



Greenhouse Gases Measurement at Global Atmosphere Watch (GAW) Bukit Kototabang, West Sumatra - Indonesia

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INTRODUCTION

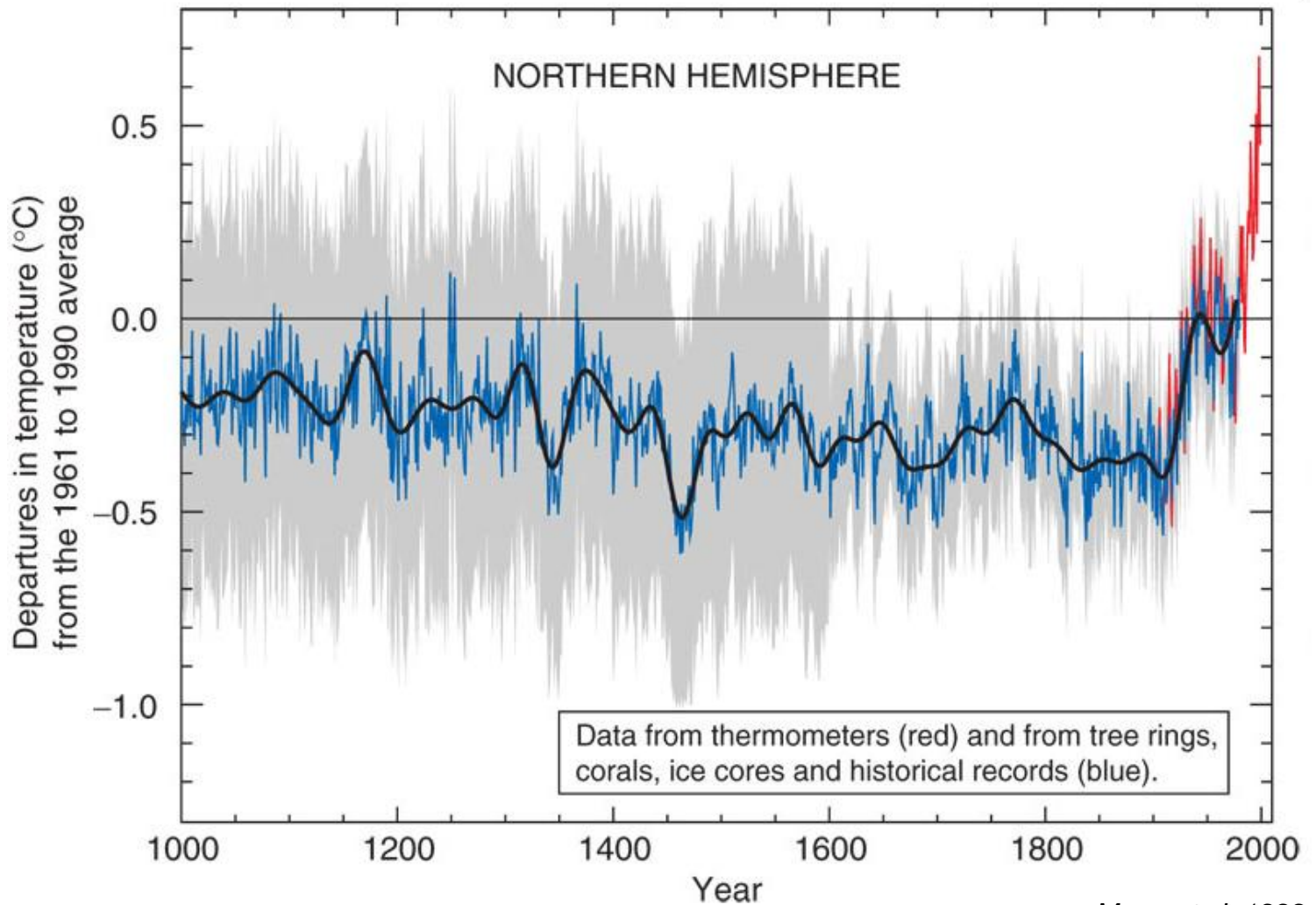
- Increasing of Greenhouse Gases concentration on the atmosphere as a global concern
- Several problems related to the phenomenon
- The outbreak of global warming and climate change



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>>Mann et al, 1999



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ASIAN'S CONTRIBUTION

Top-20 countries of CO₂ emissions in 2006 from fossil fuel use and cement production (unit = Megaton CO₂)

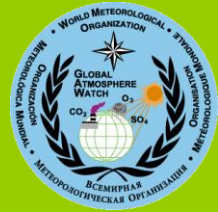
No	Country	Total CO ₂	%	Ton CO ₂ / capita
1.	China	6110	17	4.7
2.	United States	5790	16	19.2
3.	European Union	4100	12	8.4
...				
5.	India	1280	3.6	1.1
6.	Japan	1230	3.5	9.6
...				
8.	Korea	470	1.3	9.8
9.	Iran	420	1.2	6.0
...				
12.	Indonesia*	360	1	1.6
...				
14.	Saudi Arabia	330	0.9	13.4
...				
17.	Taiwan	270	0.8	11.4
...				
19.	Thailand	230	0.6	3.6

>>IEA (2007), BP (2007) (for Top-6) (energy); USGS (2007) (cement)

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GHGs MONITORING IN INDONESIA

- Started in 2004 with collaboration between Indonesia Agency for Meteorology Climatology and Geophysics Agency (BMKG) and National Oceanic and Atmospheric Administration (NOAA)
- Method: Air Flask Sampling
- Location: Bukit Kototabang, W. Sumatra (Global GAW Station)



