**Quantification of the impact of input data uncertainty**

The effect that uncertainty in the input data on the across-shelf current was quantified by simulating error on the input data at different uncertainty levels and repeating the across-shelf current calculation.

Uncertainty in the input data was reported as root mean squared error (RMSE). The uncertainty for the WaveWatch III stokes drift component is 0.03 m (Rascle and Ardhuin, 2013; WAVEWATCH III development group, 2016). Reported uncertainty for GlobCurrent reanalysis product was 0.135 m (this describes the combined uncertainty in the Ekman and geostrophic current vector data) (Chapron et al., 2015; Rio et al., 2016). For regions in which Stokes drift is included in the total current calculation, the total expected uncertainty is therefore calculated as

where εT is the uncertainty in the total current, εEG is the combined uncertainty (RMSE) associated with the combined Ekman and geostrophic current input data and εS is the uncertainty (RMSE) associated with the Stokes drift input data. For regions which did not include a Stokes drift component (e.g. where wind stress was high or significant wave height low), an RMSE of 0.135 m was used.

The effect of uncertainty was assessed at 21 levels by simulating error in the total current. Uncertainty levels were selected to be equally spaced intervals between 0% and 200% of the total expected uncertainty. The simulated error was added to the total current vectors (i.e. independently to the North-South and East-West components) prior to calculating the adjusted Ekman transport vector (due to the Coriolis force) but before the calculating across-shelf current and regional statistics. Errors were modelled using a normal distribution centred at zero with a standard deviation equal to the uncertainty level (root mean squared error). It is assumed that there are no spatial or temporal correlation in uncertainties. This procedure was repeated 2000 times at each uncertainty level to/which resulted in clear convergence.

Regional calculations were performed for each of the shelf sea regions identified by Laruelle et al. (2018)⁠ and the mean and standard deviation of total across-shelf current were calculated using the methodology described in the main text. These are shown in Table S1:

Expected SKIM error ~ 0.04 m???

|  |
| --- |
|  |
| Table S1: |

Figure S1:

\*\*Build Table 1: error level, regions, mean (sd)

**References**

Chapron, B., Johannessen, J. A., Donlon, C., (2015) GlobCurren Analysis and Interpretation Framework, Version 0.5, Technical note, 36 pp, [**http://www.globcurrent.nersc.no**](http://www.globcurrent.nersc.no/)

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