

# **Experimental and theoretical models of wave-induced flexure of a sea ice floe**

## **Electronic Supplementary Material**

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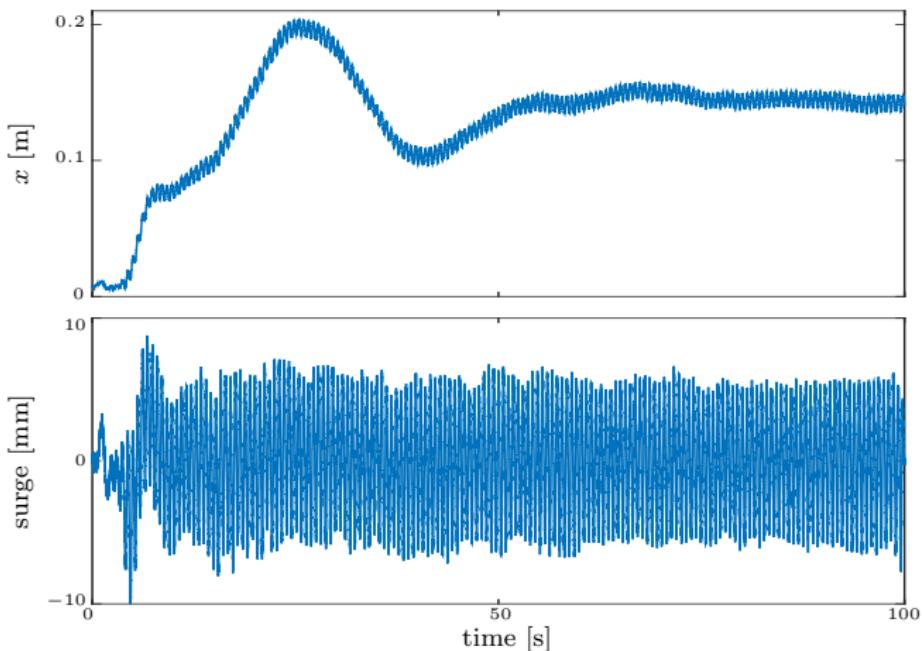
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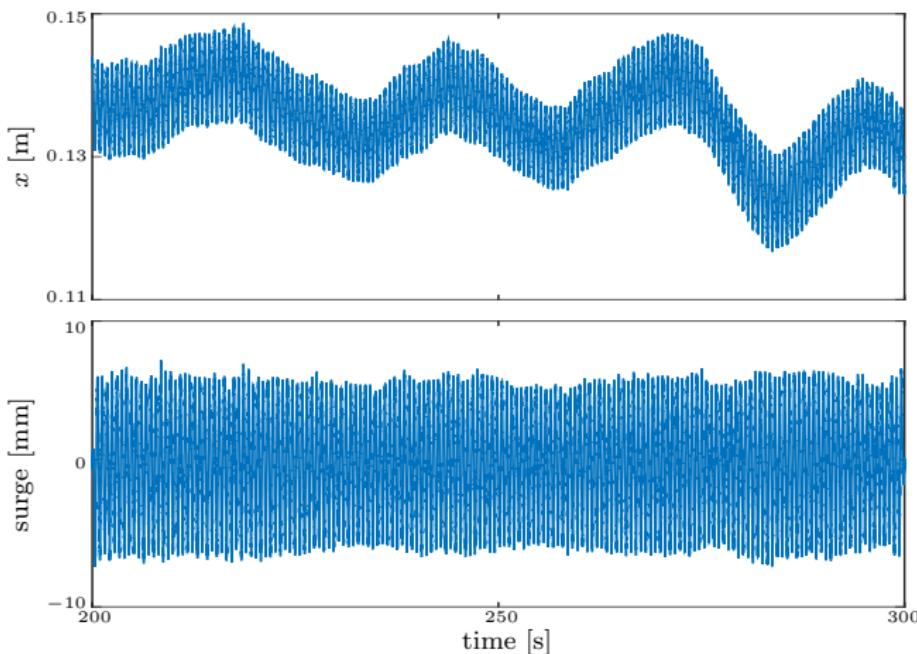
## **Example of surge/drift and mooring forces in experiments**

# Initial motions



Test using 10 mm thick PVC floe and incident wave with length 0.56 m and steepness 0.04. Top panel: motion of centre of mass in  $x$ -direction. Bottom panel: extracted surge motion.

