Tracking the dispersion of contaminated sediment along the main rivers draining the radioactive plume in Fukushima Prefecture (Japan)

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TRACING THE ENVIRONMENTAL CONSEQUENCES OF THE TOHOKU EARTHQUAKE-TRIGGERED TSUNAMI AND THE FUKUSHIMA ACCIDENT

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- Japan hit by a powerful earthquake on 11 March 2011
- Earthquake triggered a giant tsunami
- Damage to cooling system of several reactors at Fukushima-Daiichi nuclear power plant
- Massive radionuclide release into the atmosphere, mainly between 13 and 15 March :
  - 190 – 700 PBq (10^{15} Bq) of ^{131}I (11 – 40% Chernobyl)
  - 12 – 53 PBq of ^{137}Cs (14 – 62% Chernobyl)
- Direct radionuclide release into the Pacific Ocean

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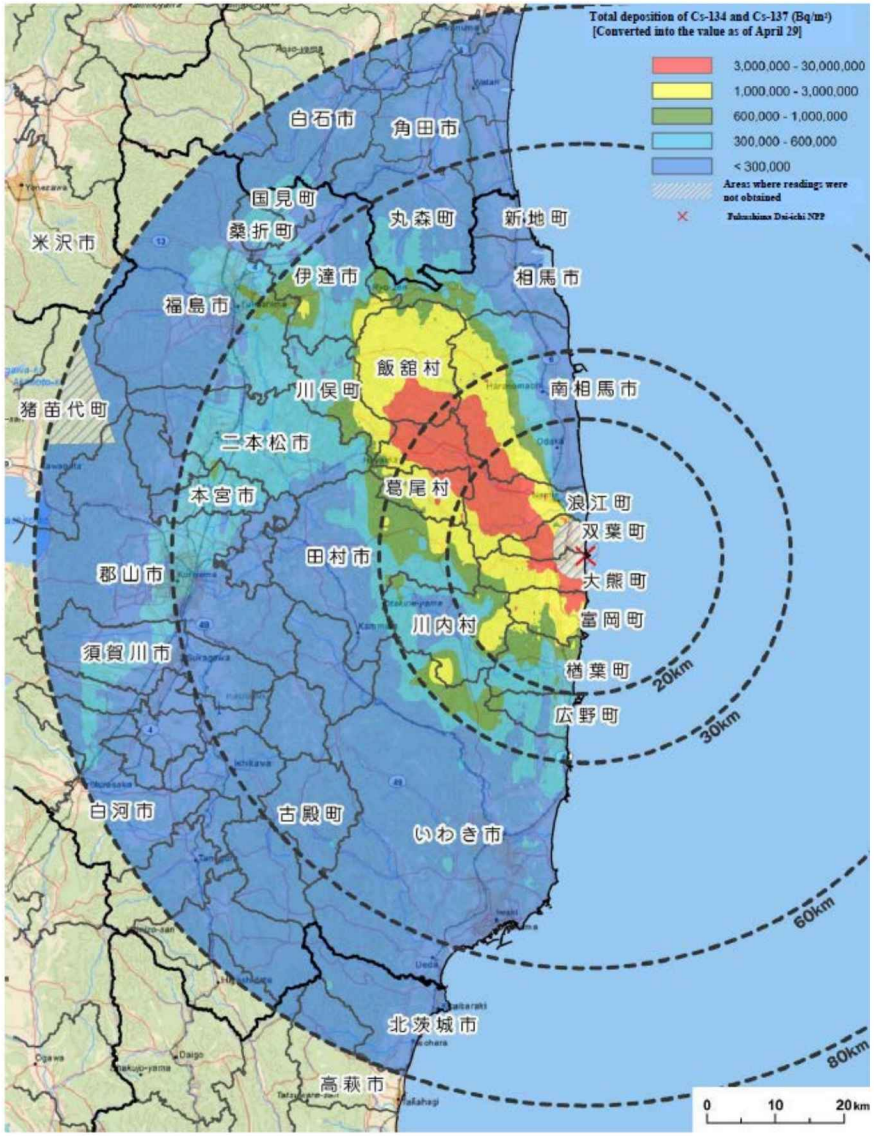
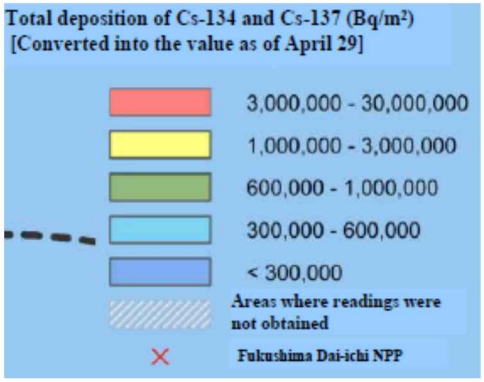
- Airborne survey of radionuclide fallout (MEXT – DoE) – April 2011

