

The 3<sup>rd</sup> Asian GAW Workshop on Greenhouse Gases

29-30 September 2011, Seoul, Korea

# **THE GLOBAL ATMOSPHERE WATCH (GAW) ACTIVITIES IN MALAYSIA**

**Maznorizan Mohamad**

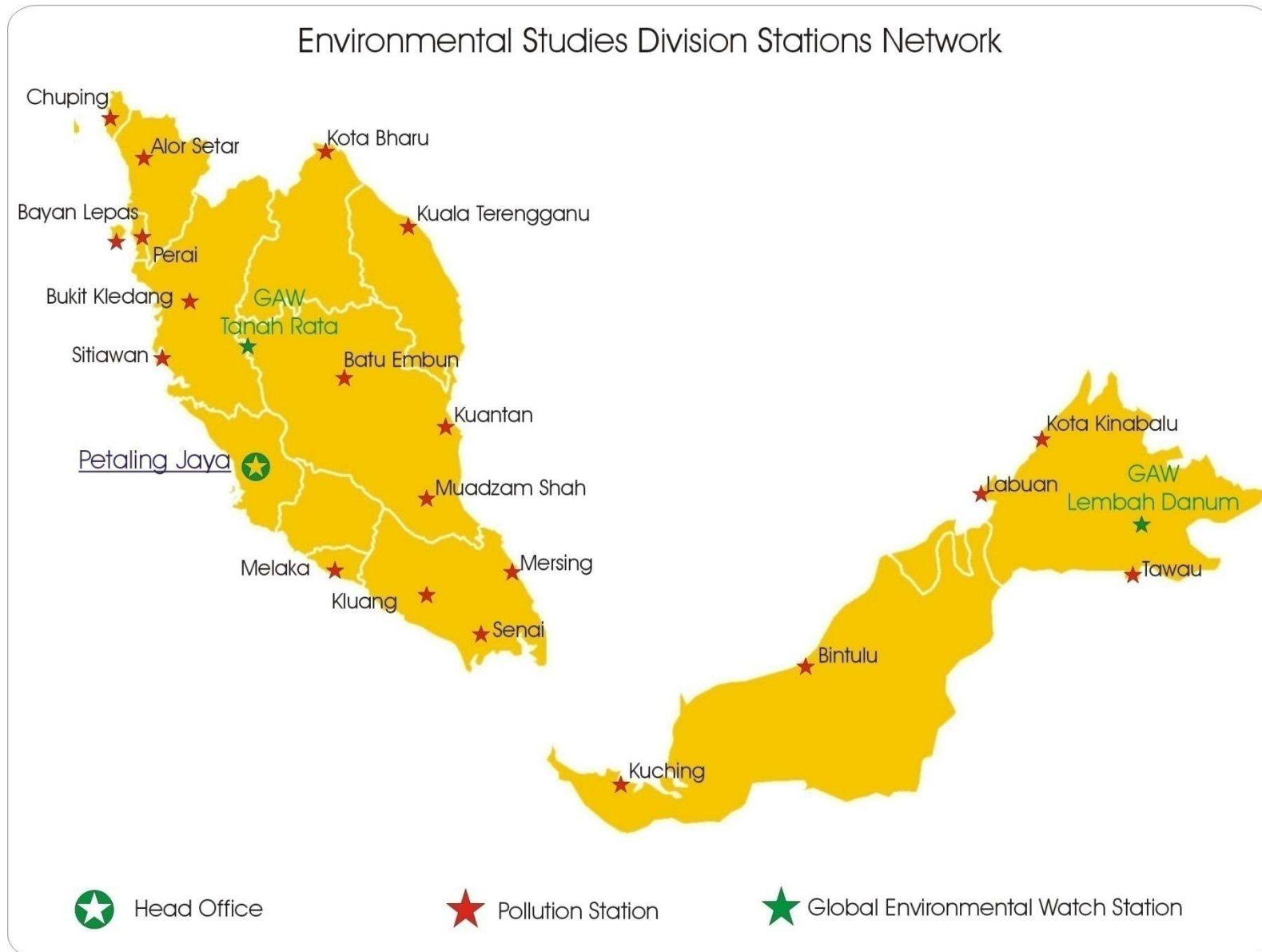
**Malaysian Meteorological Department**



# INTRODUCTION

- **The air quality monitoring network presently comprises 23 stations which 17 are located in Peninsular Malaysia, 4 in Sabah and 2 in Sarawak.**
  
- **3 Global Atmosphere Watch (GAW) stations**
  - **Regional ( Developing Rural Site)**  
**Cameron Highland, Pahang**
  - **Regional (Urban Site) – Petaling Jaya, Selangor**
  - **Baseline (Forest Site) Danum Valley, Sabah**

# The GAW and Air Quality Monitoring Network



# The GAW Station in Malaysia

Three sites:

- Petaling Jaya (Urban site)
- Cameron Highland (Developing Rural site)
- Danum Valley (Forest site)



# **GAW Station at Petaling Jaya**

- **Regional (Urban site)**
- **Latitude -  $3^{\circ} 06' N$ , Longitude -  $101^{\circ} 39' E$   
Altitude - 87.0 m above MSL**
- **Observation Program:**
  - **Meteorological Observation**
  - **Wet and Dry Deposition**
  - **Reactive Gases**
  - **Aerosol load**
  - **AOD**
  - **UV**
  - **$O_3$  &  $SO_2$  (total column)**