# Steady motions



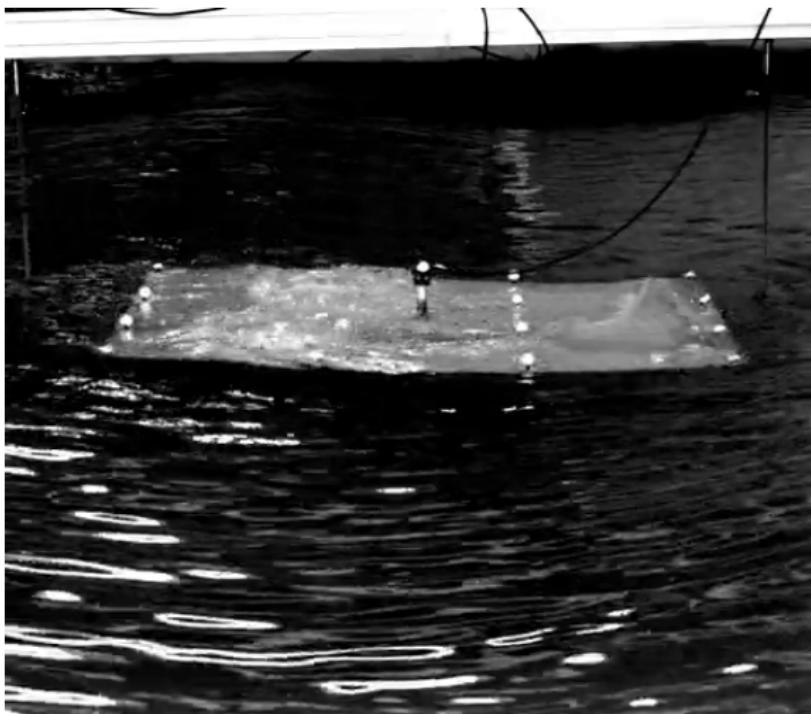
Test using 10 mm thick PVC floe and incident wave with length 0.56 m and steepness 0.04. Top panel: motion of centre of mass in  $x$ -direction. Bottom panel: extracted surge motion.

