

## 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.

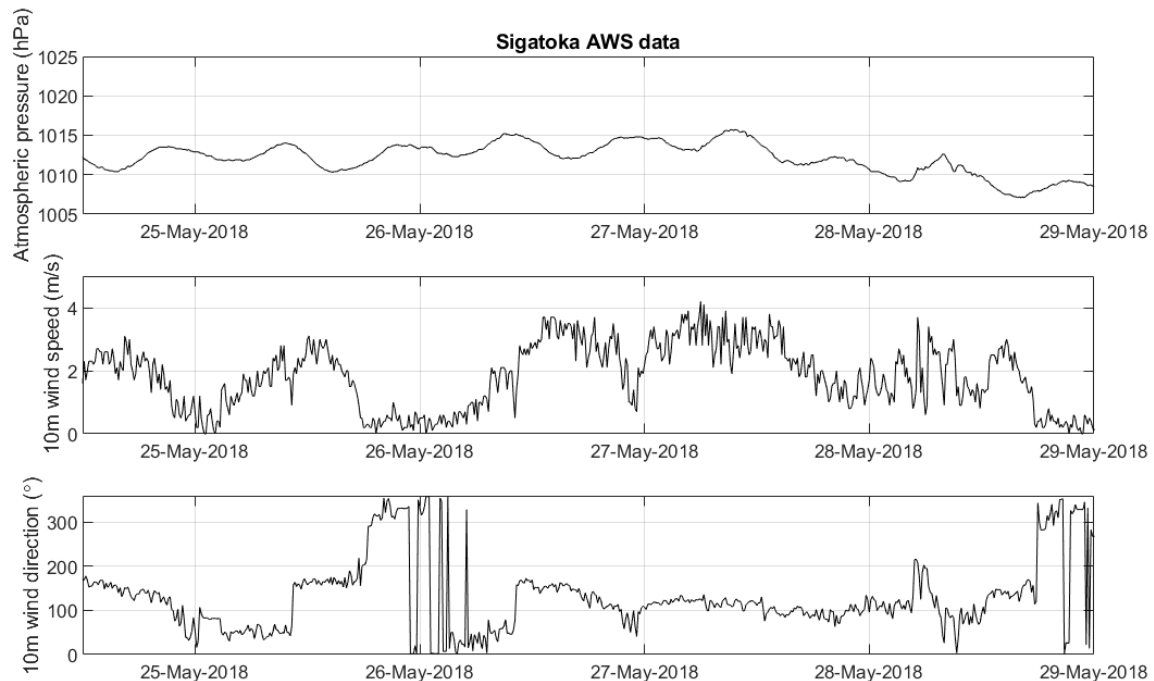
Figure S3: Illustrates the wave field in the South Pacific and Tasman sea leading up to and during the large swell event.

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.

