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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.

Anonymous Referee #3

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This paper reports the use of three radium isotopes – ^{223}Ra , ^{224}Ra , and ^{228}Ra , to determine surface water ages around the Kerguelen Island in Southern Ocean. Together with a Lagrangian particle analyses and an altimetry-based Lagrangian model, the authors conclude that chemical elements can be transported across or via the Polar Front. Overall, the paper is very well organized and written. The data quality is high, though some measurements suffer from large uncertainties (this is particularly the case for ^{223}Ra measurement) due to the extremely low levels of radium isotopes in this remote ocean. The conclusion is very convincing. I do not have major concerns on this paper and recommend it for publication after some minor revisions.

Minor comments: 1. P. 14030, line 5-7, MnO_2 fibers are analyzed using different protocols and with different detectors. Were there any cross calibrations of the protocols

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and detectors? 2. P. 14030, line 11-12, What are the uncertainties with the gamma detectors. It would be nice to propagate this source of error into the final uncertainties. 3. P. 14037, line 2, ...are subject to... 4. P. 14037, Eq.1, The assumptions inherent to this equation should be made clear. 5. P.14037, line 22-24, What is the range of the $^{224}\text{Ra}/^{223}\text{Ra}$ ratios that were used as the initial ratio? 6. Conclusions: In the last paragraph, it would be nice to mention that future studies should directly investigate the sources of Ra and chemical components (nutrients, Fe...etc) and quantify the fluxes of these species from bottom sediments, say, using the newly developed $^{224}\text{Ra}/^{228}\text{Th}$ disequilibrium approach (e.g., Cai et al., 2012; 2014). References: a. Cai Pinghe, Xiangming Shi, Willard S. Moore, Minhan Dai (2012), Measurement of $^{224}\text{Ra}:^{228}\text{Th}$ disequilibrium in coastal sediments using a delayed coincidence counter. Marine Chemistry 138-139, 1-6. b. Cai Pinghe, Xiangming Shi, Williard Moore, Shiyun Peng, Guizhi Wang, Minhan Dai (2014), $^{224}\text{Ra}:^{228}\text{Th}$ disequilibrium in coastal sediments: Implications for solute transfer across the sediment-water interface. *Geochimica et Cosmochimica Acta* 125, 68-84.

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