

WET DEPOSITION MONITORING ACTIVITIES IN MALAYSIA

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Outline

- Introduction
- Wet Deposition Monitoring
- Sampling & Chemical Analysis
- Constraints

Introduction

MET Malaysia has established Global Atmosphere Watch (GAW) Global/Regional stations and 23 atmospheric composition stations to carry out systematic monitoring of atmospheric constituents in response to acquire a high quality data to study and understand the regional issues on trans-boundary haze, acid deposition, climate variability, climate change and stratospheric O₃ depletion.

Research Paper on Mercury in Malaysia

Mercury Pollution in Malaysia

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and Nor Ainy Mahyudin

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1 Introduction

Mercury is a hazardous pollutant; concern for its environmental presence arises from the human health effects caused by methylmercury through consumption of fresh water and marine fish (Clarkson 1995). Researchers first became concerned about the harmful effects of mercury when anthropogenic sources were released into the marine environment, and caused poisoning episodes (e.g., neurological disorders) in Japan (Minamata and Niigata) (Keckes and Miettinen 1972). This first known human poisoning by mercury from ingestion of seafood occurred in Japan

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▪ *Considering the high levels of mercury that now exists in human tissues, efforts should be continued, and accelerated in the future, if possible, to monitor mercury contamination levels in the coastal states, and particularly along the west Peninsular Malaysian coast.*

▪ *Most studies that have been carried out on mercury residues in environmental samples are dated, having been conducted 20-30 years ago; therefore, the need to collect much more and more current data is urgent.*

***Atmospheric Deposition* is the key input of Mercury in water bodies**

Environ. Sci. Technol. 2006, 40, 6261–6268

Mercury in Soils, Lakes, and Fish in Voyageurs National Park (Minnesota): Importance of Atmospheric Deposition and Ecosystem Factors

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- Hg source to water bodies is *overwhelmingly atmospheric deposition and anthropogenic*

*“We conclude that **nearly all of the mercury in fish in this seemingly pristine landscape was derived from atmospheric deposition**, that most of this bioaccumulated mercury was from anthropogenic sources, and that both watershed and lacustrine factors exert important controls on the bioaccumulation of methylmercury.”*

Wet Deposition Monitoring in MMD

- Started since year 1984.
- involve 23 stations under Atmospheric Composition Monitoring Network over Malaysia.
- current instrumentation use are:
 - i. Tisch Acid Precipitation Sampler (APS) – collect **both wet and dry deposition** by using two different collector.
 - ii. Ecotech Wet Only Sampler - collect **wet deposition only** .
- Samples are then analyzed by Department of Chemistry.

