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Temporal changes of the radiocesium activity concentration in river bottom sediment and suspended sediment in Eastern Japan

Yuichi Onda1, Chen Tang1, Xiang Gao1, Yukio Takeuchi1,2, Keisuke Taniguchi2, Momo Kurihara1,3, and Katsumi Hirose1

[1]University of Tsukuba, Center for Research in Isotopes and Environmental Dynamics, Tsukuba, Japan
[2]Fukushima Prefectural Centre for Environmental Creation
[3]National Institutes for Quantum and Radiological Science and Technology

1.Purpose of this research

Temporal trends in Cs-137 concentrations and suspended solids in river sediments from September 2011 to January 2017 in eastern Japan, based on Ministry of the Environment data from 716 monitoring 461 sites, with particle size corrections applied.

Also. In some locations, the active concentration of suspended solids was compared with dissolved Cs-137.

2、Samplings and data

Database of this research is based on the Report on Radioactive Substance in Public Water Environment Monitoring Surveys(2011-2018).

Data size :

Cs-137 concentration in bottom sediment and dissolved:

in Hamadori, Nakadori from 2011 to 2018; other areas in eastern Japan from 2013-2018;

Cs-137 concentration in suspend sediment:

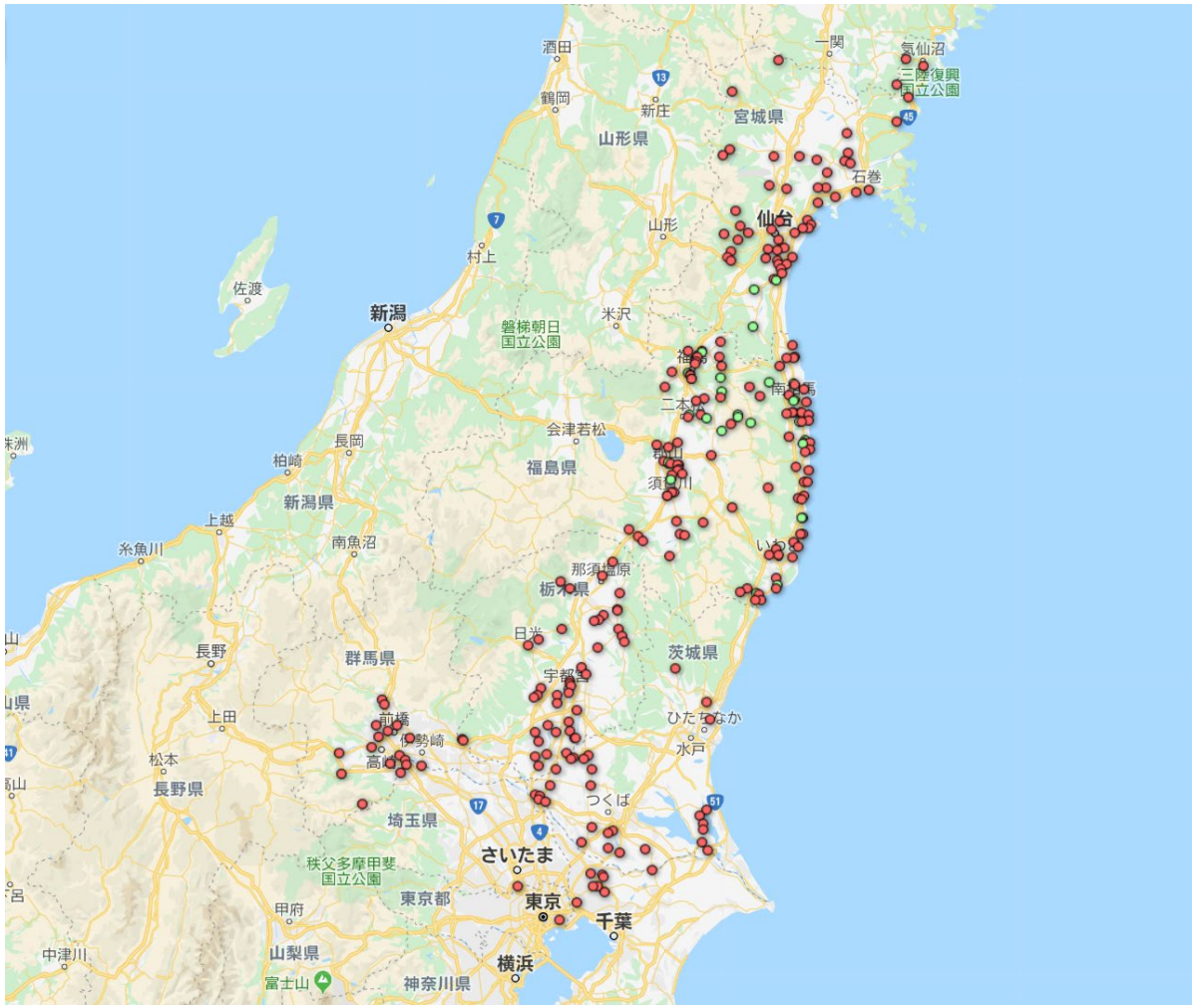
in Hamadori, Nakadori from 2011 to 2017.

Sampling took by **every month or season.**

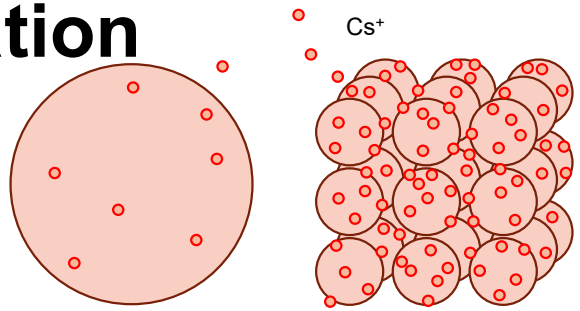
Number of samplings:

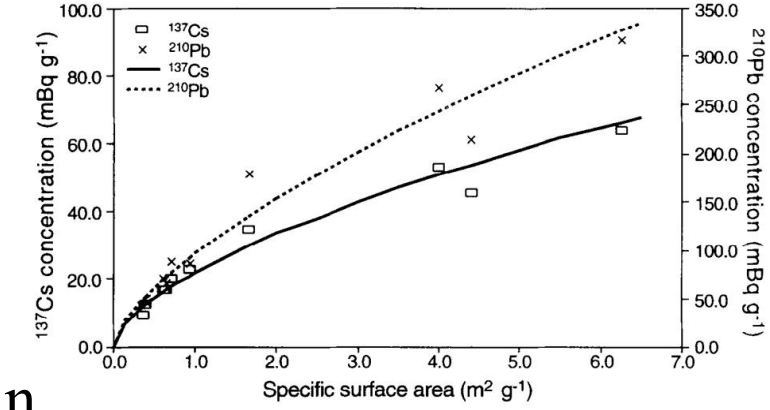
Bottom sediment: 3006 in east Japan

SS: Combined with bottom sediment 30 groups in Fukushima.