THE NETWORK – GLOBAL GAW

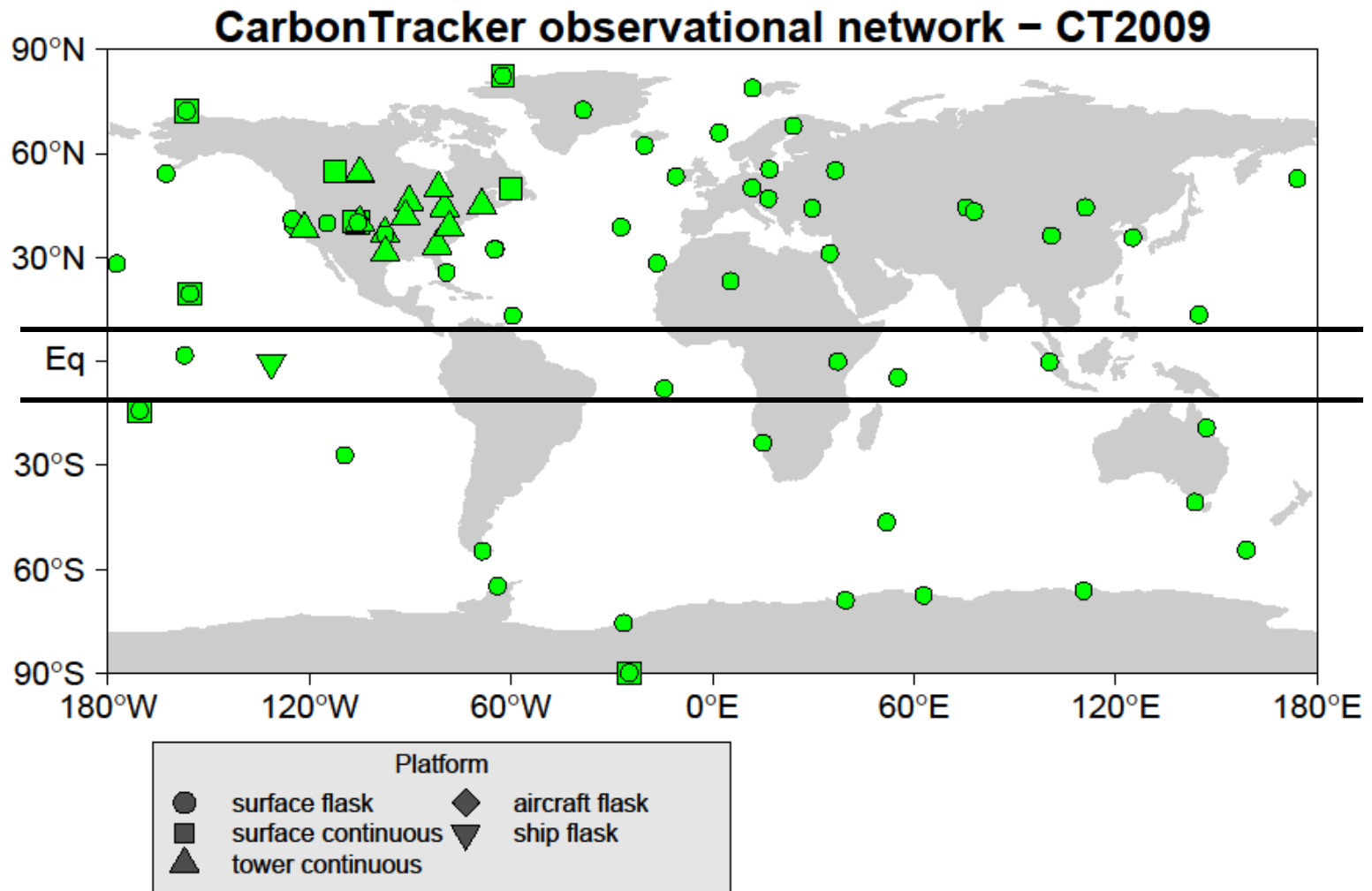


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THE NETWORK - SAMPLING



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0.2 S, 100.32 E, 864.5 m a.s.l

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Climatology

Tropical Rainforest on the mountainous area

Temperature : 21.6°C
Humidity : 89.6%
Air Pressure : 917.6 mbar
Rainfall : 2560 mm



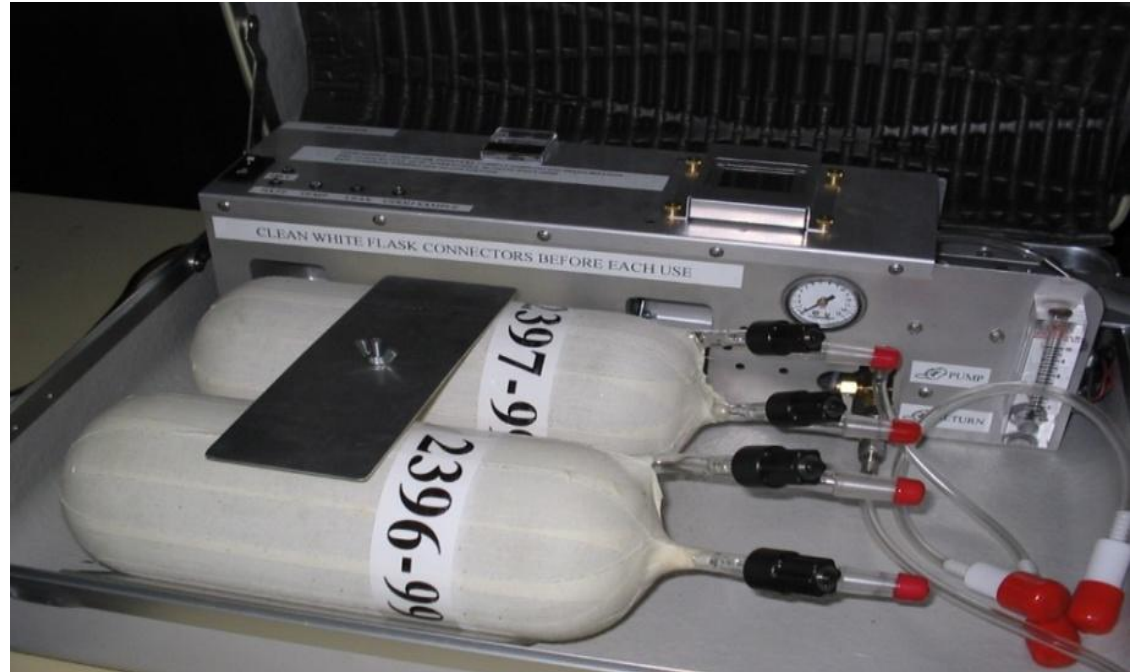
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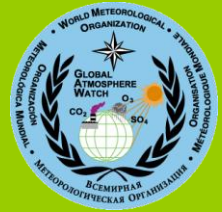
Greenhouse Gases Measurement



