Supplementary Material

1 Supplementary figures

The supporting material provides:

Figure S1: Illustrates the atmospheric pressure, wind speed, and wind direction at the study site throughout the swell event.

Figure S2: Illustrates the synoptic patterns resulting in the large swell event.

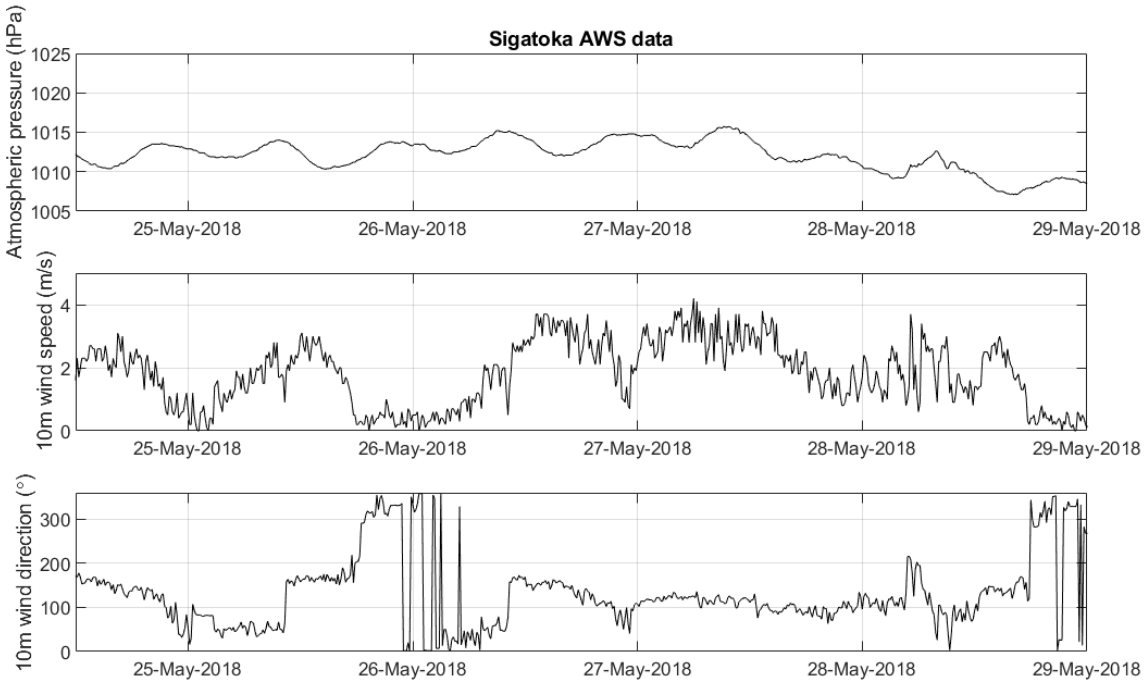
Figure S3: Illustrates the wave field in the South Pacific and Tasman sea leading up to and during the large swell event.

Figure S4: Illustrates the multivariate sensitivity analysis of the wave model.

Figure S5: Illustrates the root mean square error of all runs during the sensitivity analysis.