2、Correction and calculation





He and Walling(1996) Journal of Environmental Radioactivity,Vol. 30, pp. 117-137

The bottom sediment standard particle size as **1** m^2/g(**89.61** cm^2/g in Hamadori and Nakadori), the suspend sediment is **0.202** m^2/g. The correction index *P* can be described by(*v*=0.65):

$$P = \left[\frac{S_{ms}}{S_s}\right]^v$$

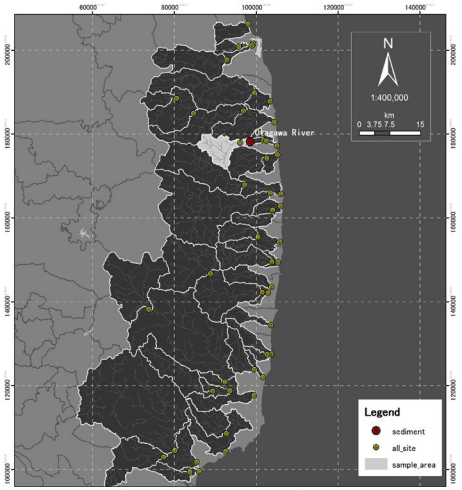
And the calculation of K_{dac}(apparent K_d in fresh water) can be described by:

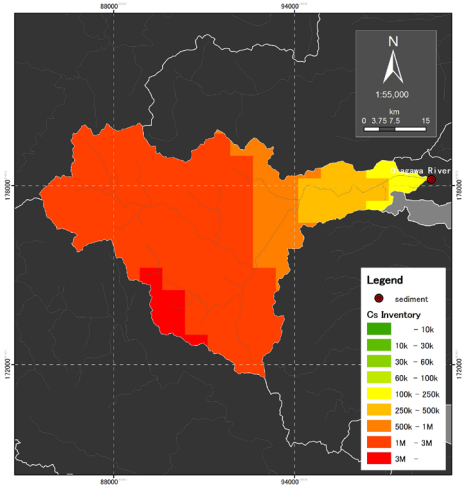
$$K_{d(ac)} = K_{d(a)} / S_{sa}^{0.65}$$

3、Correlation of Cs-137 concentration in bottom sediment and SS

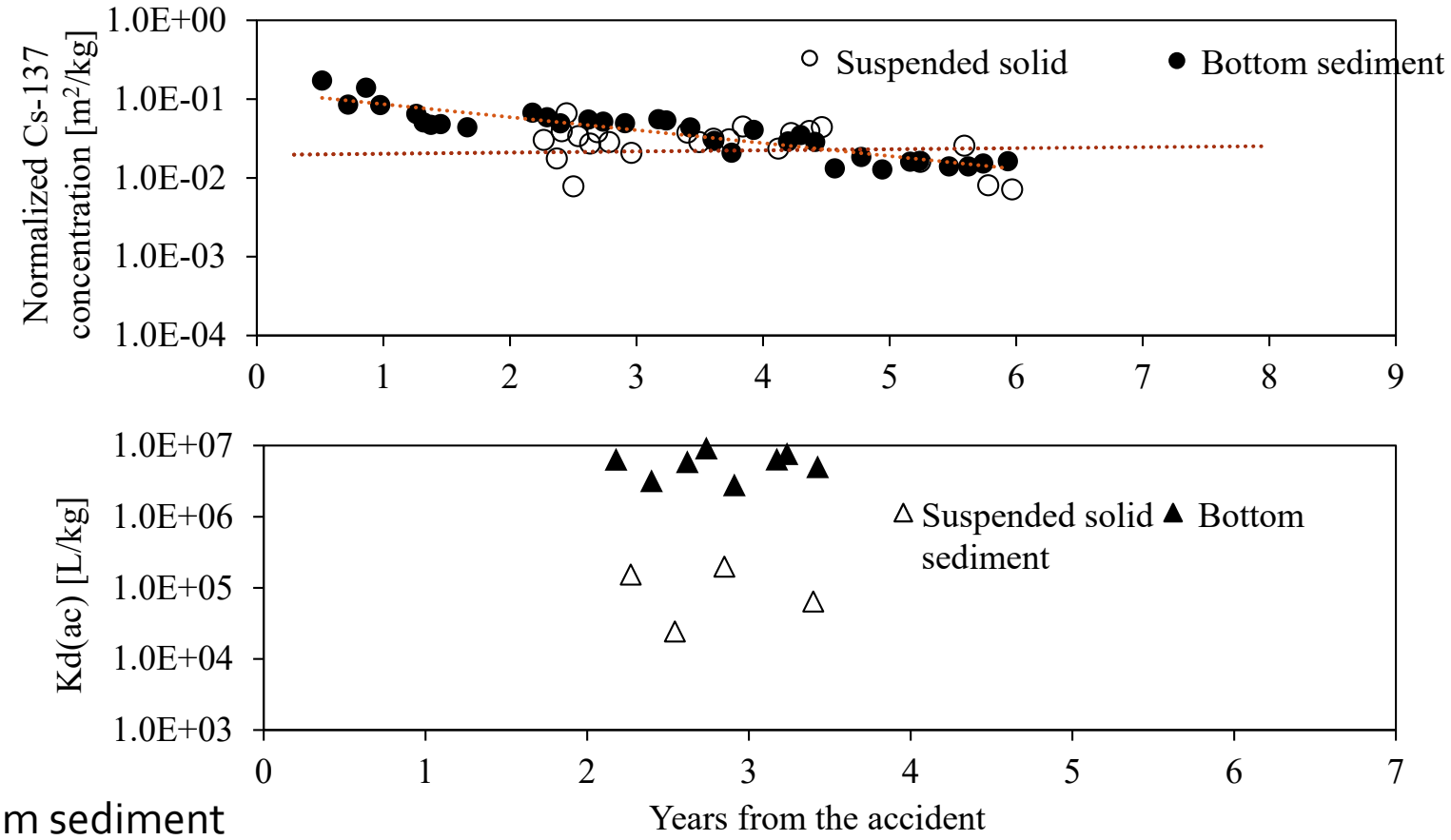
The change of SS and bottom sediment coincided