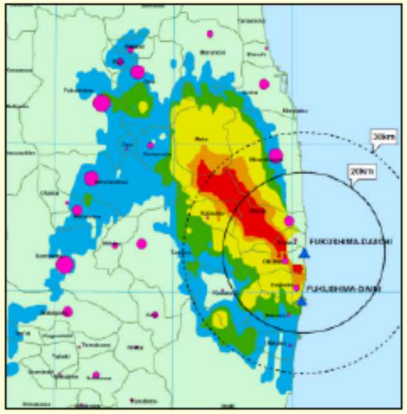




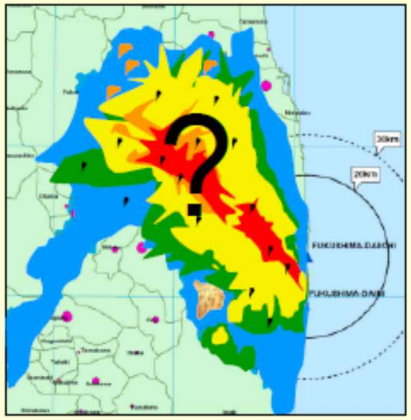
^{134}Cs

^{137}Cs

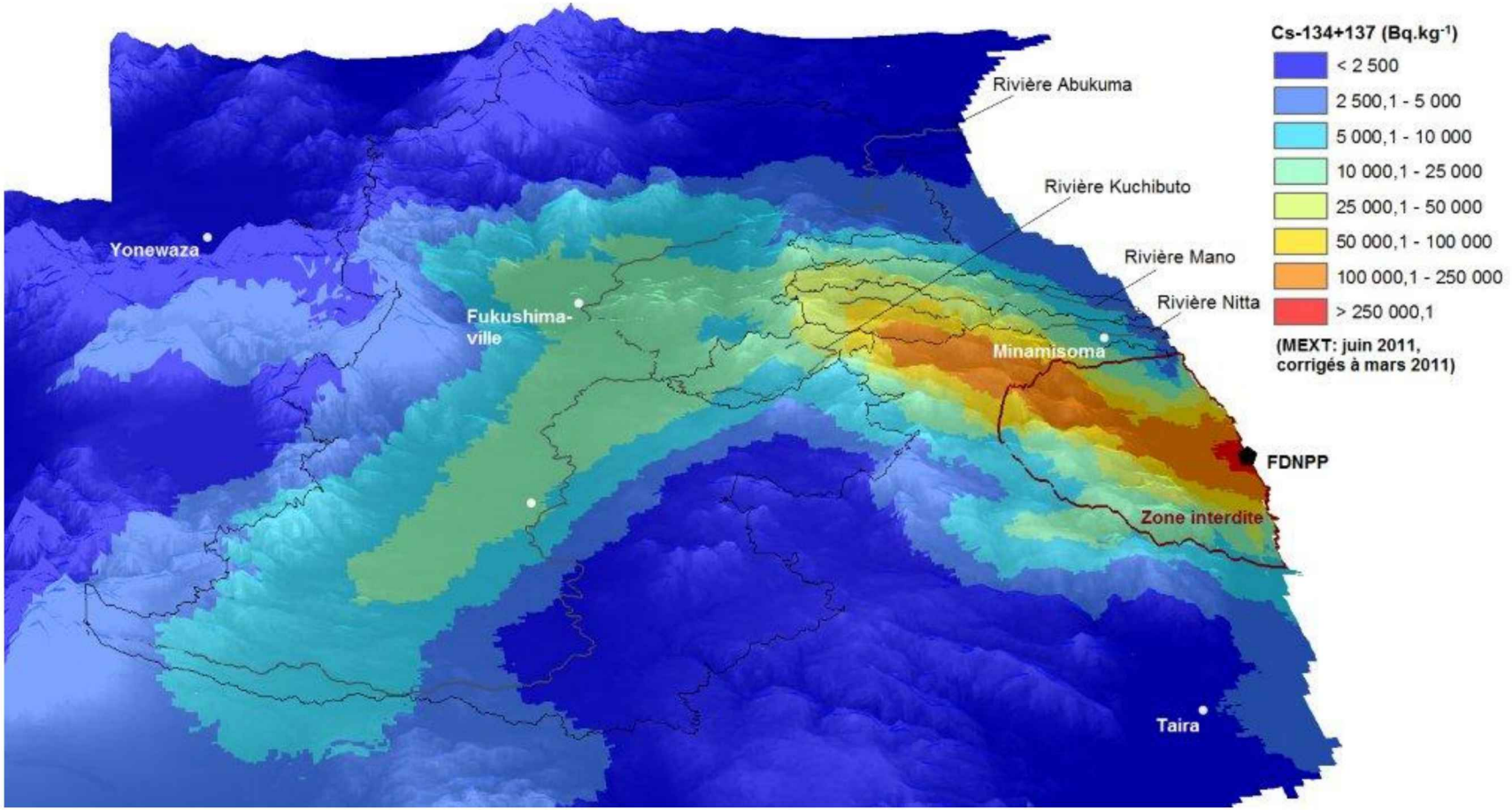
Initial contamination



Redistribution ?



- Initial contamination plume and topography of Fukushima Prefecture



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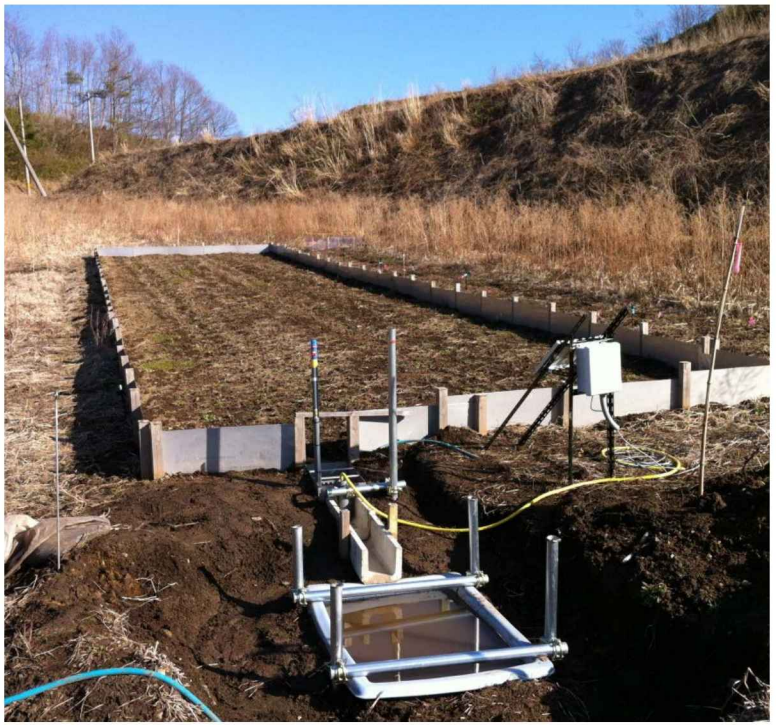
Monitoring of radionuclide transfer under different vegetation cover types

