

Modelling of depth-induced wave breaking over sloping and horizontal beds

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Importance of finite-depth wave conditions

Wave heights near coastal defenses are mostly depth-limited in the western Wadden Sea, and dominated by local wind seas.





Motivation



Depth breaking based on shallow water nonlinearity

From Thornton & Guza (1983):

$$D_{tot} = -\frac{B^{3}}{4} \frac{f_{m01}}{d} \int_{0}^{\infty} H^{3} p_{b}(H) dH$$

 $p_b(H) = W(H) p(H)$

Introduce a biphase-dependent weighting function on the pdf:







Conclusions

- 1. Depth-induced breaking in SWAN found to be overestimated in finite-depth growth situations, in agreement with earlier findings.
- 2. Breaker index of BJ78 show positive correlations with local wave steepness and local $k_p d$.
- 3. Breaker index parameterization of Ruessink et al. (2003), developed for surf zones, improves finite-depth results with BJ78 significantly.
- 4. Depth-induced breaking can be related to shallow water nonlinearity.
- 5. Biphase scaling, implemented in TG83 model, yields similar improvement as Ruessink et al. parameterization, but with physical explanation of model behaviour.
- 6. Proposed model performs well over both sloping and horizontal beds (finite-depth growth conditions).



Contents

- 1. Shallow water dissipation terms & relative importance
- 2. Data sets
- 3. Sensitivity of results to breaker index
- 4. Dependencies of breaker index on local variables
- 5. Biphase model: breaking based on shallow water nonlinearity
- 6. Calibration and validation

Van der Westhuysen, *Modelling of depth-induced wave breaking* under finite-depth wave growth conditions, JGR, in press.

Shallow water dissipation terms & relative importance

- Bottom friction has significant influence over intermediate dimensionless depths
- Depth-induced breaking dominant for smallest dimensionless depths. H_{m0}/d ratio strongly dependent on value of breaker parameter.



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(Battjes & Janssen 1978; Hasselmann et al. 1973)

Data sets









Sensitivity of model to breaker index \Box_{BJ} (vd Westhuysen 2009)



SCI and Rel. bias in $T_{m-1,0}$



Dependencies of \Box_{BJ} on local variables (vd Westhuysen 2009)





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Calibration and validation of biphase model





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Amelander Zeegat (18/01/07, 12:20)



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