(under equilibrium condition) —— 15 sites





Ota (SS) -Otagawa River (bottom sediment)

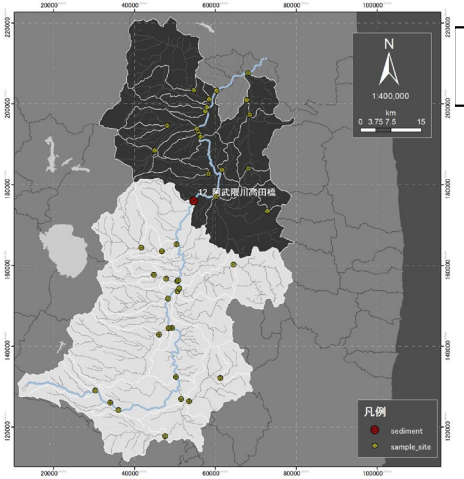


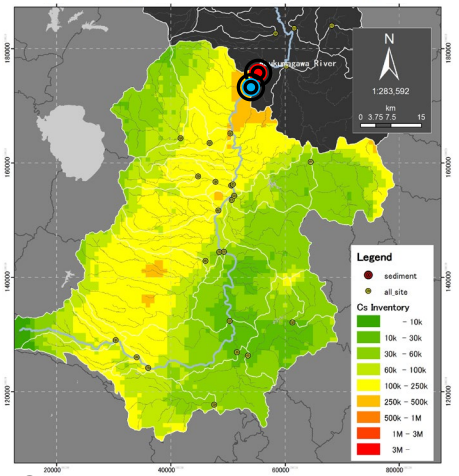
◉SS, dissolved ◉bottom sediment

3、Correlation of Cs-137 concentration in bottom sediment and SS

SS and bottom sediment changes do not match

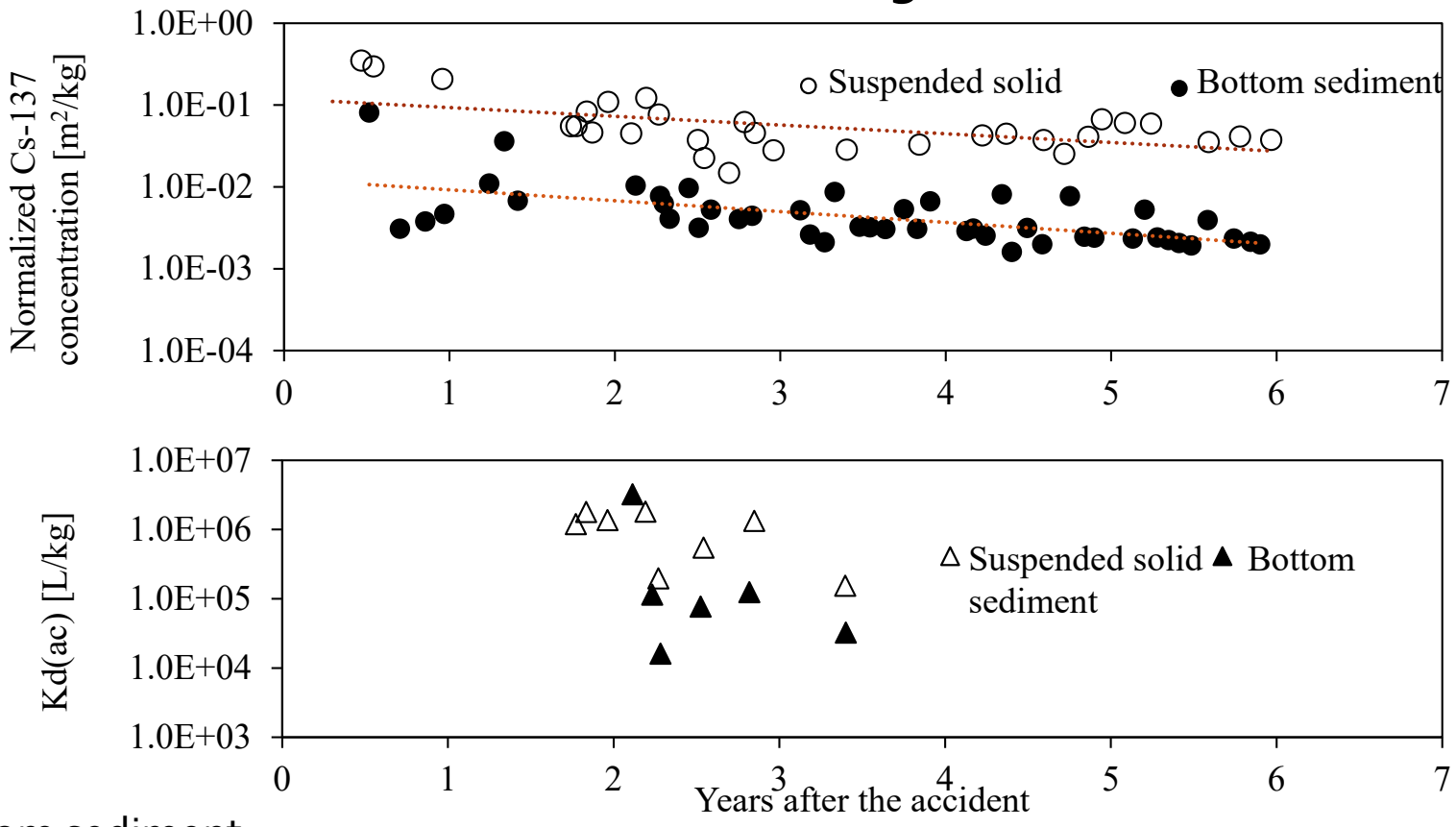
(disequilibrium) —— 4 sites





SS, dissolved bottom sediment

Nihonmatsu (SS)-Takadabashi Bridge (bottom sediment)