Evergreen forest

Broadleaf forest



Bare soil

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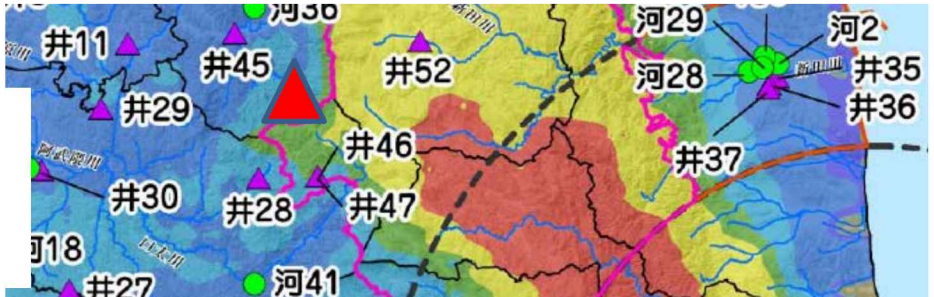
平成 23 年度科学技術戦略推進費
放射性物質による環境影響への対策基盤の確立
福島 陸域・水域モニタリング大学連合チーム
FUKUSHIMA RADIATION MONITORING OF WATER, SOIL AND ENTRAINMENT

FMWSE



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Portable Ge detector


Sediment sampling

Limit of the 20 km area


Portable NaI detector

Portable radiameter


Soil sampling

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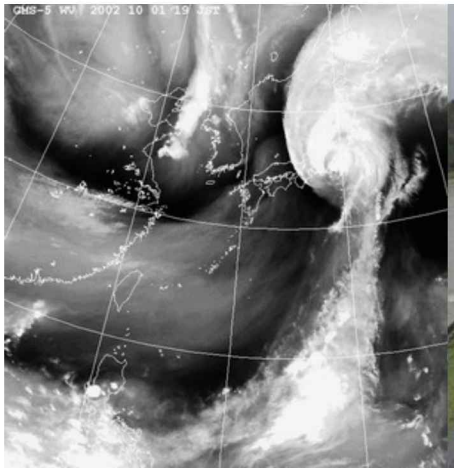
Occurrence of typhoons during the year that followed the accident

In **2011 across Fukushima Prefecture:**
***Ma-On* on July, 20; *Roke* on September, 22**



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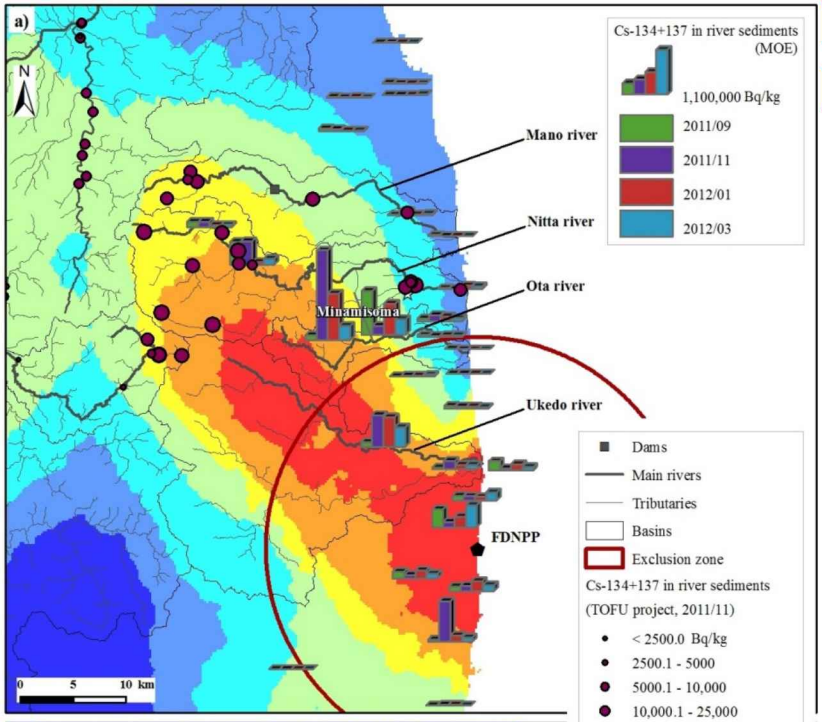