- Sampled on weekly time-base
- Sent to NOAA CMDL for further analysis
- Data collected every month (date 28)
- Four main greenhouse gases measured with some other gases were also reported



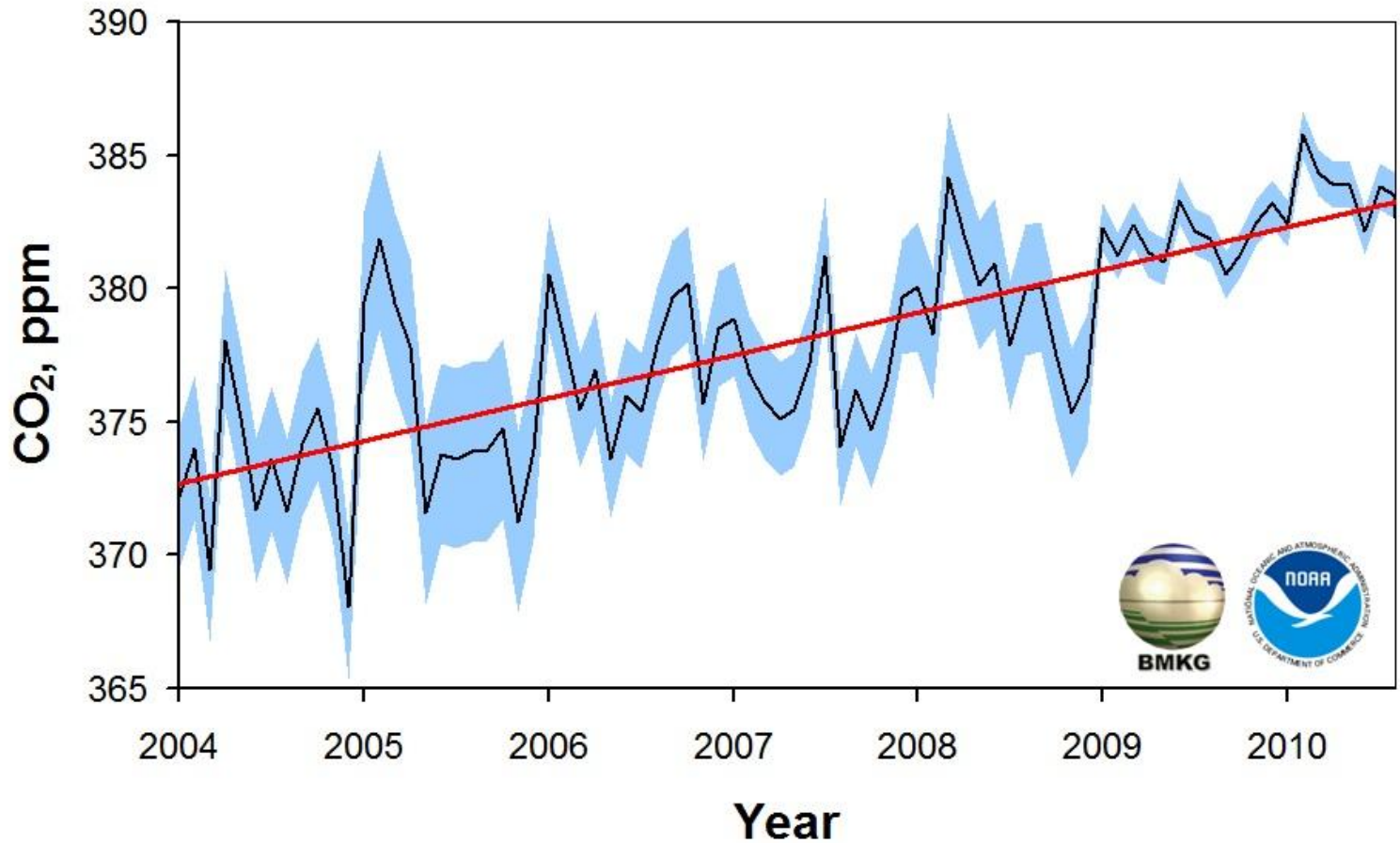
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Result – CO₂ mixing ratio