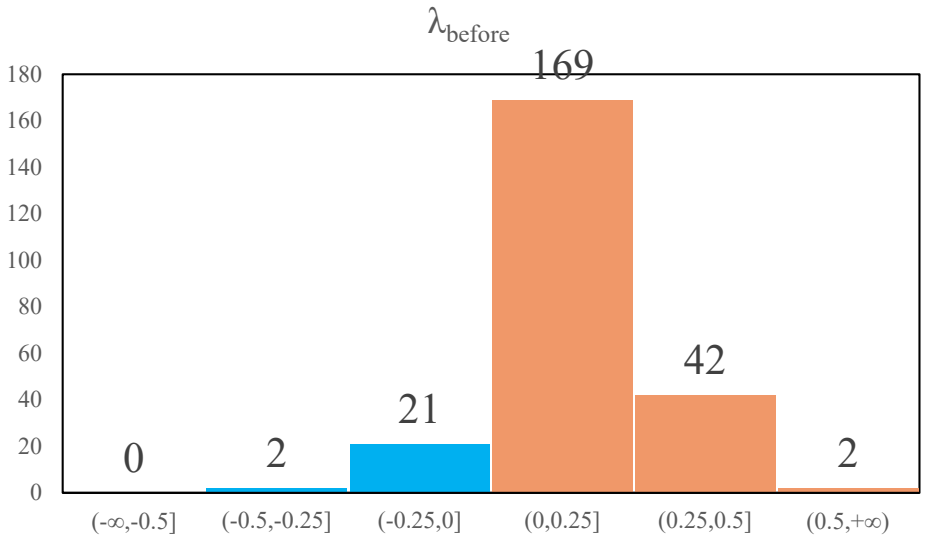


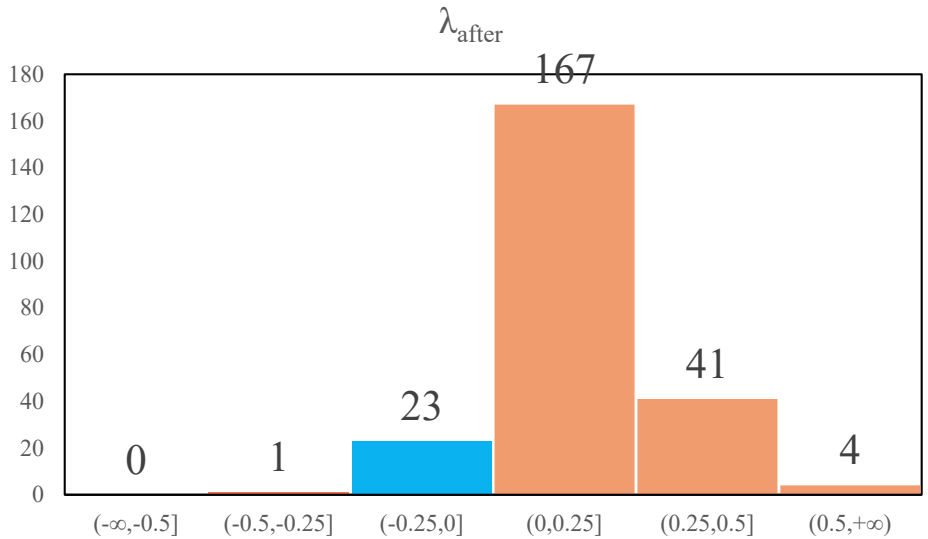
5、Results of correction in bottom sediment(in other sites)

Whole situation(2013-2018):

Without correction(213 declining, 23 increasing);

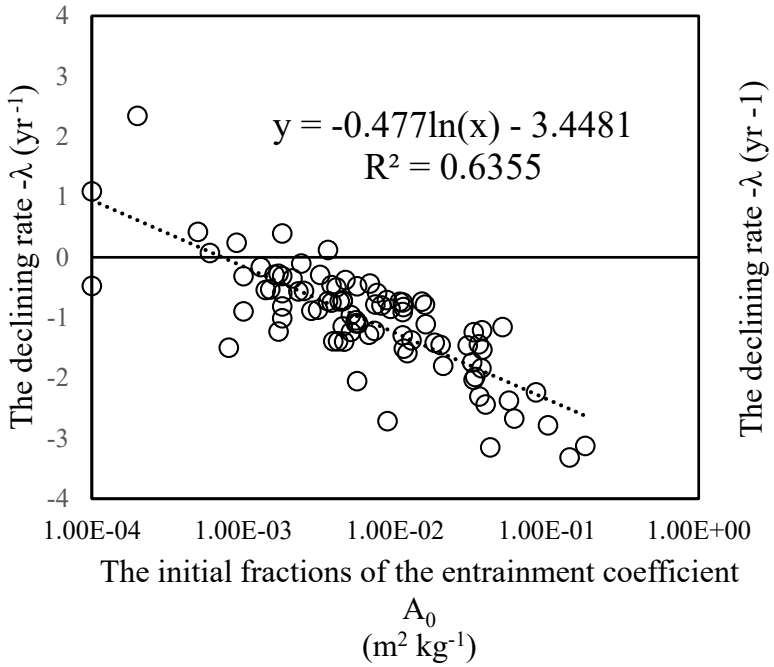
With correction(212 declining, 24 increasing);



