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DELIVERABLE IRA-Marine-D1

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Modelling radionuclide transfers in Fukushima marine ecosystems

COMET Marine Group (Initial Research Activity)

ABSTRACT: The Fukushima accident in 2011 has refocused the vision for marine radioecology by highlighting the importance of post-accidental marine issues. It constituted the most important accidental release of artificial radionuclides to the marine environment that has ever occurred. Contamination of every marine component (water, sediment and biota) has been observed. The understanding of contamination levels and radionuclide distributions in the environment, along with prediction of their future evolution requires analyses of detailed monitoring data and the use of modelling tools. In the aftermath of an accidental situation where radioisotopes in the different marine compartments have not equilibrated, time dependent radioecological models of transfer are required.

Within COMET project (Coordination and Implementation of a pan-European instrument for radioecology, 2013-2017), WP3 is dedicated to the improvement and the validation of radioecological models. The marine Initial Research Activity (IRA) focuses on radioecological transfer modelling and plans to use existing models as a basis for the work with a view to improving some of them to achieve more sophisticated models e.g. trophic transfers modeling or combining transfer modeling with sediment modelling to improve estimates concentration in biota. Three tasks are on-going in the IRA:

- Implementation and use of classical radioecological models based on dynamic transfer equations to evaluate concentrations in marine organisms (fish, mollusks, crustaceans). Improvement of radioecological parameters (concentration factors and single or multicomponent biological half-lives) for ^{137}Cs, ^{134}Cs, ^{131}I and ^{90}Sr, including sensitivity. This task includes the constitution of a database with parameter values from the different models used, and comparison with observed half-lives from Fukushima monitoring dataset. This work will be enlarged to other radionuclides that could be important in post-accidental situation due to their dose potential contribution or their environmental accumulation capacity (i.e. Pu, Am, Ag…).

- Inclusion of sediment processes in dynamic transfer modelling. This work will follow ongoing studies adapting an existing dynamic model (D-DAT). The tool has been adapted to include depletion of radionuclides adsorbed onto suspended particulates (particle scavenging), molecular diffusion, pore water mixing and bioturbation (modelled effectively as a diffusive process) represented by a set of coupled differential equations which are related with the biological uptake/turnover processes. The model is now completed and tested with the available data to see if it is capable of reproducing activity in sediment to give a more realistic calculation of concentrations in biota and improving the dose models for humans and biota based on Kd values.

- Process oriented modelling for mid and long-term predictions: ecological and environmental processes. Modelling trophic transfer to pelagic fishes in Fukushima coastal

area, including ecosystem modelling and food-webs transfers is in development. The first results and comparisons with measurements data show good agreement.