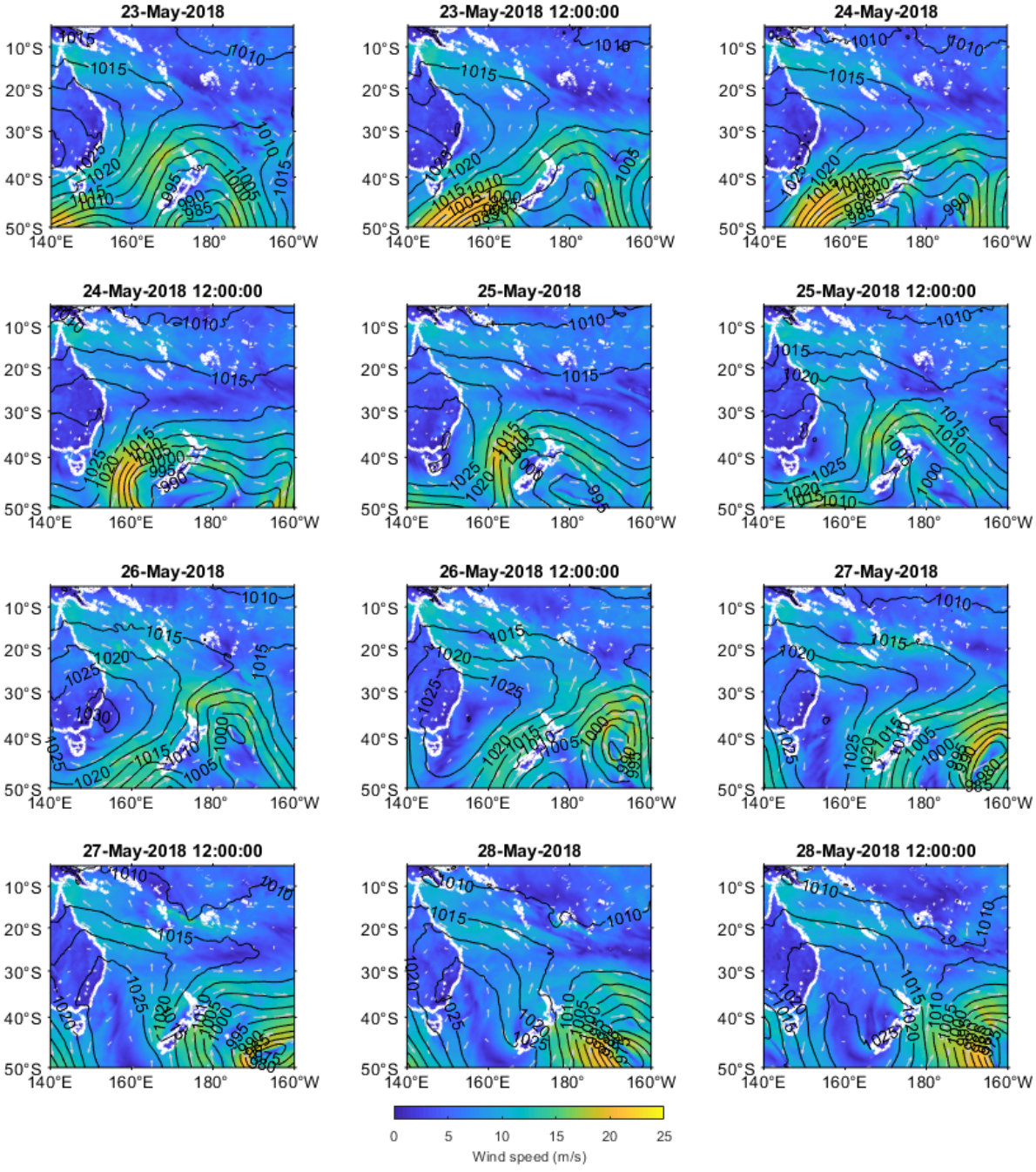
Figure S6: Illustrates the inundation extent simulated by the XBeach model under the current and future sea level (0.84 m of sea level rise associated with the RCP8.5 scenario).

Table S7: Illustrates the root mean square error (RMSE) of the different models when simulating wave setup (η_{wave}) and hourly maximum total water level (TWL_{max}).