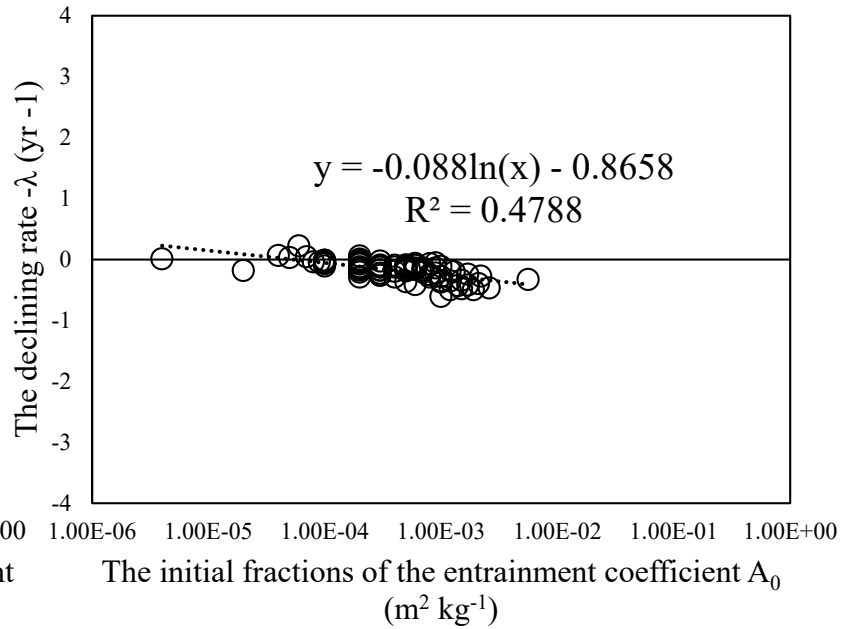


5、Relationship of entrainment coefficient A_0 and declining rate -λ

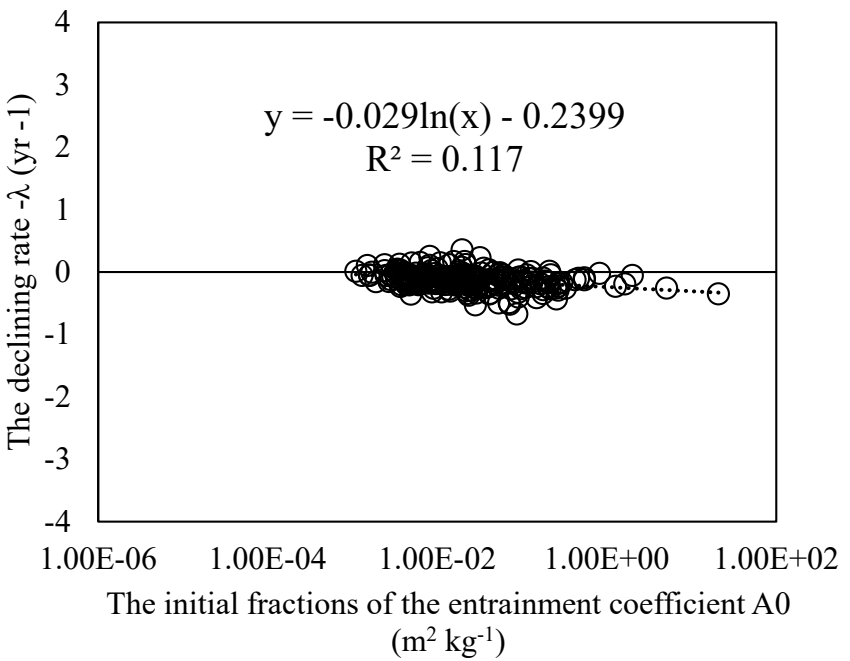
The relationship between declining rate -λ and the initial fractions of the entrainment coefficient A_0 2011-2012



The relationship between declining rate -λ and the initial fractions of the entrainment coefficient A_0 2013-2018



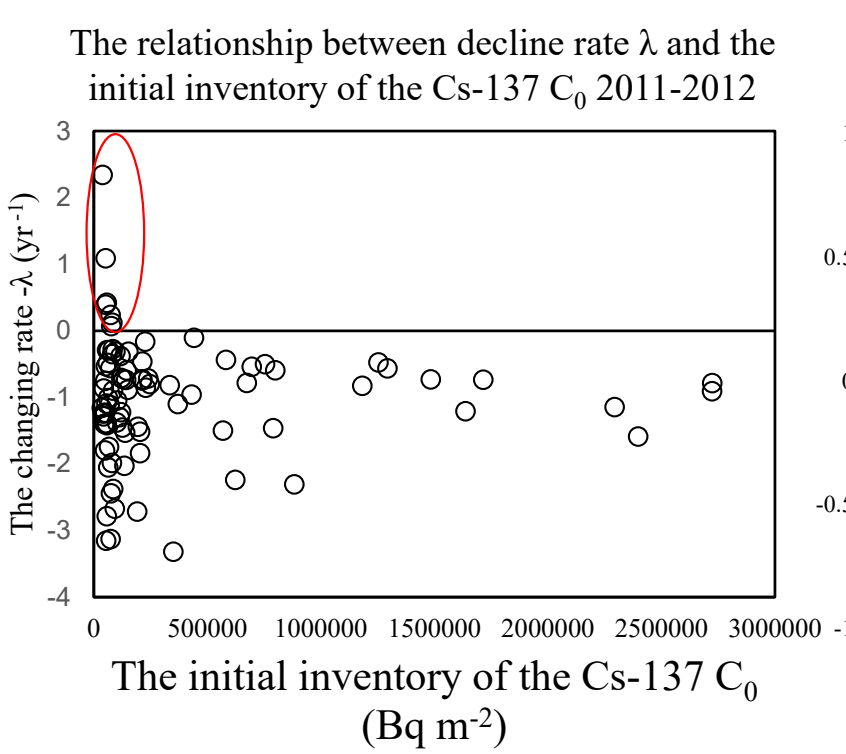
The relationship between declining rate -λ and the initial fractions of the entrainment coefficient A_0 2013-2018**(except Hamadori, Nakadori)**