# Monitoring Site in Petaling Jaya On the Roof Top



# GAW Station at Cameron Highland



# GAW Station at Cameron Highland

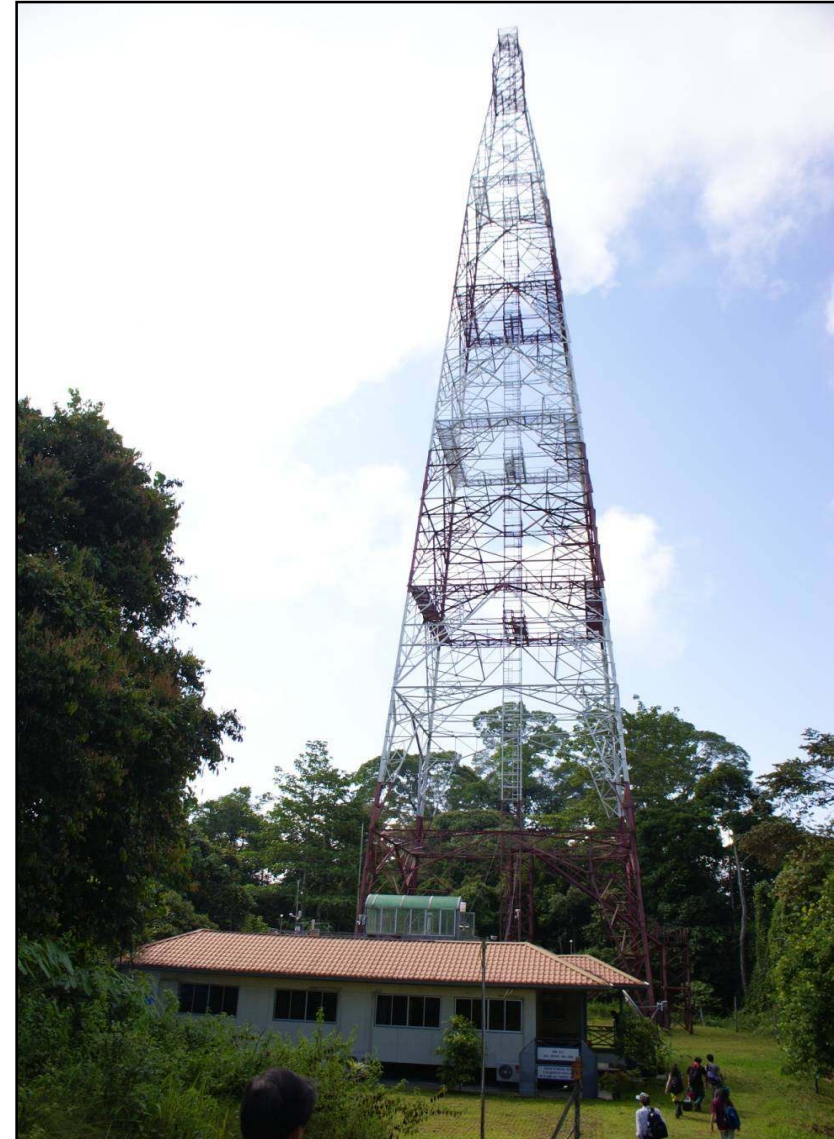
- **Regional (Developing Rural Site)**
- **Latitude -  $04^{\circ} 28' N$ , Longitude -  $101^{\circ} 23' E$**   
**Altitude - 1545.0 m above MSL**  
**(mountainous region)**
- **Observation Program:**
  - **Meteorological Observation**
  - **Wet and Dry Deposition**
  - **Reactive Gases &  $O_3$**
  - **Aerosol load**





# GAW Station at Danum Valley, Sabah

- **Global/Baseline GAW (Forest Site)**
- **Latitude: 04° 58' 53" North (4.95 deg. N)**
- **Longitude: 117° 50' 37" East (117.85 deg. E)**
- **Elevation: 426 metres above MSL (Atur Hill)**
- **Within the 973 km<sup>2</sup> forest reserve (managed by the Sabah Foundation)**
- **Construction work began in 2002 under the 8th Malaysian Development Plan**
- **Started operating in Nov.2003**





# **“Tropical lowland evergreen rain forest”**

**Canopy: 25-45 m**



## Danum Valley Baseline GAW Station

**Facilities :**

**Laboratory,**

**15ft high platform on the rooftop, and**

**100 m high sampling tower,**

**Meeting room /office**

**Satellite Communication thro' VSAT**



# Monitoring Activities in Danum Valley GAW Station

## Dry Deposition & Wet Deposition



Ecotech Wet Only Sampler



Filter Pack



Passive Sampler

## Persistent Organic Pollutants



Polyurethane Foam (PUF)  
Disk Passive Sampler



XAD Passive Sampler

## Meteorological Parameters



AWS

# Monitoring Activities in Danum Valley GAW Station

## Greenhouse Gases & Surface Ozone



Lo Flo Mark II CO<sub>2</sub>



O<sub>3</sub> Analyser

## Aerosol



TEOM



Nephelometer



MAAP



PFR

**Lo Flo Mark II CO<sub>2</sub> System** with the inlet located at  
100m high on the tower-  
(A collaboration with CSIRO)