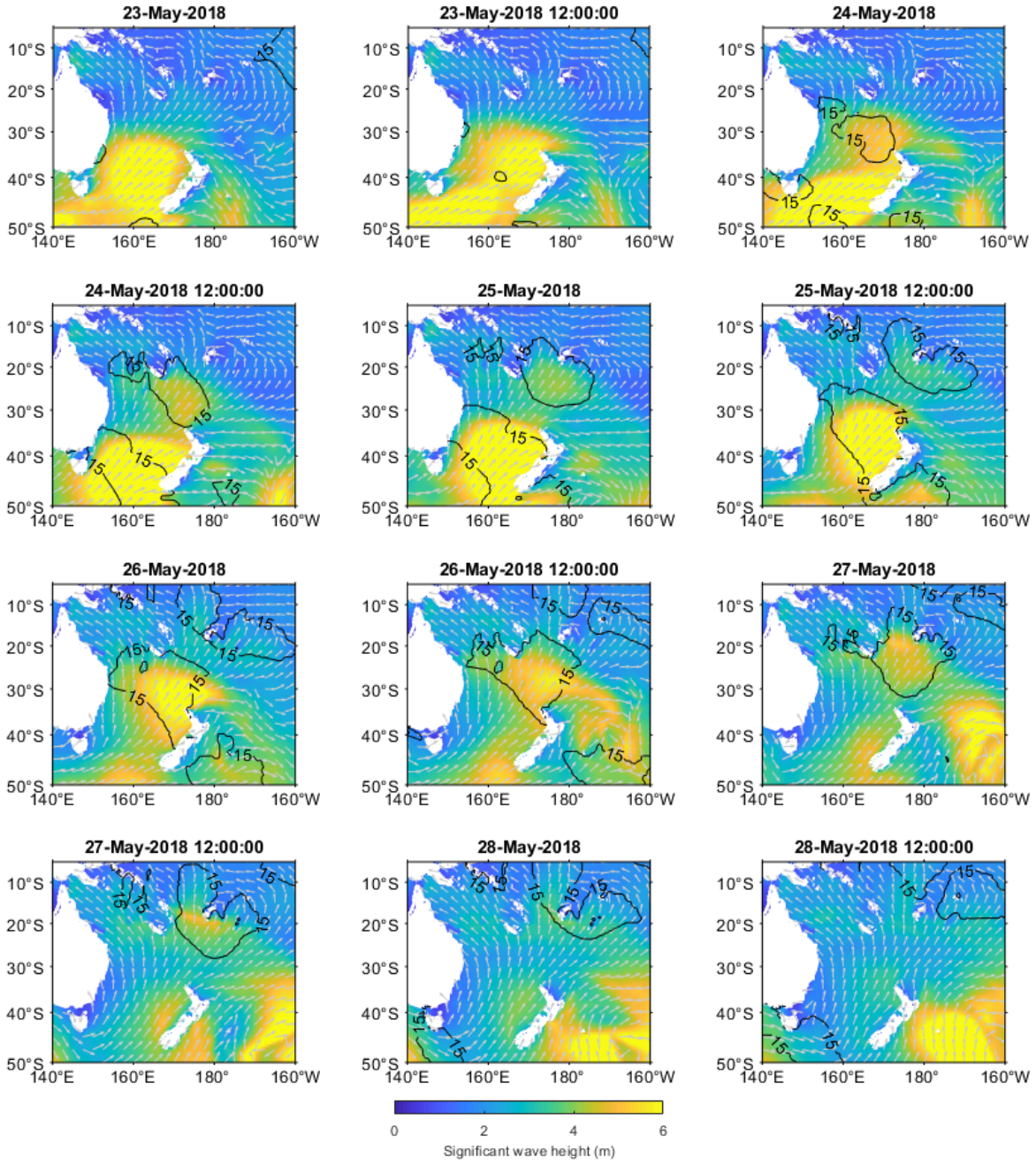
Supplementary Figure S1. Atmospheric pressure, 10m wind speed, and 10m wind direction observed

at the Sigatoka automated weather station (AWS). See Figure 1 in the article for the location of the AWS.

