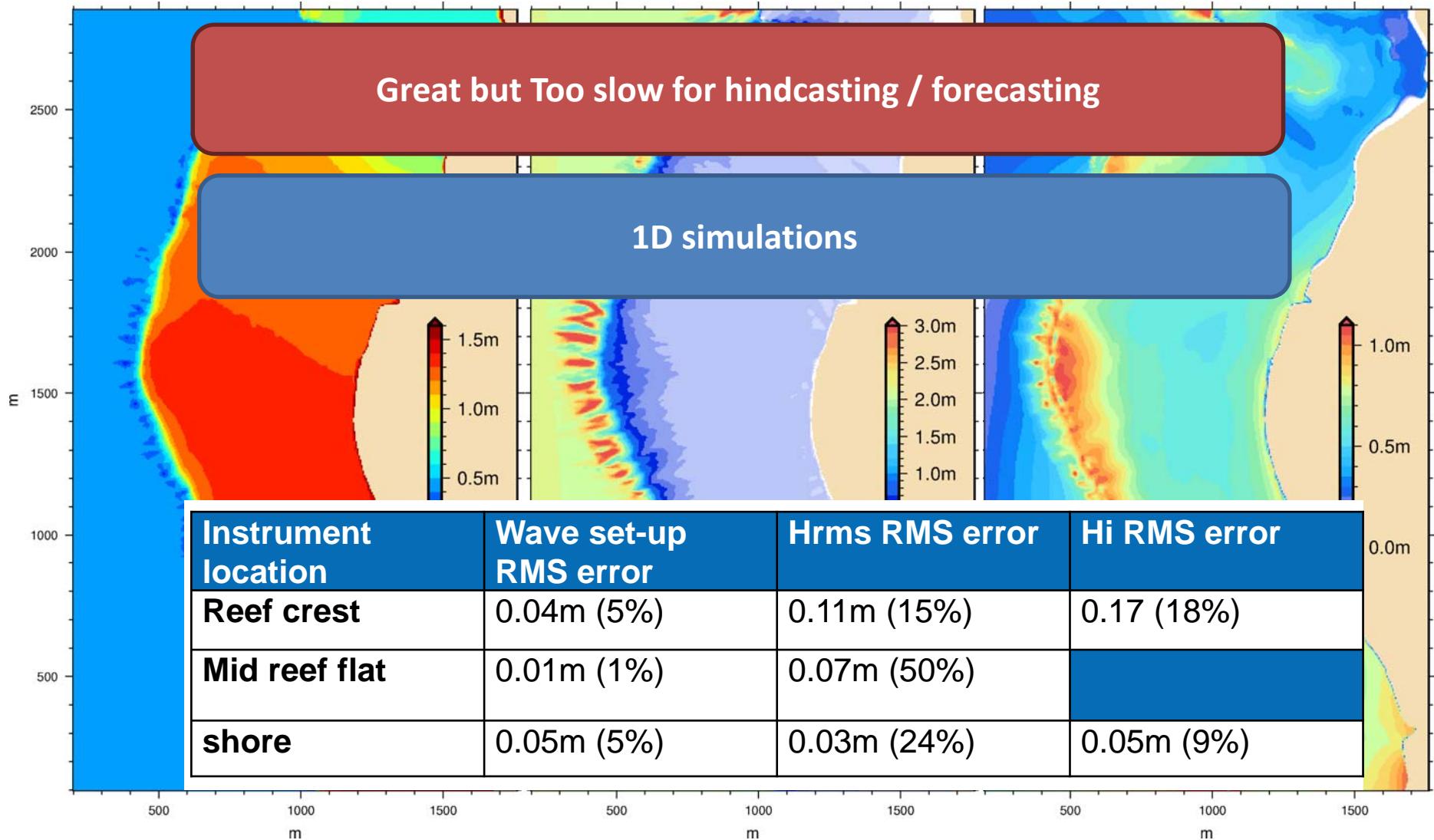
Mean Water Level

Mean H_{RMS}

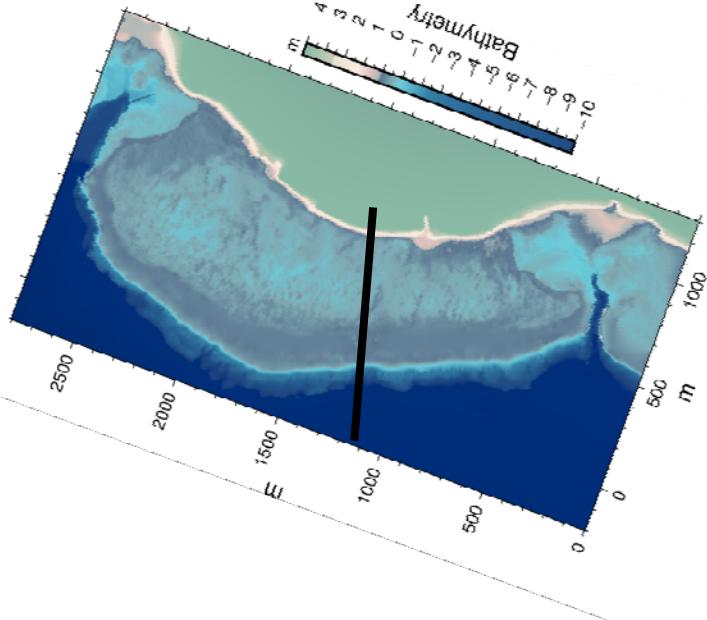
Mean H_{IG}

Great but Too slow for hindcasting / forecasting

1D simulations



1D Wave model look-up table



Parameter	Range	19,008 runs
Wave height	0.5m to 6m every 0.5m	
Wave period	6s to 20s every 2s	
Wave direction	170° to 230° every 20°	
Water level	-1m to 1.1m every 0.1m (MSL)	

Interpolate output for past/future wave/water level conditions

Output:

