SESSION: OCEAN 1-SEA ICE

MARS Themes:

Earth Systems Observations

Title:

Computational Fluid Dynamics Modelling of Pancake Ice on Waves

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Abstract:

The seasonal evolution of the pancake ice size distribution is not well documented due to the high variability of the MIZ and difficulty in obtaining high resolution in situ data sets. Computational models are used to simulate the small-scale interactions of pancake ice and waves. However, many of these models are limited to two dimensions, and approximate pancake ice as cylindrical. This study presents a computational fluid dynamics model of a single pancake ice floe in a sinusoidal wave field, made with OpenFOAM. Kinematic data for all six degrees of freedom were collected by running simulations of various pancake ice geometries and sizes on waves with different parameters. A validation experiment using a wave flume is set to be conducted at the CSIR in Stellenbosch and Aalto University in Helsinki, to test the fidelity of the model. The simulation data will be compared to visual and inertial data collected with an artificial floe in the wave flume. From the analysis of the simulation data, it was seen that the translational motions of different pancake ice sizes were largely similar and that most of the variation was visible in the rotations. It was noted that, while the surge and heave motions were sinusoidal as expected, the pitch motion displayed two modes. It is hypothesized that there are two main components in these responses: the waves frequency and the natural frequency of the geometry used. It is also hypothesized that the geometry of the pancake ice floe can be approximated from its dynamic behaviour. In future work we hope to develop an algorithm that can approximate the size and geometry of pancake ice using the inertial measurements captured by buoys deployed on them. This will enable us to study the evolution of the size of individual floes.

Format:

5 minute Oral presentation

Keywords: (add ; between keywords)

Computational Fluid Dynamics; Sea Ice Dynamics; Pancake Ice; Marginal Ice Zone