Transport history of Fukushima radioactivity on Line P in the northeast Pacific Ocean: 2012-2018

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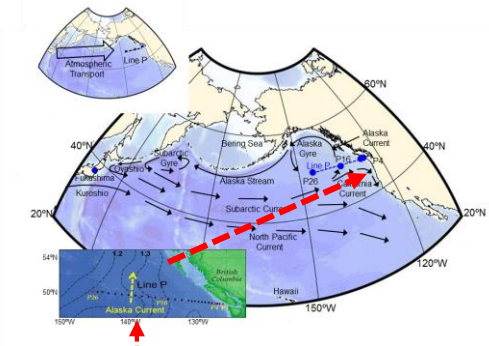

Figure 1. Current systems transported oceanic discharges of radioactivity from Fukushima Daiichi NPP (western blue symbol) eastward across the Pacific and northward across Line P at the eastern edge of the Alaska gyre. *Upper inset*: Open arrow illustrates general northeastward direction for transport of atmospheric discharges of Fukushima radioactivity. *Lower inset:* Positions of stations illustrated for Line P. Dashed curves are streamlines whose values (cm) represent the average dynamic height field for 2002-2012 indicating strong northward flow in the Alaska Current (yellow arrow). Fifty liter water samples were collected on Line P on the CCGS J. Tully during 2011-2019 and analysed for radiocesium at the radio analytical laboratory at the Bedford Institute of Oceanography.

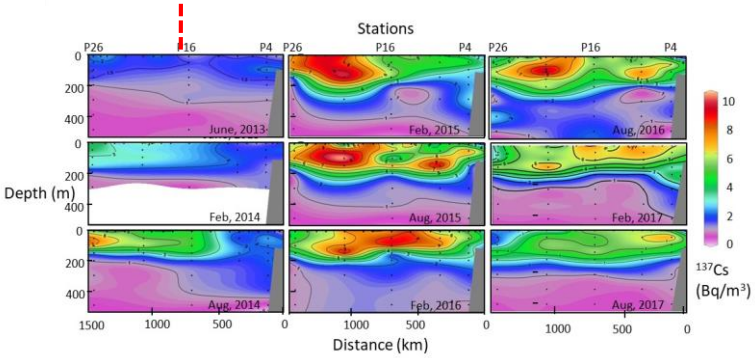

Figure 2, Time series of Fukushima ^{137}Cs sections on Line P shows signal increasing from June, 2013 and spreading eastwards towards BC coast. ^{137}Cs flow stalls in the weak, disorganized flow regime east of Sta. P16 where sea surface height streamlines (dashed lines; left panel) indicate strong, northward flow in the Alaska Current.

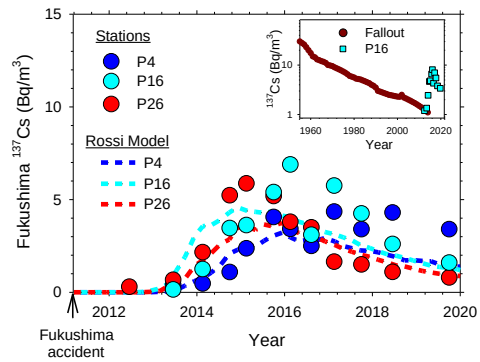

Figure 3. Symbols are Fukushima ^{137}Cs in surface water at Stas. P4, P16 and P26. In Feb. 2016 levels of ^{137}Cs were still increasing at Sta. P4 over the shelf, but had begun to decline at Sta. 26 in the interior of the subpolar gyre. Dashed lines are model results (Rossi et al., 2013) in reasonable agreement with data. Inset: model ^{137}Cs results are compared to historical record for ^{137}Cs fallout levels in North Pacific.

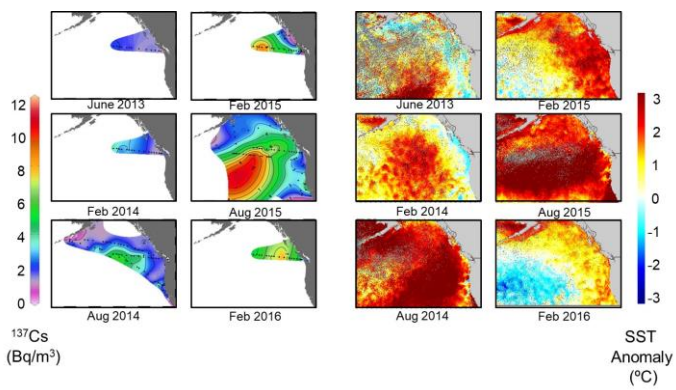

Figure 4. *Left two columns:* ^{137}Cs surface water distributions, June 2013-Feb 2016 show spatial evolution of the Fukushima plume as it nears Canada. *Right two columns:* SST anomaly distributions for same time period outline the development of the "Warm Blob" which occupied the same water masses as Fukushima tracer patch and whose configuration was shaped by an anomalously high atmospheric pressure system over the northeast Pacific in 2013-14.

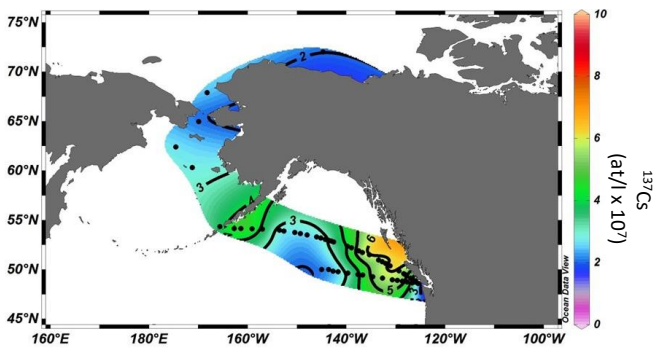

Figure 5. July-August, 2016 results show flow of Fukushima ^{134}Cs north from Line P in the Alaska Gyre (Fig. 1), then west in the Alaska Stream into the Bering Sea, Bering Strait and Arctic Ocean. ^{134}Cs is close to detection limit, but Fukushima ^{137}Cs at levels > 3 Bq/m^3 may become useful tracer for Pacific Water spreading out through surface mixed layer and halocline of the Arctic Ocean and through the Canadian Archipelago.