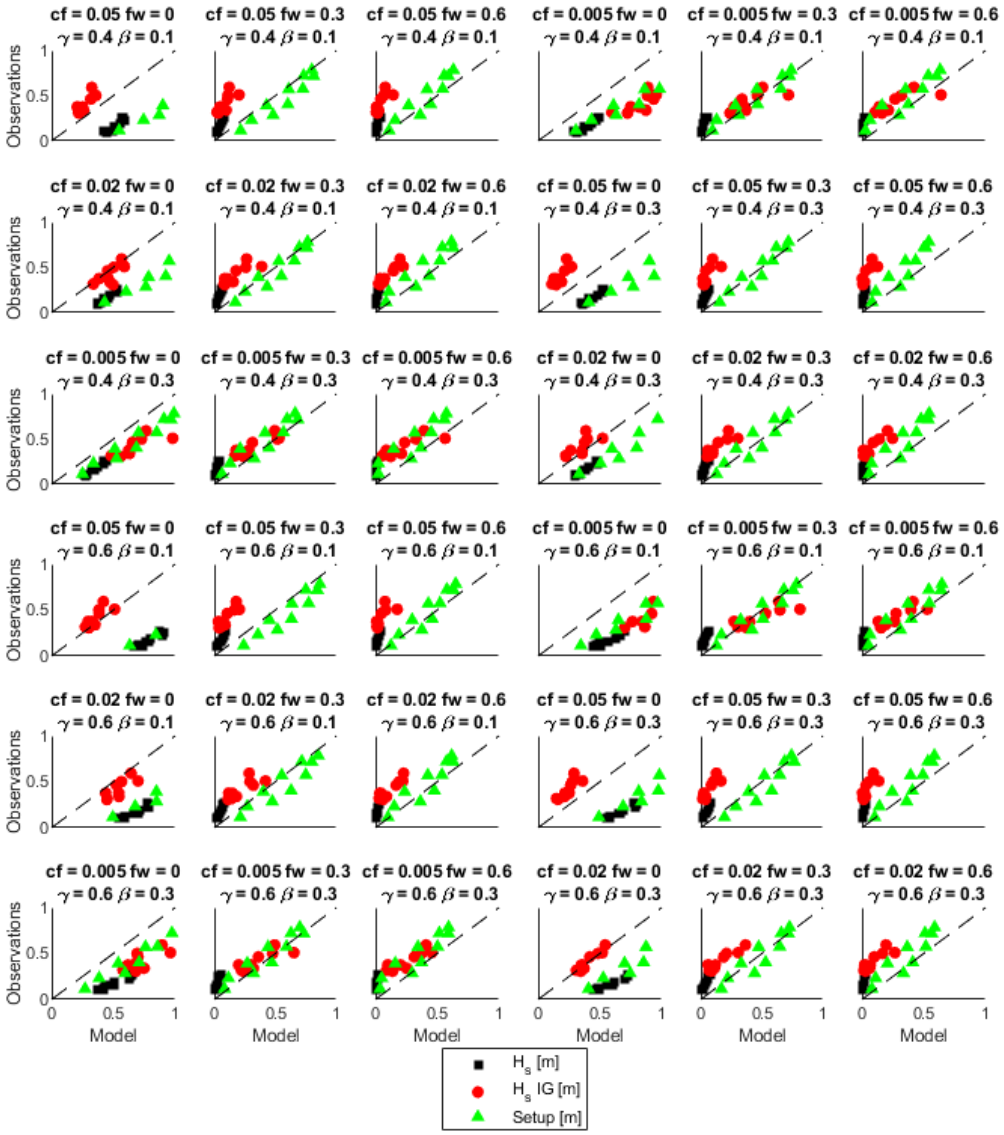


Supplementary Figure S2. Wind speed in the South Pacific and the Tasman Sea between 23rd May 2018 and 28th May 2018. Black contour lines represent the mean sea level pressure in hPa. Data were

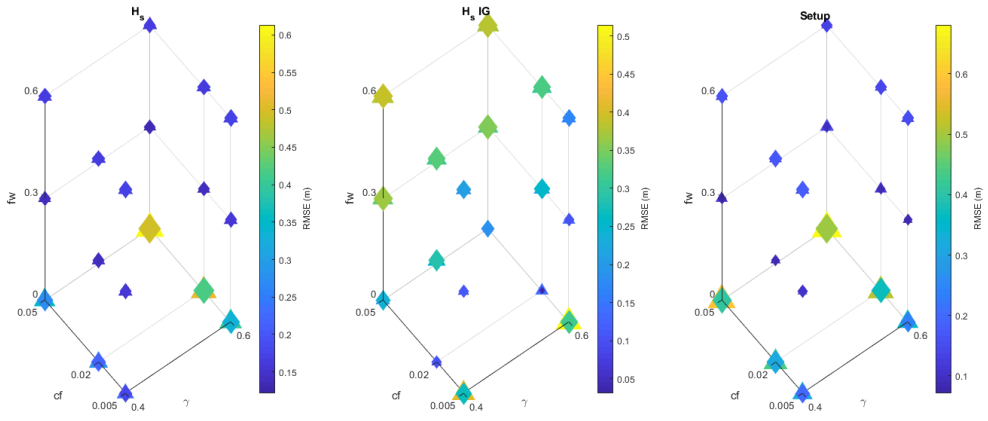
obtained from the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA5 reanalysis dataset (European Centre for Medium-Range Weather Forecasts (ECMWF), 2019).