- Mean water levels
- Max water levels
- Wave height
- IG wave height

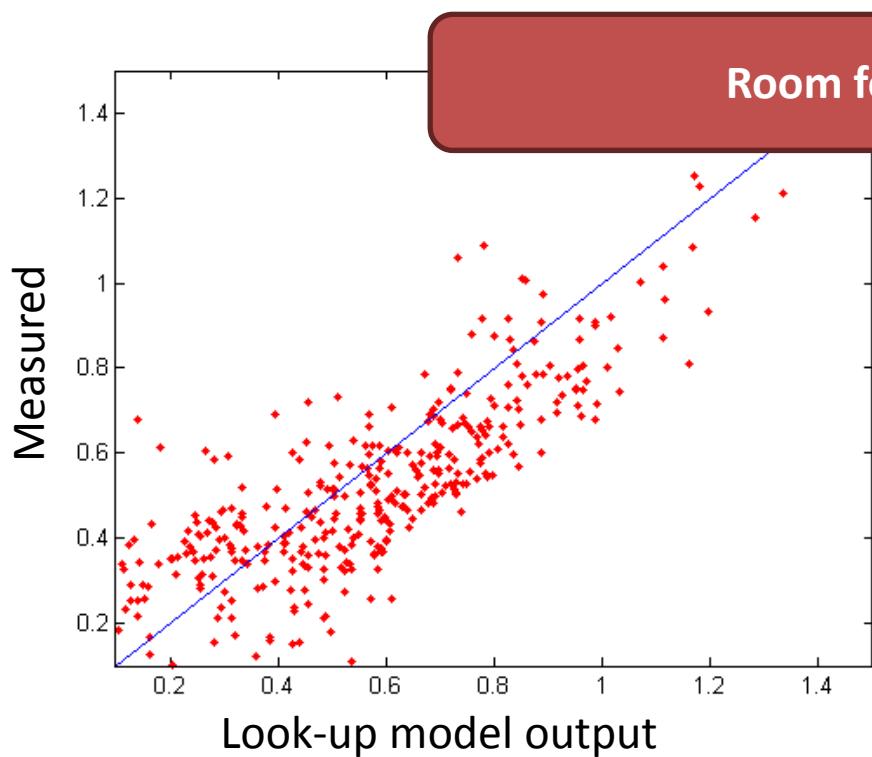
Wave condition on the reef slope