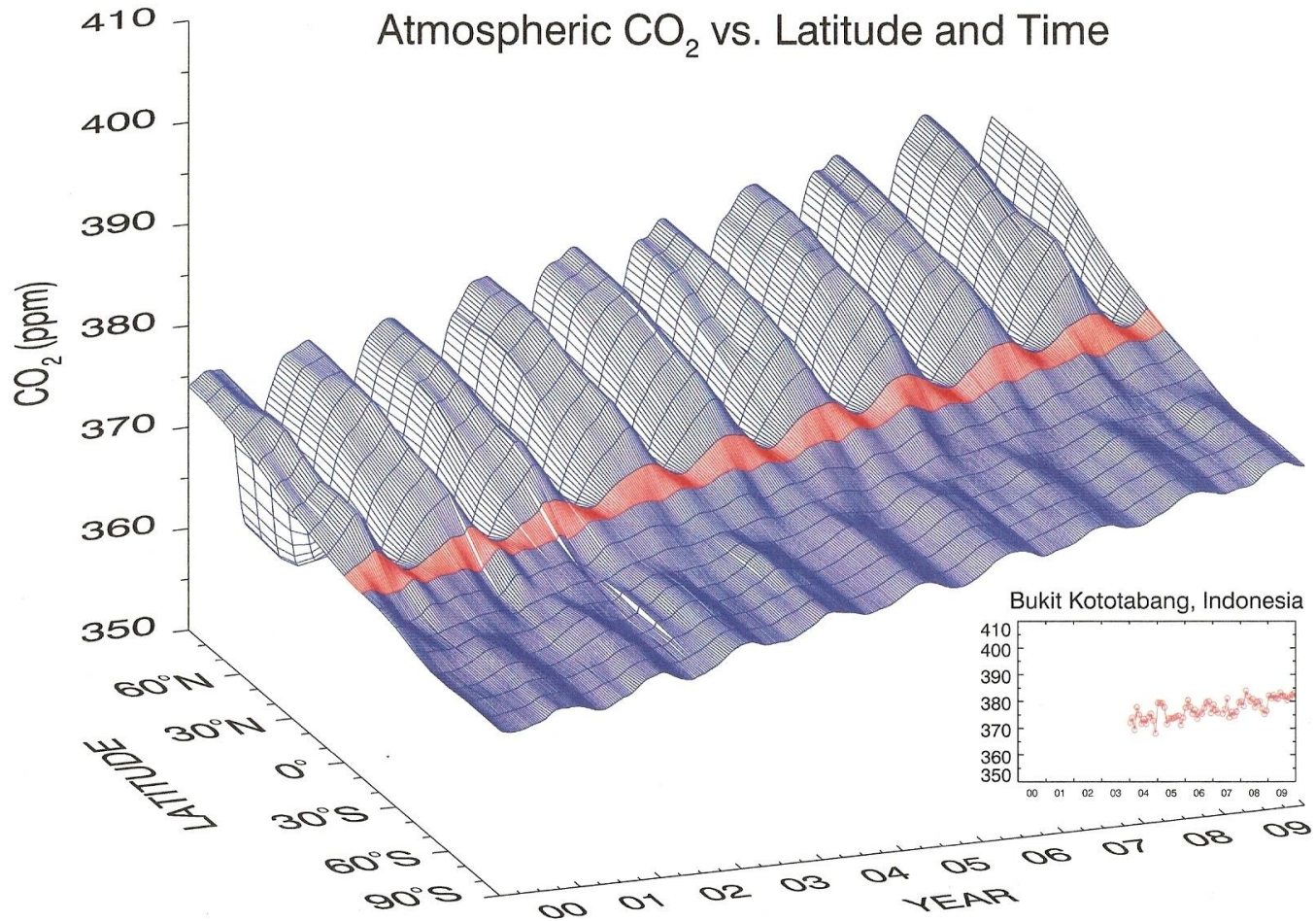
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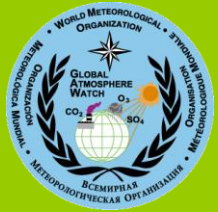
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Result – Global Outlook CO₂



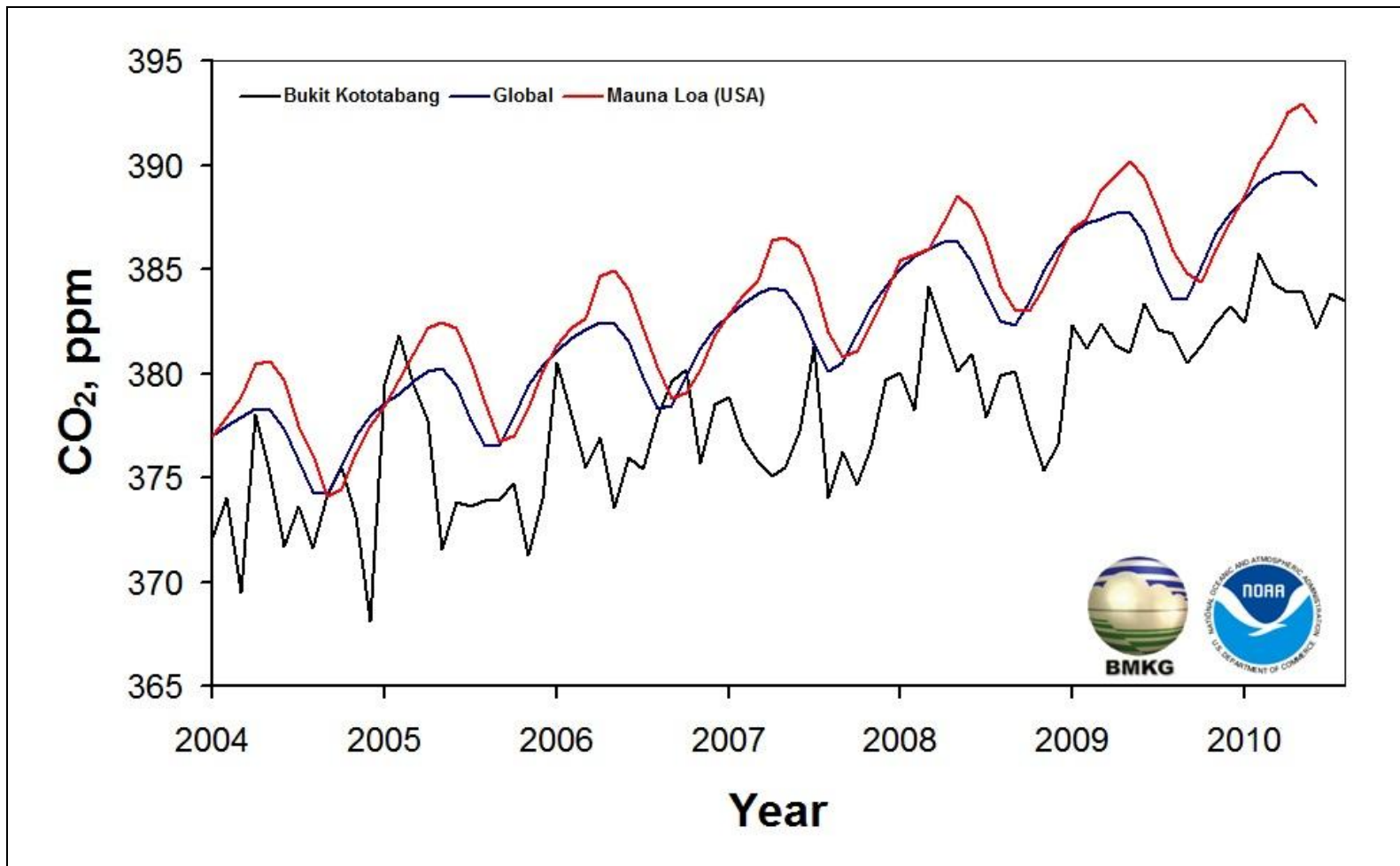
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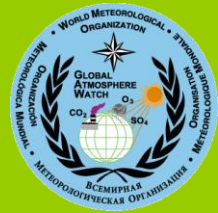
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Result – Comparing CO₂



