**Evaluating impacts of the Fukushima Daiichi Nuclear Power Plant accident on tritium tracer applications in Fukushima Prefecture waters, Japan**

**Maksym Gusyev1,\*, Alexandre Cauquoin2, and Kateryna Korepanova1**

*1Fukushima University,* *960-1296, Fukushima, Japan*

*2: Institute of Industrial Science (IIS), The University of Tokyo, Kashiwa, Japan.*

\* *e-mail:* *maksymgusyev@gmail.com**, r891@ipc.fukushima-u.ac.jp*

The anthropogenic tritium (H-3) with a half-life of 12.32 ± 0.02 years was released during the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident prompting tritium radionuclide measurements and complicating tritium-tracer interpretation in terrestrial waters of Fukushima Prefecture, Japan. In Fukushima Prefecture, the long-term tritium monitoring of rivers, dams, lakes and the ocean waters started from May 2011 to present, accounting for 96 monitoring sites sampled twice a year in summer and autumn-winter periods [1]. For the Fukushima coastal area, the highest tritium concentration of 12.71 TU was recorded on June 25, 2013, in the Maeda River site, which is located 5 km north of the FDNPP site boundary. Also, a few coastal river sites located from 20 km north of the FDNPPS site had measured tritium values up to 8 TU in 2011, indicating the anthropogenic influence. To establish tritium data in Fukushima precipitation, tritium in precipitation values from a general circulation model simulation of the FDNPP atmospheric release were matched to available tritium measurements in daily and monthly precipitation across Japan, leading to a tritium peak of 582 TU [2]. These modeled tritium values were combined with the tritium time-series scaled from the Tokyo to Fukushima coastal area allowing the estimation of mean transit times (MTTs) for tritium measurements in river, spring and artesian well between 2011 and 2014 [2]. The results show that tritium measurements in river and springs required the FDNPP tritium input while the artesian well tritium measurements were only affected by the thermonuclear testing input and not by the FDNPP accident [2]. Comparing these short-term measurements with long-term tritium monitoring data of the Fukushima Prefecture allows us to confirm that the FDNPP tritium pulse had negligible impact on the tritium levels [3]. It is also important to note that tritium in monthly precipitation had the highest value of 12.5 TU on June 2023 [3], whereas the release of water treated by an Advanced Liquid Processing System from the FDNPP site to the Pacific Ocean started on August 2023 below the established international safety standards [4]. In summary, the primary tritium source is precipitation containing natural tritium formed by cosmic rays in the upper atmosphere and tritium remains a useful tracer to estimate Fukushima waters circulation considering both natural and anthropogenic inputs.

References:

[1] Fukushima Revitalization Portal Site (2025). <https://www.pref.fukushima.lg.jp/site/portal/>

[2] Cauquoin, A., Gusyev, M., et al. (2025) Modeling tritium release to the atmosphere during the Fukushima Daiichi Nuclear Power Plant accident and application to estimating post-accident water system transit times, Japan, Environmental Science and Pollution Research, https://doi.org/10.1007/s11356-025-35919-1

[3] Gusyev, M., Cauquoin, A., Hirao, S., and Akata, N.: A review of tritium radioisotope in Fukushima waters, Japan, EGU General Assembly 2025, Vienna, Austria, 27 Apr–2 May 2025, EGU25-20793, https://doi.org/10.5194/egusphere-egu25-20793, 2025.

[4] Cauquoin, A., Gusyev, M., Komuro, Y., Ono, J., and Yoshimura, K.: Simulation of anthropogenic tritium discharge into the ocean from the Fukushima Daiichi Nuclear Power Plant, EGU General Assembly 2025, Vienna, Austria, 27 Apr–2 May 2025, EGU25-11395, https://doi.org/10.5194/egusphere-egu25-11395, 2025.