## Flask sampling project - A collaboration with National Institute of Environmental Studies (NIES), Japan





# Monitoring Programmes

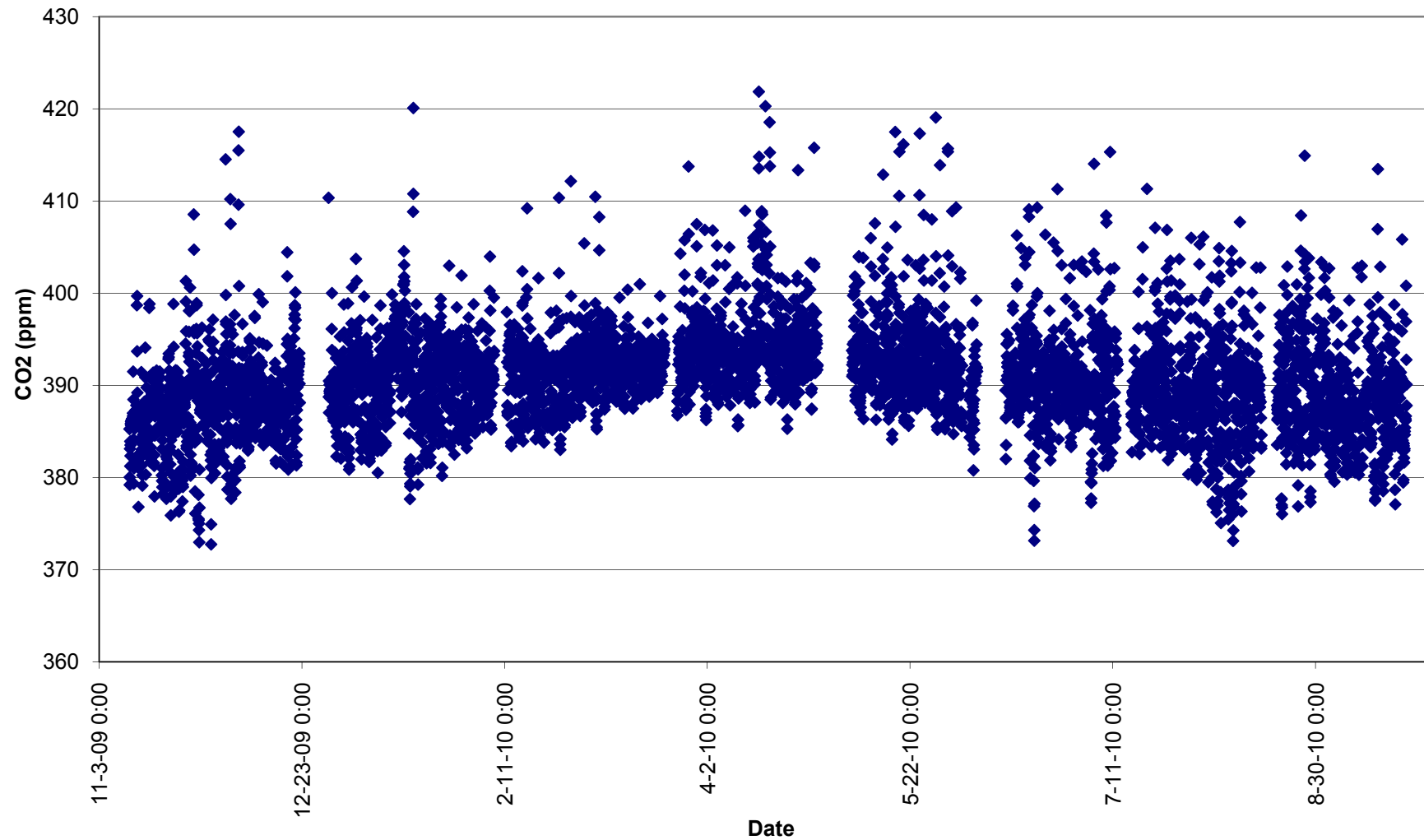
	Type of Element/Parameter	Type of Instrument
1.	Wet Deposition (pH, EC, anion, cation, heavy metal) (rainwater chemical composition) Dry Deposition (anion, cation)  Dry Deposition (reactive gases – NH <sub>3</sub> , SO <sub>2</sub> , NO <sub>2</sub> )	Ecotech Wet Only sampler  Filter Pack sampler  Passive Gas sampler
2.	Reactive Gases (NH <sub>3</sub> , SO <sub>2</sub> , HNO <sub>3</sub> , HCL)	Filter Pack Sampler
3.	Greenhouse Gases ( CO <sub>2</sub> )	Lo Flo Mark II CO <sub>2</sub> Analyzer
4.	Persistent Organic Pollutants (POPs) – PCBs, Dibenzo-dioxins	POPs PUF Disk Sampler XAD Disk Sampler
5.	GHG (CFCs, CH <sub>4</sub> , N <sub>2</sub> O, and CO <sub>2</sub> )	Flask sampling
6.	Surface O <sub>3</sub>	Ozone Analyzer
7.	Aerosols Total load /mass concentration (PM10) Back scattering coefficient Absorption coefficient/black carbon Aerosol Optical Depth	Tapered Elemental Oscillating Microbalance (TEOM ) Nephelometer Multi Angle Absorption Photometer (MAAP) Precision Filter Radiometer (PFR)
8.	Bromoform	µDirac (collaborate with Uni. of Cambridge)
9.	Meteorological parameter	VAISALA AWS

# Collaboration and Cooperation with International Scientific Community

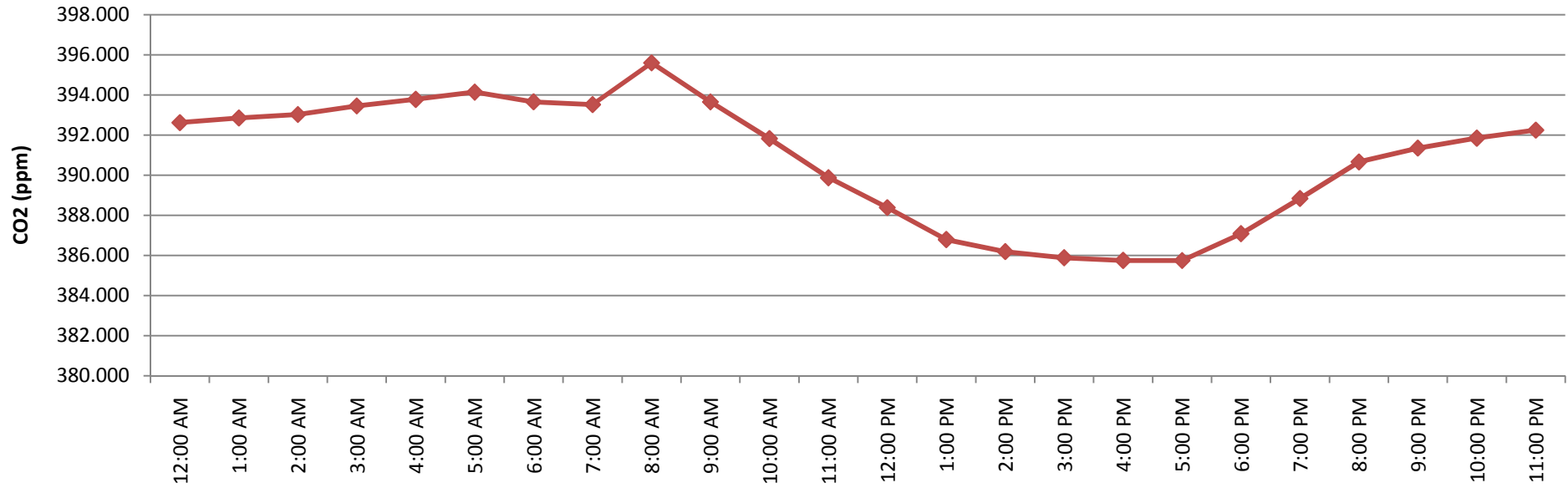
- ✿ National Institute of Environmental Studies (NIES), Japan - flask sampling
- ✿ Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia - LoFlo Mark II CO<sub>2</sub>
- ✿ Yayasan Sabah, University Malaysia Sabah, Lancaster University, University of Leicester, University of Cambridge, University of York, Leeds University, University of Manchester, University of East Anglia, Centre for Ecology and Hydrology Edinburgh, Facility for Airborne Atmospheric Measurement & National Center for Atmospheric Research and Environmental Protection Agency - Oxidant and Particle Photochemical Processes Above a South-East Asian Tropical Rain Forest (OP<sub>3</sub>)
- ✿ Twinning Programme with World Calibration Center for Physical Aerosol Properties (WCCPAP) – Institute for Tropospheric Research, Germany
- ✿ Collaboration with the Environment Canada on the Global Atmosphere Passive Sampling (GAPS) programme - Persistent Organic Pollutants (POPs)
- ✿ Acid Deposition Monitoring Network in East Asia (EANET) - Acid deposition
- ✿ Collaboration with World Radiation Centre, Davos, Switzerland – Aerosol Optical Depth monitoring using Precision Filter Radiometer (PFR)