Water level on the reef slope

Validation for 2013 data for Maui Bay

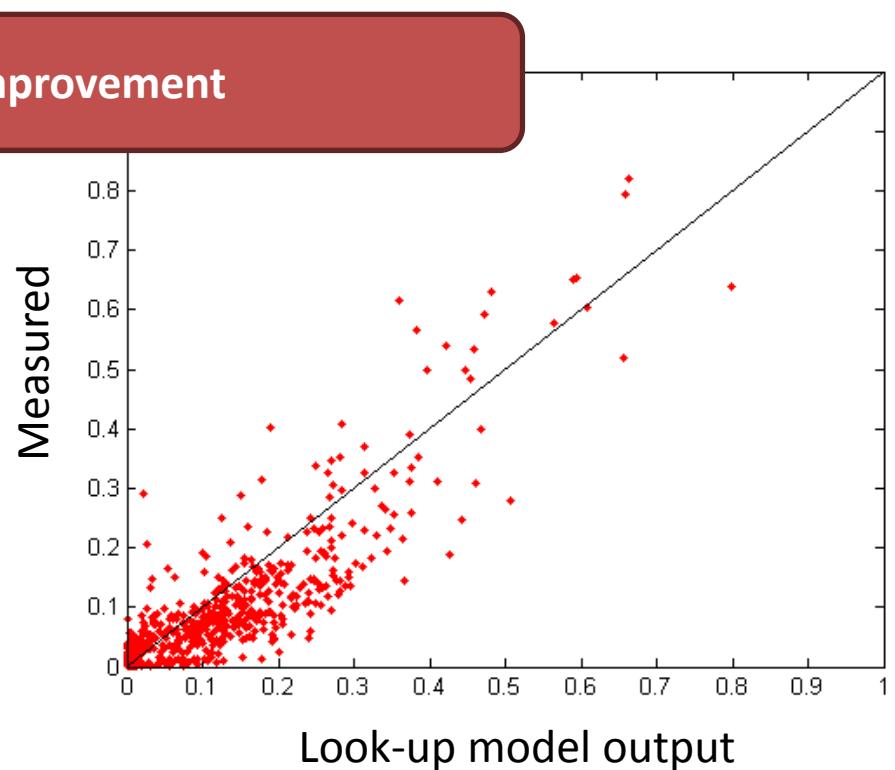