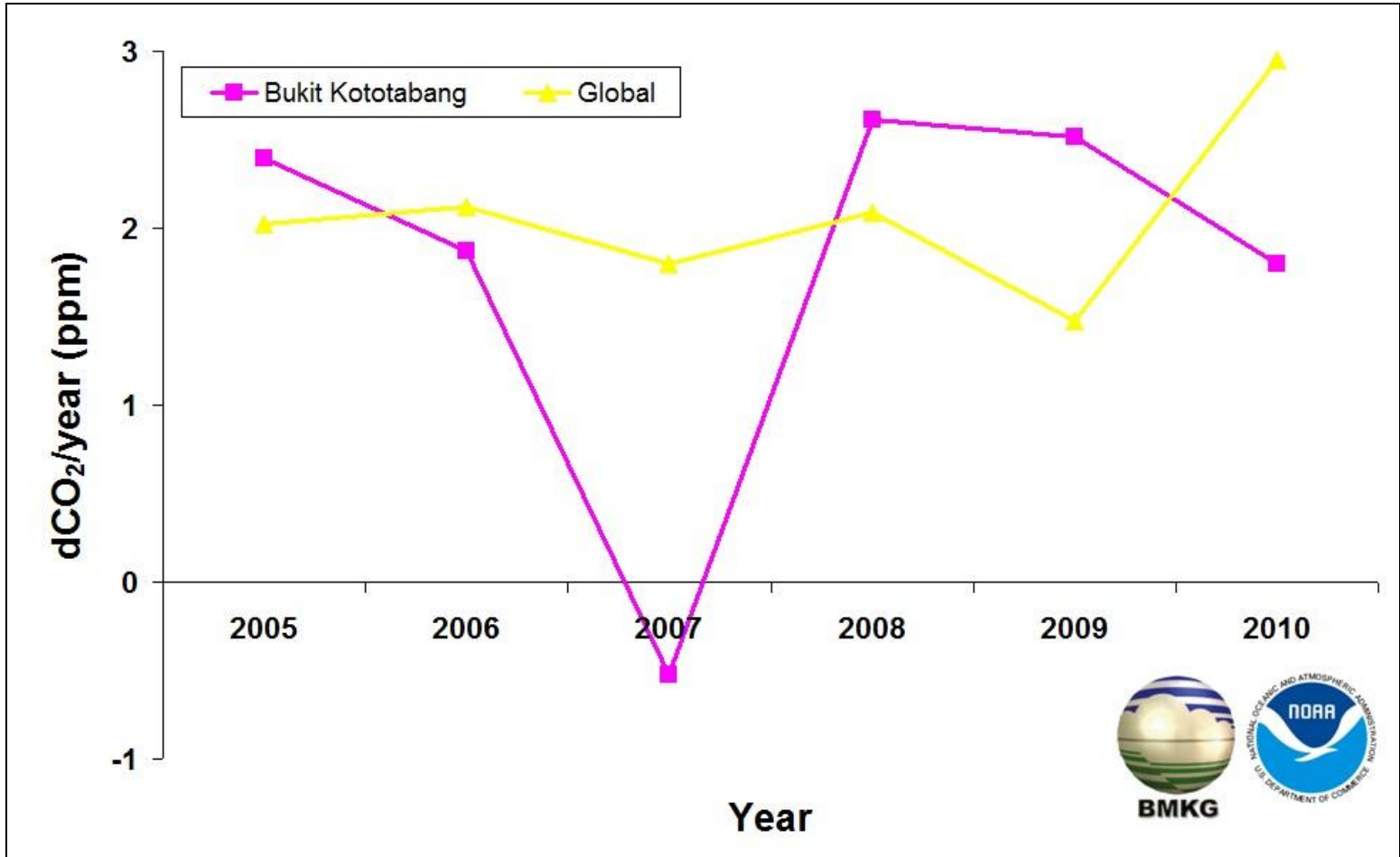
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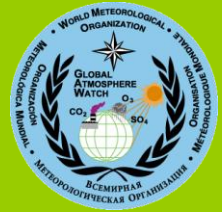
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Result – CO₂ Growth Rate