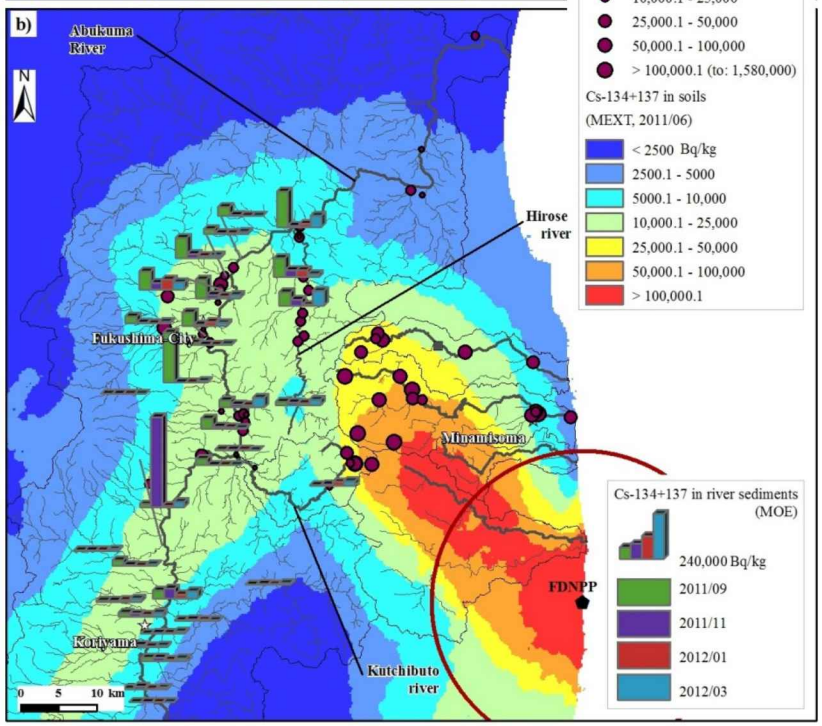

Coastal catchments draining the main pollution plume
(up to 1,100,000 Bq kg^{-1} of $^{134+137}$Cs measured in sediment)

Contamination export along the Abukuma River and some of its tributaries
(up to 240,000 Bq kg^{-1} of $^{134+137}$Cs measured in sediment)

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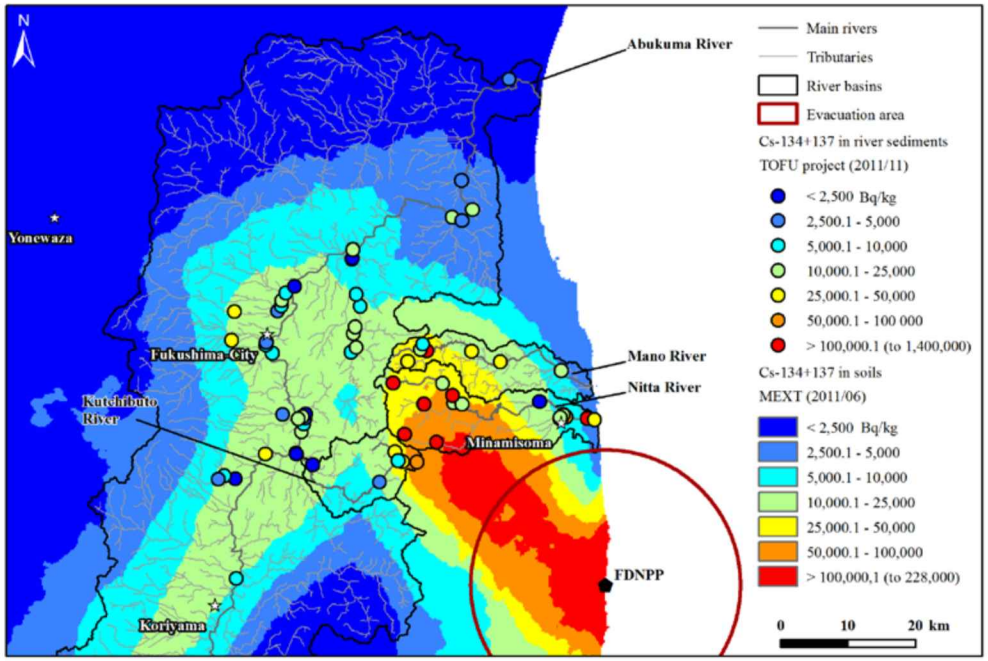
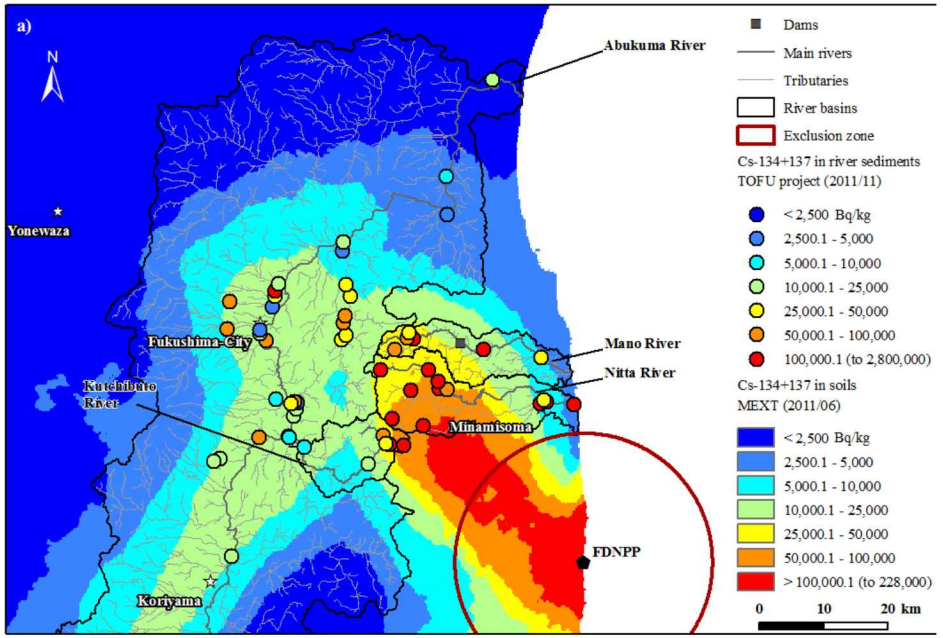