## **Figure 2: accompanying movies**

**PVC floe;  $h = 10 \text{ mm}$ ;  $ka = 0.15$ ;  $\lambda/2L = 1.51$**

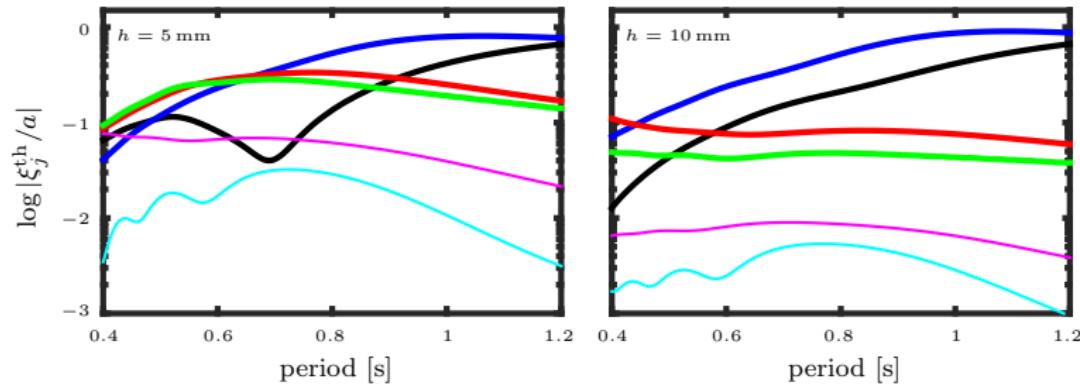


**Polypropyl. floe;  $h = 10 \text{ mm}$ ;  $ka = 0.15$ ;  $\lambda/2L = 1.51$**



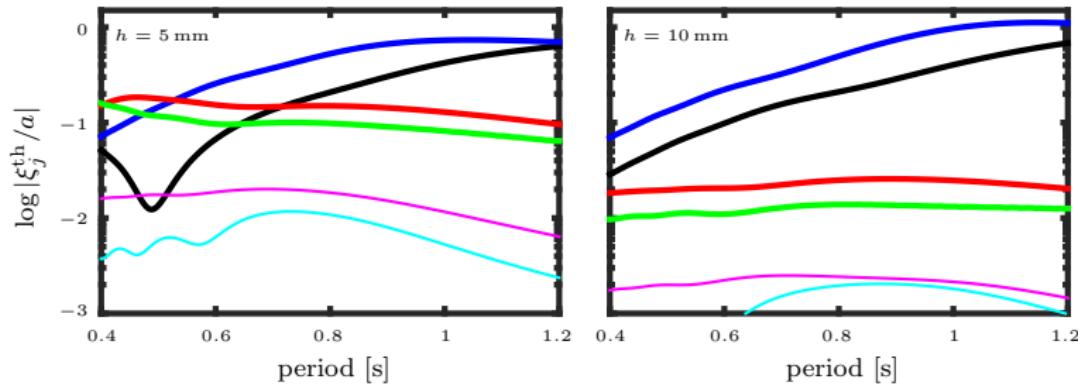
## **Model results: modal weights vs incident wave period**

# PVC floes



Theoretical model predictions of modal weight magnitudes as functions of incident wave period for PVC floes, plotted on a log scale. Modal index  $j = 1$  (black curves) 2 (blue), 5 (red), 6 (green), 7 (cyan) and 11 (magenta).

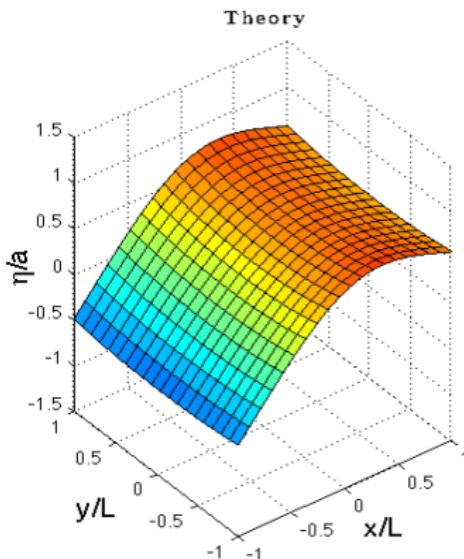
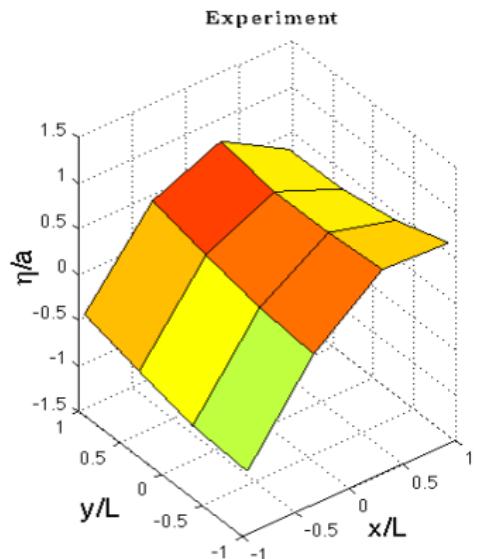
# Polypropylene floes



Theoretical model predictions of modal weight magnitudes as functions of incident wave period for polypropylene floes, plotted on a log scale. Modal index  $j = 1$  (black curves) 2 (blue), 5 (red), 6 (green), 7 (cyan) and 11 (magenta).