30min avg Water level validation



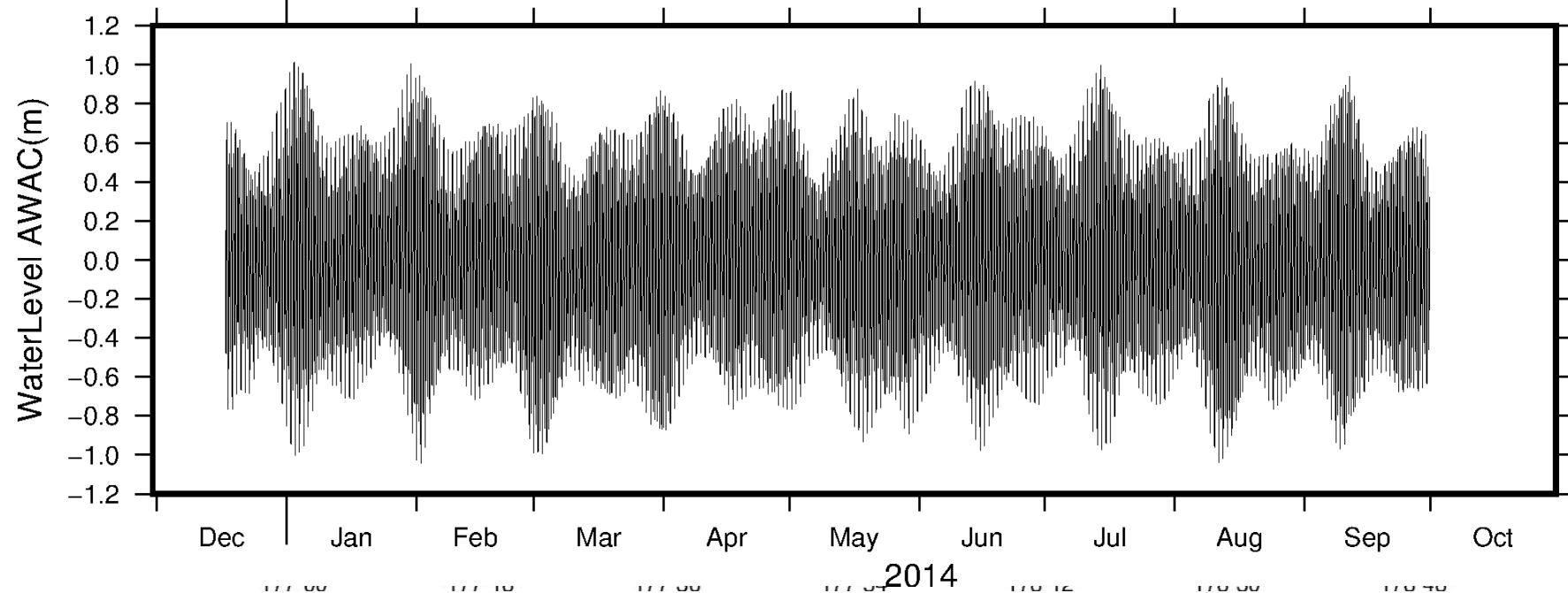
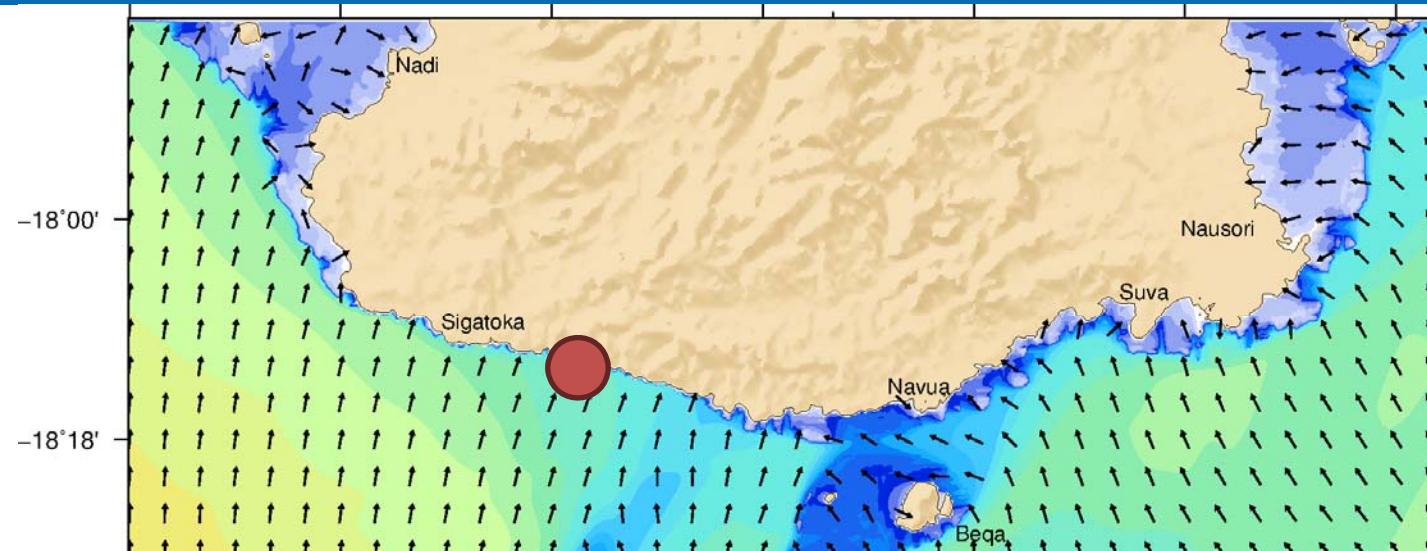
Skill: 0.91
RMS=0.17m
Bias=0.04m