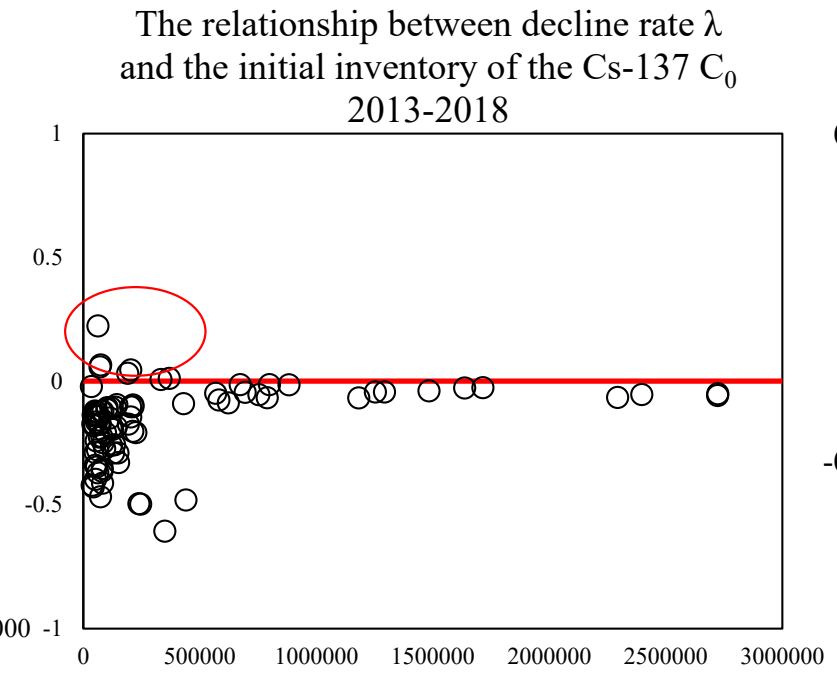


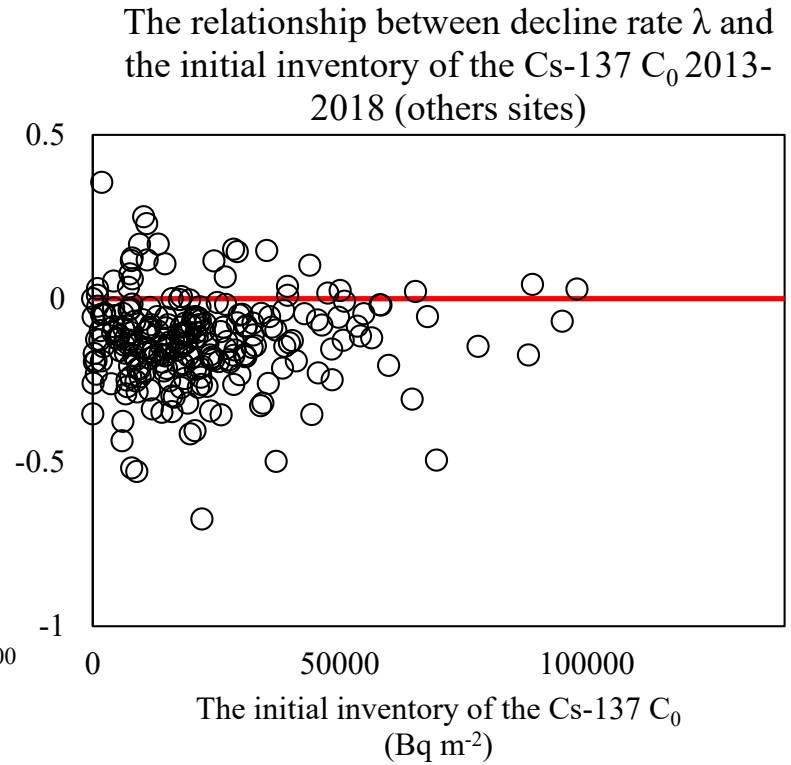
Negative correlation and range of –λ is big

Negative correlation and range of –λ is getting smaller in last 5 years.

5、Relationship between declining rate -λ and the initial inventory of the Cs^{137} C_0