Activities in $^{134+137}$Cs measured in bulk sediment

Activities in $^{134+137}$Cs measured in sediment normalised to grain size



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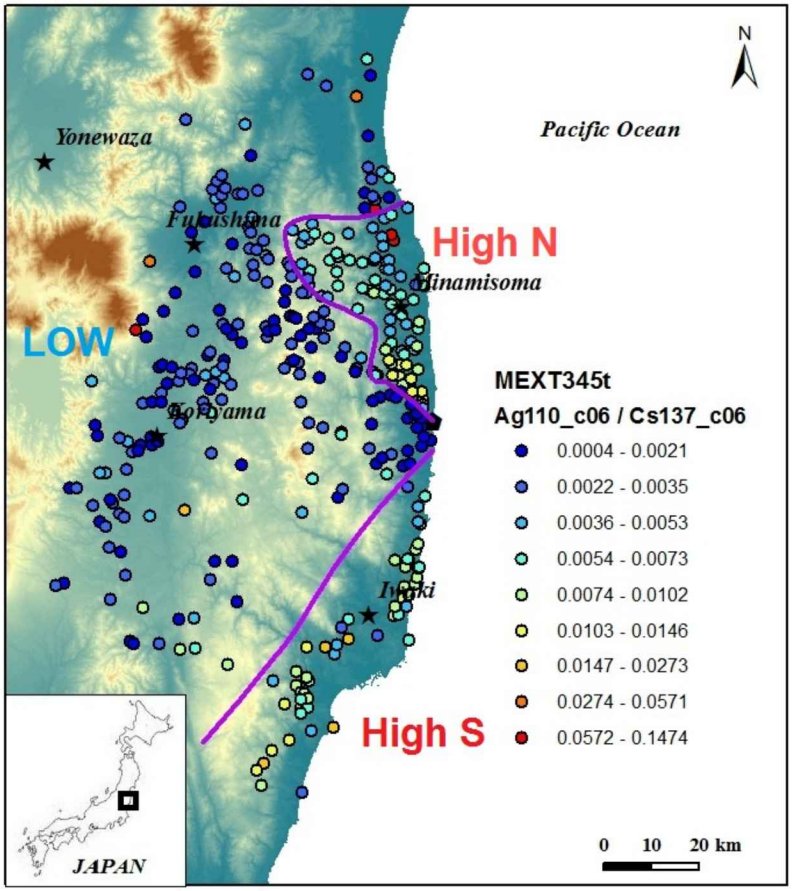
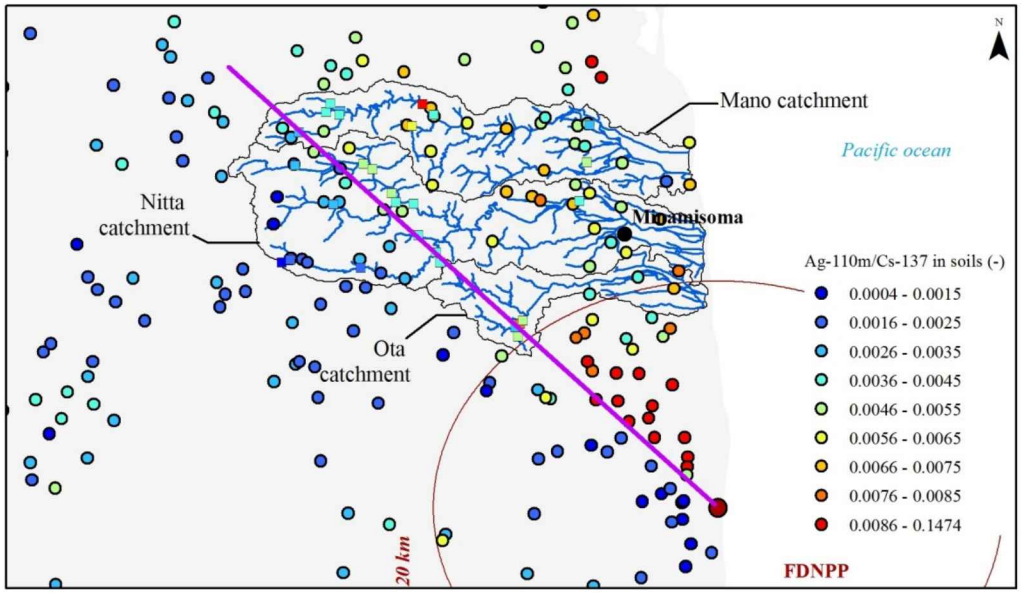
Spatial pattern of the initial $^{110m}Ag/^{137}Cs$ ratio in soils





This could provide a tracer of sediment origin in the coastal catchments

Two plumes clearly enriched in $^{10m}Ag/^{137}Cs$

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Fingerprinting based on the simple $^{110m}Ag/^{137}Cs$ ratio (Nitta River catchment)