# THE DATA ANALYSIS FOR GHGS

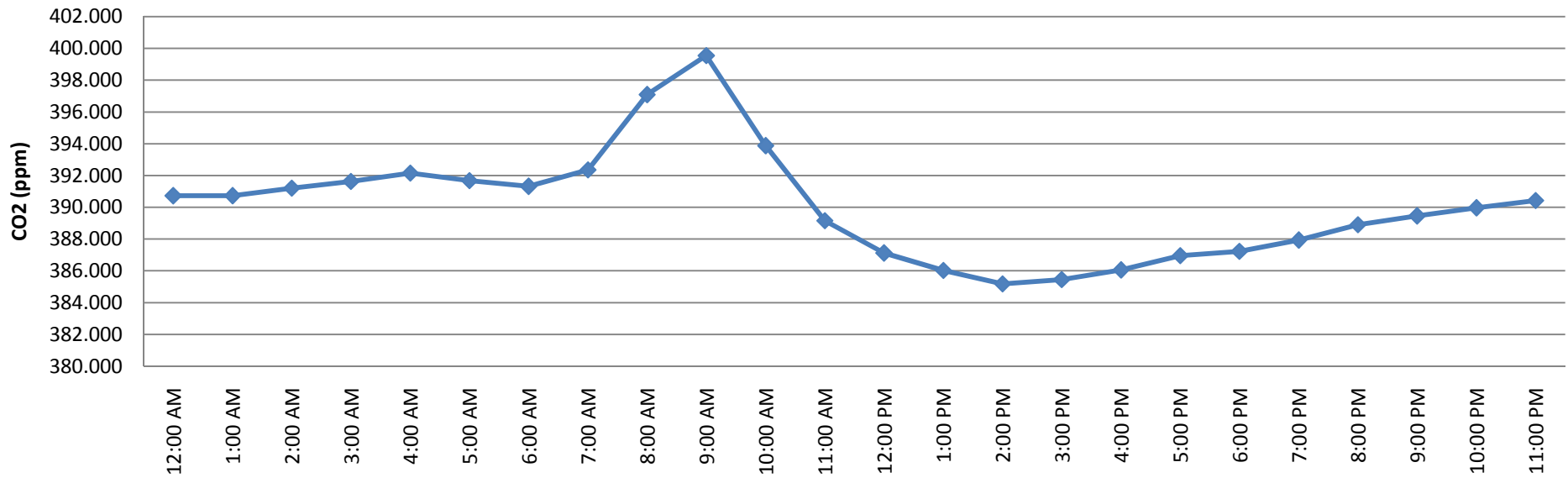
The Hourly Mean Mixing Ratio of CO<sub>2</sub> from Nov2009-Sep2010  
Station: Danum Valley



### Danum Valley - Hourly Mean CO<sub>2</sub> for January 2010



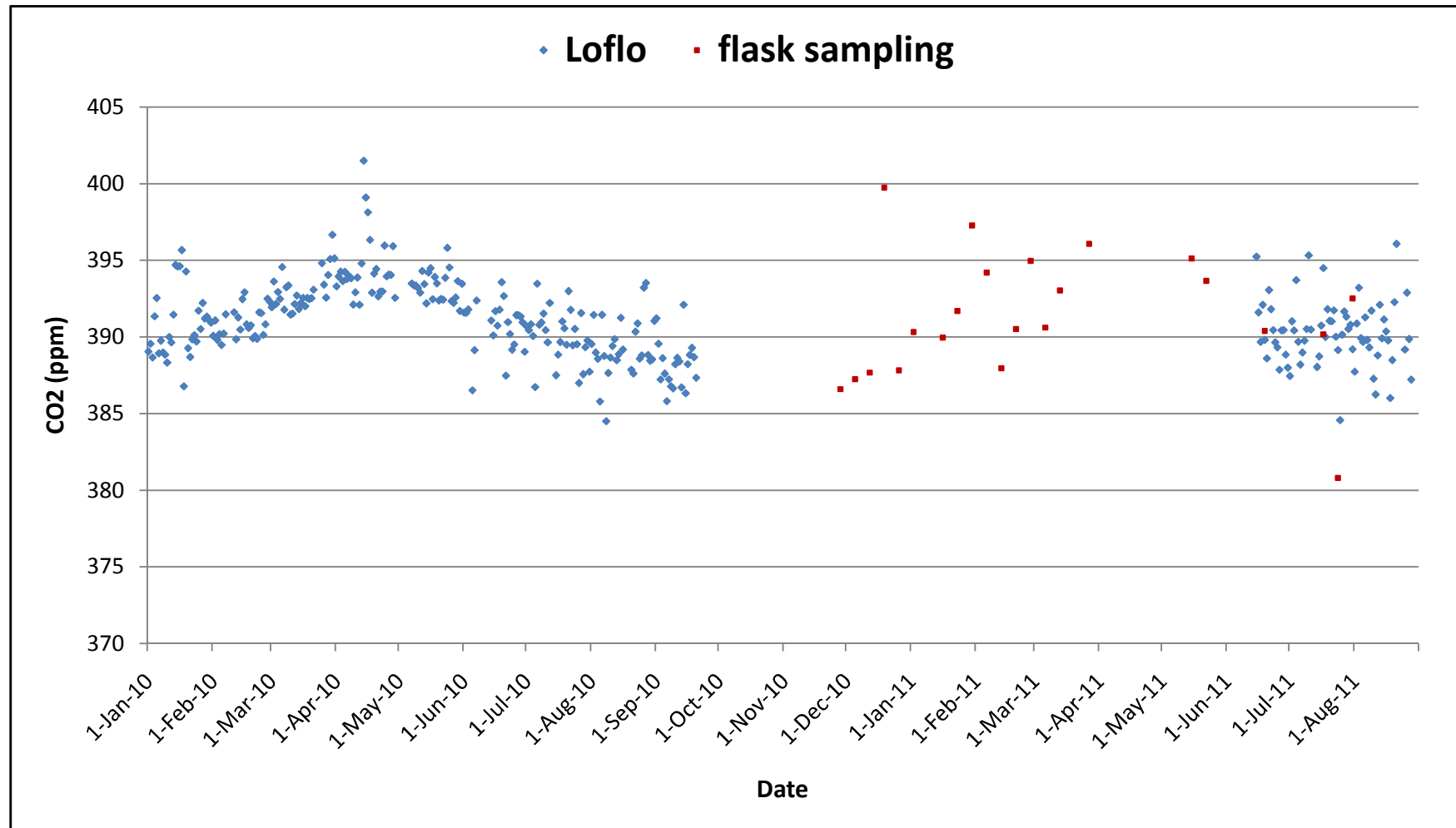
### Danum Valley - Hourly Mean CO<sub>2</sub> for July 2010