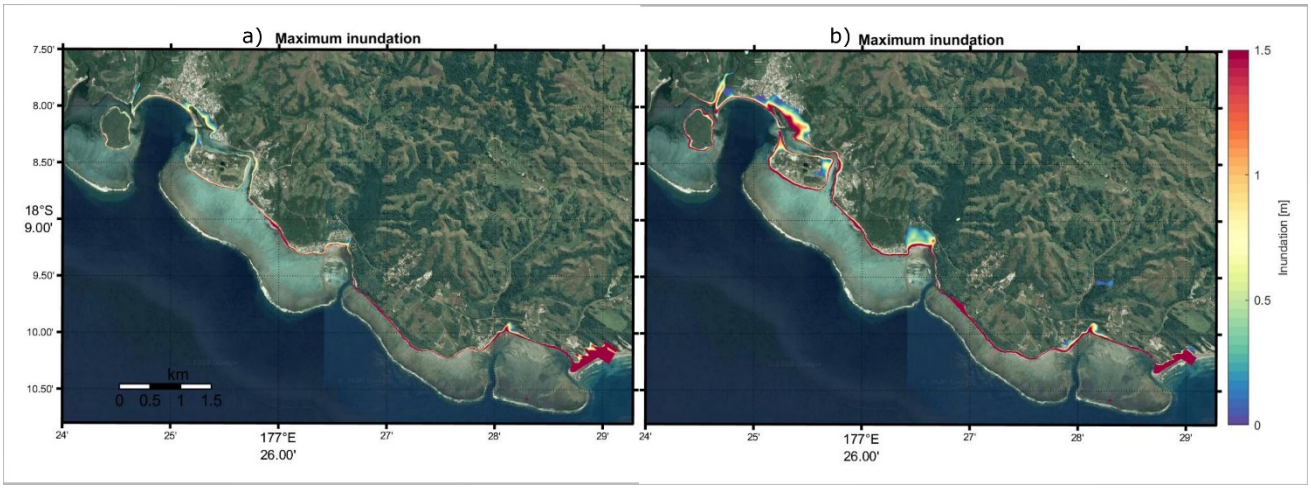
Supplementary Figure S3. Significant wave heights in the South Pacific and the Tasman Sea between 23rd May 2018 and 28th May 2018. Black contour lines represent the 15 second peak period contour of the wave field. Data were obtained from the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA5 reanalysis dataset (European Centre for Medium-Range Weather Forecasts (ECMWF), 2019).



Supplementary Figure S4. Multivariate sensitivity analysis of Xbeach to identify ideal values of cf, fw, γ, and β.



Supplementary Figure S5. Root mean square error of all simulations with different parameters. The diamond shape represents $\beta = 0.3$ and the triangle represents $\beta = 0.1$.



Supplementary Figure S6. (a) Maximum simulated coastal inundation caused by the swell event. (b) Maximum simulated coastal inundation caused by the swell event with 0.84 m of sea level rise (RCP 8.5).

Supplementary S7: Root mean square error (RMSE) of the different models when simulating wave setup (η_{wave}) and hourly maximum total water level (TWL_{max}). The last column shows the maximum observed TWL – the maximum modelled TWL. Positive values indicate an underprediction of the maximum hourly water level.

	RMSE η_{wave}	RMSE TWL_{max}	$TWL_{max,\ Observed} - TWL_{max,\ Modelled}$
Multiple linear regression model	0.05 m	0.18 m	0.25 m
XBeach	0.13 m	0.33 m	0.56 m
Vitousek et al. (2017)	0.28 m	0.43 m	0.82 m

Vousdoukas et al. (2018)	0.37 m	0.34 m	0.68 m

2 References

European Centre for Medium-Range Weather Forecasts (ECMWF), 2019. ERA5, Reanalysis datasets. https://doi.org/10.24381/cds.adbb2d47