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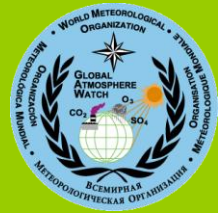
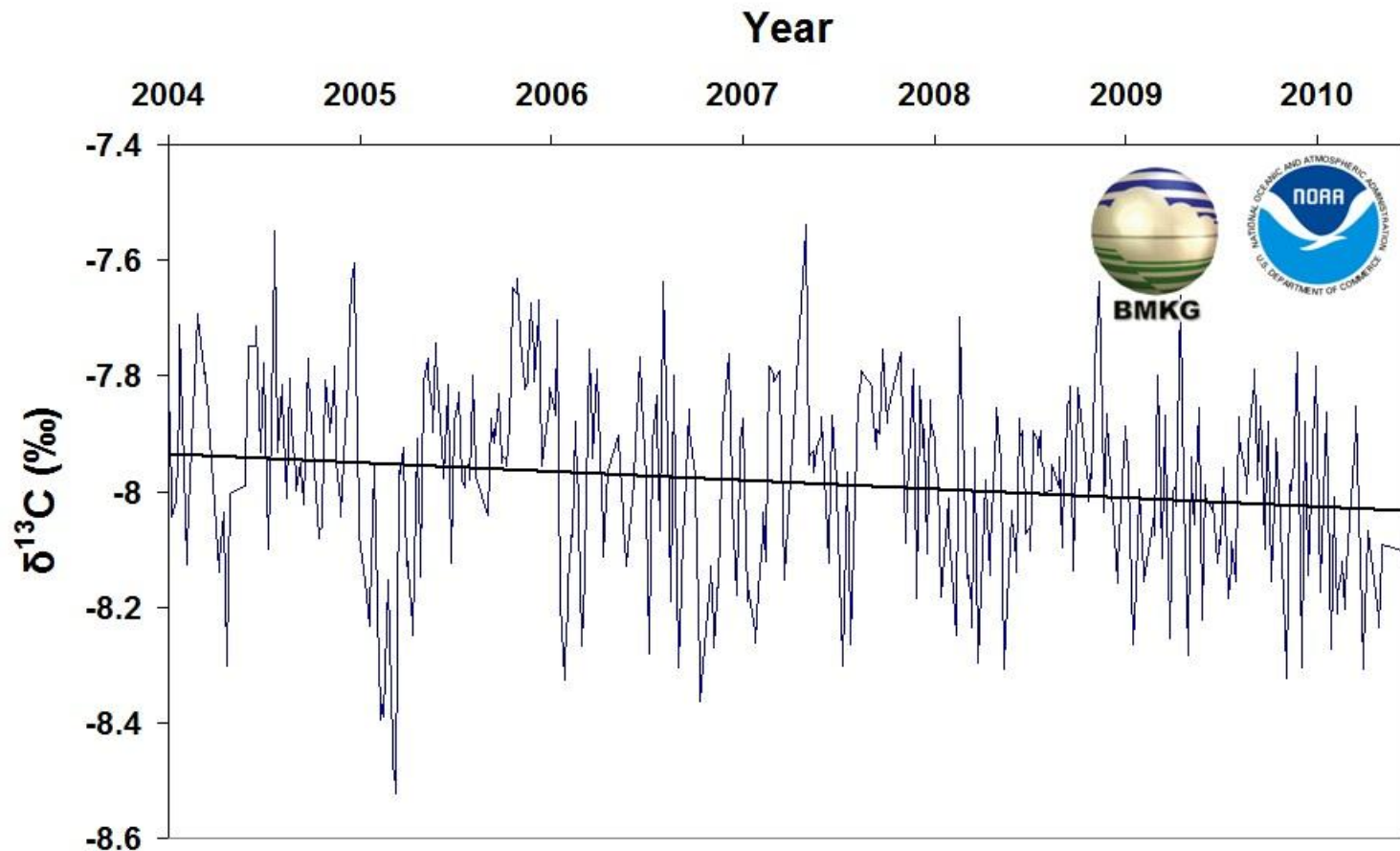
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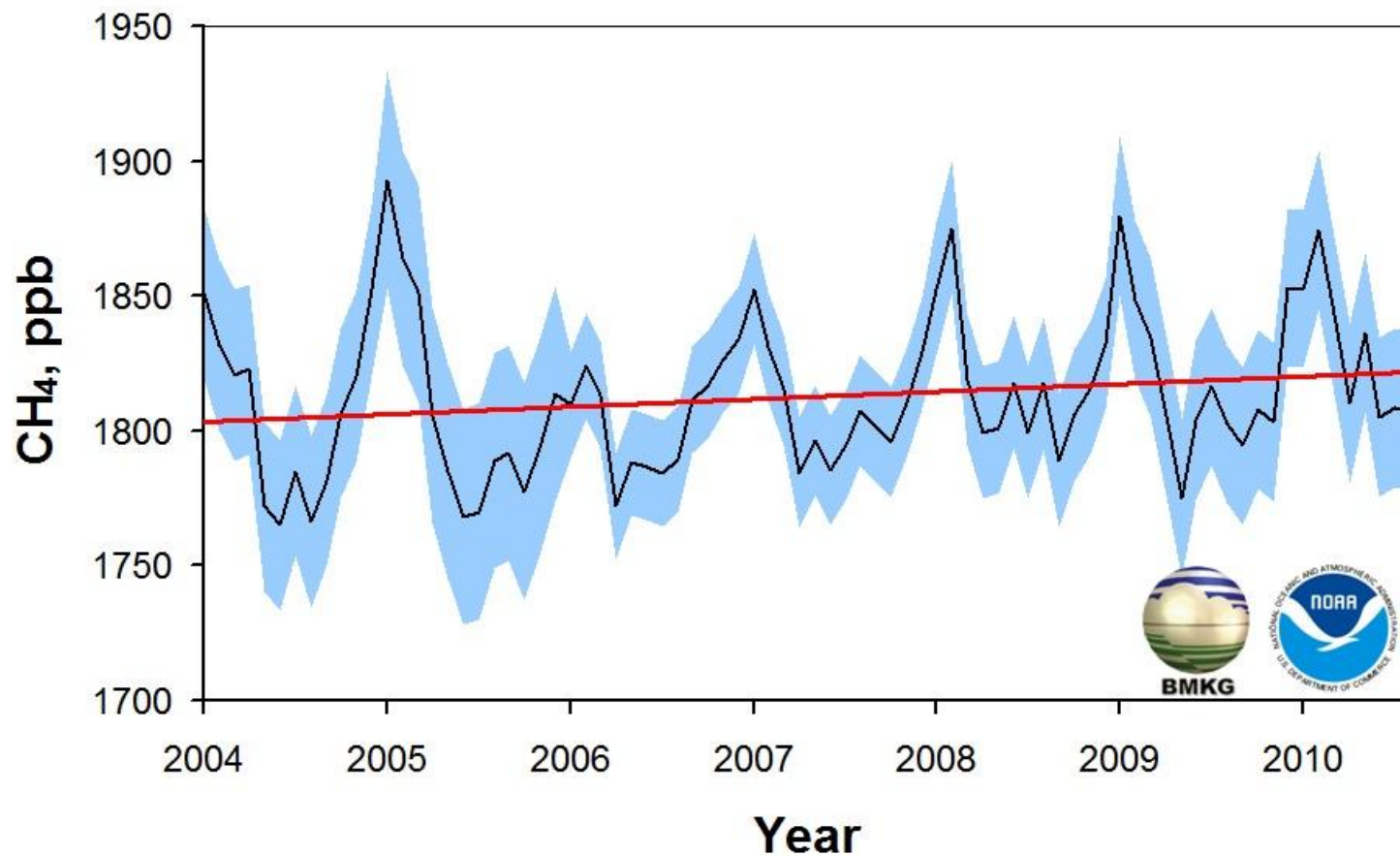
Result – $\delta^{13}\text{C}$ from CO_2



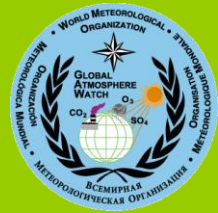
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Result – CH₄ Mixing Ratio