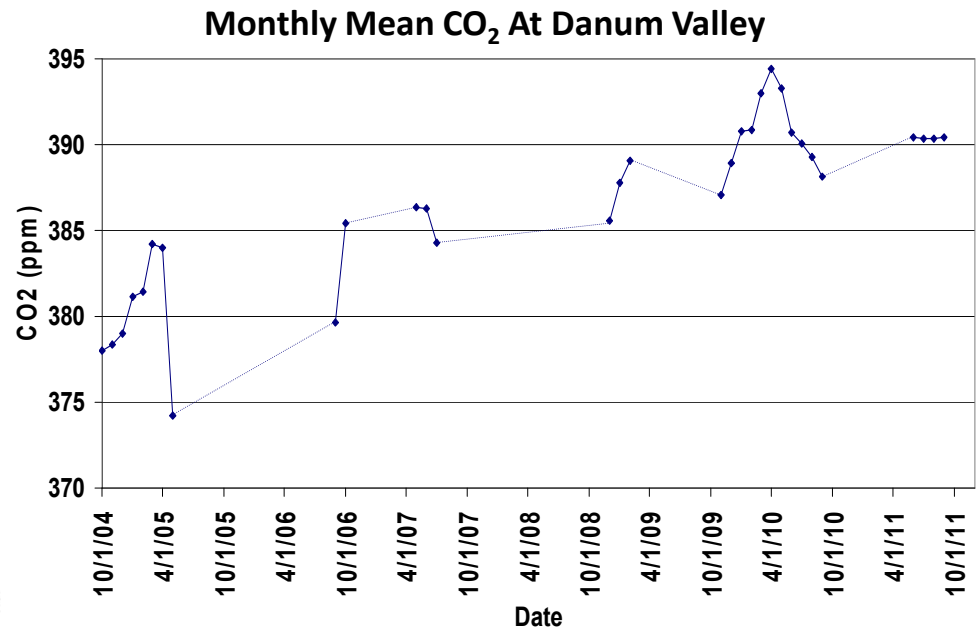
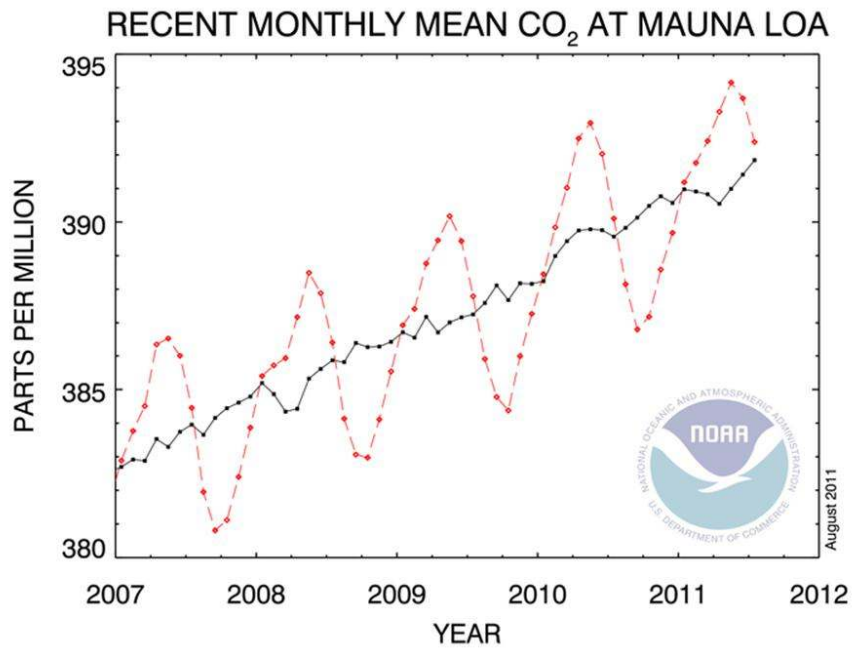
# The Daily Mean Mixing Ratio of CO<sub>2</sub>

## Station: Danum Valley

(January 2010 – August 2011)



