

*Flux and Characteristics of
Polychlorinated Dibenzo-*p*-dioxins
and Dibenzofurans
in Atmospheric Deposition*

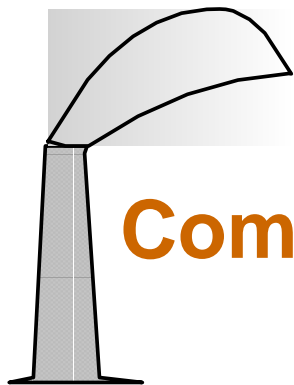
**Isamu Ogura
(Yokohama National University)**

Dioxins

PCDDs: Polychlorinated dibenzo-*p*-dioxins

PCDFs: Polychlorinated dibenzofurans

Emission



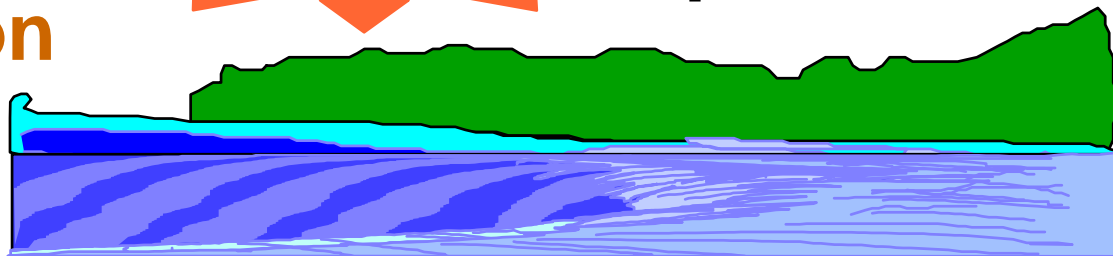
Combustion



Transport and diffusion



Deposition



Deposition

the major pathway for the input of PCDD/PCDFs into the biosphere.

We investigated the flux and characteristics of PCDD/PCDFs in atmospheric deposition to reveal air-transported contamination levels of these compounds and their atmospheric behavior.