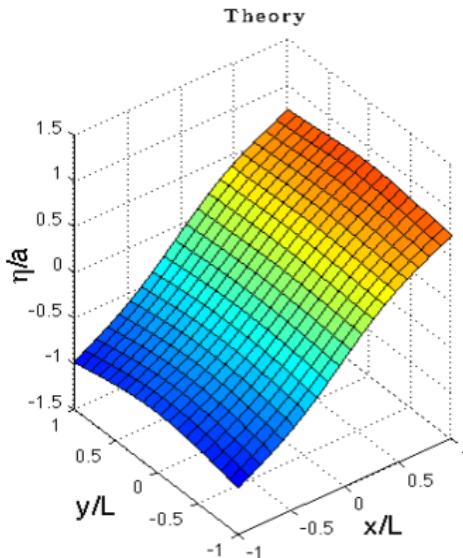
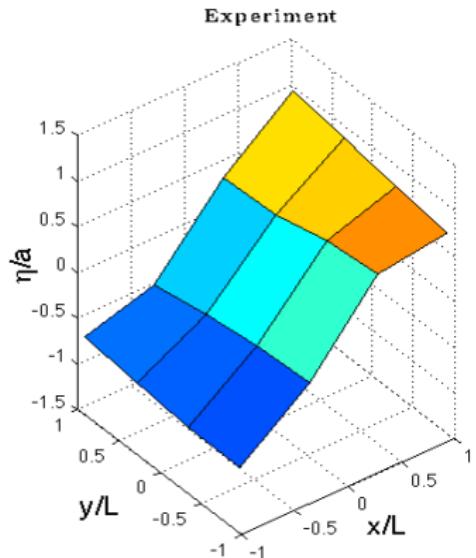
# **Example experiment-theory comparisons**

# PVC floe; $h = 5 \text{ mm}$ ; $ka = 0.04$ ; $\lambda/2L = 1.51$



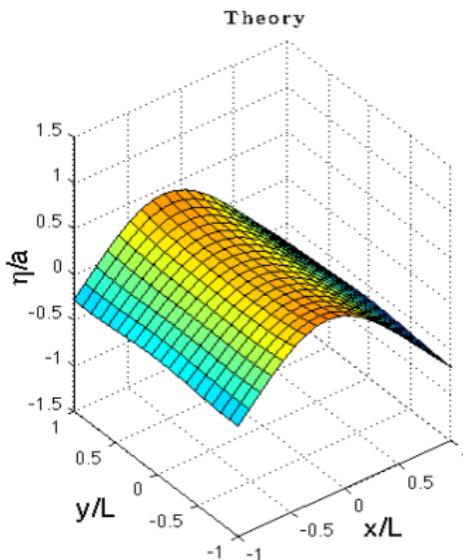
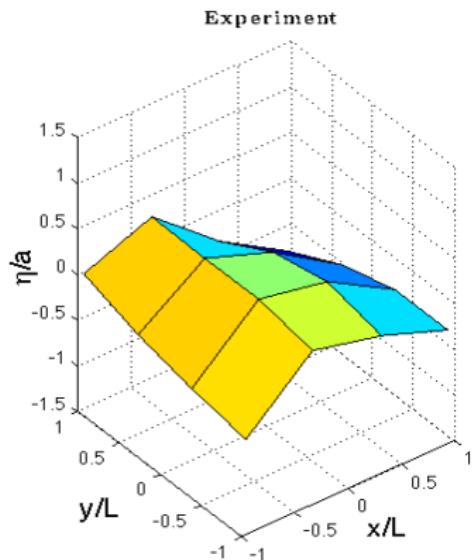
$\eta$  is vertical displacement of floe;  $L$  is half-length of floe;  
 $a$  is incident wave amplitude

# PVC floe; $h = 5 \text{ mm}$ ; $ka = 0.04$ ; $\lambda/2L = 1.00$



$\eta$  is vertical displacement of floe;  $L$  is half-length of floe;  
 $a$  is incident wave amplitude