***Nov 2011** campaign*

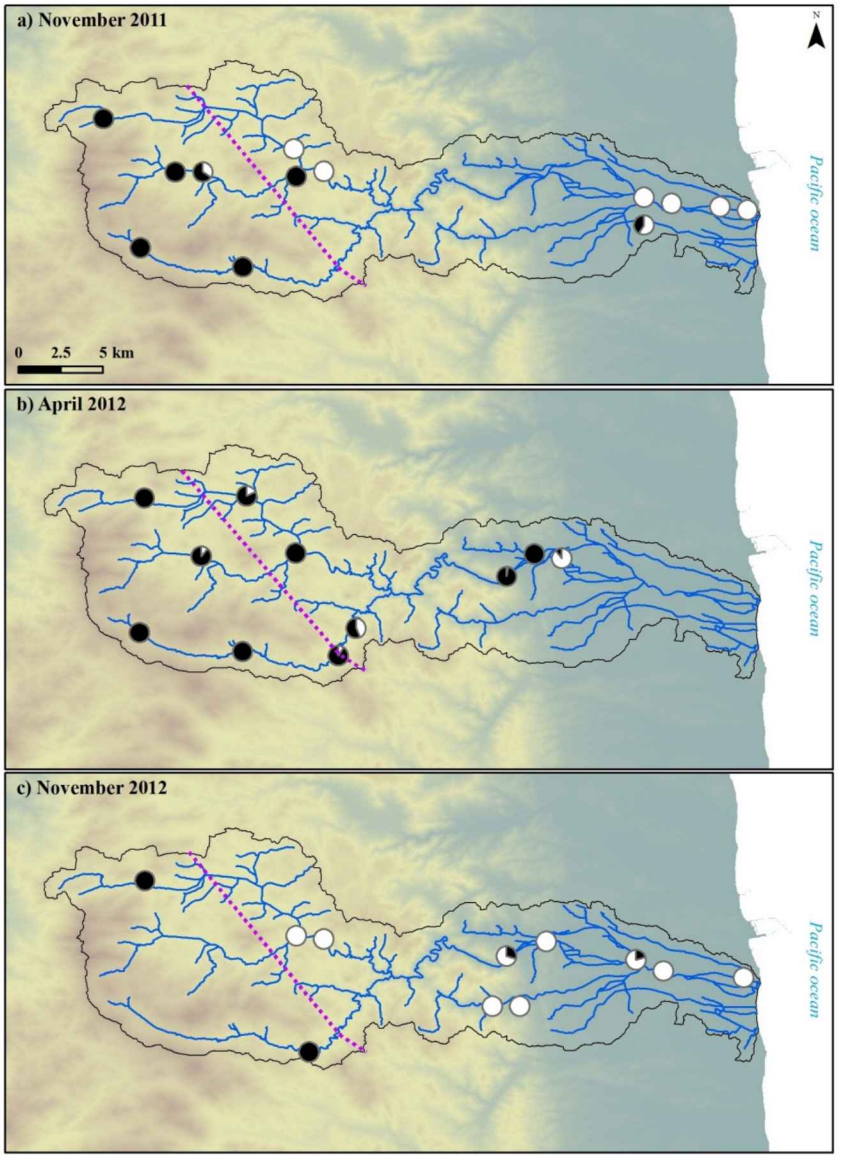
After the summer typhoons

***April 2012** campaign*

After the snowmelt

***Nov 2012** campaign*

After the summer typhoons



Upstream contribution

Downstream contribution

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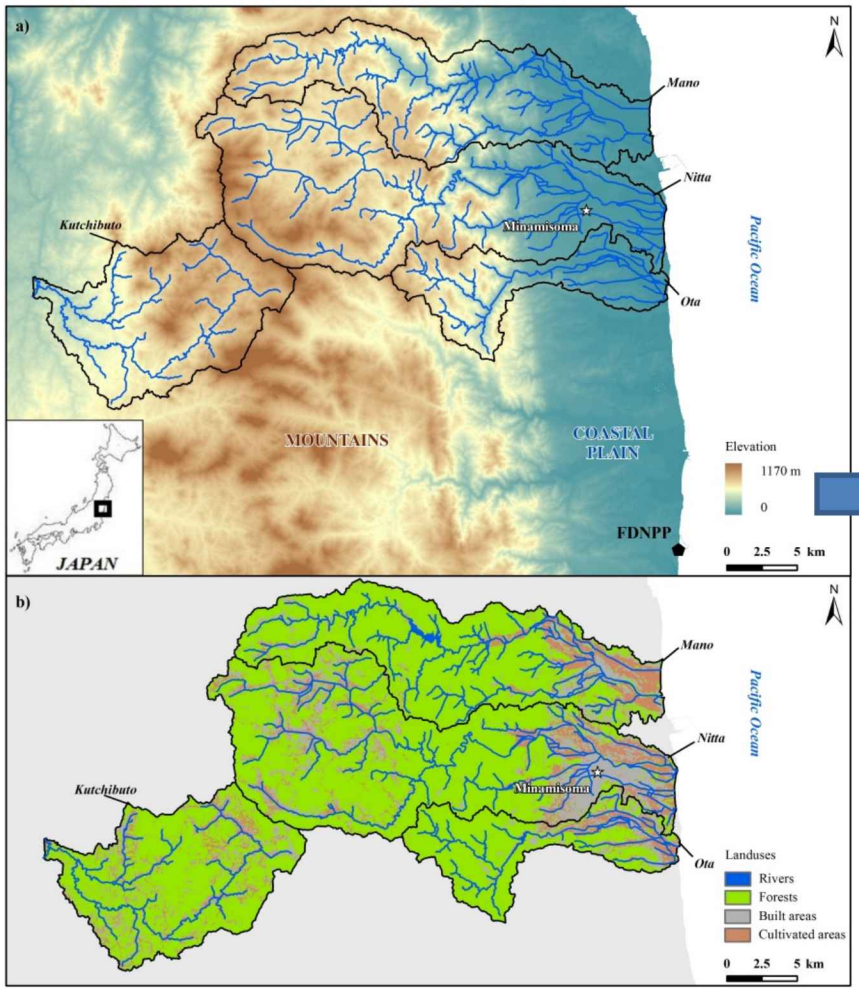
