

Interactive comment on “A 50 % increase in the amount of terrestrial particles delivered by the Mackenzie River into the Beaufort Sea (Canadian Arctic Ocean) over the last 10 years” by D. Doxaran et al.

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Review by D.G. Bowers

The flux of solid material from the land to the ocean is one of the key geophysical processes on our planet. One of the most rapidly changing areas at the moment is the Arctic and this paper presents a clear account of how the fluxes of particulate material from a major estuary to the arctic can be estimated using satellite and ground observations. The results are surprising: The mass flux of suspended sediment from

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the chosen river has increased by 50% over the last 50 years.

The paper is well-written, the science is carried out rigorously and it is presented in a transparent way. The results are important and the paper should be published. I have just two points to raise with the authors about their methods and there are some small points about presentation.

Methods:

1. The flux is calculated by multiplying river discharge by suspended sediment concentration. The river discharge is measured at a gauging station and the concentration at the river mouth. Is the gauging station far from the river mouth? If so, the river discharge will probably increase (perhaps by quite a lot) between the station and the mouth as tributaries join the river. This won't affect the pattern of the results, probably, but may change the absolute value of the flux. 2. Any satellite measurement of suspended solid concentration will be in a surface layer which the satellite can 'see'. In a turbid estuary, this layer may be less than a metre thick. Suspended sediment concentrations tend to increase towards the bed, so the surface concentration measured from space is likely to be an under-estimate of the depth-mean concentration which is needed for the flux calculation. This limitation, like that in point 1 above, will lead to an under-estimate of flux. The extent of the under-estimate is tantalising: it will depend on the vertical profile of sediment concentration and on the depth to which the satellite sees. These two quantities will be related and it would be interesting to explore what reflectance measurements tell us about depth-mean sediment concentrations. An interesting problem for a future paper. I should think these two points could be dealt with by appropriate remarks added at the right place in the text.

Some smaller points: a) The title is good, but the word 'amount' is ambiguous. Amount of particles could mean number, volume or some other quantity. The authors mean mass, so I suggest replacing 'amount' with 'mass' here, and elsewhere in the text (including the abstract) where the 50% increase in export is mentioned. b) The word

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'precipitations' is sometimes used. I think the correct English is always to use the singular 'precipitation'. c) Top of page 308, I don't understand the need for 'for SPM' after Doxaran et al., 2009. d) On page 320, substitute 'remember' for 'remind'... It is also important to remember... e) In figure 10, the units on the y-axis need attention, I think. A flux is usually expressed in units of mass/time. In figures 10a) and 10b) we are shown the mass in one month, which is OK, but in figure 10c) I'm not sure what the time scale is. Is it still mass per month? f) What does figure 9a show exactly? The caption says SPM concentration, but the axis label says SPM flux (but gives units of concentration). g) Figure 5 caption mentions June to July, but the figures cover the period June to August.

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