Traces of the Fukushima accident pollution in India and the Arabic Sea

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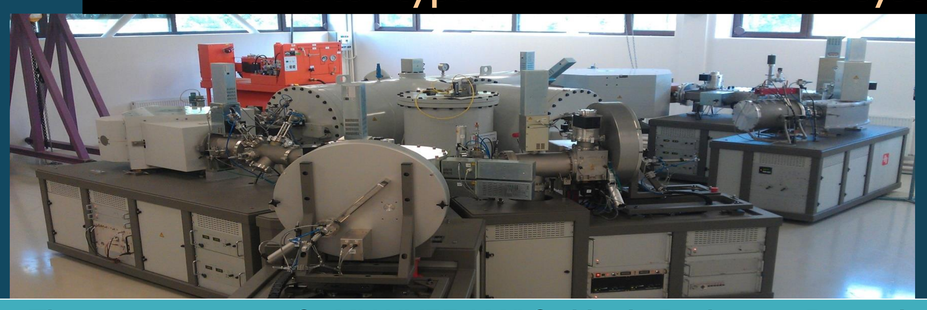
Introduction

- **Our work:** a Continuation of AMS experiments with the 129I tracer to follow the outspread of nuclear pollution from the Fukushima Nuclear Accident (Japan) by atmospheric transport and ocean water currents.
- The points of interest were :
  - Rivers in India,
  - China Sea,
  - Arabian Sea.

(water samples were collected between 2014 and 2019).

- We observed, westwards of Japan, interesting differences between I129 measured values, as result of competition between the atmospheric transport and the ocean water transport that is hindered by the strong ocean Kuroshio current.

Cockcroft Walton type 1 MV HVEE Tandetron system in Bucharest



The general layout of 1 MV HVEE AMS facility in Bucharest, Romania

- Two Ion Sources of Negative Ions by Cesium Sputtering (SNICS), model SO110–50;
- An eelectrostatic switching system between the two ion sources;
- Low energy analysing Magnet with bouncing system;
- Q-Snout device;
- 1MV tandem accelerator, with gas stripper channel;
- High energy Analysing Magnet;
- Three offset Faraday cups and Si_3N_4 foil as passive absorber for boron-beryllium measurements;
- High voltage Electrostatic Analyser;
- ΔE-E_{res} gas particle detector;
- Cockcroft-Walton type HV power supply.
- control room, acquisition system

We measured 6 years after the Fukushima accident the 129I concentrations in the North Pacific Ocean, which showed that the Ocean has much lower values at that time, with an average of 2.5×10^7 atoms L^{-1}, close to the pre- accident concentrations values.

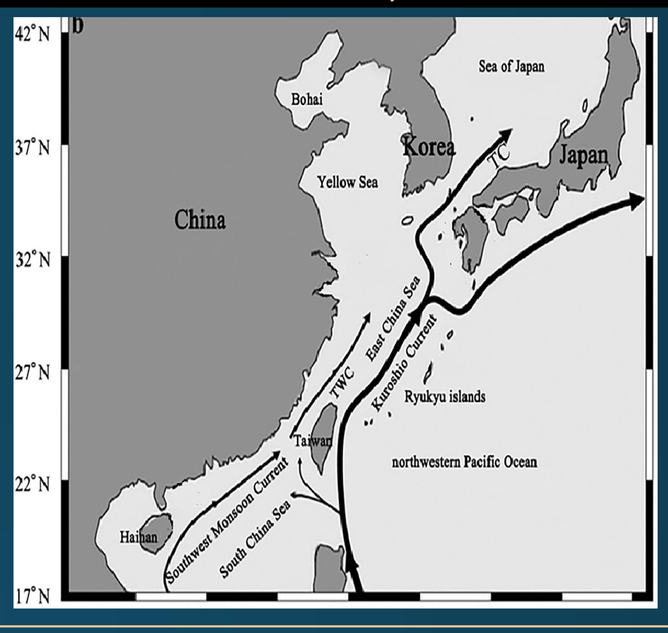
However, Fukushima and its vicinities remained an isolated area of nuclear pollution in the range of $(0.9–1.6)\times10^8$ atoms L^{-1}. Higher values of 6.4×10^8 atoms L^{-1} have also been found in the Tadami River, located close to the damaged reactor.

To emphasise: the pollution dispersion through the Pacific Ocean currents ends in west direction. The Kuroshio Current blocks the propagation towards the Yellow Sea and China Sea and those locations have much lower concentrations 1.5×10^7 atoms/L (thus, not affected by Fukushima accident)