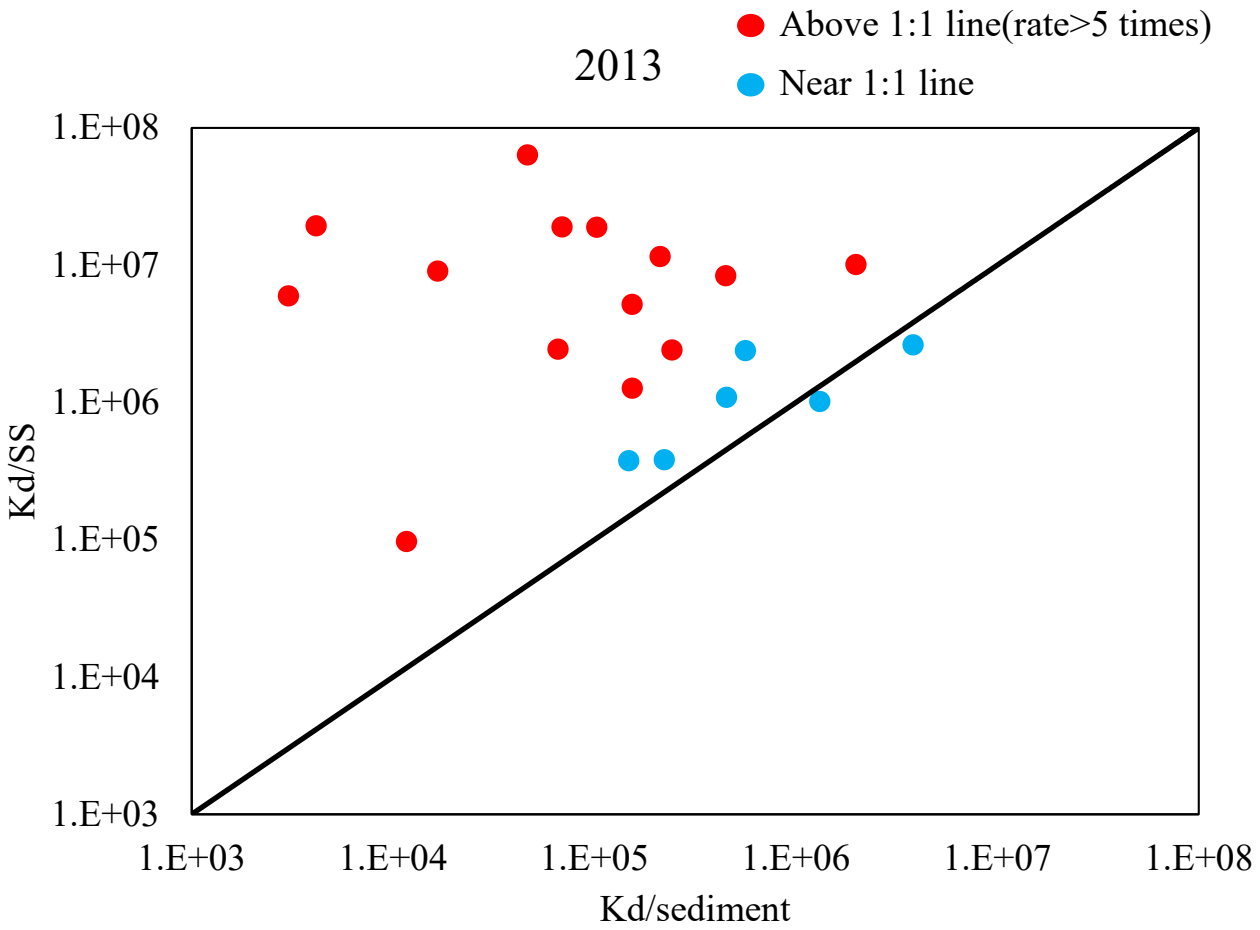


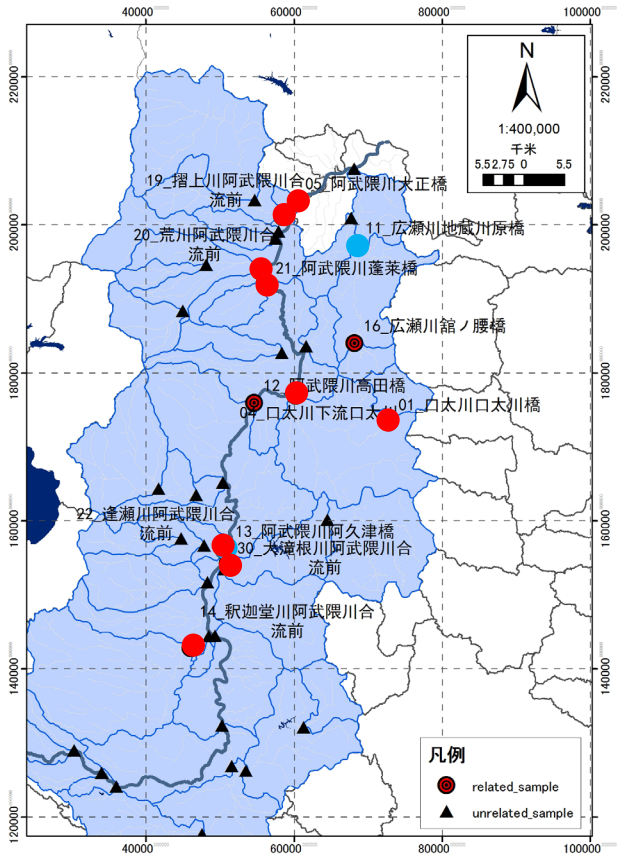


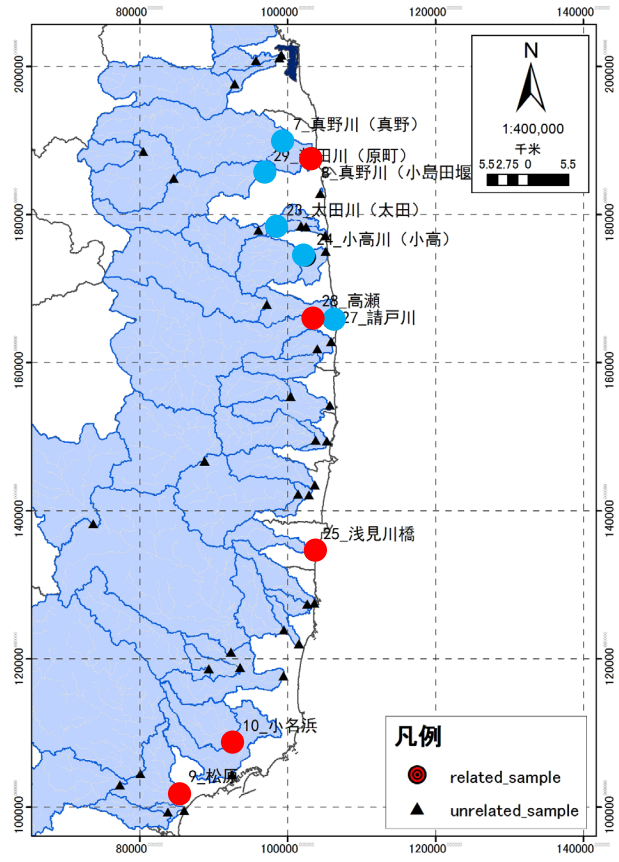


some point is over the x axis and near by the y axis. It is also same in other areas.