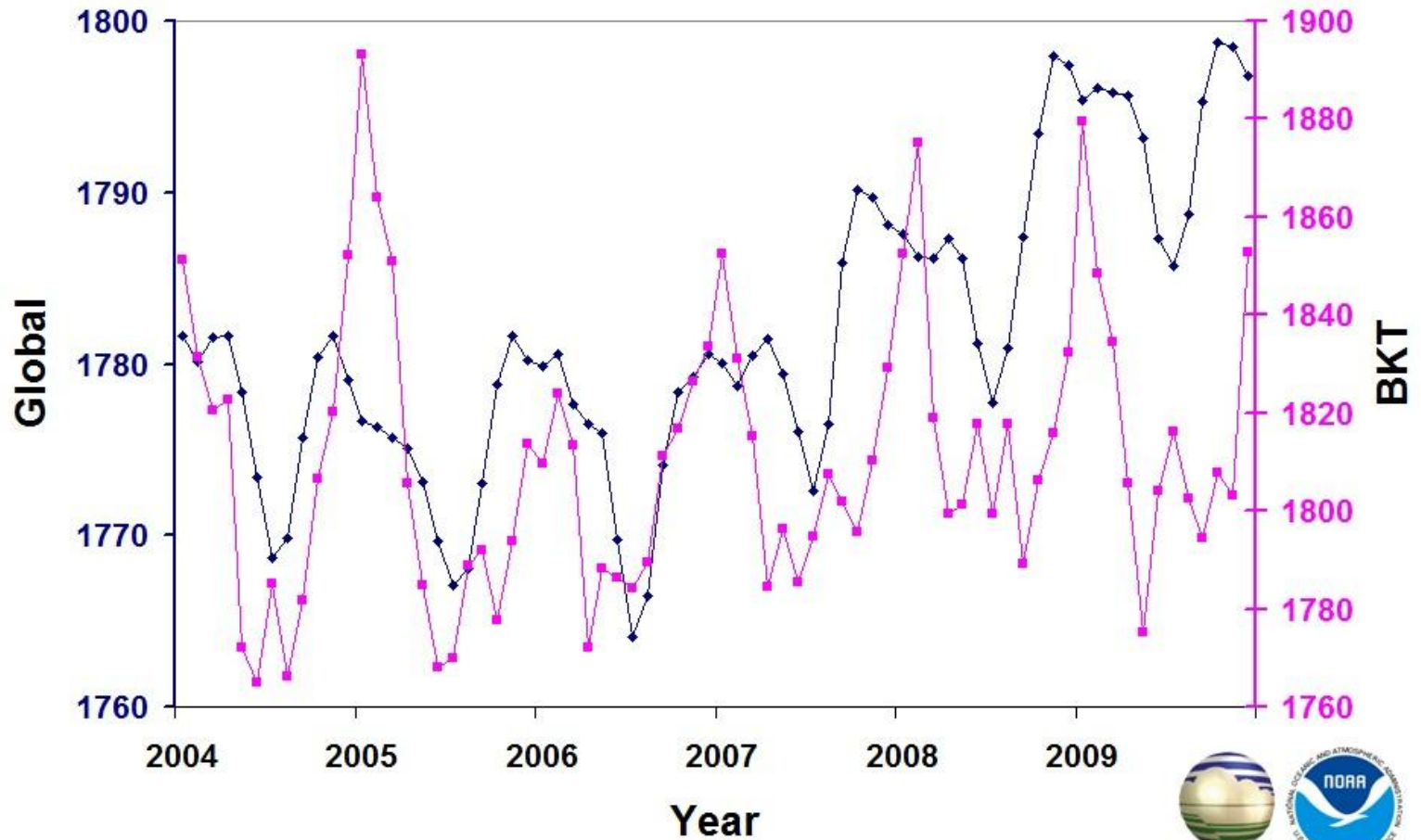
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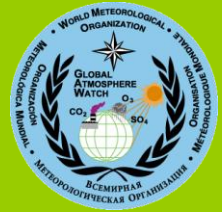
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Result – Comparing CH₄



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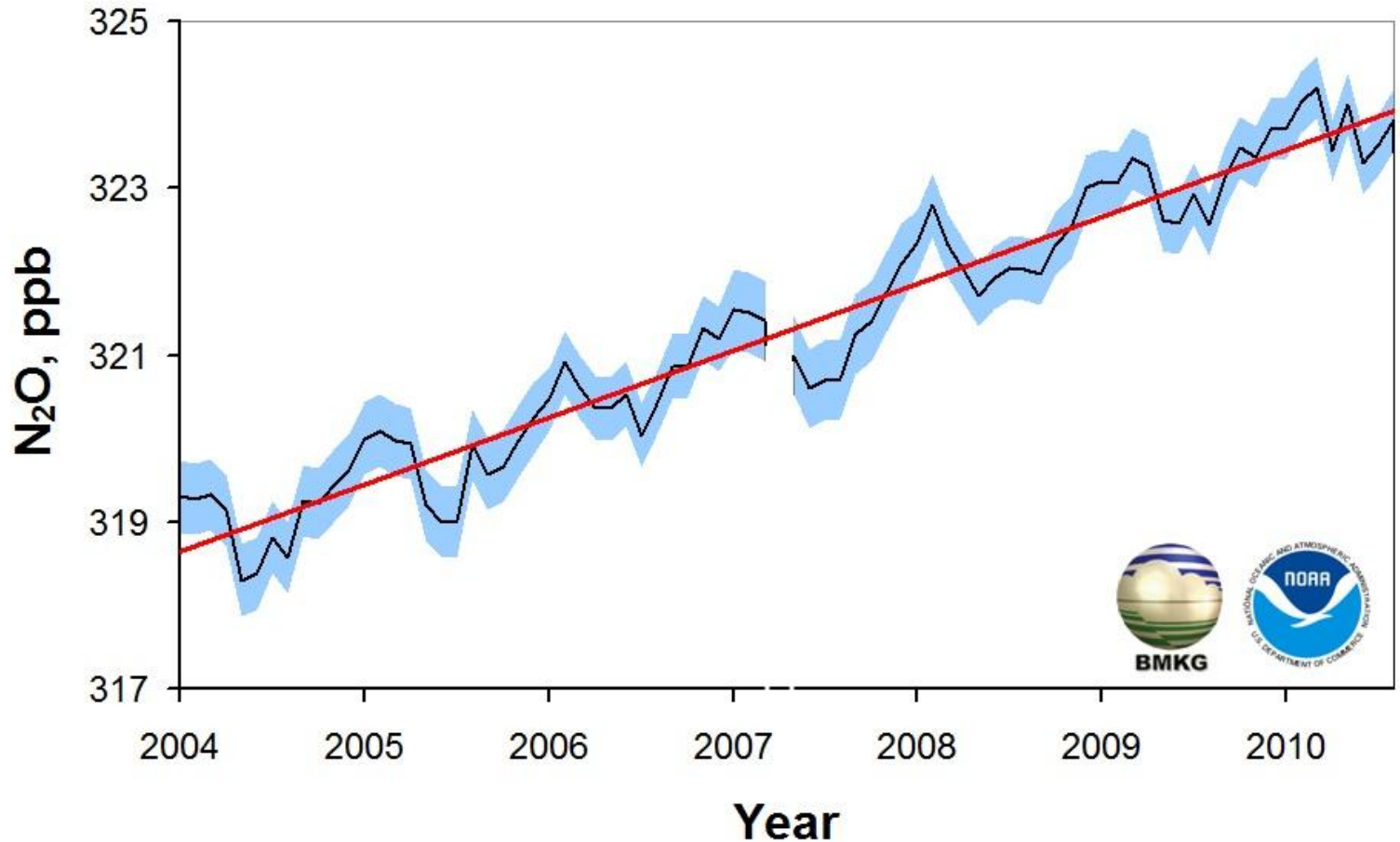
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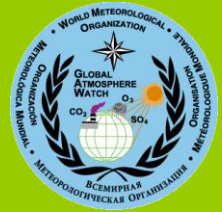
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Result – N₂O Mixing Ratio