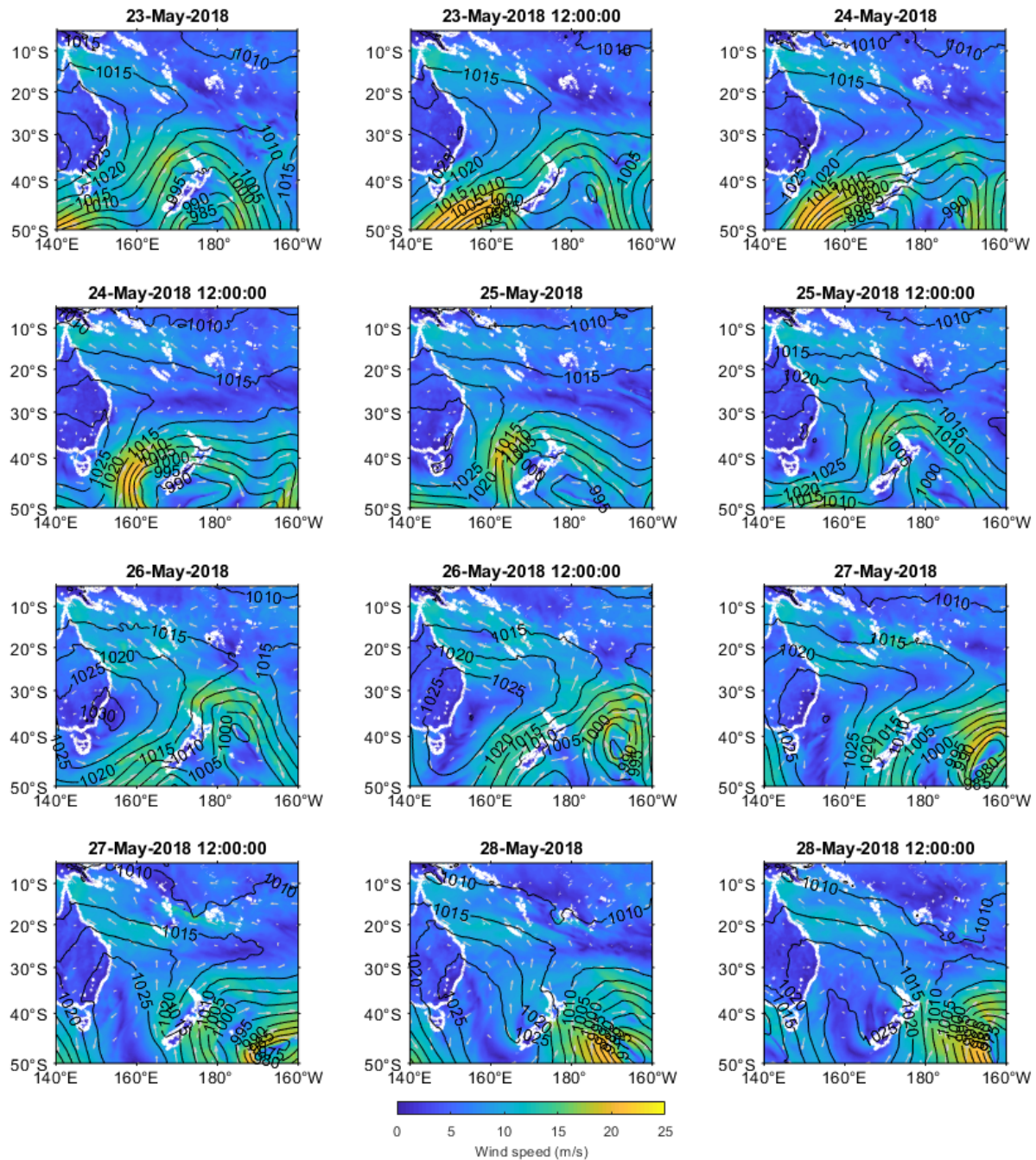
Figure S6: Illustrates the inundation extent simulated by the XBeach model under the current and future sea level (0.84 m of sea level rise associated with the RCP8.5 scenario).

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



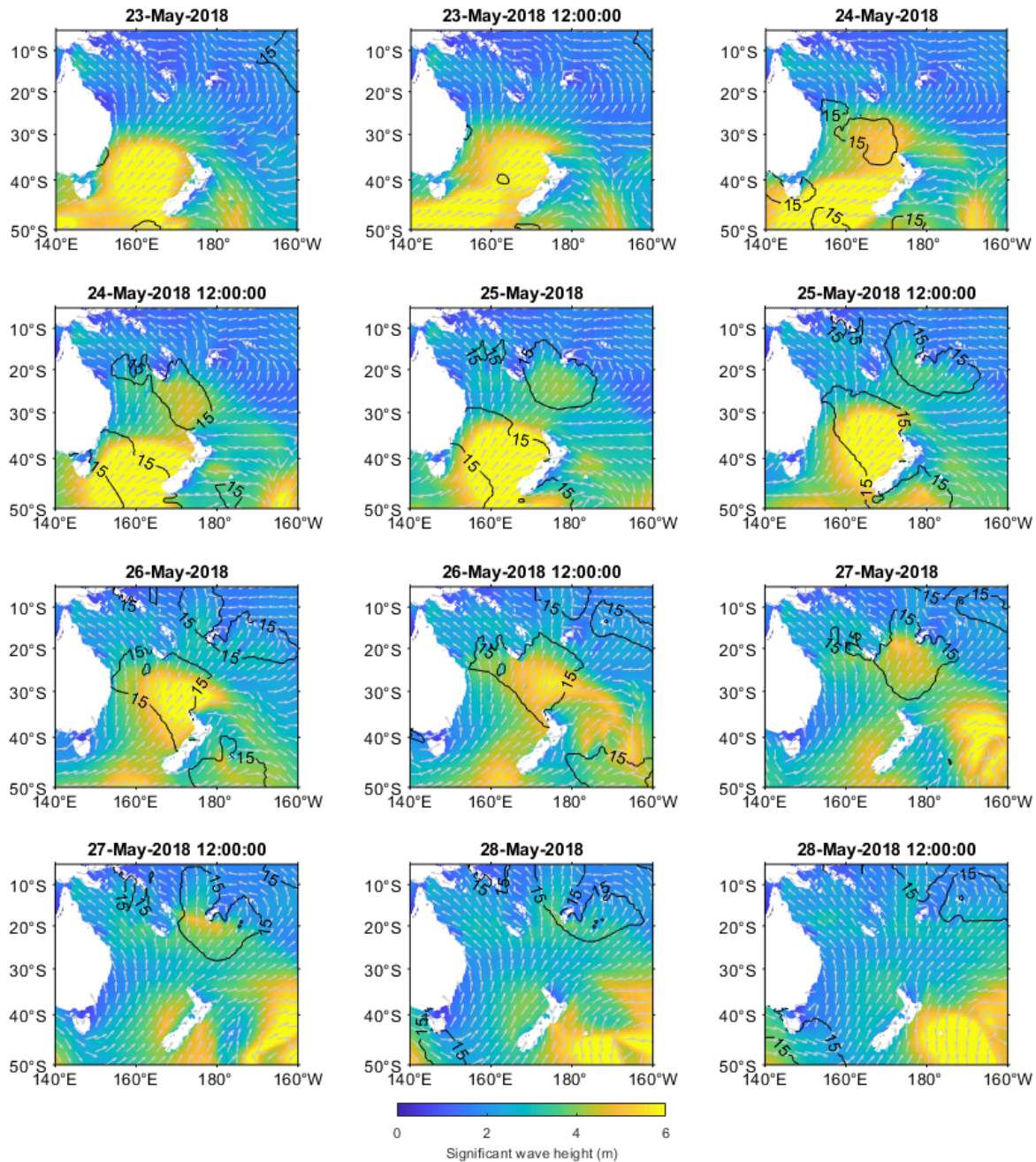
**Supplementary Figure S1.** Atmospheric pressure, 10m wind speed, and 10m wind direction observed

