Separating the sources of ^{228}Ra to the open ocean with ^{223,224,226,228}Ra measurements in Loch Etive and the South-East Atlantic

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Open ocean ^{228}Ra concentrations have been suggested as a proxy to constrain SGD fluxes – an important flux of nutrients and other dissolved species to seawater which is otherwise very difficult to constrain in magnitude [1]. Using open-ocean ^{228}Ra to assess SGD fluxes relies on being able to independently estimate the global fluxes of ^{228}Ra from other sources, particularly from shelf sediments and rivers. The magnitude of these fluxes has significant uncertainty.

We have provided new constraints on these fluxes with a suite of analysis on Loch Etive, a Scottish fjord. The loch has no known or expected groundwater input, and the fjordic overturning circulation usually restricts water exchange in the inner deep basin, with renewal events resetting the system to ocean values irregularly, about every 1 to 2 years. This allows us to assess ^{228}Ra flux from typical shelf sediments to the deep water, without groundwater inputs. At the same time, riverine input is assessed by measurement of the surface layer. We report ^{224}Ra and ^{223}Ra measurements by RaDeCC, and ^{228}Ra and ^{226}Ra measurements using a newly developed MC-ICP-MS approach [2]. Water in the deep loch shows higher ^{228}Ra concentrations than surface layer due to the sedimentary input, which is used to estimate ^{228}Ra sediment flux. Ra fluxes assessed from sediments and rivers in this setting are compared with values from the literature, which helps in the interpretation of the extant ^{228}Ra open ocean dataset.

We make use of understanding from Loch Etive in interpreting new preliminary data for the Ra quartet from the UK-GEOTRACES cruise in the SE Atlantic Ocean (GA10). Surface samples and depth profiles were collected for Ra using bottle and stand-alone-pumping and allow assessment of the fluxes of Ra, and hence information about the mixing transport of other elements to the open ocean.

[1] Moore *et al*. (2008) *Nat. Geosci*. **1**, 309-311. [2] Hsieh and Henderson (2011) *J. Anal. At. Spectrom*. DOI:10.1039/ C1JA10013K.

Global distributions of mineral dust properties from SeaWiFS and MODIS: From sources to sinks

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The impact of natural and anthropogenic sources of mineral dust has gained increasing attention from scientific communities in recent years. Indeed, these airborne dust particles, once lifted over the source regions, can be transported out of the boundary layer into the free troposphere and can travel thousands of kilometers across the oceans resulting in important biogeochemical impacts on the ecosystem. Due to the relatively short lifetime (a few hours to about a week), the distributions of these mineral dust particles vary extensively in both space and time. Consequently, satellite observations are needed over both source and sink regions for continuous temporal and spatial sampling of aerosol properties.

With the launch of SeaWiFS in 1997, Terra/MODIS in 1999, and Aqua/MODIS in 2002, high quality comprehensive aerosol climatology is becoming feasible for the first time. As a result of these unprecedented satellite data records, studies of the radiative and biogeochemical effects due to dust aerosols are now possible. In this study, we will show the comparisons of satellite retrieved aerosol optical thickness using Deep Blue algorithm with data from AERONET sunphotometers over desert and semi-desert regions as well as vegetated areas. Our results indicate reasonable agreements between these two. These new satellite products will allow scientists to determine quantitatively the aerosol properties near sources using high spatial resolution measurements from SeaWiFS and MODIS-like instruments. The multiyear satellite measurements since 1997 from SeaWiFS will be compared with those retrieved from MODIS and MISR, and will be utilized to investigate the interannual variability of source, pathway, and dust loading associated with the dust outbreaks over the entire globe. Finally, the trends observed over the last decade based upon the SeaWiFS time series in the amounts of tropospheric aerosols due to natural and anthropogenic sources (such as changes in the frequency of dust storms) will be discussed.