Evolution of surface concentrations of ^{90}Sr and ^{137}Cs through 2016 from the Fukushima Dai-ichi nuclear accident

J. KENYON[1], **K. BUESSELER[1]**, N. CASACUBERTA[2], M. CASTRILLEJO[3], S. OTOSAKA[4], J. DRYSDALE[1], S. PIKE[1], X. DIAZ[3]

[1]Woods Hole Oceanographic Institution, USA (kbuesseler@whoi.edu)
[2]ETH Zurich, Switzerland
[3]Universitat Autònoma de Barcelona, Spain
[4]Japan Atomic Energy Agency, Japan

The Fukushima Dai-ichi Nuclear Power Plant (FDNPP) accident in 2011 led to an unprecendented release of radionuclides into the atmosphere and ocean. Of importance are ^{90}Sr and ^{137}Cs due to their known health detriments and long half-lives ($T_{1/2}$≈30 years) relative to ecological systems. In addition, they can be used as a geochemical tracer for hydrological, atmospheric, ocean, and geochemical processes.

This study attempts to reconcile the sources and relative inputs of ^{90}Sr and ^{137}Cs using the measured activities and their ratios of $^{137}Cs/^{90}Sr$ off the coast of Japan. Pre-accident levels correlate with 1960's nuclear weapons testing fallout activity ratios of 1.6. Immediately following the accident, $^{137}Cs/^{90}Sr$ ratios experienced a sharp increase before reaching an average of 39±1 [1]. A ratio between these two endmembers indicate a variance in source inputs. Decontamination systems as well as leakages within the FDNPP have resulted in variable $^{137}Cs/^{90}Sr$ activity ratios since 2011 [2].

Here we present the data from six cruises from 2011 to 2016 off the coast of Japan. Results show that radionuclide concentrations have been decreasing since the accident, but are not yet comparable to pre-accident levels in the areas immediately surrounding FDNPP. Waters farther away from FNDPP show ratios closer to pre-accident levels, giving insight to the transport and mixing of water off the coast of Japan. The influence of leakages from FDNPP, storm events, and other secondary pathways are also evaluated in this study.

We observe that the release of radionuclides from FDNPP is ongoing, but at rates more than one thousand times lower than initial releases in 2011. However, given the changing concentrations and activity ratios from FDNPP, further monitoring of artificial radionuclide inputs to the Pacific Ocean is warranted.

[1] Casacuberta *et al*. (2013) *Biogeosciences*, **10**, 2039-2067
[2] Castrillejo *et al*. (2015) *Environ. Sci. Technol.*, **50**, 173-180