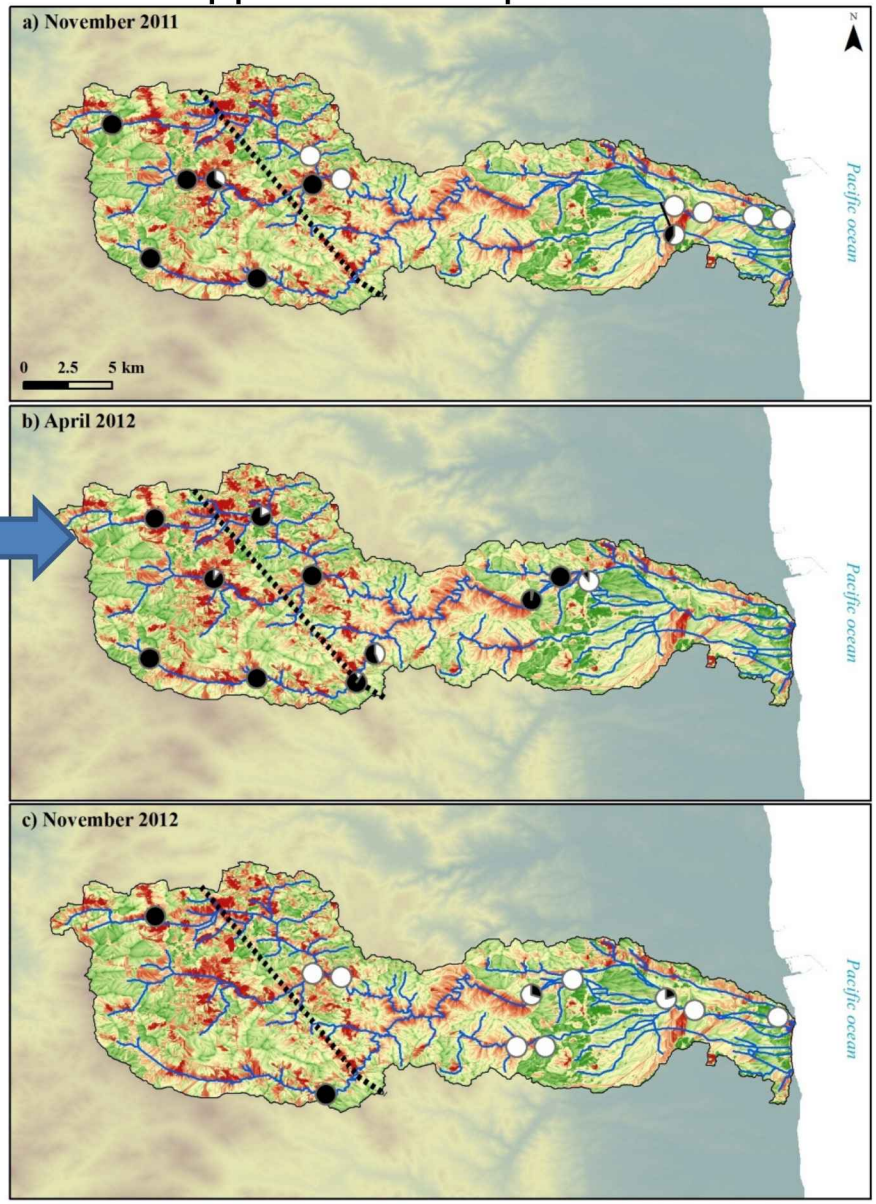
Computation of connectivity indexes: tools to support the interpretation





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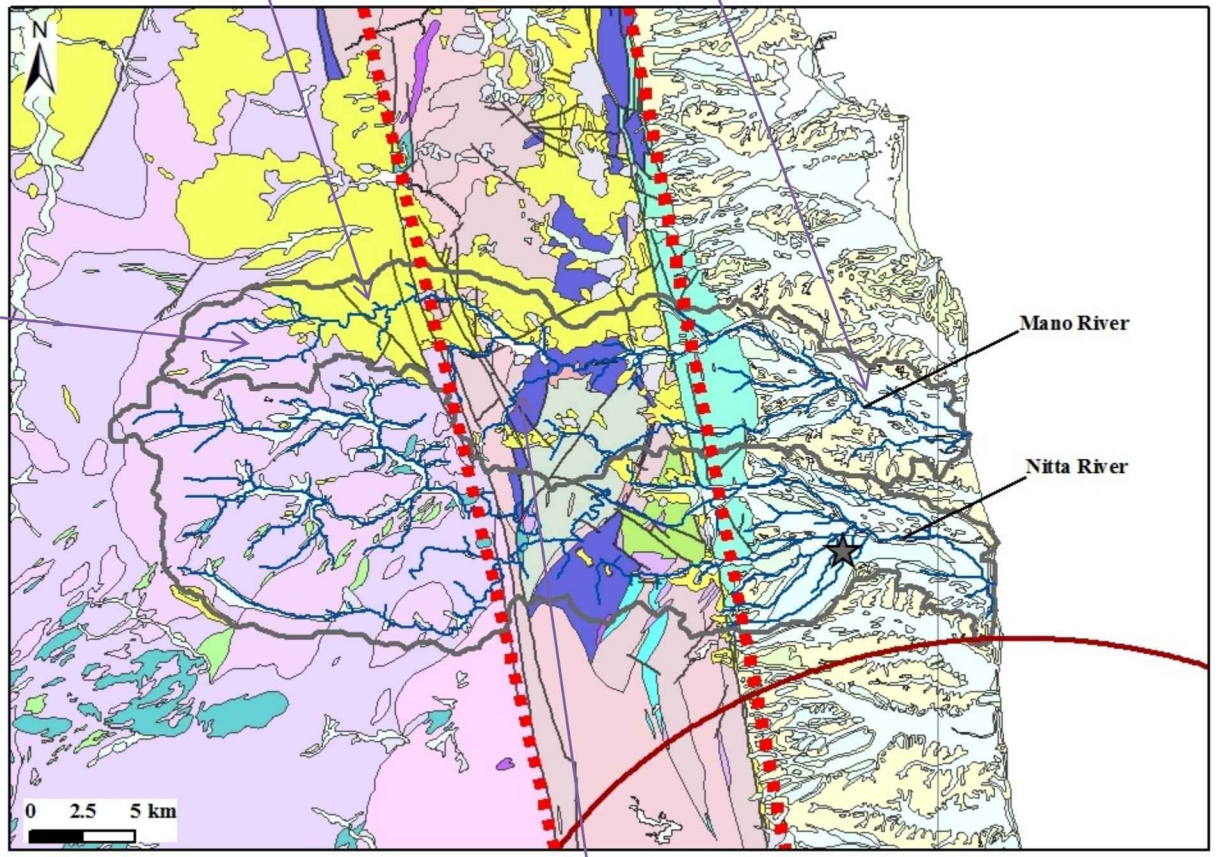
Ongoing fingerprinting of lithological sources in selected coastal catchments to confirm the results obtained with the $^{110m}Ag/^{137}Cs$ ratio