# The Monthly Mean Mixing Ratio of CO<sub>2</sub> recorded at Mauna Loa and Danum Valley

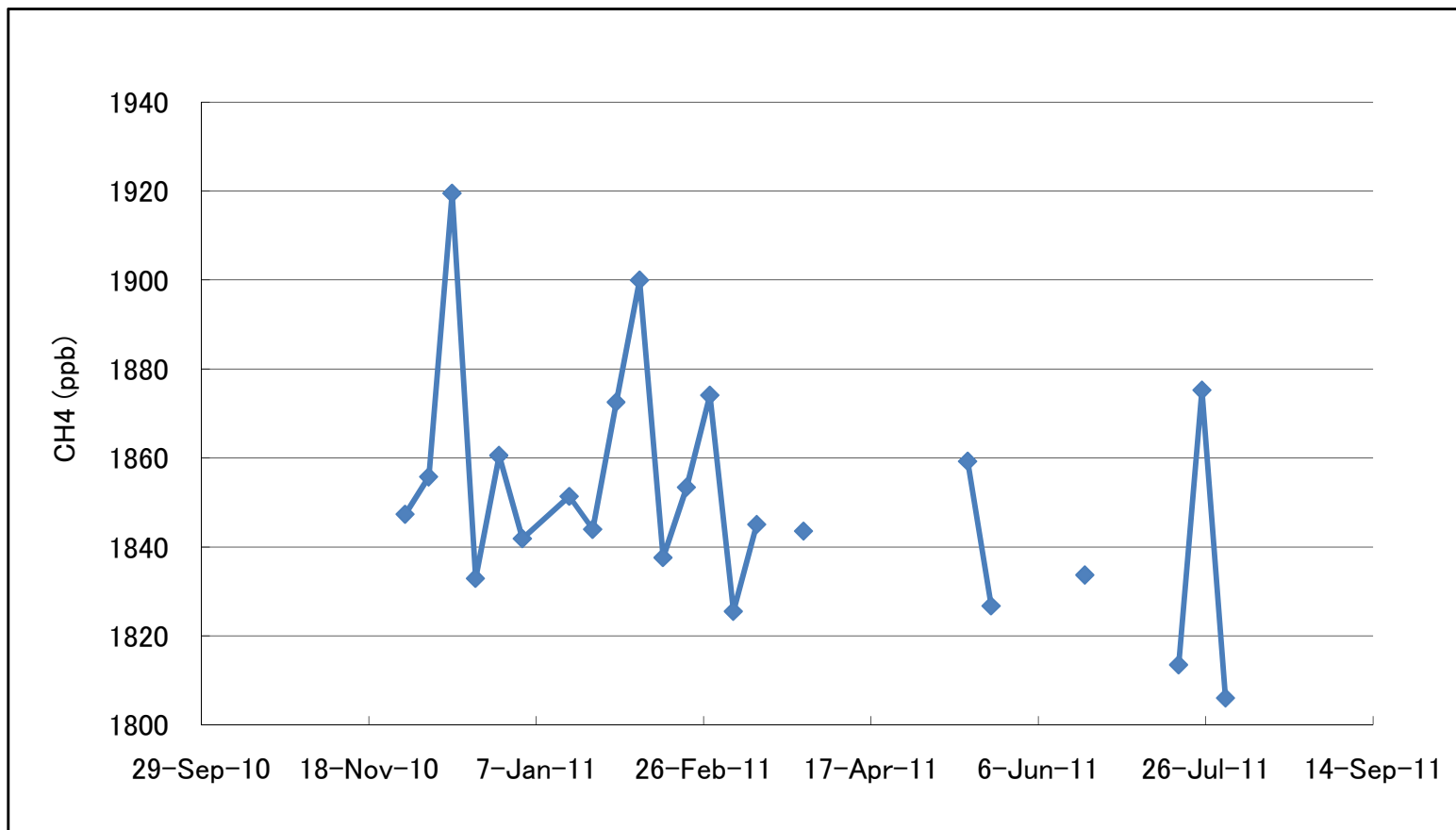


**Notes:**

- red line represents the monthly mean values, centered on the middle of each month.
- black line represents the same, after correction for the average seasonal cycle.

