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Interactive comment on "Use of Ra isotopes to deduce rapid transfer of sediment-derived inputs off Kerguelen" *by* V. Sanial et al.

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General review In general, this is a very well written paper that addresses of topic of great relevance for marine biogeochemistry. The sources of iron and the dynamics of its transport control primary productivity of a large part of the ocean. The chosen approach, using short-lived radium isotopes, is particularly suitable to improve our understanding of sediment-water exchange, and the time-scales of water transport and mixing. The comparison of Lagrangian particle ages and Ra-ages is very interesting (detailed comments on comparison below). Methods are state of the art and well described (exceptions see below). Data are well described, only the names of the stations are confusing, but this is probably not the author's choice. The conclusions are in part supported by the data (see below). The figures are about right in content and quality

(except a few details discussed below). The tables are helpful, but the column headers are not entirely clear. Literature is relevant and up to date.

Specific comments

Major issues: *It is not clear whether the authors consistently discuss 224Ra excess and 223Ra excess, or total 224Ra and 223Ra. This is also true for the tables, in which both 224Ra – 224Raex and 223Ra - 223Raex are used, but not clearly labelled, and possibly 224Ra designates actually 224Raex in some cases. Reading the caption for table 2, "The Radium excess, supported by thorium and actinium isotopes, is reported as Raex", the situation is also not resolved, as Ra excess should be the part *not* supported by parent isotopes. Consequently, the authors should clarify in detail in the methods section how they calculate excess activities, clearly differentiate the two, and name and label them consistently throughout the text before publication in Biogeosciences.

*The authors conclude that short-lived Ra isotopes cross the Polar Front from Kerguelen, as they could not migrate northwards from Heard Island on the relevant timescales. There is, however, a third possible source, a plateau west of the Kerguelen Plateau, which could at least in theory supply short-lived Ra isotopes at the timescales in question (Fig. 1). Given the strong eastward current in the Polar front, transport rates of 20 km/day seem easily perceivable. The authors must at least discuss all potential sources and explain why this large topographic feature is no possible source for Ra, if they think so. Please also note how very different water masses and chl-a patterns are in the polar frontal region. Please note that assuming a different source region for excess Ra in some locations could also help to explain a mismatch between model age results and Ra ages in some cases.

Minor issues: The figures would benefit from clearly indicating the position of the polar front. The colour scale for the comparison of Lagrangian particle model and Ra ages is very difficult to read (I'm still not sure I understood what the grey colours mean)

Suggested revision: I feel that the suggested changes are essential, but they can easily be made, and that the overall quality of subject, data and possible conclusions is excellent and will deserve publication in Biogeosciences.

Interactive comment on Biogeosciences Discuss., 11, 14023, 2014.

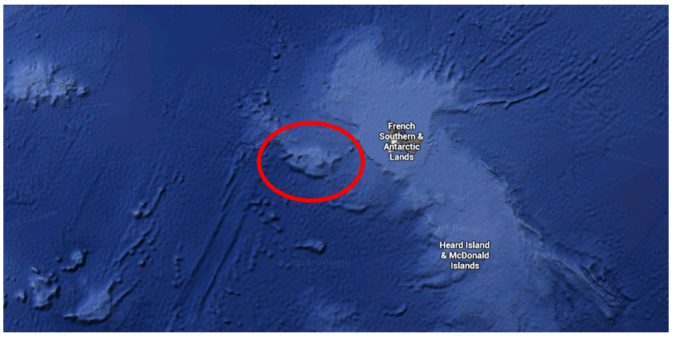

Fig. 1. Plateau as possible Ra-source west of Kerguelen plateau. Source: Google Maps