Mafic volcanic rocks

Sedimentary rocks

Granite – granodiorite



Schists

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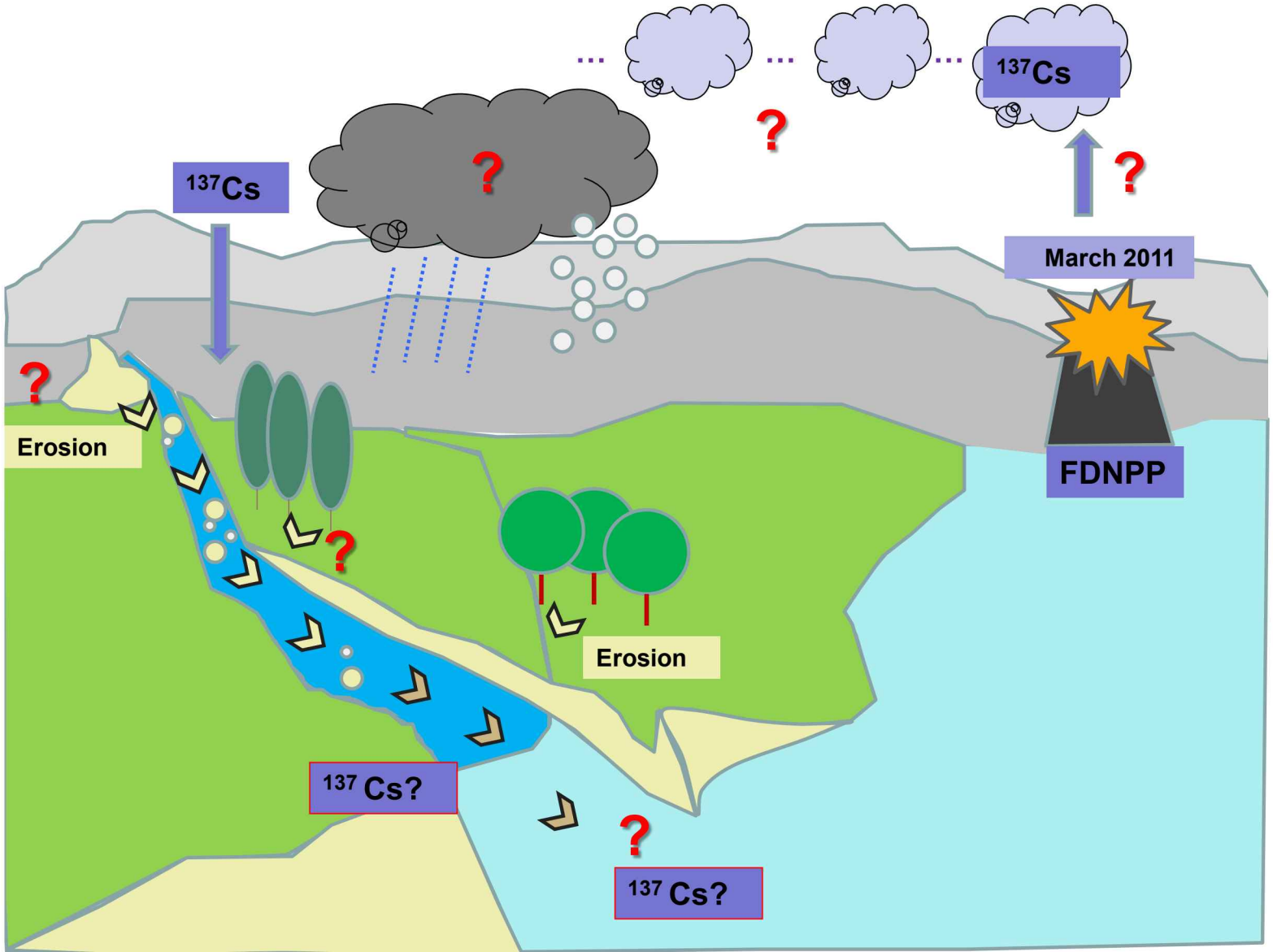
Perspectives: modelling the transfer of particle-borne contaminants along the continuum atmosphere – hillslopes – rivers – ocean



- Very strong soil contamination in $^{134+137}Cs$ in the plume
- Potential use of ^{110m}Ag to trace sediment dispersion
- Rivers transferred contaminated sediment to the coastal regions
- Need for regular monitoring because of intense weather conditions (typhoons and snowmelt)
- Important implications for soil and river management
- Implications for urgent research to conduct (e.g. on the behaviour of ^{110m}Ag) !

どうもありがとうございました!

Believe in the Power of Knowledge. Be Together.

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