# The Daily Mean Mixing Ratio of CH<sub>4</sub> from Nov 2010 – July 2011

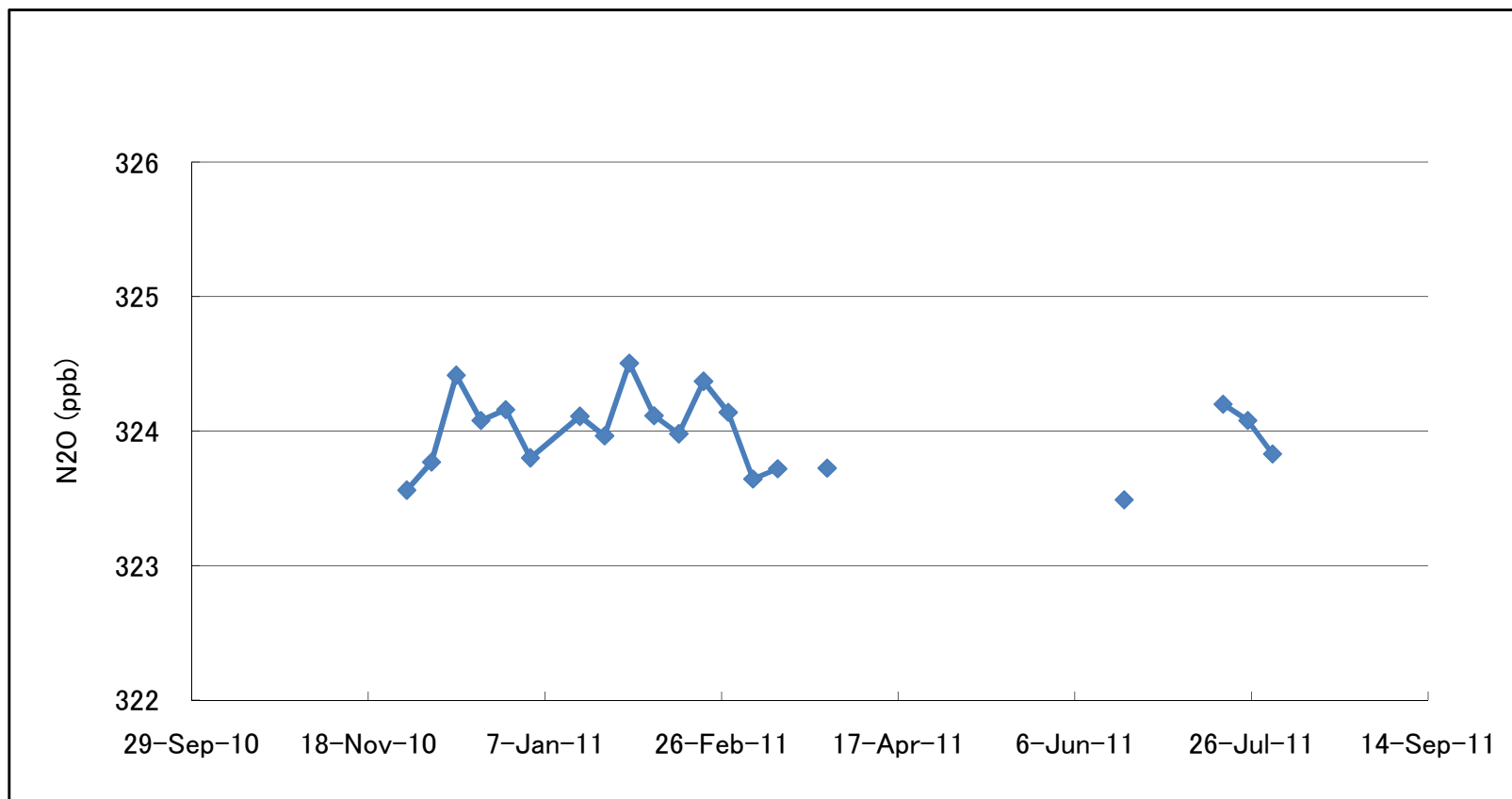
## Station: Danum Valley





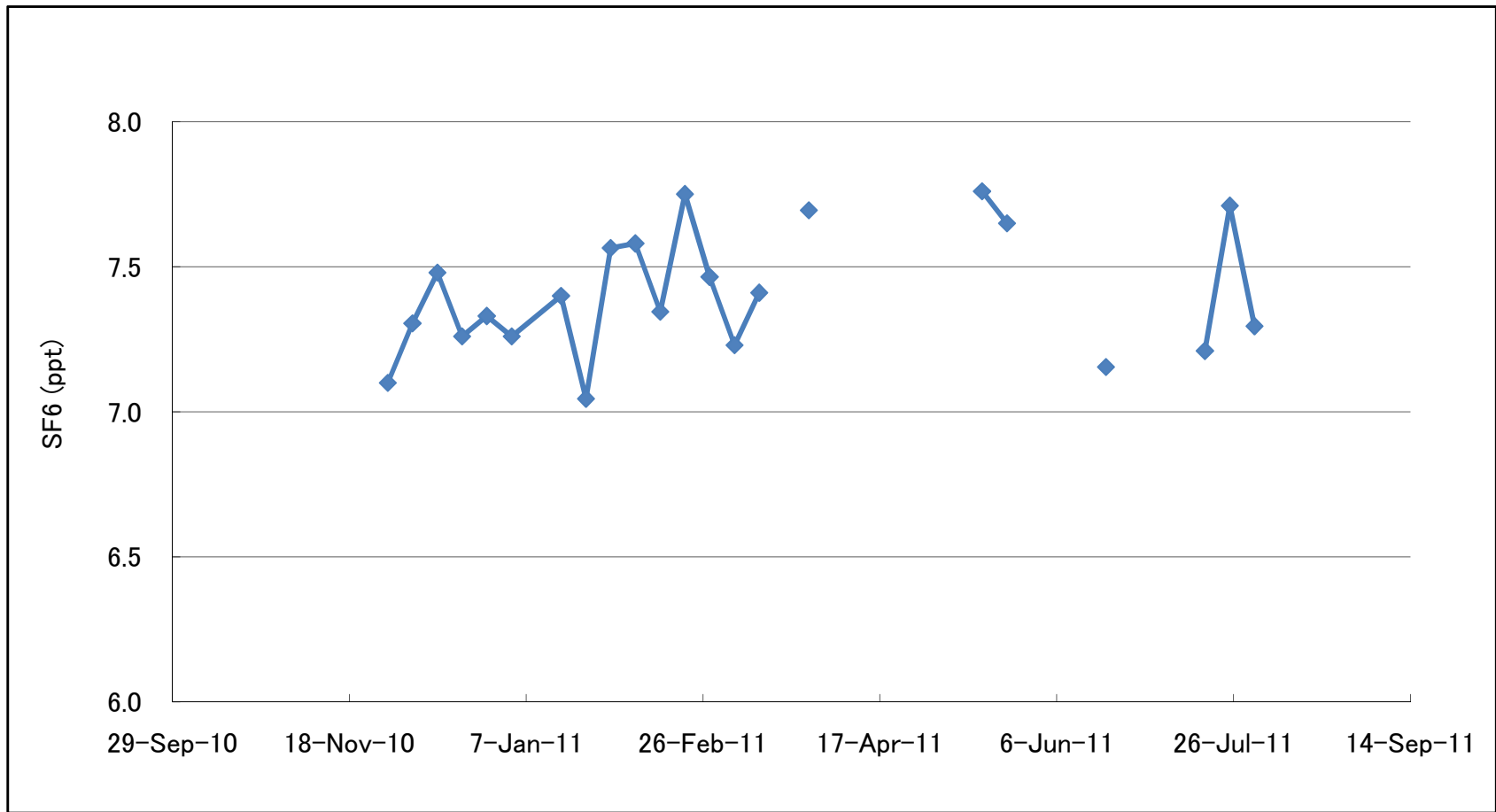
# The Daily Mean Mixing Ratio of N<sub>2</sub>O from Nov 2010 – July 2011