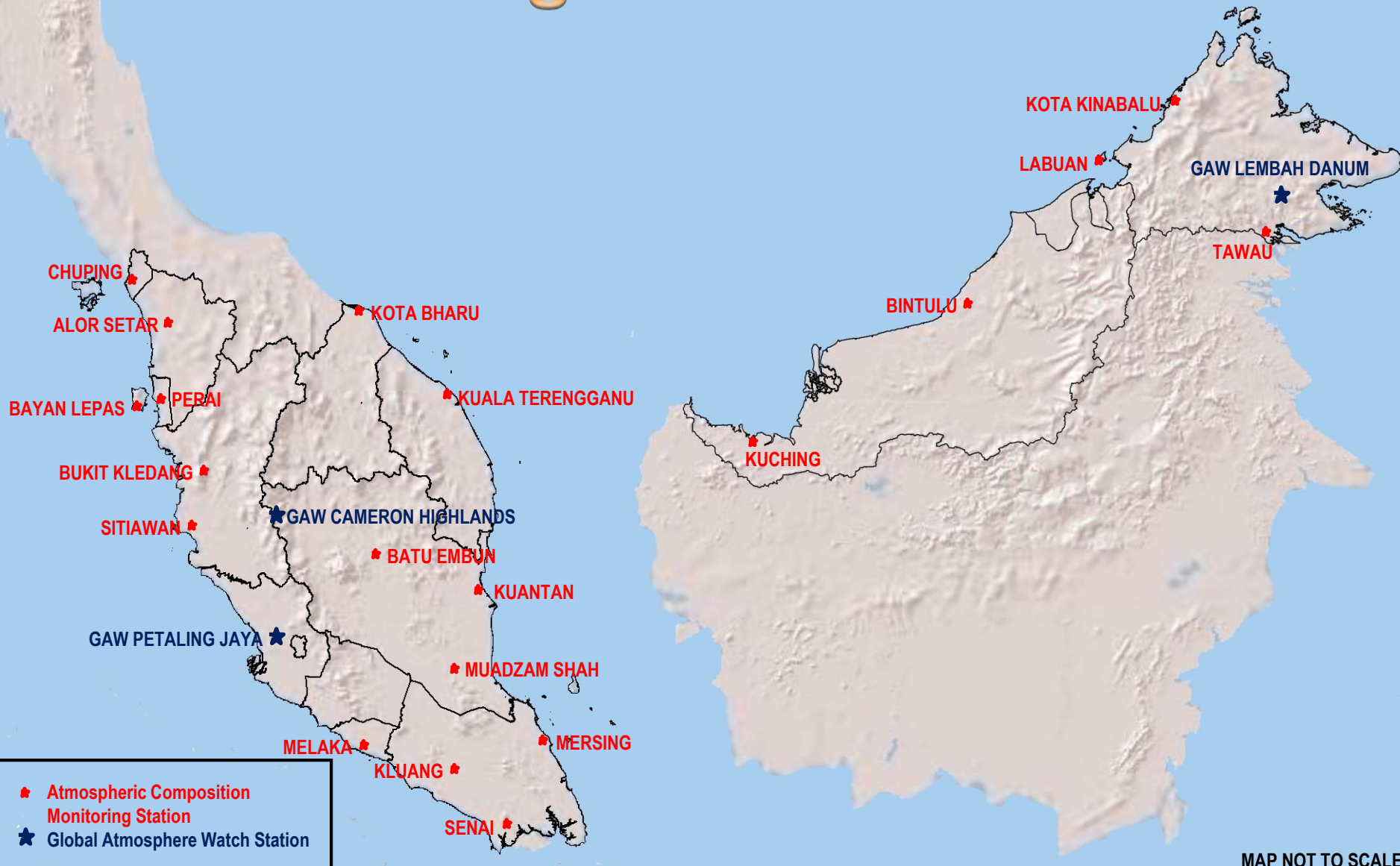


Acid Precipitation Sampler (APS)



Ecotech Wet Only Sampler

Atmospheric Composition Monitoring Network Stations



Sampling & Chemical Analysis

Instruments	Sampling Period	Parameter Analyzed	Chemical Analysis Instrument
Acid Precipitation Sampler (APS)	Wet Deposition: 1 week	Wet Deposition: Conductivity, pH, Anions(Cl^- , NO_3^- , SO_4^{2-} , organic acids), Cations (Na^+ , K^+ , Ca^{2+} , Mg^{2+} , NH_4^+) & Metals (Cd, Cu, Fe, Pb, Mn, Hg , Ni & Zn).	Wet Deposition: Ion Chromatography, Inductively Coupled Plasma Mass Spectrometry (ICP-MS), pH meter & Conductivity Meter
	Dry Deposition: 1 month	Dry Deposition: Dust weight, Metals (Mg, Ca, Cu, Fe, Pb, Mg, Mn. Hg , Ni & Zn)	Dry Deposition: Ion Chromatography
Ecotech Wet-Only Rainwater Sampler	1 week	Conductivity, pH, Anions(Cl^- , NO_3^- , SO_4^{2-} , organic acids), Cations (Na^+ , K^+ , Ca^{2+} , Mg^{2+} , NH_4^+) & Metals (Cd, Cu, Fe, Pb, Mn, Hg , Ni & Zn).	Ion Chromatography, ICP-MS, pH meter & Conductivity Meter

Wet Deposition Data

1. Monthly Wet Deposition Data - Petaling Jaya GAW Station (Urban Site)

JABATAN METEOROLOGI MALAYSIA

Wet Fallout WEF
Wet Fallout WEF results

Station: PETALING JAYA
 Period: 2017-01-01 00:00 - 2017-12-31 23:59
 Latitude : 3° 06' 07" N
 Longitude: 101° 38' 42" E
 Elevation : 58.6 m
 Unit: umol/L

