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Actinium-227 as a tracer for diapycnal mixing and deep upwelling

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^{227}Ac is a naturally occuring radioactive tracer (half-life 21.8 years) that is continuously released into the overlying water by deep-sea sediments. Since the pioneering work of Nozaki (1984), it has been recognized that ^{227}Ac in excess of its progenitor ^{231}Pa ($^{227}Ac_{ex}$) has a huge potential as a tracer for diapycnal mixing in the deep sea. However, data on the distribution of ^{227}Ac are still scarce due to the difficult sampling and measurement. Recently, some additional information on the global distribution of ^{227}Ac has become available (Geibert et al. 2002), confirming the results of Nozaki, and adding new insights to the role of deep upwelling for its distribution in the Southern Ocean. There, $^{227}Ac_{ex}$ has been shown to be detectable throughout the water column up to the sea surface as a consequence of intense and rapid vertical exchange of water masses.

Here, we give an overview about the distribution of ^{227}Ac in the ocean, including new results from inverse modelling. The obtained maps of the modelled global distribution of $^{227}Ac_{ex}$ confirm that this tracer closely reflects the underlying patterns of circulation and mixing. Additionally, we give an introduction to the available measurement techniques (different α-spectrometric techniques, delayed coincidence counting of its daughter nuclides), and present the potential applications of ^{227}Ac in the near future.

References

Nozaki, Y. (1984), Nature **310**, 486-488.

Geibert, W. et al. (2002), Earth Planet. Sci. Lett. **198** (1-2), 147-165.