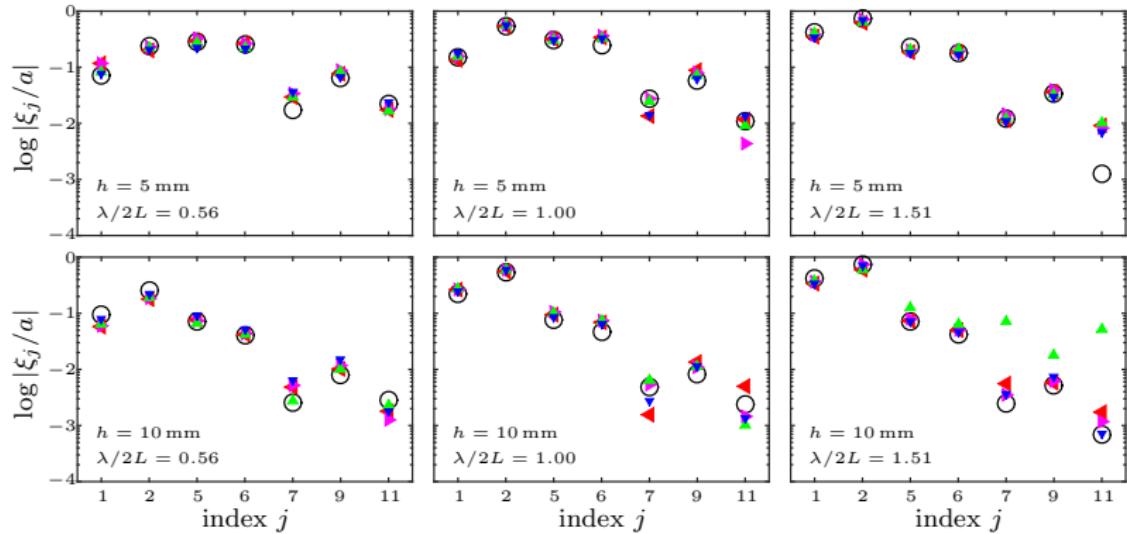
# PVC floe; $h = 5 \text{ mm}$ ; $ka = 0.04$ ; $\lambda/2L = 0.56$



$\eta$  is vertical displacement of floe;  $L$  is half-length of floe;  
 $a$  is incident wave amplitude

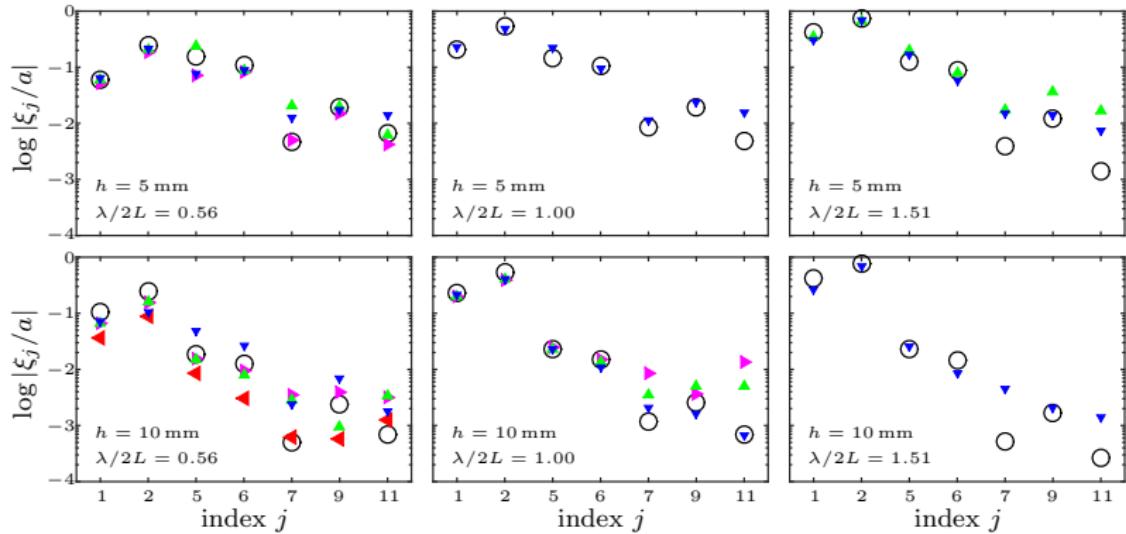
## **Figures 6–7: extended**

# Figure 6



Comparison of scaled modal weight magnitudes extracted from experimental data (triangles) and predicted by theoretical model for PVC floes (black circles), plotted on a log scale. Incident steepnesses are:  $ka = 0.04$  (blue, triangles down);  $0.08$  (green, up);  $0.1$  (magenta, right); and  $0.15$  (red, left).

# Figure 7



Comparison of scaled modal weight magnitudes extracted from experimental data (triangles) and predicted by theoretical model for polypropylene floes (black circles), plotted on a log scale. Incident steepnesses are:  $ka = 0.04$  (blue, triangles down);  $0.08$  (green, up);  $0.1$  (magenta, right); and  $0.15$  (red, left).