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The Fukushima releases: an inverse modelling approach to assess the source term by using gamma dose rate observations.

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A few hour after the earthquake struck the Japan on March 11, the Technical Crisis Centre of the Institut de Radioprotection et de Surete Nucleaire (IRSN), was fully activated, 24/7 for the next 4 weeks to give its expertise to the French government and to the French embassy in Tokyo.

From this experience, lots of difficulties were highlighted. Our consequences assessment capabilities had been limited by uncertainties coming from source term assessment, meteorological data and, on smaller scale, dispersion model.

Since then, the institute has been working on improving its assessment of the atmospheric release and environmental contamination (Mathieu et al., 2012, Korsakissok I. et al, 2013). One of the largest sources of error is the source term estimation including the time evolution of the release rate and its distribution between radioisotopes. Inverse modelling methods have proved to be efficient to assess the source term due to accidental situation (Gudiksen, 1989, Krysta and Bocquet, 2007, Stohl et al 2011, Winiarek et al 2012). Most existing approaches are designed to use air sampling measurements (Winiarek et al, 2012) and some of them use also deposition measurements (Stohl et al, 2012, Winiarek et al, 2013). During the Fukushima accident, such measurements are far less numerous and not as well distributed within Japan than the dose rate measurements. To efficiently document the evolution of the contamination, gamma dose rate measurements were numerous, well distributed within Japan and they offered a high temporal frequency. However, dose rate data results from all the gamma emitters present on the ground and in the atmosphere. A specific methodology based on invert modelling has been developed to operate efficiently dose rate data. Applied to the Fukushima case, the emissions for the 8 main isotopes Xe-133, Cs-134, Cs-136, Cs-137, Ba-137m, I-131, I-132 and Te-132 have been assessed automatically without case specific assumption or guess source term. The Daiichi power plant releases events were well identified and the atmospheric dispersion of the retrieved source term shows a good agreement with environmental observations. The most important outcome of this study is that the method is perfectly suited to crisis management and will improve our diagnosis capabilities in case of a nuclear accident.

キーワード: Inverse modelling, Fukushima, gamma dose rate data, atmospheric dispersion
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