Sampling locations



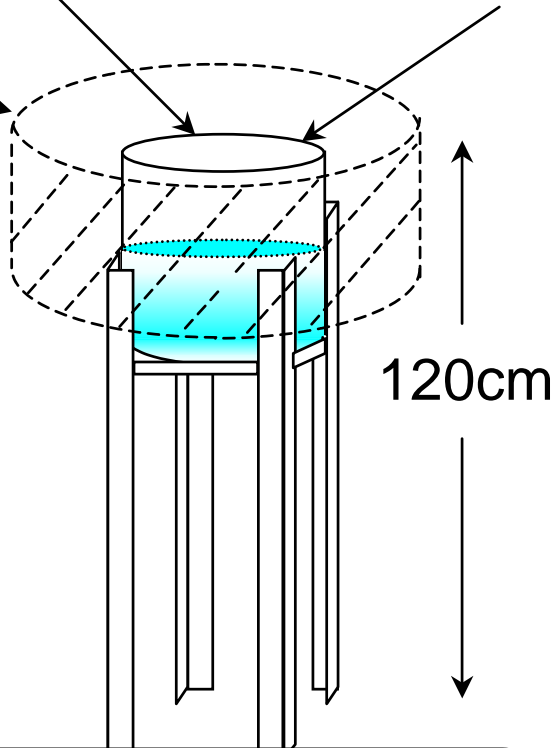
Sample collection

Sampling period: 1 ~ 2 months

Stainless steel pot

30cm inner diameter

Net

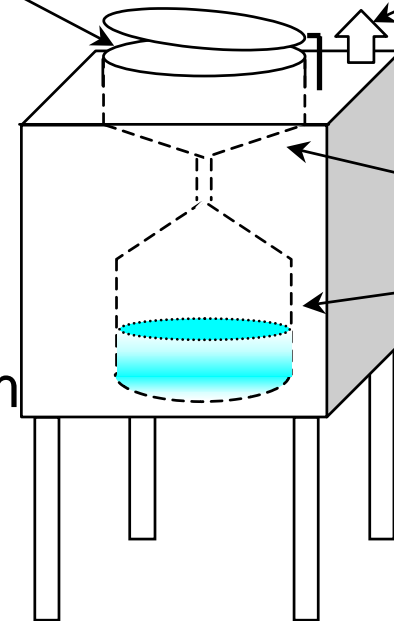


**Sampling for
total (dry and wet)
deposition**

36cm inner diameter

Rain sensor

105cm



Glass funnel

Glass bottle

**Sampling for
wet deposition**

Sample analysis

Sample

Filtration through a glass fiber filter and
a solid-phase extraction disk

Extraction using a Soxhlet/Dean-Stark trap extractor
with toluene 16hrs

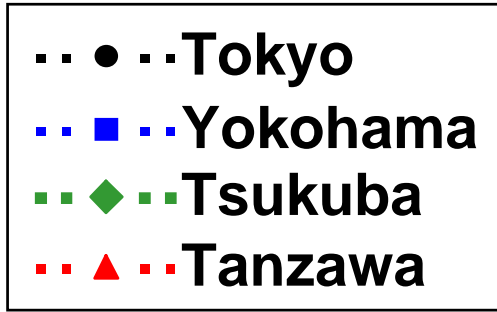
Shaking with conc. H_2SO_4

Silica gel column chromatography,
Activated-carbon-impregnated silica gel

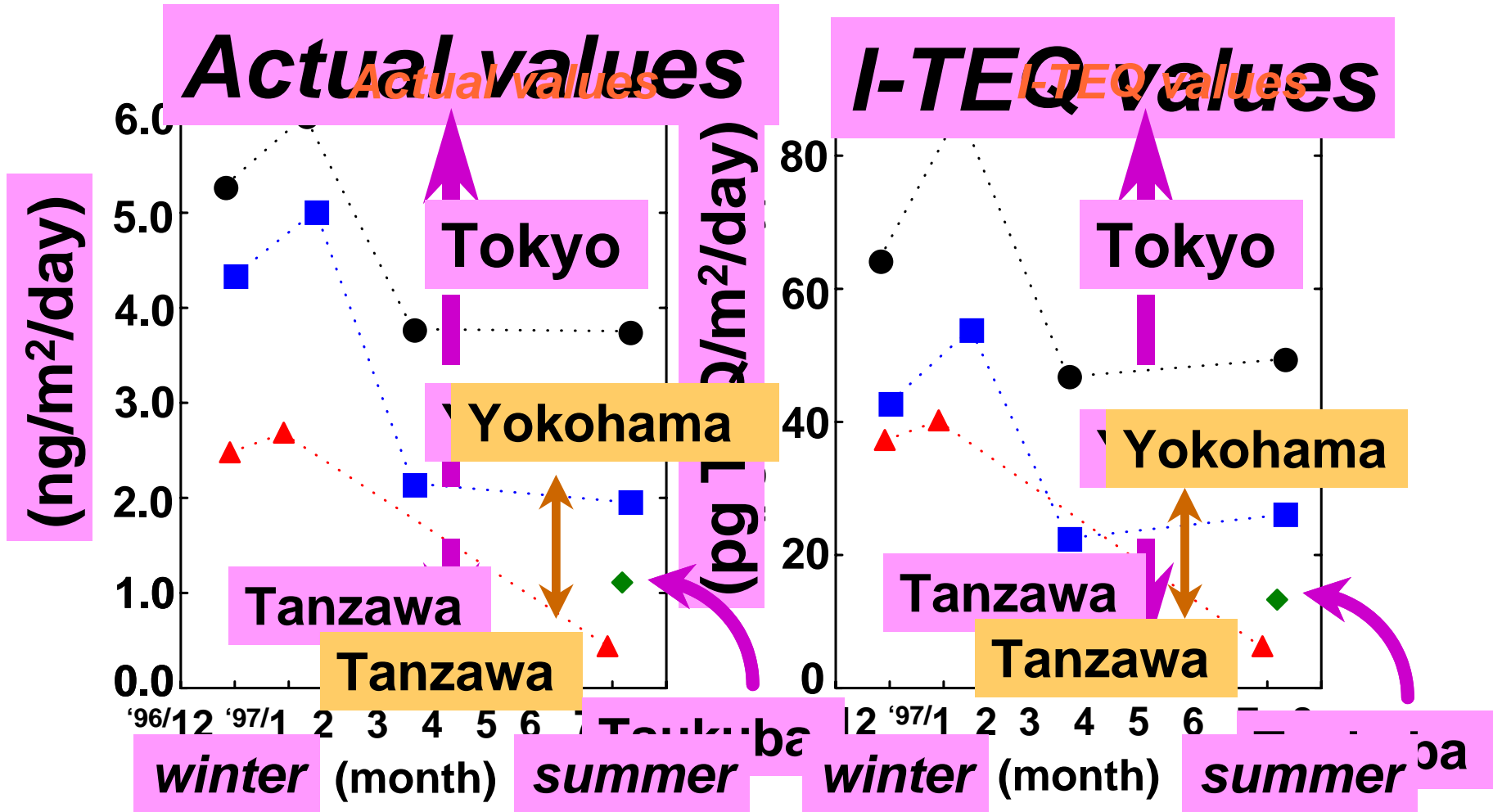
GC/MS quantitation
(GC column:DB-5, DB-17)

PCDD/PCDFs
4C/ ~ 8C/
136 isomers
↓ using DB-5
87 peaks

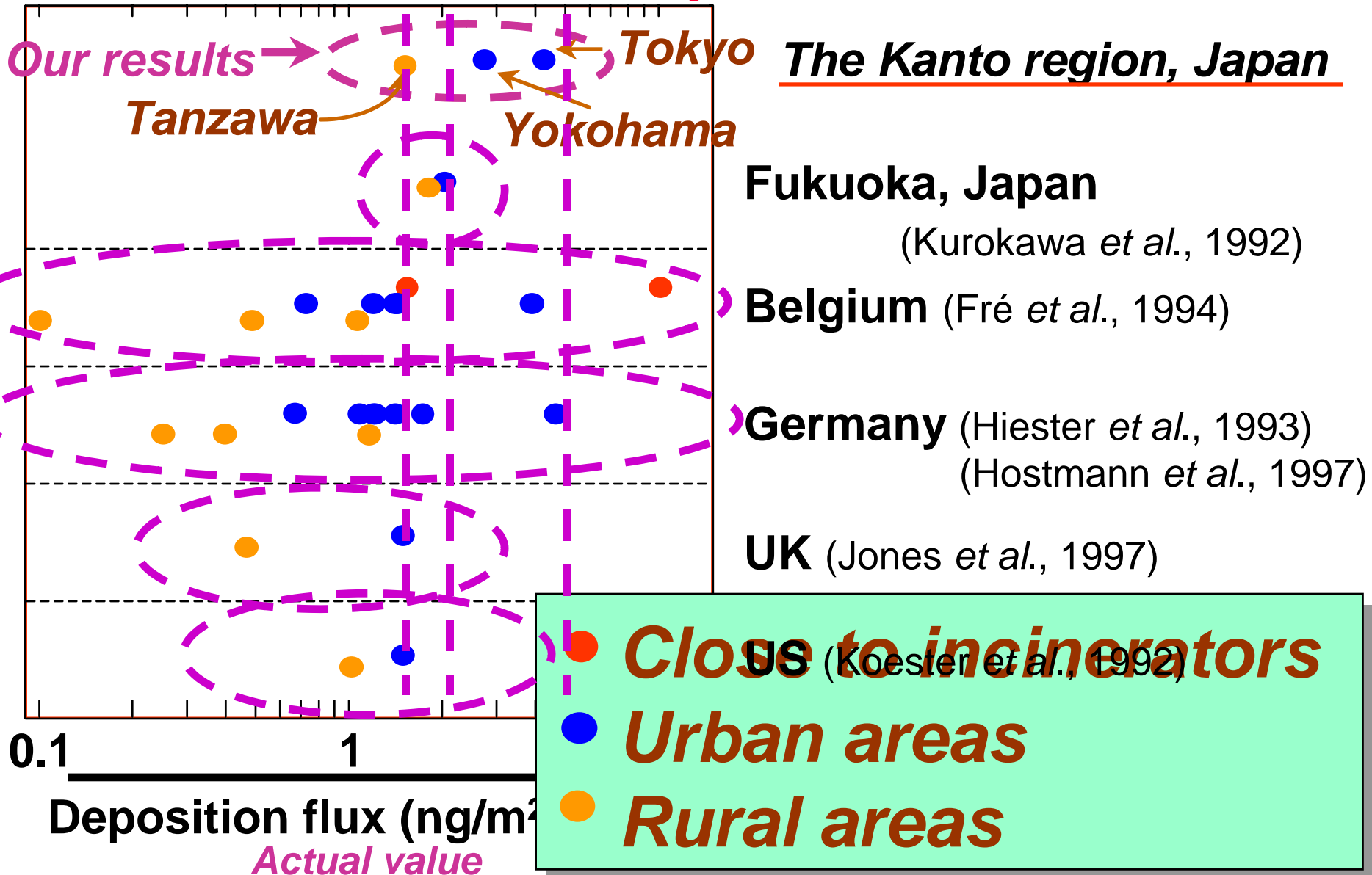
Deposition fluxes of total PCDD/PCDF



I-TEQ: International toxic equivalent



The deposition fluxes from our results and from other reported studies



**The total annual
emission from municipal
solid waste incinerators
in the Kanto region**

approximately **800 g TEQ**

**total annual
deposition flux
emission from**

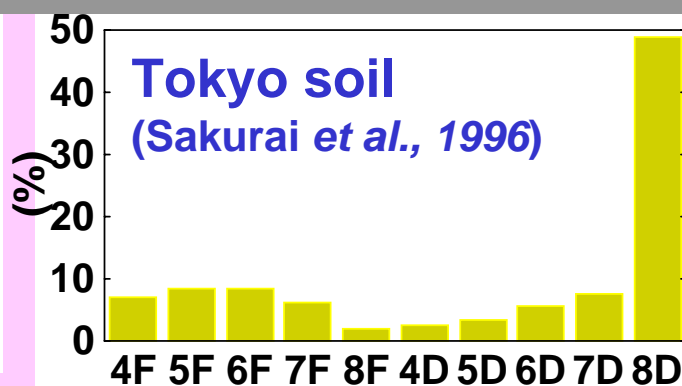
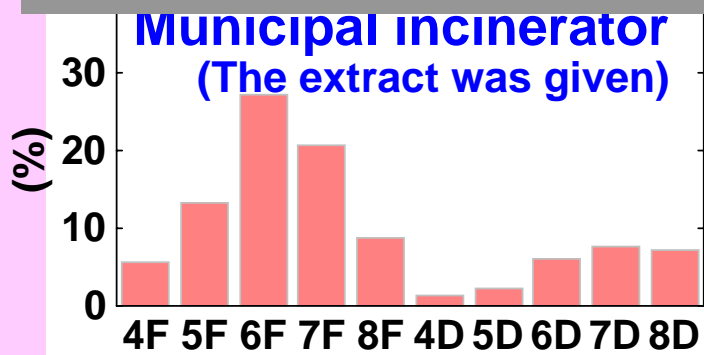
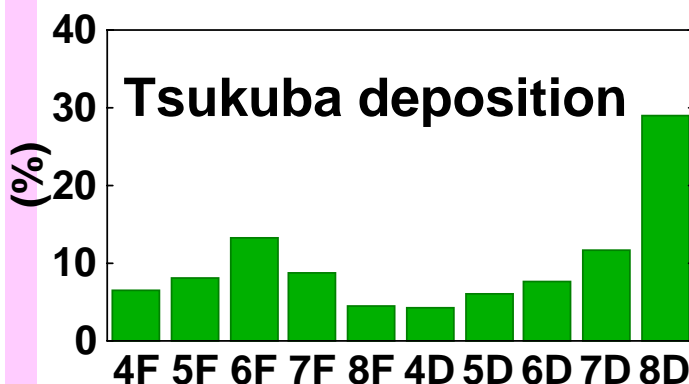
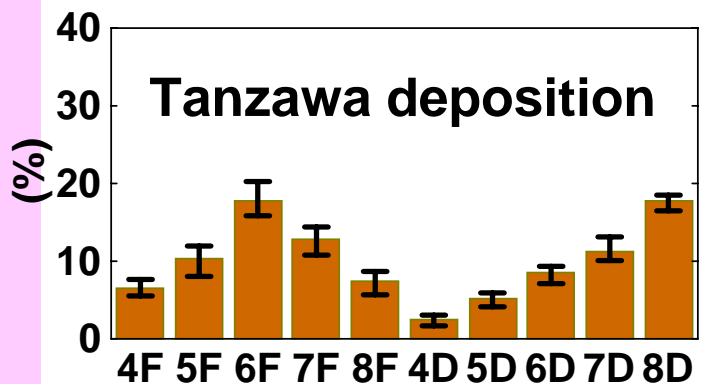
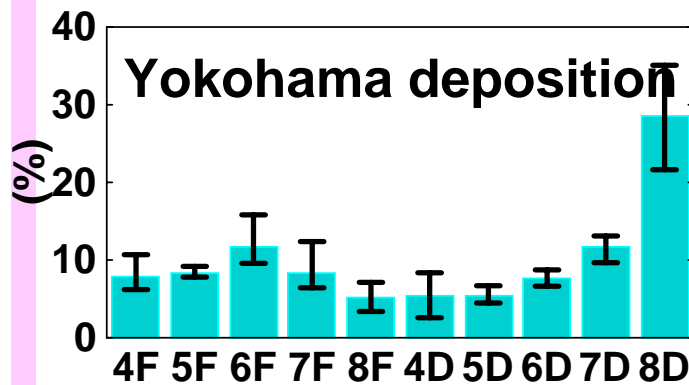
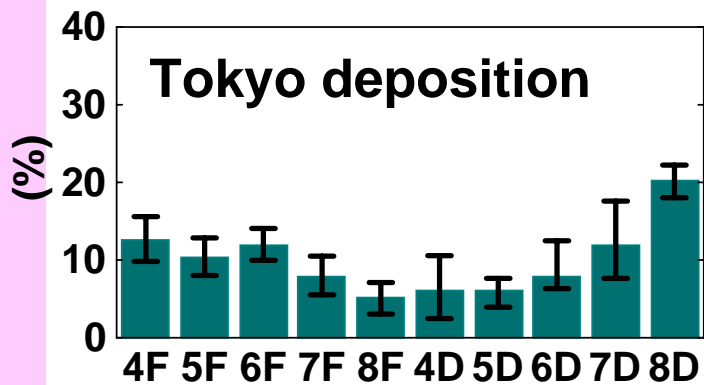
**total annual
deposition flux
in the Kanto region**

~ 650 g TEQ



Emission data from the Ministry of Health and Welfare of Japan

Homologue profiles



Average

Max.

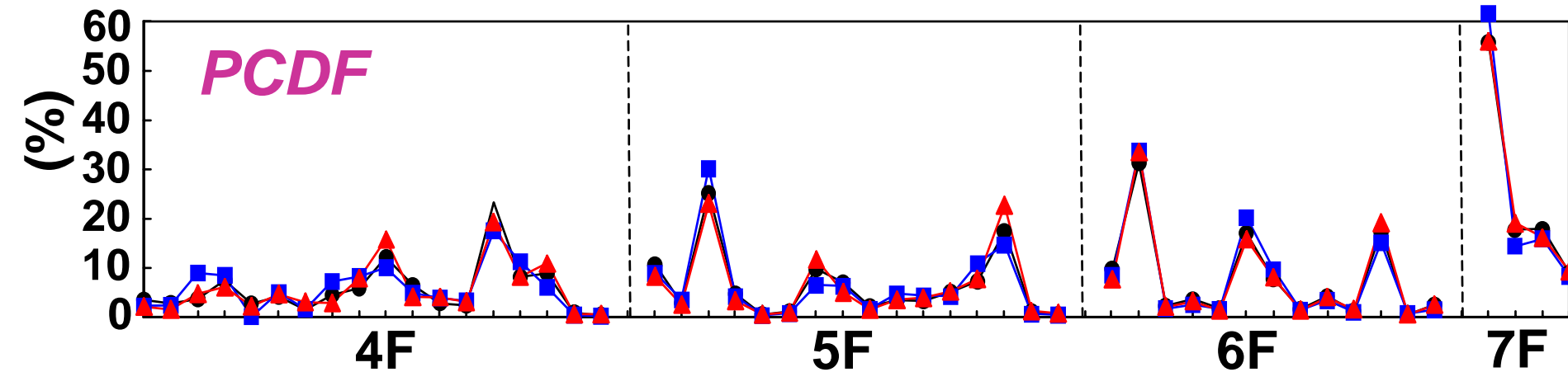
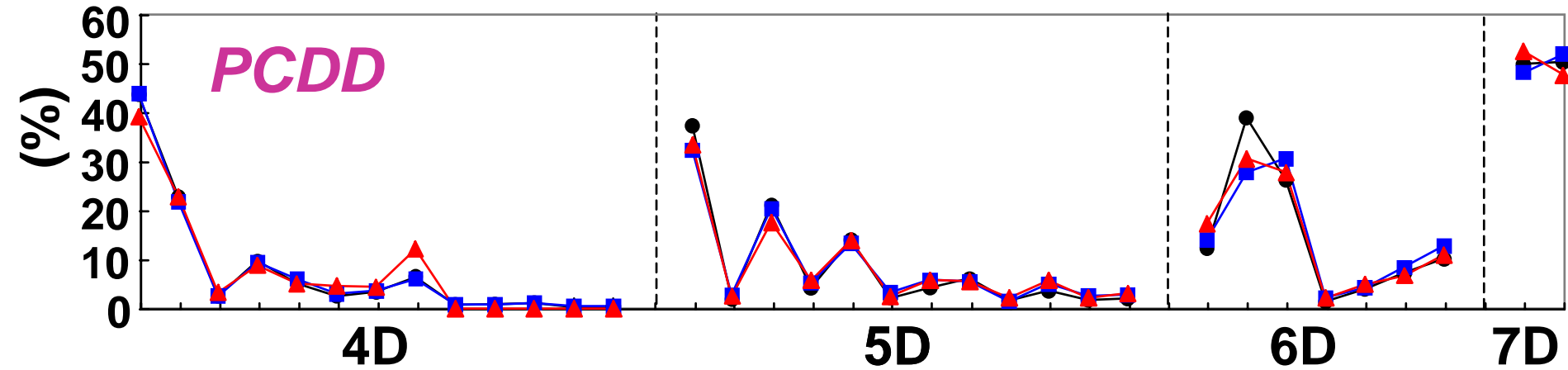
Min.

8:
e of
ination

D

F

Isomer profiles



4, 5, ..., 8:

degree of chlorination

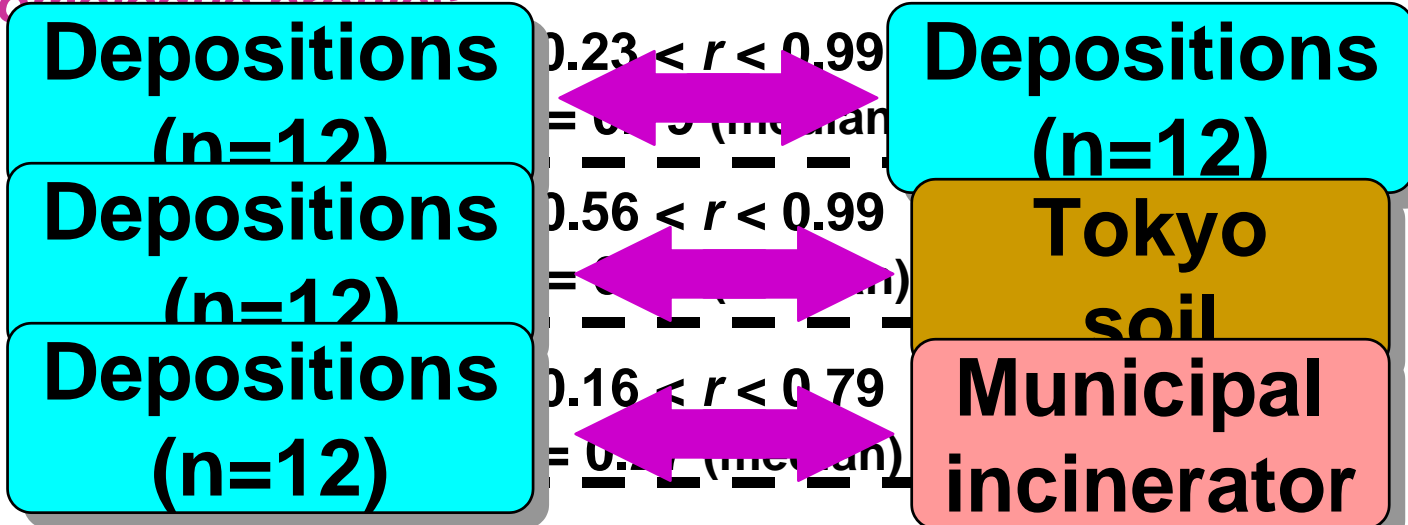
D: PCDD

F: PCDF

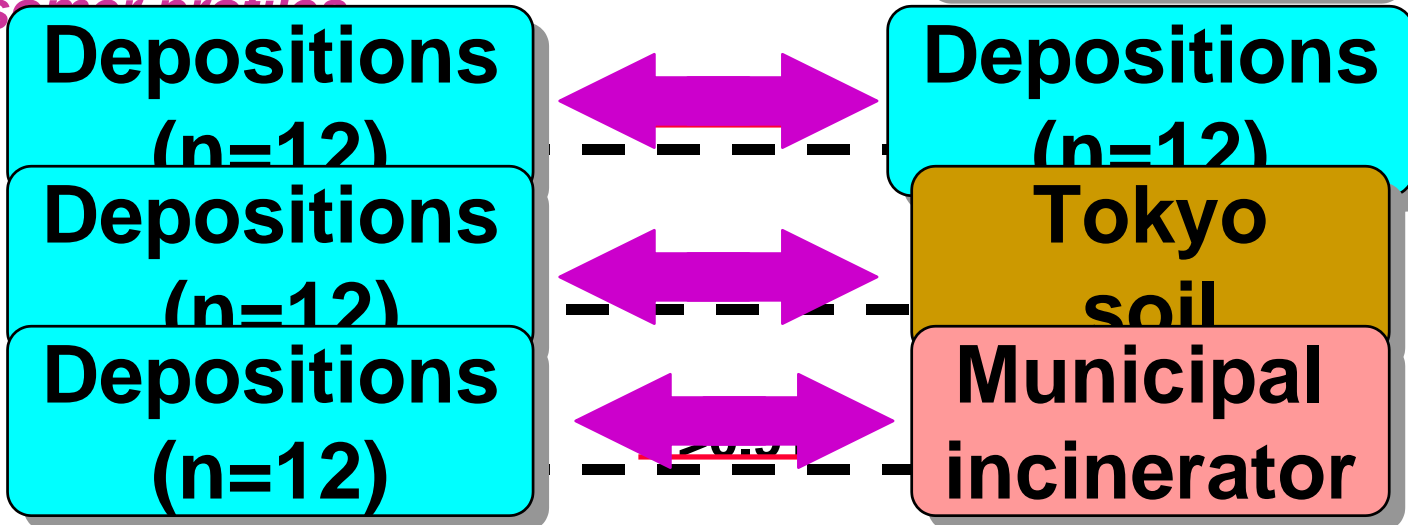
- Tokyo deposition ('96/12-'97/1)
- Yokohama deposition ('96/12-'97/1)
- ▲ Tanzawa deposition ('96/12-'97/1)

Correlation coefficients for homologue and isomer profiles

Homologue profiles



Isomer profiles

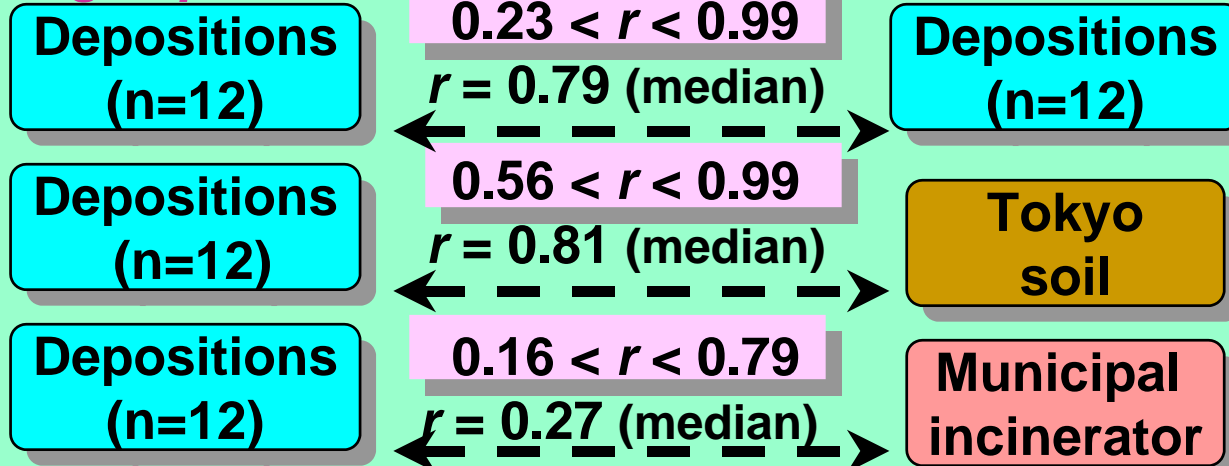


Tokyo soil: (Sakurai *et al.*, 1996)

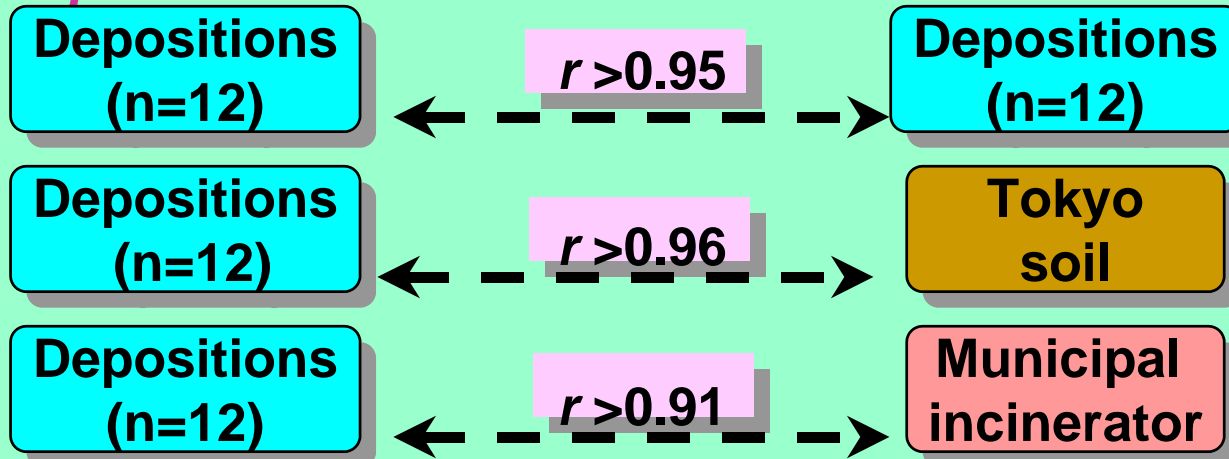
Municipal incinerator: exhaust gas from a municipal incinerator (extract was given)

Correlation coefficients for homologue and isomer profiles

Homologue profiles



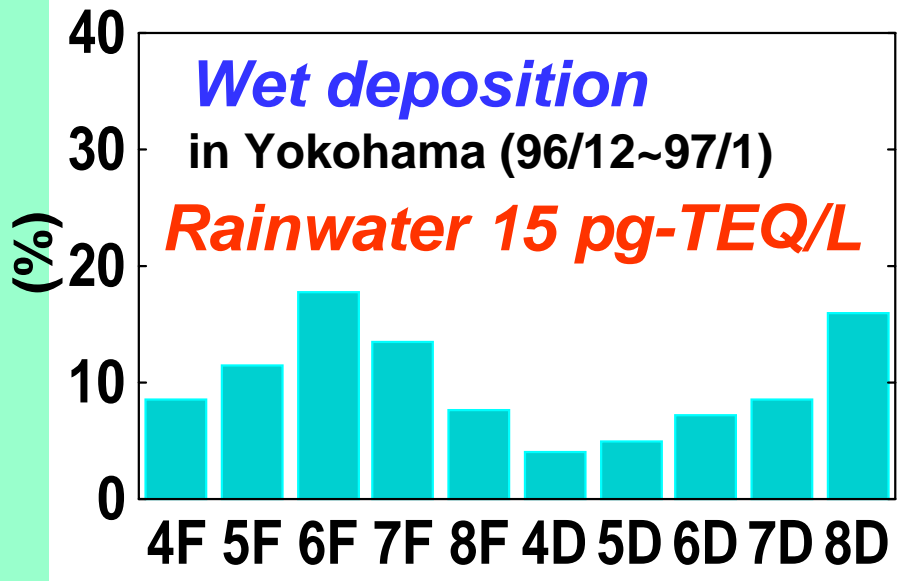
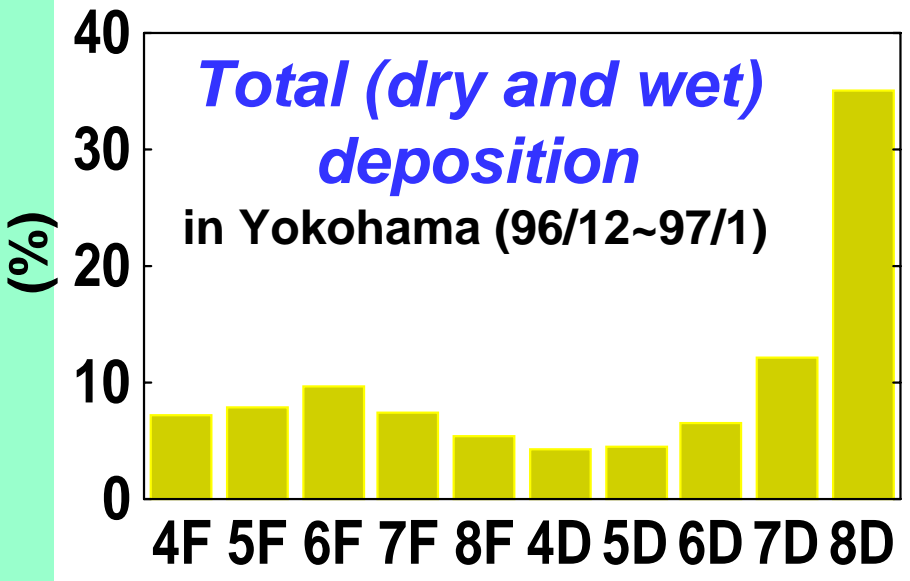
Isomer profiles



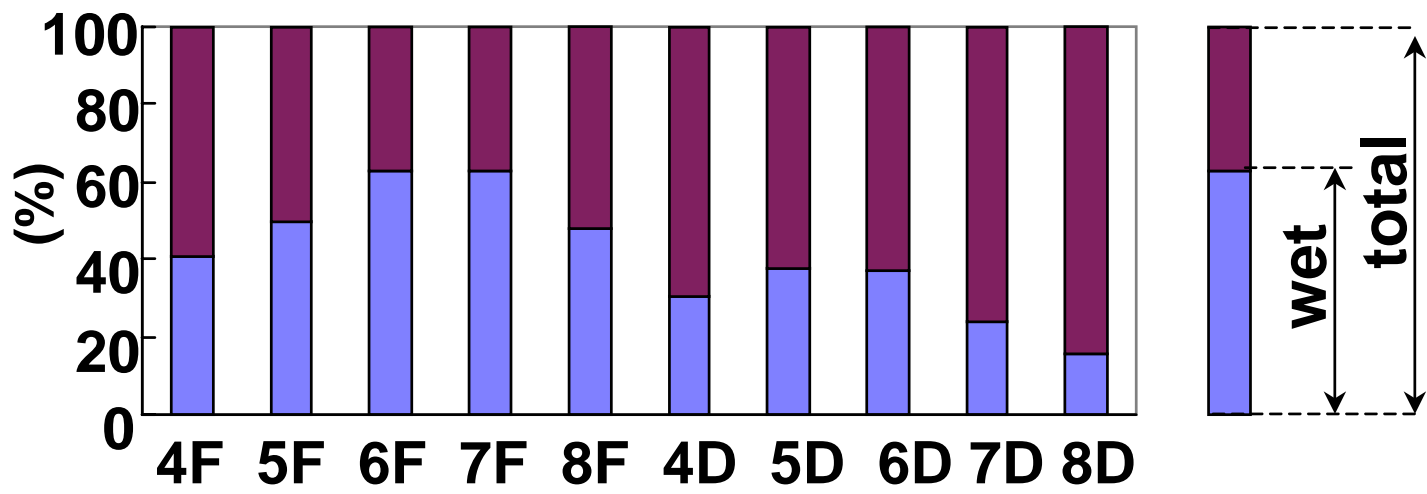
Tokyo soil. (Sakurai *et al.*, 1996)

Municipal incinerator: exhaust gas from a municipal incinerator (extract was given)

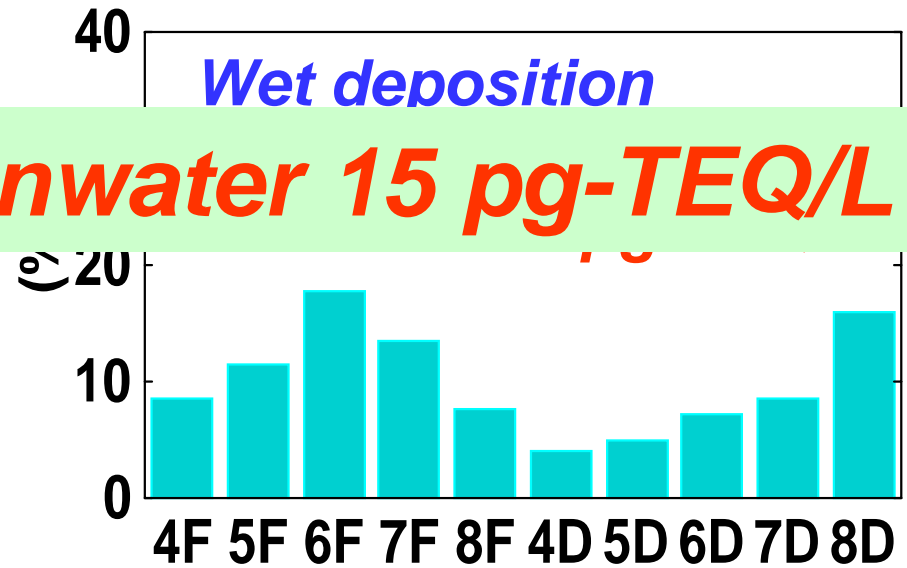
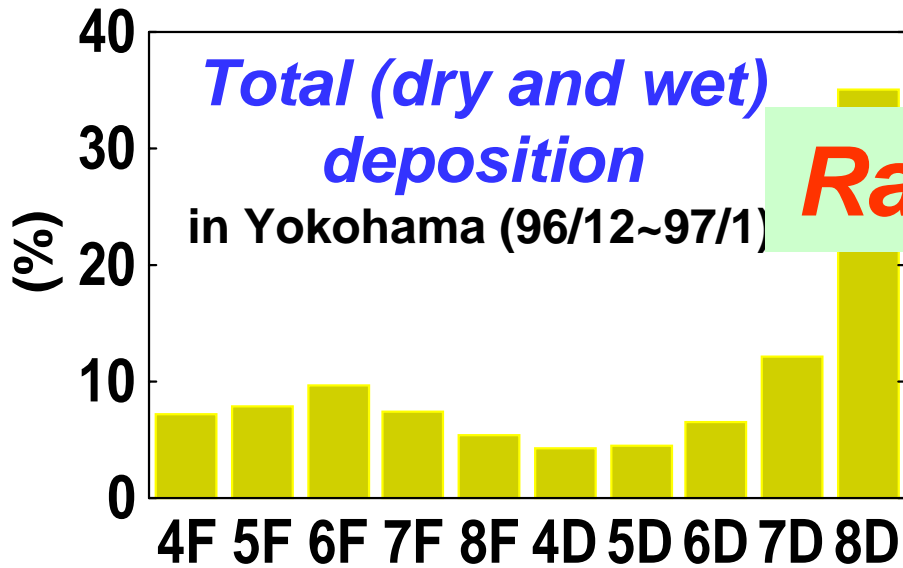
Total (dry and wet) deposition and wet deposition



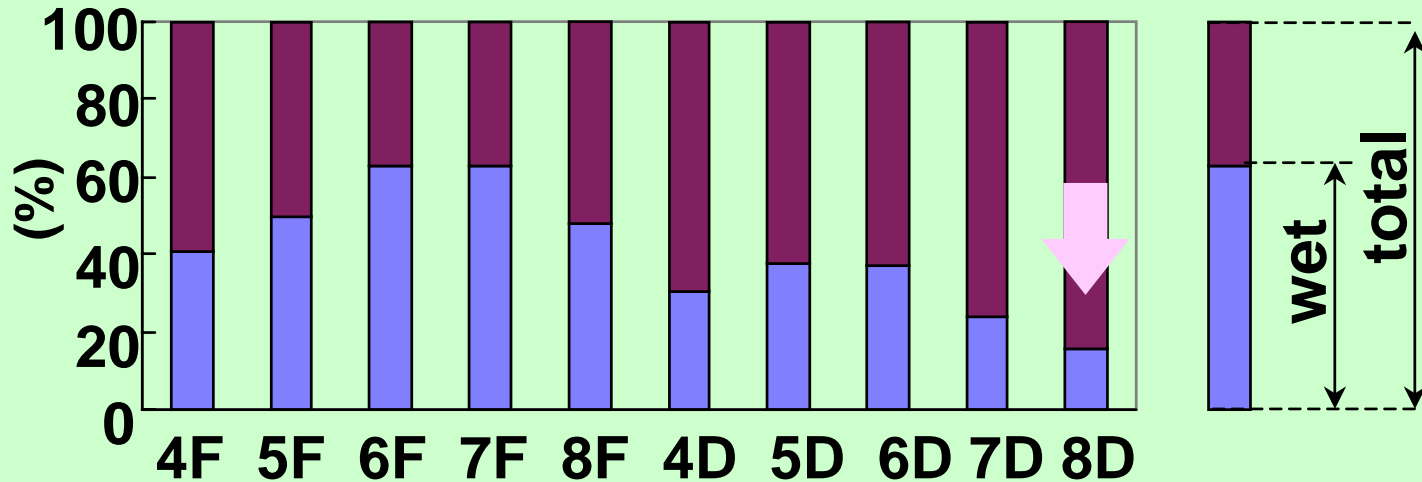
4, 5, ..., 8:
degree of
chlorination
D: PCDD
F: PCDF



Total (dry and wet) deposition and wet deposition



4, 5, ..., 8:
degree of
chlorination
D: PCDD
F: PCDF



Conclusions

Results

- Deposition flux of total PCDD/PCDF in Tokyo, Yokohama, Tanzawa and Tsukuba.
 - 0.45~6.0 ng/m²/day (actual value)
 - 6.1~87 pg TEQ/m²/day (TEQ value)
- Deposition flux was higher in the winter than in the summer.
- For the deposition samples, the Tokyo soil, and the municipal incinerator, homologue profiles were varied, but isomer profiles were very similar.
- Homologue profiles of total (dry and wet) deposition and wet deposition were not similar, but these isomer profiles were very similar.
- The measured concentration of PCDD/PCDFs in the rainwater was 15 pg TEQ/L.

Hypotheses

- PCDD/PCDFs in atmospheric deposition are primarily derived from emissions of incineration processes.
- Isomer profile may be stable in air and soil.
- The environmental behavior of PCDD/PCDFs may depend on the degree of chlorination and structural differences between PCDDs and PCDFs

Looking ahead

The observation of homologue profiles

The elucidation of their atmospheric behavior

The observation of isomer profiles

The elucidation of the contribution of various emission sources