Introduction

The half life of $^{228}$Ra is 1.7 years. Each year the Atlantic Ocean loses 12% of its inventory of $^{228}$Ra by radioactive decay. This inventory must be continually replaced by inputs from rivers, sediments, and submarine ground water discharge (SGD). By evaluating the loss of $^{228}$Ra from the ocean, we can infer the amount of SGD that is occurring. To determine the SGD fluxes from $^{228}$Ra, we must consider the radioactive decay of the $^{228}$Ra that is lost from the ocean.

What is Submarine Groundwater Discharge?

Submarine groundwater discharge is the advective flux of water through permeable sediments that is driven by the-pressure difference between the ocean and the land. SGD is estimated to be between 50 and 150 km3/yr, with 15% of the SGD occurring in the North Atlantic. SGD is important in the carbon cycle because it can transport organic matter from the land to the ocean.

General model for quantifying SGD using radium isotopes

In this poster, we use data from the Transient Tracers in the Ocean (TTO) project to determine the SGD fluxes in the upper Atlantic. Three tracer inputs to the ocean are considered: riverine, particulate, and sedimentary.

Inputs from Sediments

$^{228}$Ra is continually generated by decay of $^{238}$Th in sediments. Some of this $^{228}$Ra dissolves in pore waters and may enter coastal water by diffusion and advection. More information is available in the literature on SGD fluxes and their contributions to the carbon cycle.

Why is SGD Important to Carbon Fluxes?

Coastal hydrogeological systems contain high concentrations of DOC and $^{228}$Ra. SGD can transport organic matter from the land to the ocean, and $^{228}$Ra can be used as a tracer to study SGD.

Conclusions

1. There is probably more water entering the Atlantic Ocean from submarine groundwater discharge than from rivers.
2. SGD is enriched in DOC and DIC relative to river water.
3. The input of SGD and DIC to the Gulf of Mexico by SGD is likely greater than the input by rivers.