IG wave height validation



Skill: 0.92
RMS=0.07m
Bias=-0.02m

WACOP South West Fiji wave hindcast



Inundation hindcast for Maui Bay 1979-2012



Rank	Date	Hs	Tp
1	06-06-1986	4.34	18
2	28-07-1992	3.85	18
3	04-06-1996	3.19	15
4	11-08-2002	3.25	15
5	20-05-2011	3.45	18
6	06-09-2003	4.27	18
7	07-07-2003	3.55	15
8	16-07-2006	3.61	18
9	15-06-2006	3.25	15
10	07-07-2008	3.45	15

LIVING IN FEAR
HOME STONED PAGE 7

LONDON SEVENS
SAVOU FOR ENGLAND PAGE 76

The Fiji Times Fiji's Own Paper SATURDAY, MAY 21, 2011 62 PAGES 90x110 THE FJ'S NEWSPAPER PUBLISHED IN THE WORLD EVERY DAY

Coast swamped

Sandy highway ... the waves reach the Queen's Highway as Ratu Ne makes his way to Vatukarasa Village yesterday.

By FELIX CHAUDHARY

ONE school has closed and a village dwelling was damaged as tidal surges entered hotel rooms.

Nadir Bay Kholas School was closed yesterday after the tide flooded its tennis courts and washed away fences while residents living in Nadir Bay Kholas Village scrambled to get to higher ground.

"Many of the unstructured children that were arriving to school were crying because they had to leave their parents," said Nadir Bay Kholas School headteacher Mr Yedua.

At nearby Yedua Village, the tidal surge destroyed temporary dwellings used as cooking houses as water raced them into the village.

"This morning from 6am to 8am, a series of waves washed over the village flooding the low coconut trees on the beach were uprooted and the crevices between the houses were completely destroyed."

Mr Kennedy said many unstructured children that were arriving to school were crying because they had to leave their parents.

"People living along the Oora River were also affected by the big swells over the next few days," he said.

"We have had bigger swells in the past," Mr Kennedy said.

Mr Kennedy, who is the meteorological services manager at the Meteorology Department in Nadi, said the swells were caused by a high pressure system moving from the South, intensified by the wind.

"We have issued a warning to people to stay away from coastal areas in Southern Viti Levu, Kadavu passage and Southern Lau Islands," he said.

At press time last night, police officers were still on guard in villages where people stood ready to move to higher ground if the waves intensified again.

TIDAL SURGE Giant waves flood hotel rooms

"Fijian is the word for what is happening to us," he said.