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

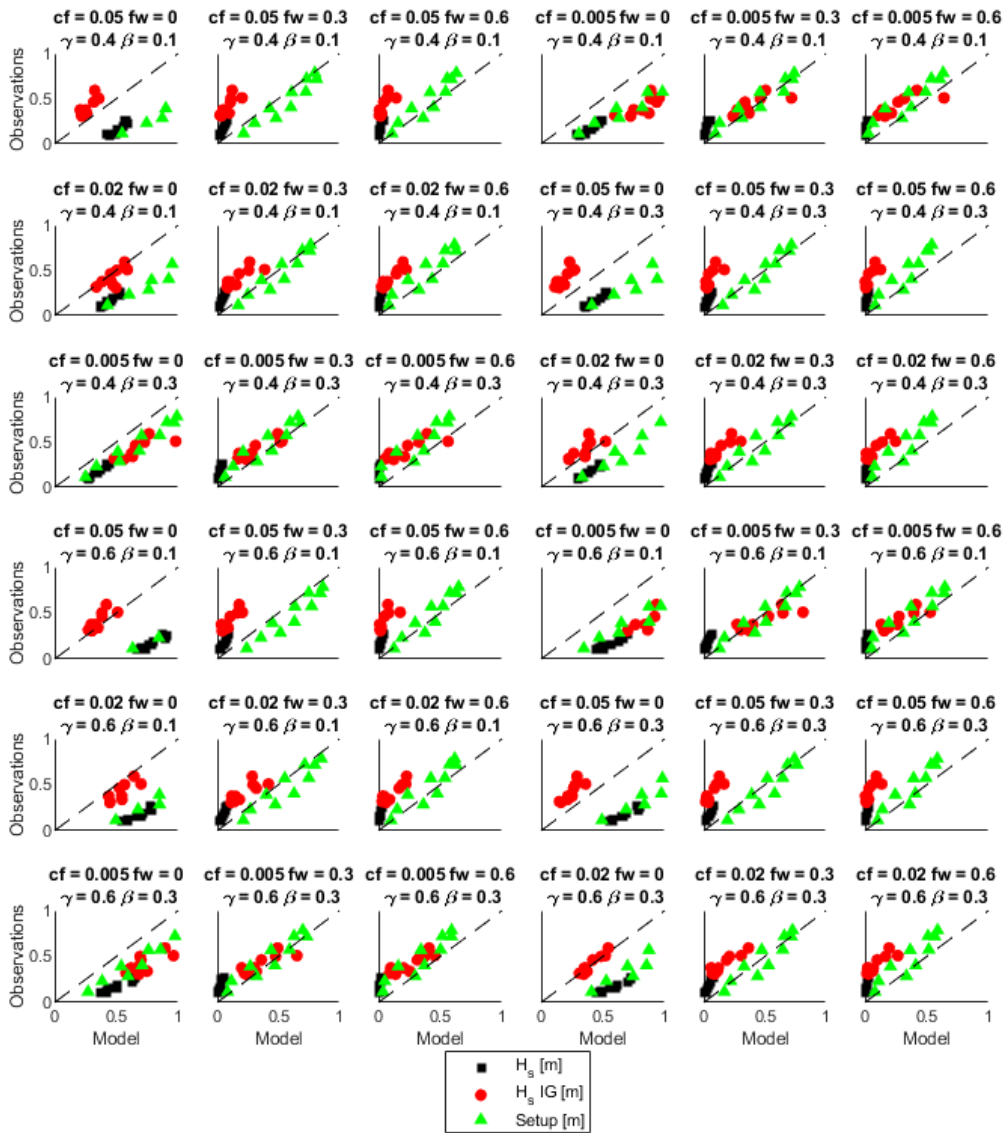


**Supplementary Figure S2.** Wind speed in the South Pacific and the Tasman Sea between 23<sup>rd</sup> May 2018 and 28<sup>th</sup> May 2018. Black contour lines represent the mean sea level pressure in hPa. Data were

