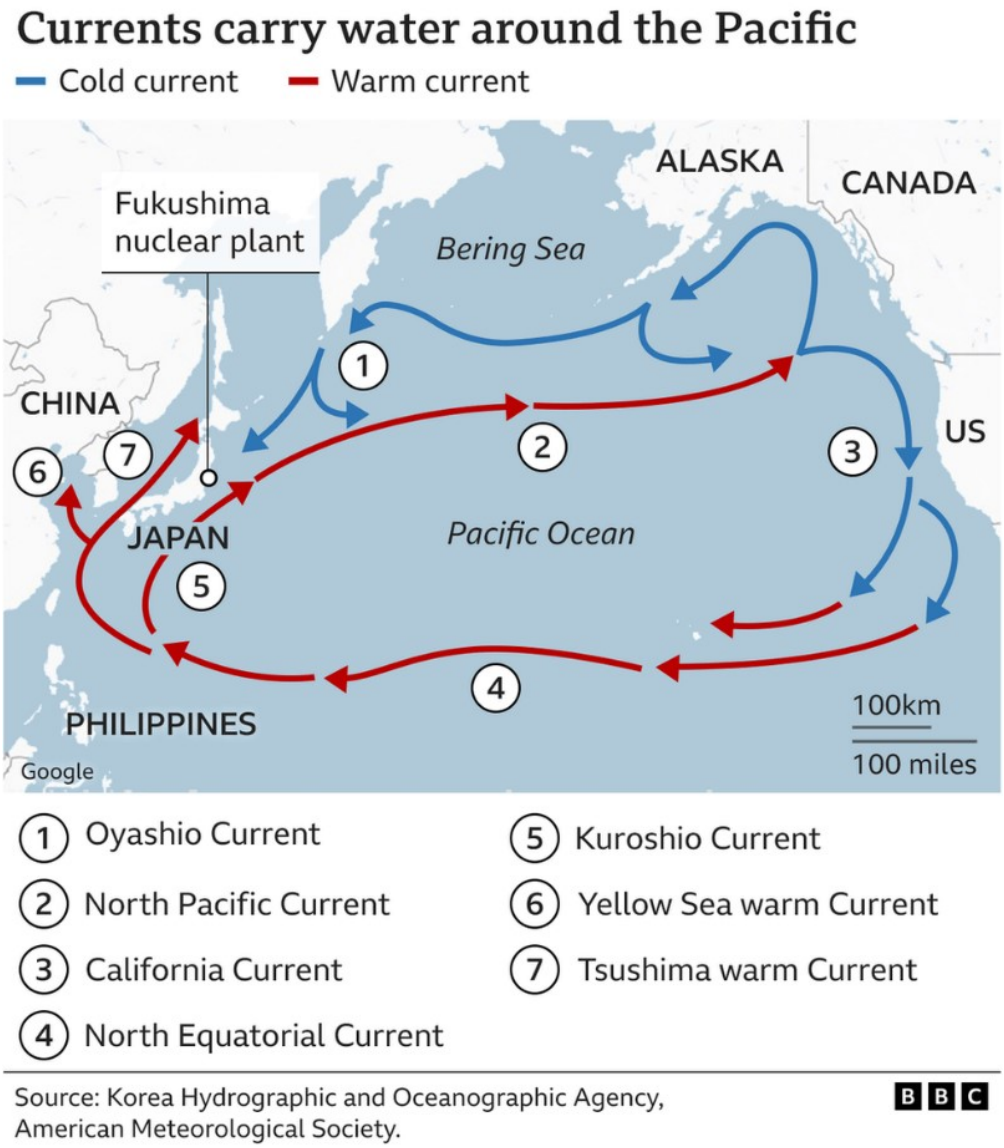
Ocean model for Fukushima's wastewater release

Prelims – *Current events of national and international importance.*

Why in News?

Recently, in Fukushima Daiichi Nuclear Power Plant researchers estimate the amount and timing of tritium release with an ocean circulation model, so far it is focused on local coastal waters.

- **Waste water release in Fukushima -** In August 2023, Japan started releasing treated wastewater into the ocean.
- This wastewater is a result of cooling the damaged reactors at the Fukushima plant after the 2011 earthquake and tsunami.
- The water is treated using the ***Advanced Liquid Processing System (ALPS),*** which aims to remove most radioactive materials, but not tritium.
- The released water is diluted with seawater to reduce the concentration of tritium. This process is expected to last for 30 years.
- Japan asserts that the water has undergone treatment and dilution prior to its discharge into the ocean.
- The water has a concentration of approximately 190 becquerels of tritium per litre, which is significantly lower than the *WHO's drinking water threshold of 10,000 becquerels* per litre (Bq/L).
- **Concerns -** Waste water released into the ocean nearby Fukushima will not be contained to waters surrounding Japan.
- It will be carried by ocean currents, particularly the cross-Pacific Kuroshio current, to other parts of the world.
- Marine creatures that travel vast distances, phytoplankton (organisms that float freely), and microplastics can all serve as Trojan horses to disseminate radionuclides over long distances.



The recent Ocean Model

- **Done by –** University of Tokyo and Fukushima University.
- **Objectives –** To trace the spread of tritium from Fukushima's planned 30-year wastewater discharge throughout the Pacific Ocean.
- **Scientific technique used** – COCO 4.9 ocean circulation model combined precise estimates of the amount and timing of tritium.

Tritium *represented by the symbol "T" or "^{3}H," is a radioactive isotope of hydrogen. It is the heaviest and rarest form of naturally occurring hydrogen. It has one proton and two neutrons.*

- **Analysis - Tritium Injection –** The researchers 'injected' tritium into the model in 2 phases.
  - 179-181 TBq for the 2011-2019 period the model's surface layer to mimic the Fukushima disaster's effects.

    - 480 TBq over 2023-2051 some 11 m below the surface This dose is the highest possible the Tokyo Electric Power Company is expected to release during the discharge.

- **Key Findings –** The significant spike immediately following the 2011 accident, tritium levels in the open Pacific remained well below detectable limits.
- They explored three scenarios, present-day conditions, a strong warming pathway (SSP5-8.5), and ocean eddies.

Eddies *are circular currents of water or air that form when a fluid's main flow is disrupted, causing swirling or rotating motion.*

- The peak concentration reached only 0.002 Bq/L—25 times lower than the natural background radiation present in seawater.
- Warmer oceans shift the Kuroshio Current northward, speeding up tritium's reach to Asia's coasts by 3 years.
- Ocean eddies may transport small amounts to North America or the South China Sea but the concentrations remain safely low.
- **Significant –** The facility is releasing tritiated water so slowly, the radiation it's responsible for is lower than that due to natural and historical sources.
- Half-life of about 12 years, it levels remained undetectable across the wider Pacific in model projections through 2099 even under extreme warming or worst-case eddy transport scenarios.

Reference

The Hindu| Fukushima Wastewater Release

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