PARAMETER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CALCIUM_WETK	5.54				2.81	8.37	4.50	4.59	3.42	2.70	3.69	4.22
CHLORIDE_WETK	7.27				6.97	12.34	10.67	13.47	6.31	15.90	6.66	12.24
CONDUCTIVITY_WETK	2.33				1.93	3.53	1.81	2.22	0.94	1.40	1.15	2.09
FLOURIDE_WETK	0.40				0.39	0.68	0.45	0.43	0.41	2.63	1.52	2.35
IRON_WETK	0.21				0.19	<0.070	<0.070	0.13	0.01	0.01	0.03	0.13
MAGNESIUM_WETK	0.79				0.02	1.03	0.83	0.47	<0.070	1.00	<0.070	1.01
MSA_WETK	<0.03				<0.03	<0.03	<0.03	<0.03	<0.03	0.06	0.03	<0.03
NH4_WETK	12.41				15.04	25.92	29.38	18.71	10.03	8.02	10.07	25.91
NO3_WETK	34.61				27.59	51.13	28.86	29.49	12.73	21.64	19.57	36.91
PH_WETK	4.40				4.49	4.24	4.61	4.50	4.79	4.67	4.68	4.57
POTASSIUM_WETK	1.68				1.07	2.92	1.63	2.05	1.06	1.57	1.24	2.06
SO4_WETK	18.64				12.41	21.90	17.76	18.50	8.87	7.14	7.44	14.02
SODIUM_WETK	5.34				3.30	5.27	5.54	8.80	3.67	11.79	3.50	6.68
ACETATE_WETK	0.132				0.074	2.025	<0.050	0.510	0.375	<0.050	<0.050	<0.050
COPPER_WETK	0.024				0.034	<0.005	0.025	0.027	0.010	0.007	0.024	0.029
LEAD_WETK	0.006				0.004	<0.001	0.006	0.015	0.002	0.005	0.008	0.013
MANGANESE_WETK	0.122				0.104	<0.003	0.024	0.080	0.030	0.013	0.015	0.047
MERCURY_WETK	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
NICKEL_WETK	<0.030				<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
VOLUME	1.380				3.590	1.820	1.150	2.470	2.820	4.680	1.980	1.650
ZINC_WETK	0.246				0.133	<0.010	0.422	0.240	0.130	0.153	0.182	0.340

Monitoring Data 2020

Monitoring Type (No. of site)	Site Name	Total No. of Samples	Remarks
Wet Deposition (4)	Petaling Jaya	51	-
	Kuching	14	Many samples cannot collect due to instrument failure.
	Tanah Rata	28	Instrument moved to other site (Brinchang) on 28 August 2020.
	Danum Valley	10	Many samples cannot collect due to Covid-19 lockdown and instrument failure.
Dry Deposition (3)	Petaling Jaya	47	Many samples cannot deploy due to Covid-19 lockdown.
	Tanah Rata	44	Many samples cannot deploy due to Covid-19 lockdown and postage problem.
	Danum Valley	11	Many samples cannot deploy due to Covid-19 lockdown and postage problem.

Constraints

1. Lack of facilities for mercury chemical analysis:

- Current instrument use are limited up to trace level detection only.
- Minimum Detection Limit (MDL) for each instruments are as follow:
 - i. Inductively Coupled Plasma Mass Spectrometer (ICP-MS) - 0.0001mg/L
 - ii. Cold Vapor-Atomic Absorption Spectrometer (CV-AAS) - 0.0008 mg/L
 - iii. Flow Injection Mercury System (FIMS) - 0.005 mg/L
- No Clean Room Class 100

2. Not able to fulfill the mercury sampling procedure:

- Technnical Manual for Wet Deposition Monitoring in East Asia by Acid Deposition Monitoring Network (EANET)
- Current rainwater monitoring instrument is not suitable for mercury monitoring.

Thank You for your
attention