

How Old is Old?

Tracking Transit Times of the North Atlantic Ocean Using Sulfur Hexafluoride

Pardo, Jordan R.¹, Smethie, William²

¹School for Engineering and Applied Sciences, Columbia University, New York, NY, ²Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY,

Sulfur hexafluoride (SF_6) is a man made gas which, due to its unique and well known tropospheric history, allows us to determine the age and transport properties of a water mass. The concentration of SF_6 has increased in the atmosphere since its introduction in the 1950s and has increased in a linear fashion since the mid-1980s. Once in the atmosphere, the SF_6 enters the surface water of the earth's ocean, becoming incorporated in the global overturning circulation (GOC). Since this tracer is conservative and its concentration is a well known function of time, we are able to estimate the age of a water mass based on the concentration of SF_6 in the water. By comparing the ages for the same region of the ocean sampled at different times we can determine if there is any variability in the GOC. In this project, results are presented from observations along Line W. Line W extends from the continental shelf off New Jersey to the southeast, almost reaching Bermuda. We have used SF_6 observations from annual research cruises between 2009 to 2012 to calculate the transit times/ages of deep water masses which form in the North Atlantic and flow south through Line W toward the equator. For Labrador Sea Water, the age determined from SF_6 concentrations in the Deep Western Boundary Current was about 24 years with little variability between 2009-2012. For Denmark Strait Overflow Water the age was about 27 years from 2009-2011 and increased to about 30 years in 2012.