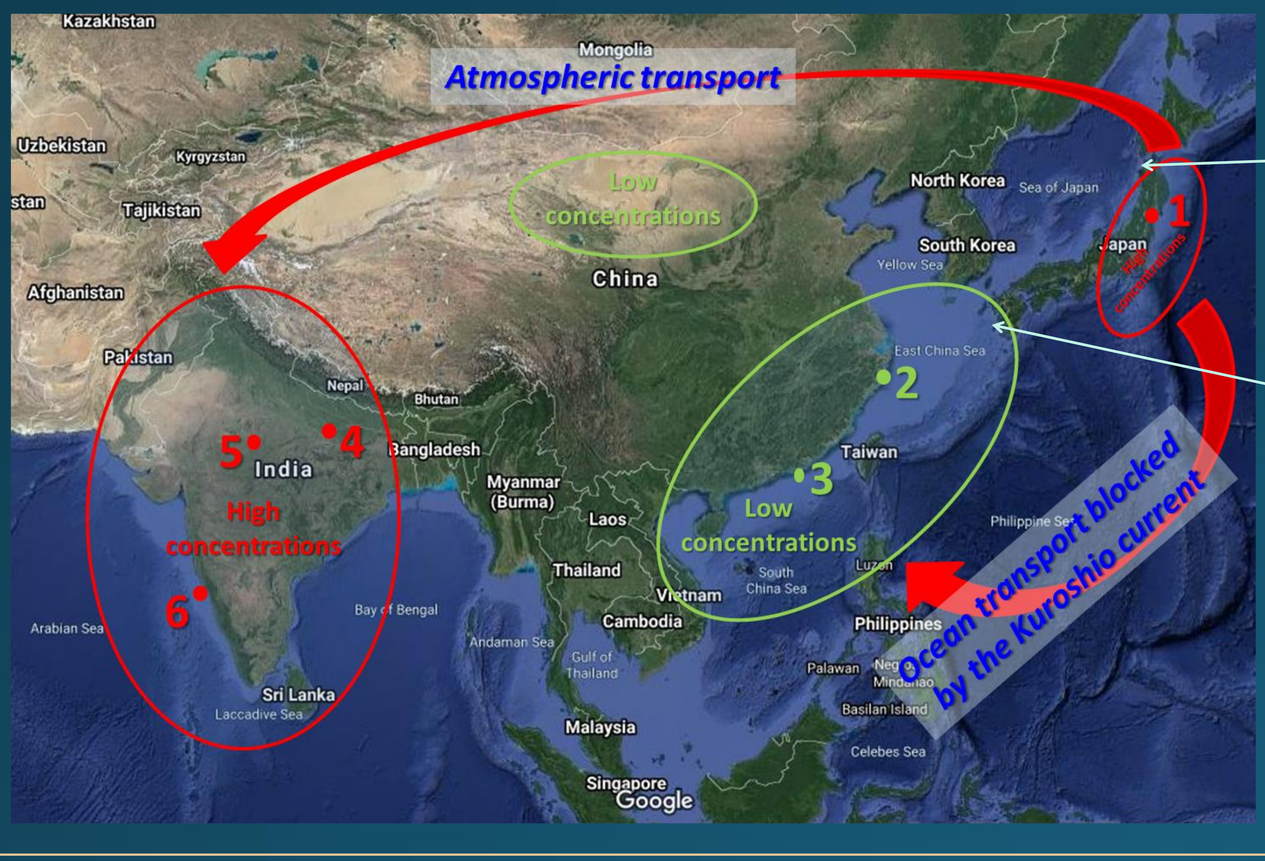
However, our test measurements showed higher concentrations for the Indian Sea and Indian rivers.

It can be explained by the following :

The natural barrier created by the Kuroshio current



Area of extracted samples: China Sea, Arabian Sea, Indian rivers



Fukushima Daiichi Nuclear Power Plant - affected by a giant tsunami - March 11, 2011

Points of interest

1) Fukushima
2) Shanghai
3) Disneyland Hong Kong
4) Gange River (Varanasi)
5) Ken River (Panna Tiger Reserve)
6) Sinquerim Beach (Arabian Sea)

Sample collection

between 2014 -2019

1) **Shanghai**
2) **China Sea Disneyland Hong Kong**
3) **Gange River**–location in front of BrijRama Palace, city of Varanasi, one of the most sacred places in India and one of the oldest city in the world.
4) **Goa shores of the Indian-Arabian Ocean** – location at the Fort Aguada, a well-preserved seventeenth-century Portuguese fort that was built in 1612 to guard against the Dutch and the Marathas. Sinquerim Beach, overlooking the Arabian Sea.

Conslusions

The far western vicinity (India) was polluted by stratospheric transport from the exploded reactor at Fukushima. China and China sea were not affected by this high altitude atmospheric transport.

We are currently measuring samples from rivers of India and we will correct the date for local pollution contributed by the big Reprocessing Nuclear Power Plants in India.

Averaged results of our measurements

Samples name	Shanghai (2)	Disneyland Hong Kong (3)	Gange River Varanasi (4)	Khan River (5)	Sinquerim Beach (6)
atoms $^{129}I/L$	$1.30 \cdot 10^7$	$1.51 \cdot 10^7$	$0.99 \cdot 10^8$	$1.80 \cdot 10^8$	$3.15 \cdot 10^8$
µg $^{127}I/L$	40.72	40.91	8.26	10.92	75.38
$^{129}I/^{127}I$	$6.71 \cdot 10^{-11}$	$7.82 \cdot 10^{-11}$	$2.93 \cdot 10^{-10}$	$3.48 \cdot 10^{-9}$	$2.93 \cdot 10^{-10}$

Nuclear Power Plants in India

Among India's *nuclear power plants,* we can list the following: 1) NARORA, 2) RAJASTHAN, 3) KAKRAPAR, 4) TARAPUR, 5) KAIGA, 6) KUDANKULAM, 7) MADRAS

Acknowledgments

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