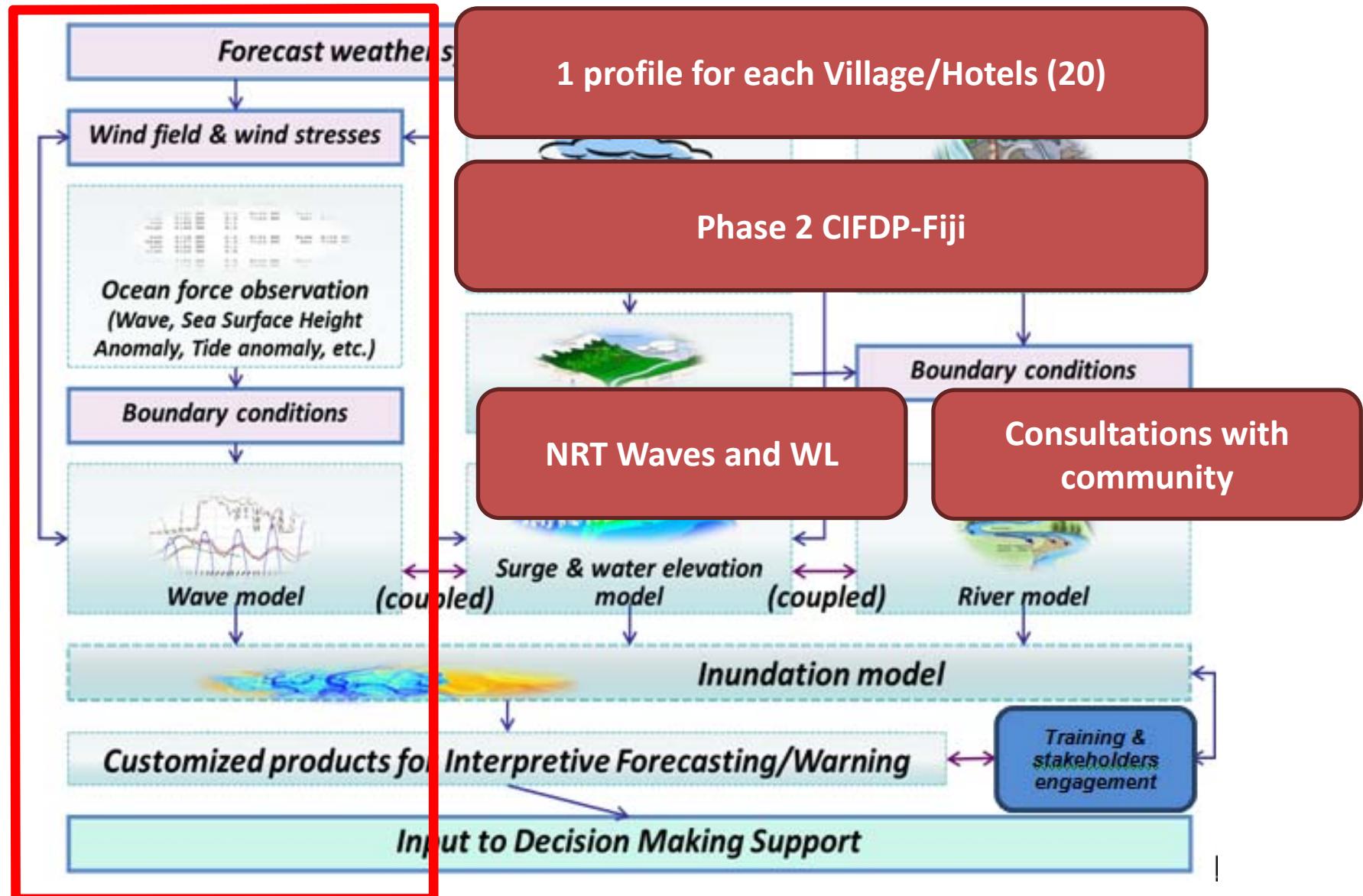
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More on PAGES 2-3

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Coastal Inundation Forecasting Demonstration Project Fiji



Next move forward



Swell events cause inundation on the Coral Coast, Fiji

- Wave setup and IG waves are causing the inundation
- Highly dependant on the reef morphology and beach topography
- Can a resonant forcing happen?
- Wave groups have a huge impact



We can design a better inundation forecast

- Numerical inundation model can be useful for operational use
- A lot of bathy, topo and modelling need to be done to apply to the all of the coral coast
- Needs additional verifications and calibrations



Need communities involvement to design suitable communication systems

- Based on a better understanding of Wave setup and IG waves
- Need to raise awareness with communities
- Visibility of the warning system needs to be raised (how?)
- Communication with hotels is very important





WACOP

Changing Waves and Coasts in the Pacific

Vinaka vakalevu!
Thank you!



Visit our website: <http://gsd.spc.int/wacop/>

Contact: cyprienb@spc.int