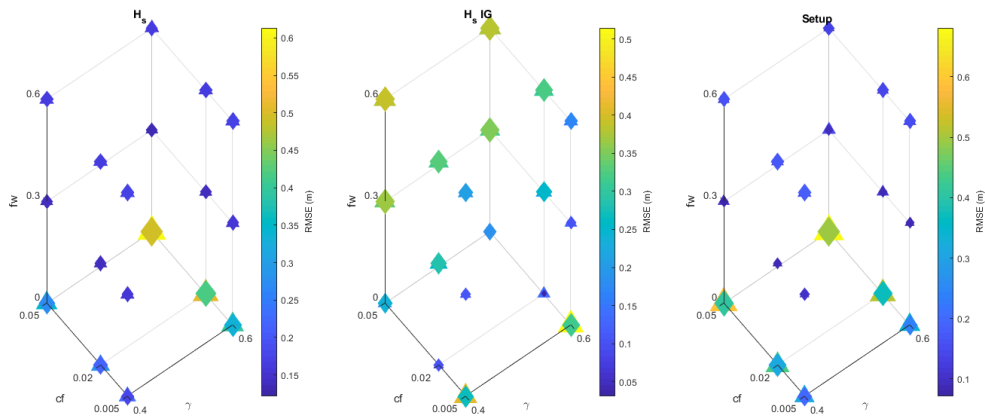
obtained from the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA5 reanalysis dataset (European Centre for Medium-Range Weather Forecasts (ECMWF), 2019).



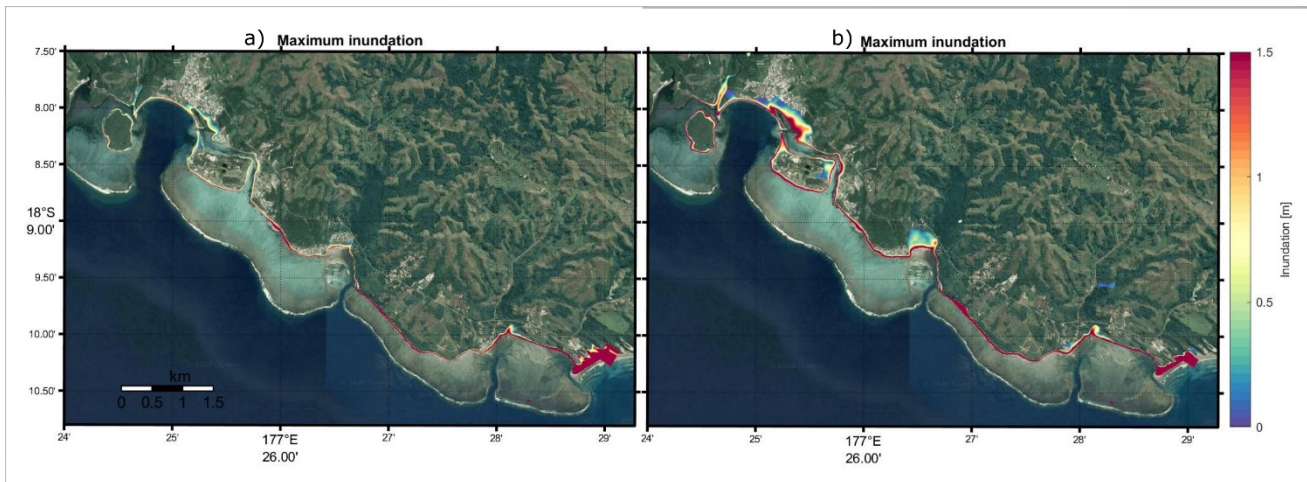
**Supplementary Figure S3.** Significant wave heights in the South Pacific and the Tasman Sea between 23<sup>rd</sup> May 2018 and 28<sup>th</sup> May 2018. Black contour lines represent the 15 second peak period contour of the wave field. Data were obtained from the European Centre for Medium-Range 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  $cf$ ,  $fw$ ,  $\gamma$ , and  $\beta$ .



**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 ( $\eta_{wave}$ ) 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 $\eta_{wave}$	RMSE $TWL_{max}$	$TWL_{max, \text{Observed}} - TWL_{max, \text{Modelled}}$
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
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## 2 References

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