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# Model simulations on the long-term dispersal of Cs-137 released into the Pacific Ocean off Fukushima

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A sequence of global ocean circulation models, with horizontal mesh sizes of 0.5, 0.25 and 0.1, are used to estimate the long-term dispersion by ocean currents and mesoscale eddies of a slowly decaying tracer (half-life of 30 years, comparable to that of Cs-137) from the local waters off the Fukushima Dai-ichi Nuclear Power Plants. The tracer was continuously injected into the coastal waters over some weeks; its subsequent spreading and dilution in the Pacific Ocean was then simulated for 10 years. The simulations do not include any data assimilation, and thus, do not account for the actual state of the local ocean currents during the release of highly contaminated water from the damaged plants in March–April 2011. An ensemble differing in initial current distributions illustrates their importance for the tracer patterns evolving during the first months, but suggests a minor relevance for the large-scale tracer distributions after 2–3 years. By then the tracer cloud has penetrated to depths of more than 400 m, spanning the western and central North Pacific between 25N and 55N, leading to a rapid dilution of concentrations. The rate of dilution declines in the following years, while the main tracer patch propagates eastward across the Pacific Ocean, reaching the coastal waters of North America after about 5–6 years. Tentatively assuming a value of 10 PBq for the net Cs-137 input during the first weeks after the Fukushima incident, the simulation suggests a rapid dilution of peak radioactivity values to about 10 Bq $m^3$ during the first two years, followed by a gradual decline to 1–2 Bq $m^3$ over the next 4–7 years. The total peak radioactivity levels would then still be about twice the pre-Fukushima values.