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DEM ON RIDGE RESISTANCE OF SHIPS

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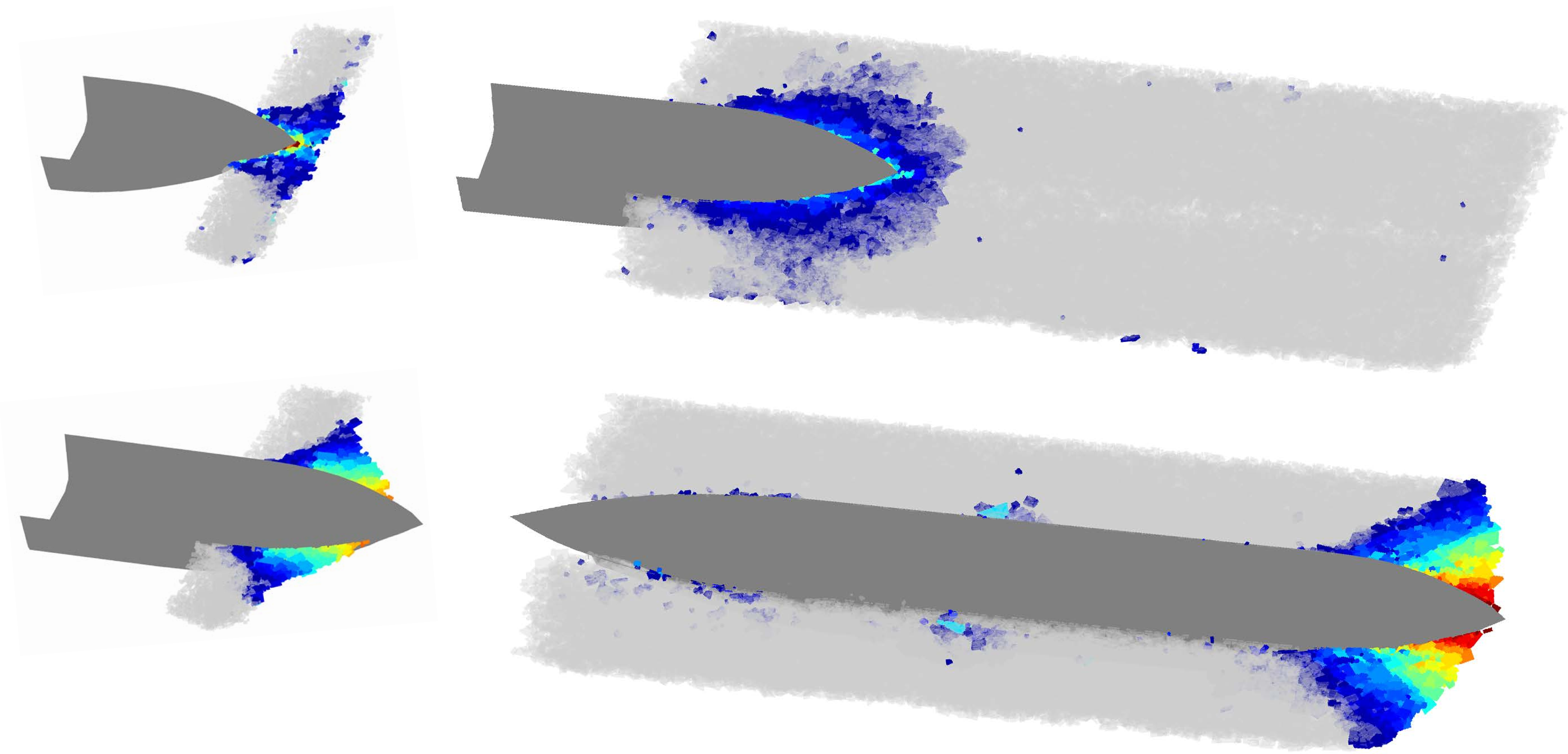
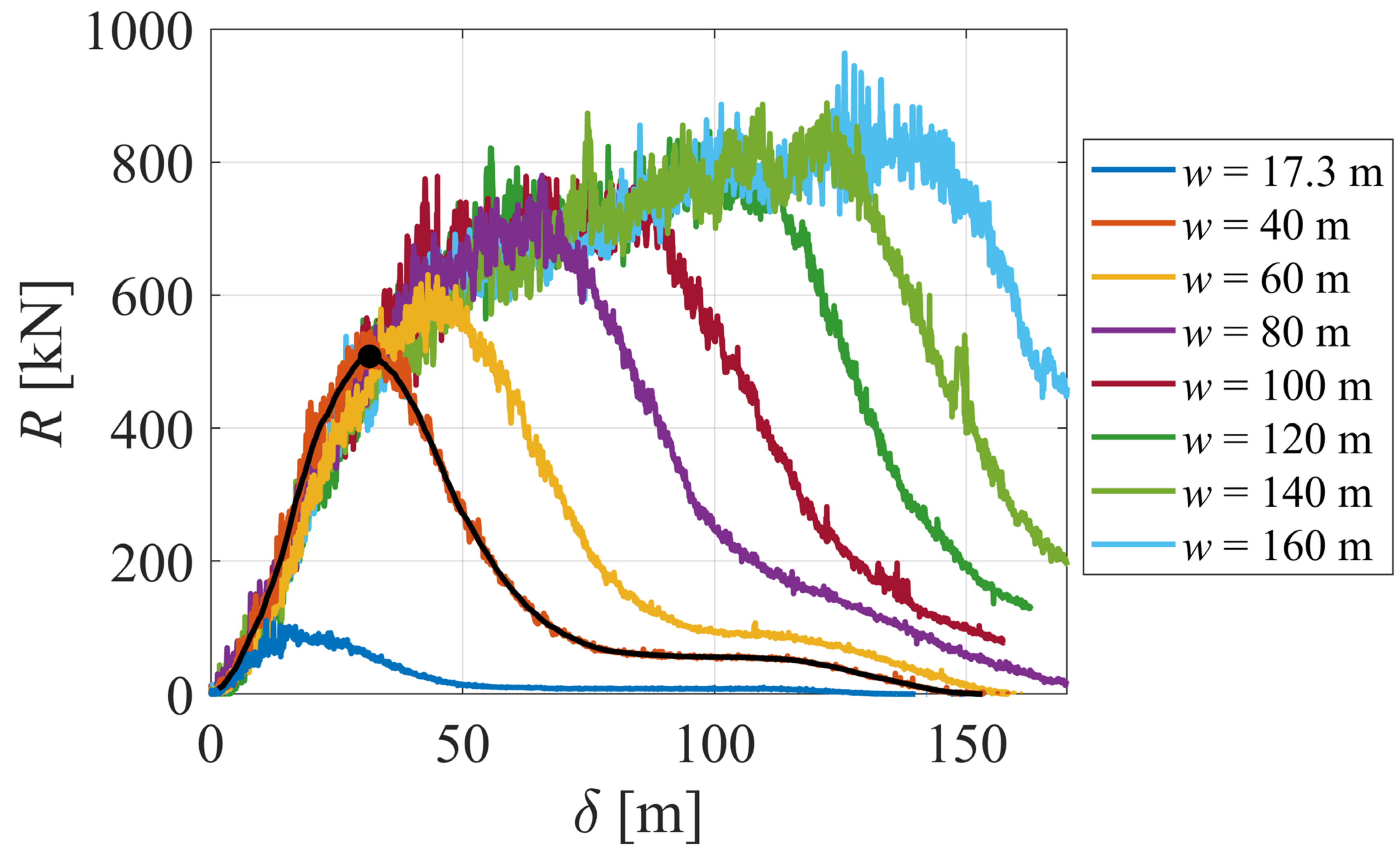
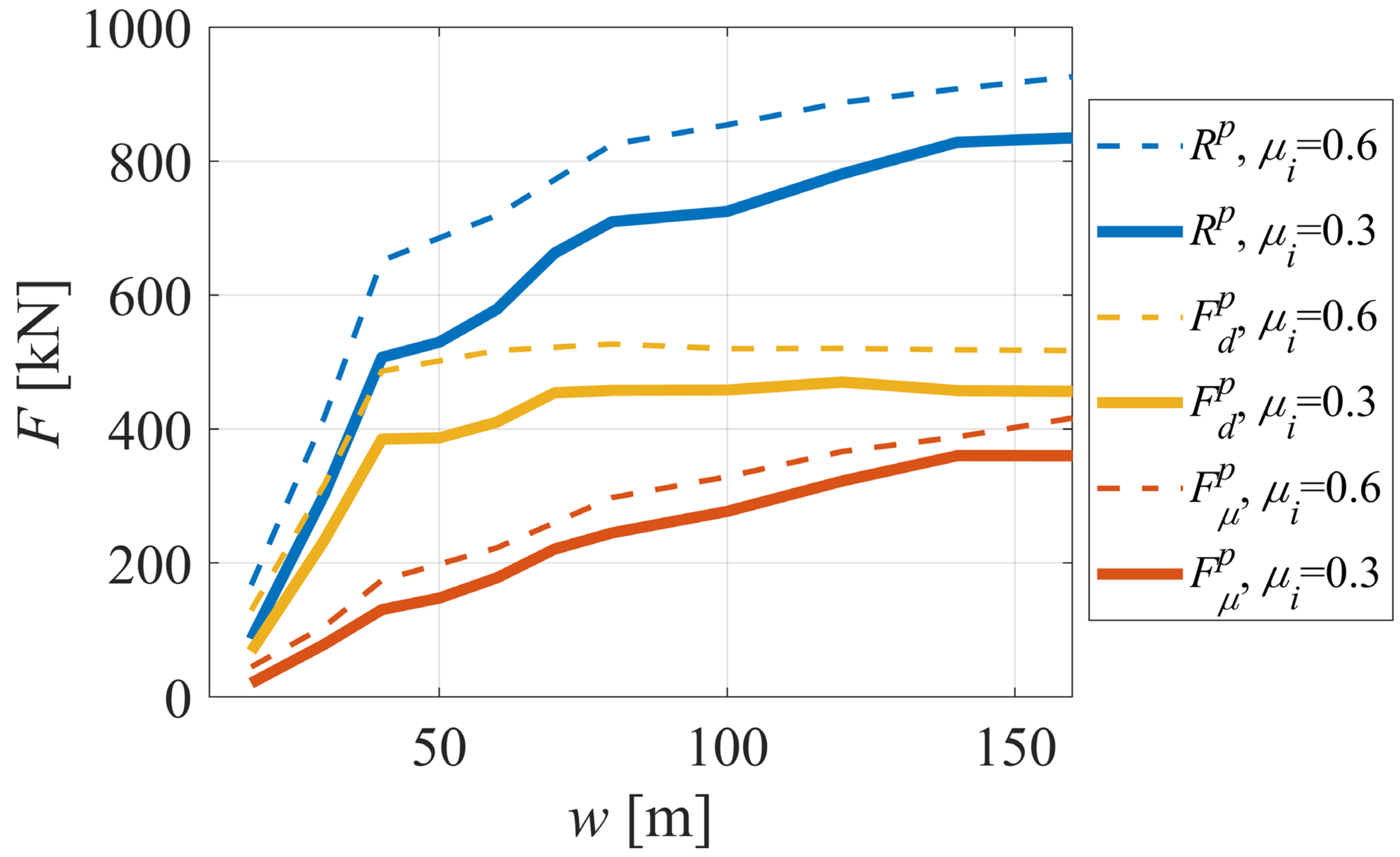
Route planning for efficient and economic marine transit on ice-covered seas requires new insights into the ridge resistance of ships. We have used a 3D discrete element method (DEM) to simulate a ship passage through an unconsolidated ridge, and shown that ridge resistance is increasing with ridge width, until the ridge width is of the same order as the ship length. The ridge resistance is related with the mass of ice blocks accelerated by and moving with the ship. This is a novel result.





The ridge resistance-displacement (R-δ) records from the simulations with different ridge widths w. The black line shows filtered data used to define the peak resistance R^p (black marker).



The peak values of ridge resistance R^p and its components, deformation force F_d^p and frictional force F_μ^p, as functions of ridge width w and ice-ice friction coefficient μ_i.

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Publications: