

**A example for evaluation of wet  
and dry deposition data**  
**Joint Research Project with  
Russia**

**ADORC**

1

**Project (1)**

- Title: “**Evaluation of Atmospheric Environment in East Siberia and Primorsky Region**”
- Period: 2002-(2004)
- Counterpart: Limnological Institute, RAS/SB
- Finance: Global Environment Research Fund of MOE Japan through NIES Japan

2

## Project (2)

Objectives of this project are:

- To evaluate long-range transformation of air pollutants from Europe to East Asia
- To clarify the atmospheric environment in East Siberia and Primorsky Region
- To develop the analytical methodology for EANET data

3

## Location of monitoring sites



4

## Main Contents of 2002 Project

- Data analyses of wet deposition and gas/aerosol concentration (FP method)
- Lead and mercury concentration in wet deposition
- Lead isotopic composition of wet deposition

5

## Wet (1) Concentration

Concentration of Major Components in Wet Deposition [Precipitation Amount Weighted Mean] 2002]

Site	Season*	Number of day**	Rainfall amount mm	pH	EC	nss-SO <sub>4</sub> <sup>2-</sup>	NO <sub>3</sub> <sup>-</sup>	Cl <sup>-</sup>	HCO <sub>3</sub> <sup>-</sup>	NH <sub>4</sub> <sup>+</sup>	Na <sup>+</sup>	K <sup>+</sup>	nss-Ca <sup>2+</sup>	Mg <sup>2+</sup>
					mS/m	μmol/L								
Irkutsk (IR)	Warm	53	252	5.0	1.6	25	18	12	11	40	3.2	1.7	17	3.4
	Cold	32	50	6.1	4.7	80	41	48	97	60	39	5.7	103	17
Listvyanka (LI)	Warm	35	232	4.9	1.3	17	15	8.2	5.9	35	1.8	1.6	6.6	1.7
	Cold	27	138	4.9	1.5	19	42	4.2	0.6	11	7.1	3.4	20	5.3
Mondy (MO)	Warm	15	195	5.4	1.0	11	14	9.1	12	35	1.7	2.3	7.9	2.1
	Cold	2	9	6.2	1.0	13	10	3.2	33	13	6.0	2.9	22	3.6
Primorskaya (PR)	Warm	50	622	5.2	1.4	19	9.5	28	8.2	33	16	3.8	8.6	3.0
	Cold	17	106	5.2	3.5	67	16	60	27	33	60	9.3	63	17
*Warm: May-October  Cold: November-April														
** Number of day, which precipitation is observed.														

6

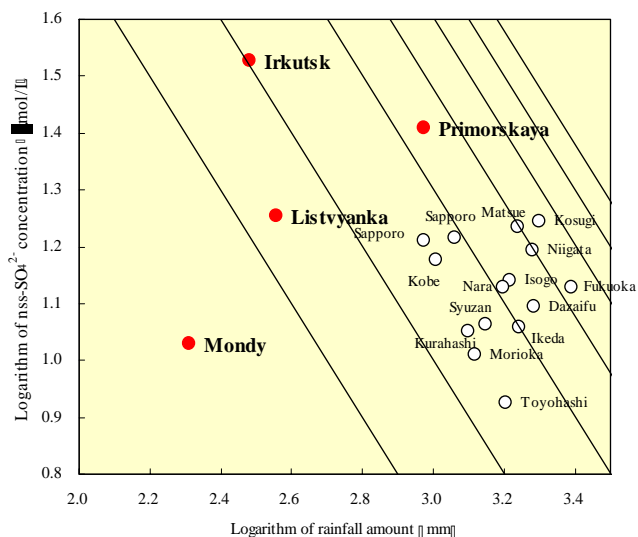
## Wet (2) Deposition

Wet Deposition of Major Components [ 2002 ]

Site	Season*	Rainfall amount mm	mmol/m <sup>2</sup>								
			nss-SO <sub>4</sub> <sup>2-</sup>	NO <sub>3</sub> <sup>-</sup>	Cl <sup>-</sup>	NH <sub>4</sub> <sup>+</sup>	Na <sup>+</sup>	K <sup>+</sup>	nss-Ca <sup>2+</sup>	Mg <sup>2+</sup>	H <sup>+</sup>
Irkutsk (IR)	Warm	252	6.2	4.5	3.1	10.0	0.8	0.4	4.3	0.9	2.8
	Cold	50	4.0	2.1	2.4	3.0	2.0	0.3	5.2	0.9	0.1
Listvyanka (LI)	Warm	232	4.0	3.6	1.9	8.2	0.4	0.4	1.5	0.4	3.2
	Cold	138	2.7	5.8	0.6	1.5	1.0	0.5	2.7	0.7	1.6
Mondy (MO)	Warm	195	2.1	2.7	1.8	6.8	0.3	0.5	1.5	0.4	0.8
	Cold	9	0.1	0.1	0.0	0.1	0.1	0.0	0.2	0.0	0.0
Primorskaya (PR)	Warm	622	11.6	5.9	17.3	20.6	10.1	2.3	5.3	1.9	4.1
	Cold	106	7.2	1.7	6.4	3.5	6.4	1.0	6.7	1.8	0.7

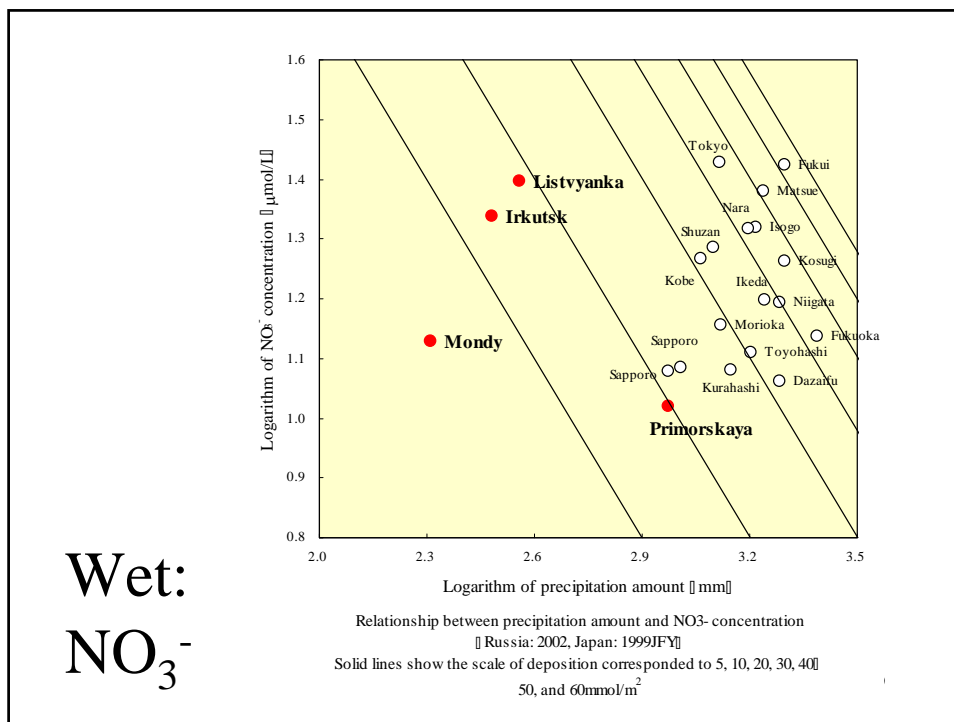
\*Warm: May-October] Cold: November-April

7



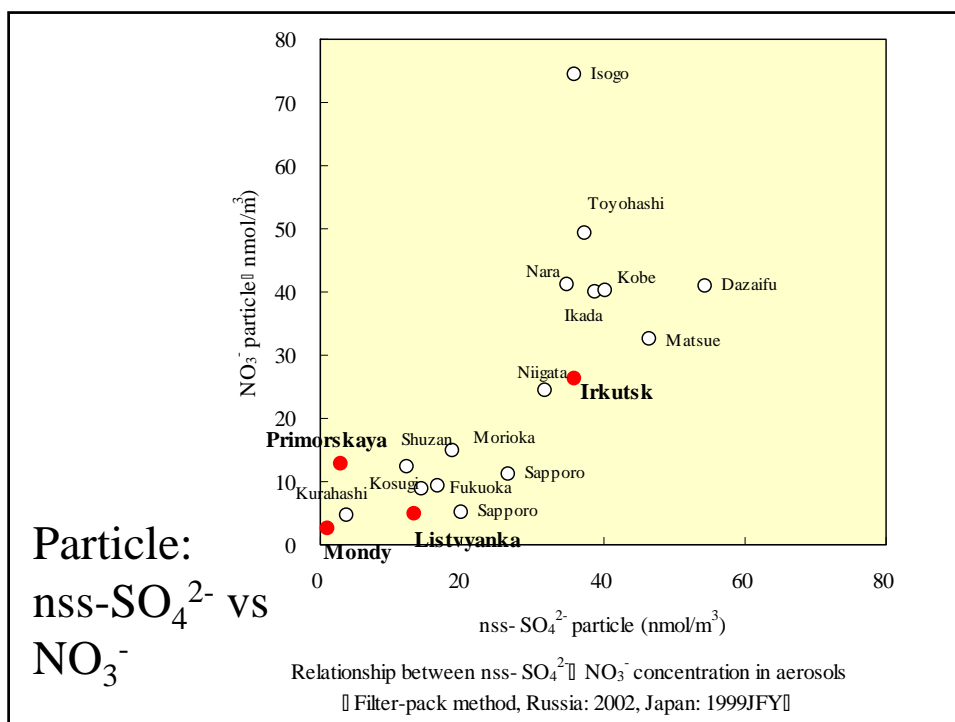
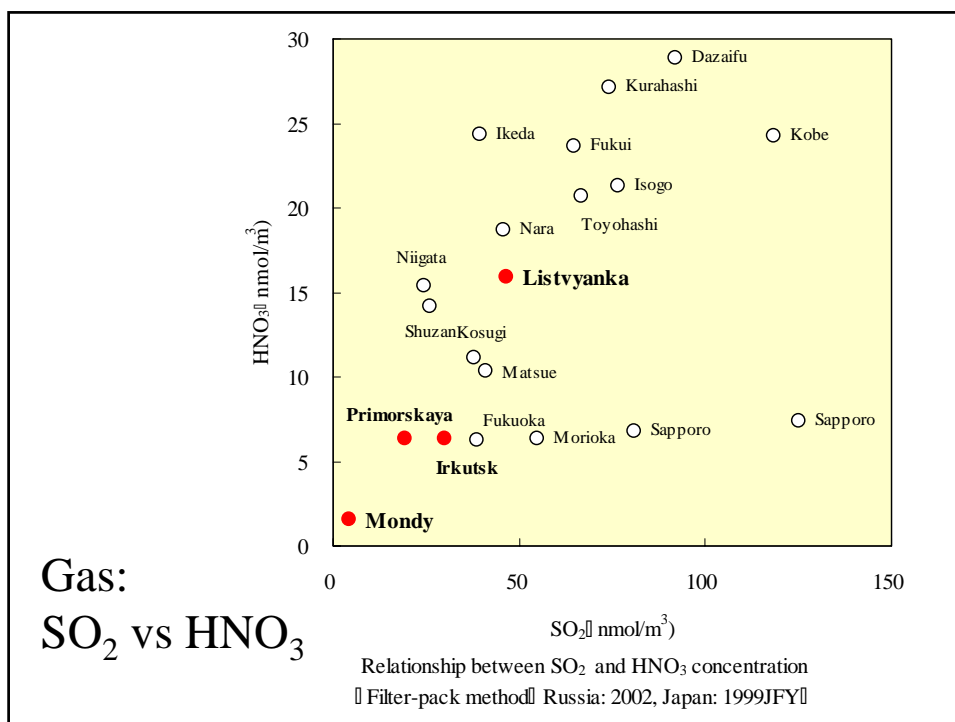
**Wet:**  
**nss-SO<sub>4</sub><sup>2-</sup>**

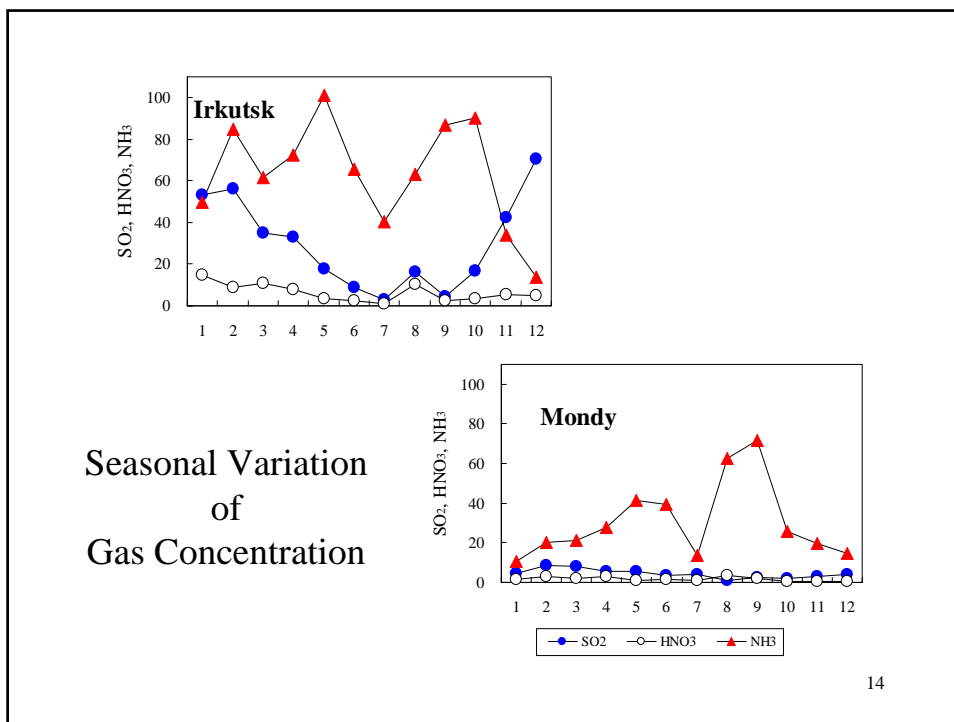
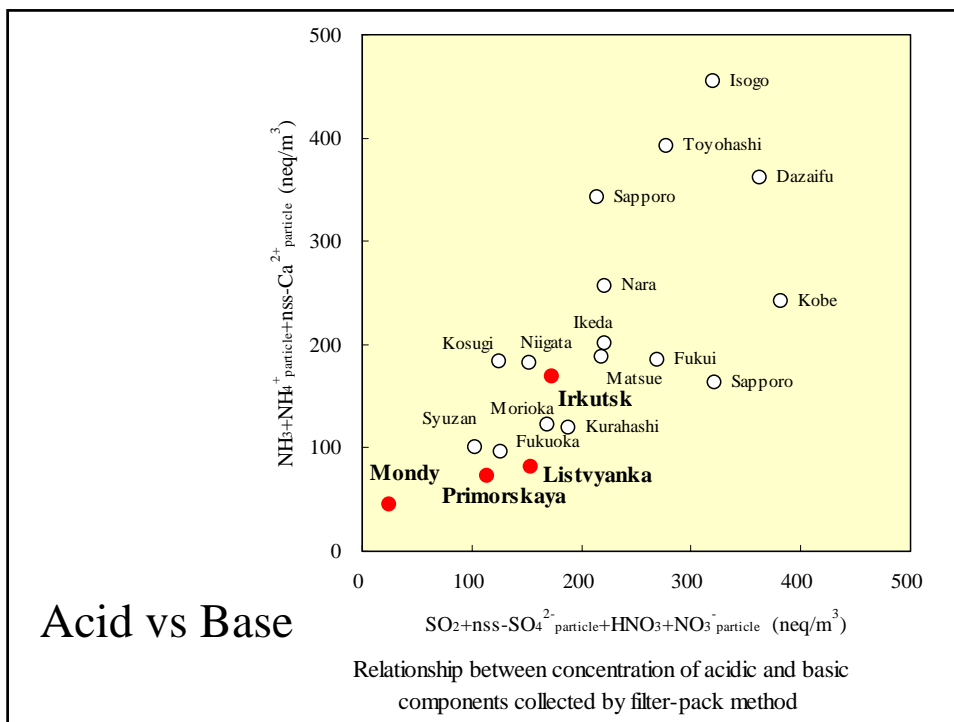
Relationship between rainfall amount and nss-SO<sub>4</sub><sup>2-</sup> concentration  
 [ Russia: 2002, Japan: 1999JFY ]  
 Solid lines show the scale of deposition corresponded to 5, 10, 20, 30, 40] 50, 60 mmol/m<sup>2</sup>



## Summary of Wet Deposition

- Precipitation Amount: 204mm/y (MO)-728mm/y (PR), Warm>Cold, Japan>PR>IR>LI>>MO
- Concentration
  - 1) Annual mean: IR>PR, LI>MO
  - 2) Seasonal variation: Cold>Warm
  - 3) nss-SO<sub>4</sub><sup>2-</sup>: IR>PR>LI>Japan>MO
  - 4) NO<sub>3</sub><sup>-</sup>: LI, IR, Japan, MO>PR,
- Deposition
  - 1) Annual: PR>IR, LI>MO
  - 2) Seasonal variation: Warm>Cold
  - 3) nss-SO<sub>4</sub><sup>2-</sup>: Japan, PR>IR, LI>MO
  - 4) NO<sub>3</sub><sup>-</sup>: Japan>PR, LI, IR>MO





## Summary of Gas/Aerosol

- SO<sub>2</sub>/HNO<sub>3</sub>: LI>PR, IR>MO
- NH<sub>3</sub>: PR>>IR>MO, LI
- Major gas/aerosol concentration: Equal or lower than that of [Japanese site](#)
- [Mondy](#): the most clean site except NH<sub>3</sub> in summer
- Seasonal Variation: Influenced by the variation of precipitation amount except NH<sub>3</sub>

15

## Mercury

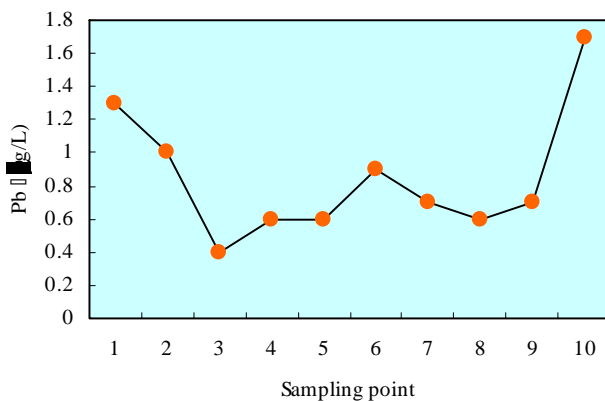
Mercury Concentration and Accumulated Amount in Snow Pack

Site	Collection Date	Number of samples	Hg		
			Conc. mg/L	Accumulated mg/m <sup>2</sup>	
Irkutsk	2002/12/2 □ 2003/2/3	8	Average	0.0063	0.13
			Max.	0.0090	0.29
			Min.	0.0014	0.015
Primorskaya		2	Average	0.0061	
			Max.	0.0090	
			Min.	0.0032	
Mondy	2003/1/9	4	Average	0.0043	0.055
			Max.	0.0052	0.075
			Min.	0.0032	0.042
Listvyanka	2002/12/8 □ 2003/2/2	7	Average	0.0069	
			Max.	0.014	
			Min.	0.0020	
Irkutsk Listvyanka	2003/2/12	9	Average	0.0051	0.27
			Max.	0.016	0.77
			Min.	0.0017	0.099

16



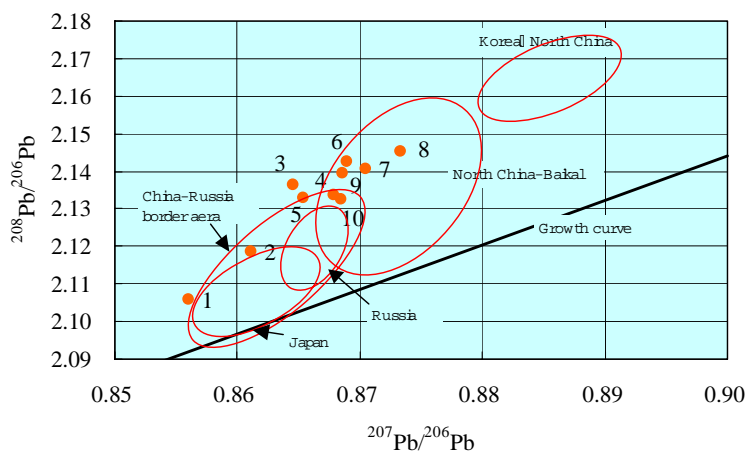
## Lead (1) Concentration



Pb concentration in snow cover  
Irkutsk Listvyanka Russia 2003

17

## Lead (2) Isotopic Composition



Lead isotopic composition of snow collected at 10 points along the line from Irkutsk to Listvyanka (Russia, 2003)

18

## Conclusion (1)

- Although concentration of  $\text{nss-SO}_4^{2-}$  and  $\text{NO}_3^-$  in the precipitation in **East Siberia** were higher than in **Japan**, deposition were extremely smaller than that in **Japan** due to small precipitation amount.
- Seasonal variation of gas/aerosol concentration may be strongly influenced by the variation of precipitation amounts except  $\text{NH}_3$  gas concentration in summer.
- Measurement of lead isotopic composition clarify the close relationship between **East Siberia** and **Japan**.

19

## Conclusion (2)

- Although these are results based on monitoring of **one year** performed for the first step to clarify the atmospheric environment in **East Siberia** and Primorsky region in Russia, these results may be useful for data analysis of EANET.
- Long term measurements are necessary to evaluate the quality of atmospheric environment in these areas due to very important of their as a transition area where long-range transportation of air pollutants from Europe and industrial regions of Russia to East Asia can be monitored.

20