5、Rate of Kd/SS and Kd/sediment







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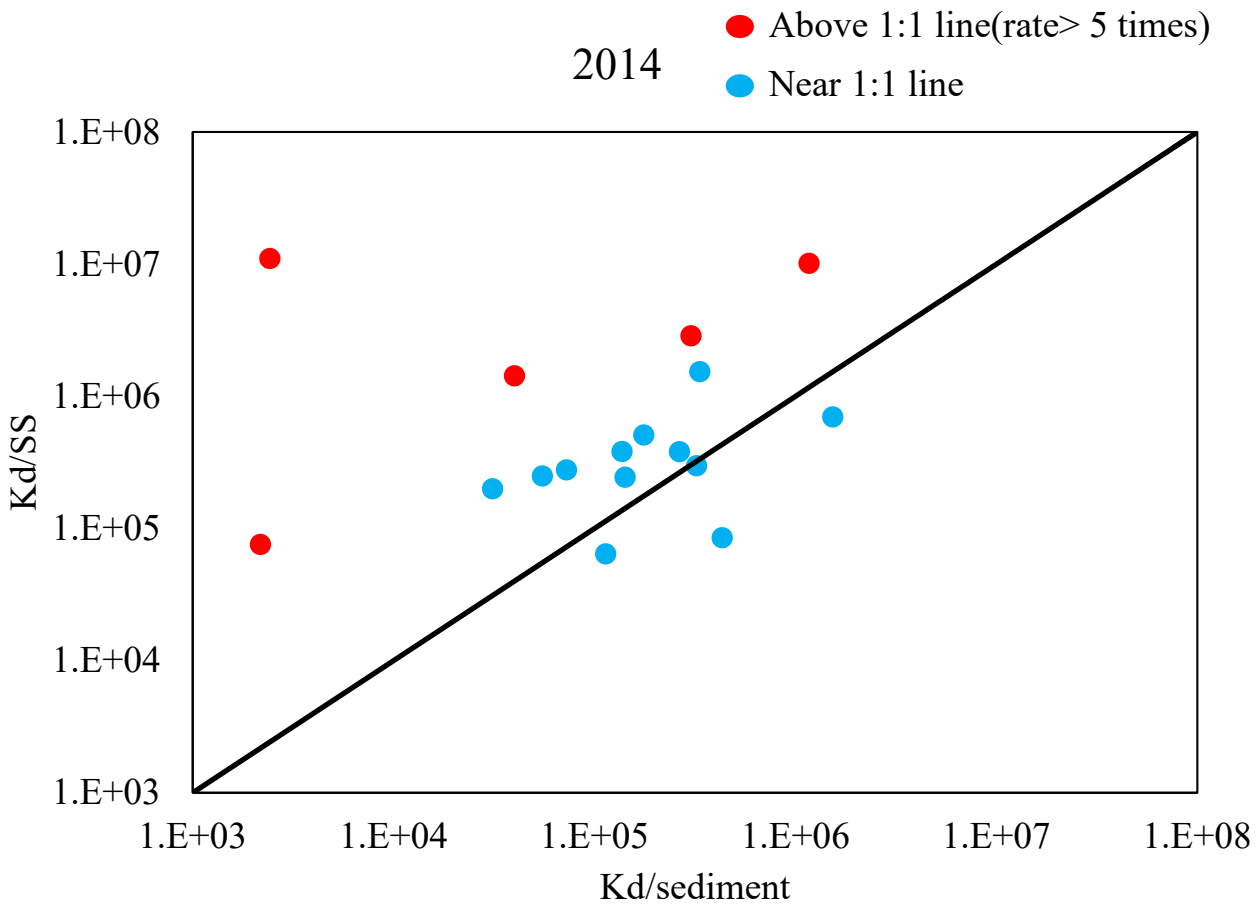

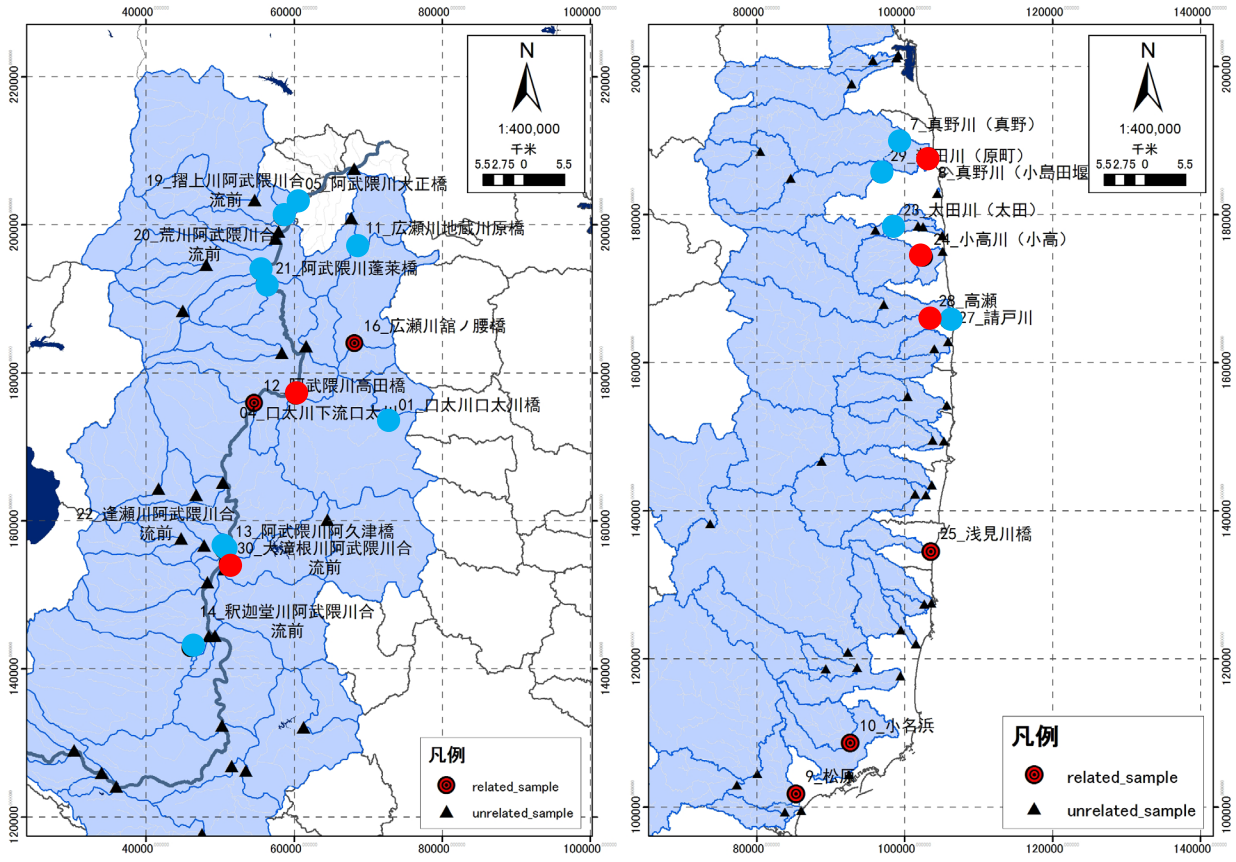

Conclusion

- **The logarithm of the initial inventory was found to be negatively correlated with the rate of decline of Cs-137 in the sediment. The sediment of Cs-137 and the K_{dac} of SS were found to be similar over time. These results suggest that geographic conditions and temporal factors also influence the decline in Cs-137 contamination levels in river systems.**