## Station: Danum Valley



# The Daily Mean Mixing Ratio of SF<sub>6</sub> from Nov 2010 – July 2011

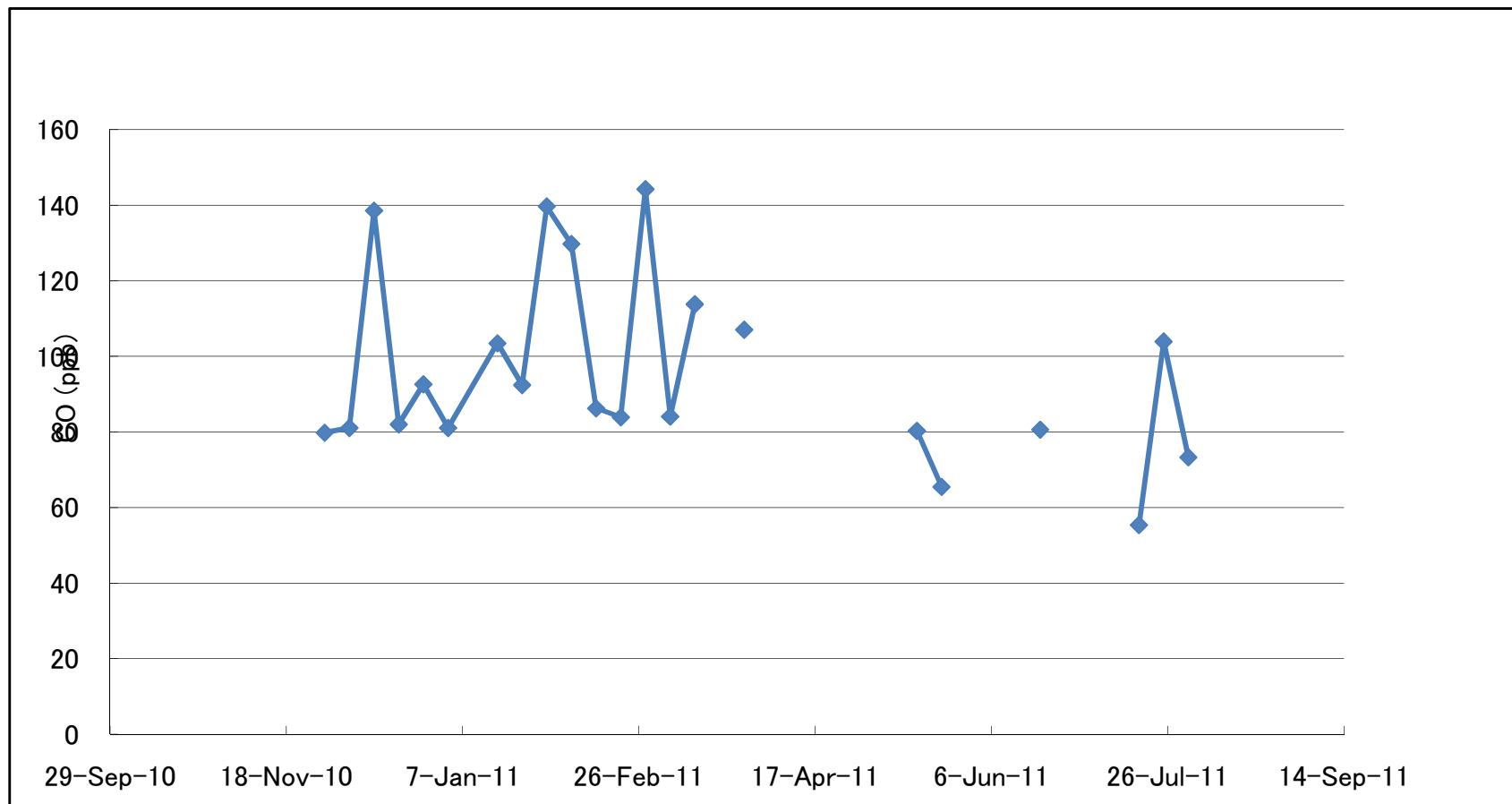
## Station: Danum Valley



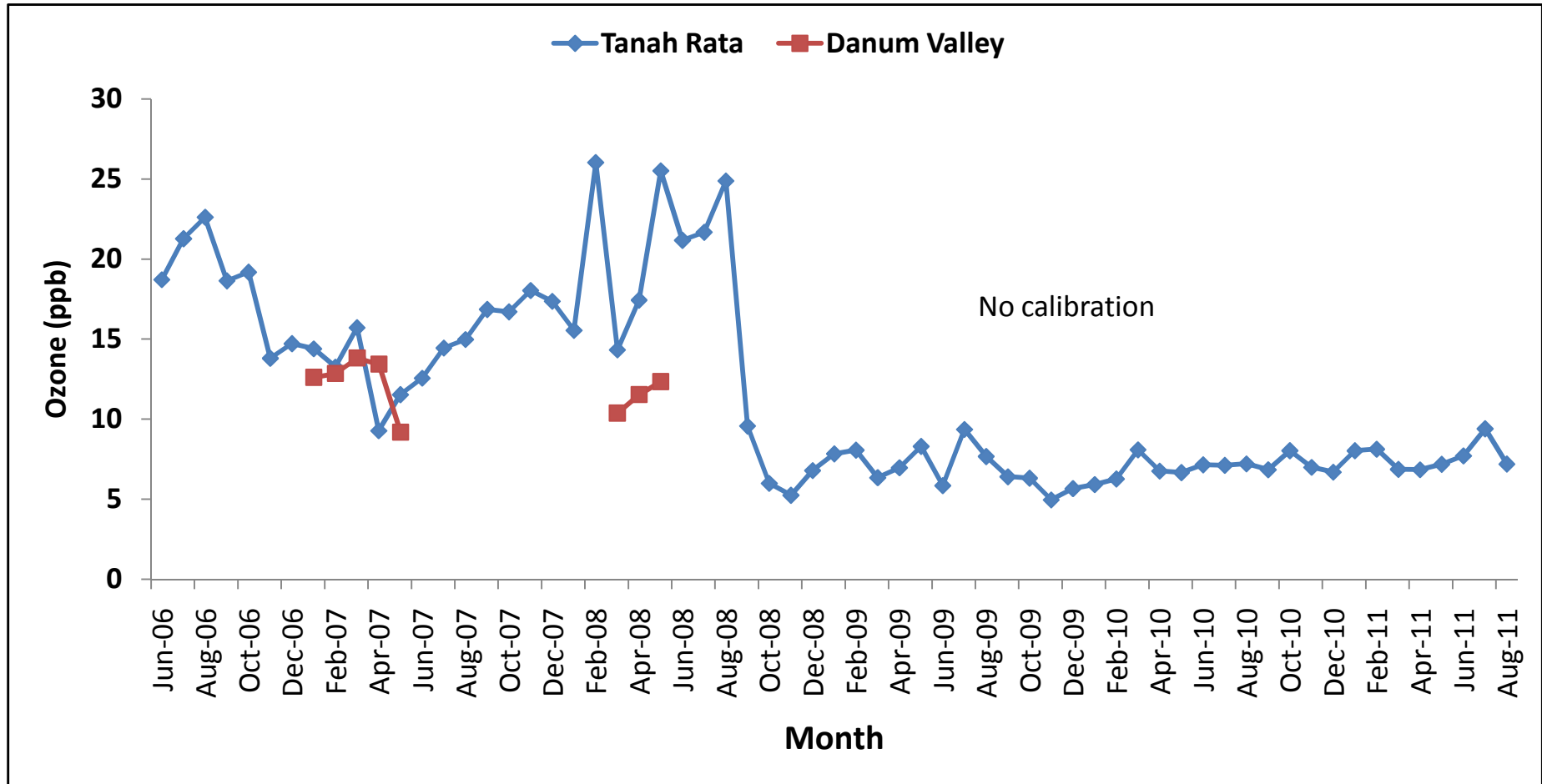
Other Reactive Gases .....

# The Daily Mean Mixing Ratio of CO from Nov 2010 – July 2011

## Station: Danum Valley



# Tanah Rata and Danum Valley GAW Station Monthly Mean O<sub>3</sub> Concentrations



From the analysis ...

- The concentration for these three major GHG and SF<sub>6</sub> show that the mixing ratio are within the range of the **global average values** that is issued by the 2009 WMO-GAW GHGs Bulletin ;
  - 386.8 ppm (CO<sub>2</sub>), 1803 ppb (CH<sub>4</sub>), 322.5 ppb (N<sub>2</sub>O) and 7.0 ppt (SF<sub>6</sub>)
- It is known that these three major GHGs are closely linked to anthropogenic activities, and also have a strong interactions with the biosphere and the oceans. This is agreeable with the locality of GAW Station in Danum Valley which is in the pristine tropical forest and about 50 km from the coast.

# Future plans

- To expand the GAW programme to include the installation of a new gas analyzers for GHG such as methane ( $\text{CH}_4$ ) and Nitrous Oxide ( $\text{N}_2\text{O}$ )
- The research activities regarding the effect of GHGs to the local /regional weather and climate will be enhanced by collaborate further with local and international universities and research institutes

Thank You