The Fetch Factor: incorporating a fetch dependency into the Overland algorithm

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The Overland algorithm predicts extreme values of sea spray vessel icing. It assumes that the ship is at sea and exposed to freezing spray conditions for a long time without escape.

The Fetch Factor was developed by Serge Desjardins at Environment Canada to compensate for the fact that Overland does not account for the spray flux availability which, in fact, can be limited near the coast or near the ice edge.

It is expressed as:

$$FF = \frac{SWH}{\left({}^{UV}/_{13}\right)^2}$$

where SWH is the significant wave height (m) and UV is the 10m wind speed (knots). In the Overland equation, zero wind gives no freezing spray and therefore eliminates the need to compute the fetch factor. For safety reasons in the code, the fetch factor is computed for wind speed greater than 1 knot.

The Fetch Factor (FF) modifies the sea spray vessel icing value given by the original Overland algorithm as follows:

$$Over^{FF} = FF * Over$$

where $Over^{FF}$ is the modified Overland value taking into consideration the availability of the spray flux, *FF* the Fetch Factor, and *Over* being the extreme value of sea spray vessel icing given by the original Overland algorithm.

Because the original Overland algorithm predicts extreme values, the extreme aspect in the fetch factor denominator is given by the maximum development of a wave by the wind without restriction on the duration and fetch. It is expressed simply by $(UV/13)^2$.
Following this same logic, the availability of the spray flux is given in the numerator by the height of waves generated by the current wind conditions, taking into account the wind duration and the fetch.

The Fetch Factor will have little impact on the value given by the original Overland algorithm when sea conditions are approaching extreme conditions encountered over well developed and mature seas. Instead it will greatly reduce the value given by the original Overland algorithm when the availability of spray flux is reduced, such as near the coast where fetch is limited. Does this modification reduce the value given by the original Overland algorithm near the coast or the ice edge too much when a strong cold outbreak favours a quick and intense episode of freezing spray? Operational evaluation of the Fetch Factor and if possible, validation by observations could identify this possible bias from the Fetch Factor and may warrant a modification of the factor in the future.