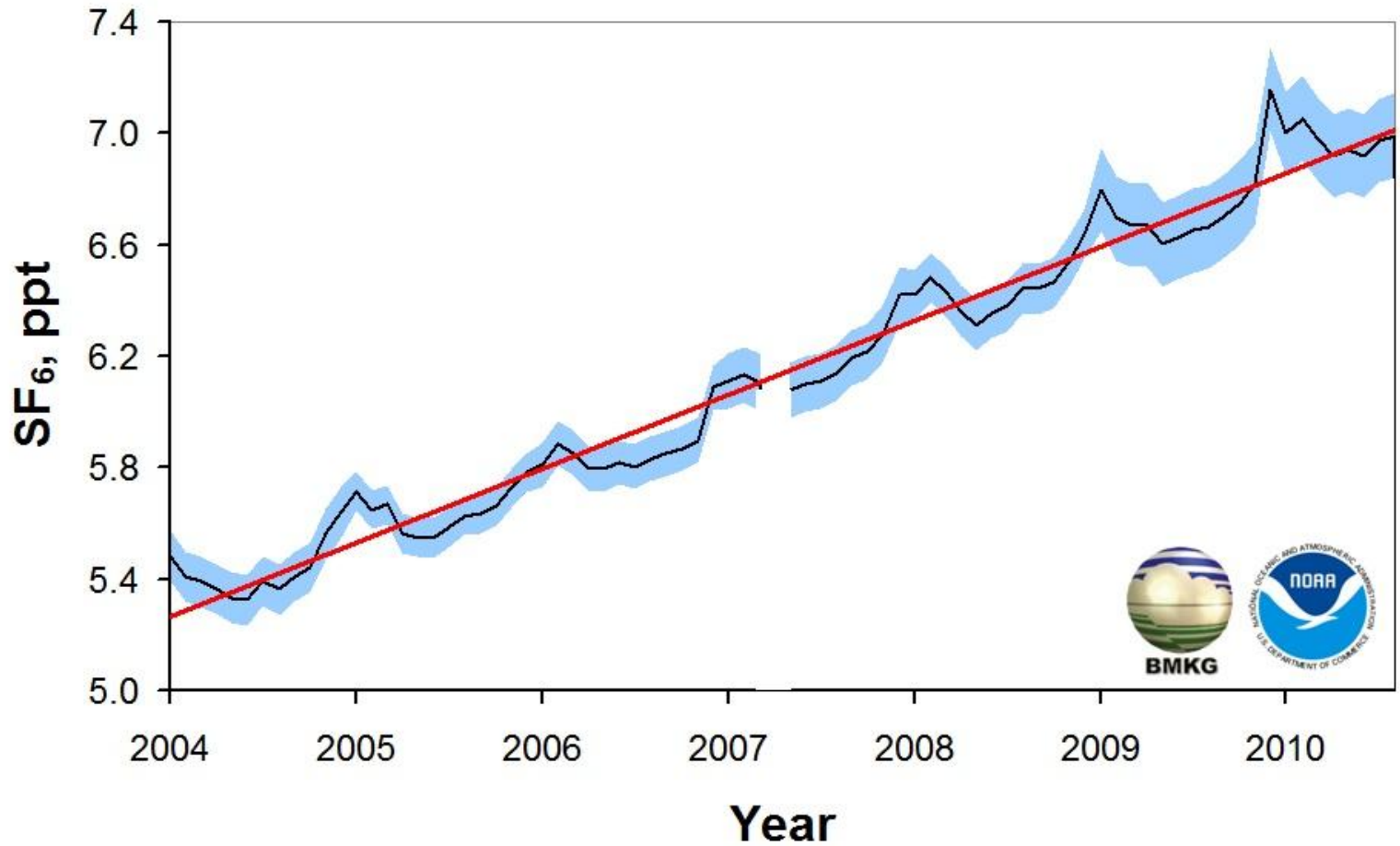
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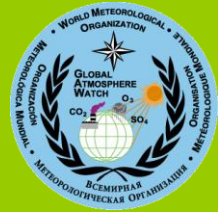
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Result – SF₆ Mixing Ratio



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NRT Monitoring CO₂ – CH₄ – H₂O

- Commenced in October 2008 by using Picarro G1301 Analyzer
- Collaboration between BMKG (instrument), Empa and MeteoSwiss (standard gases and calibration unit), with extensive guidance directly from Picarro, Inc.
- As of May 2010, instrument was temporary terminated for technical maintenance by the manufacturer



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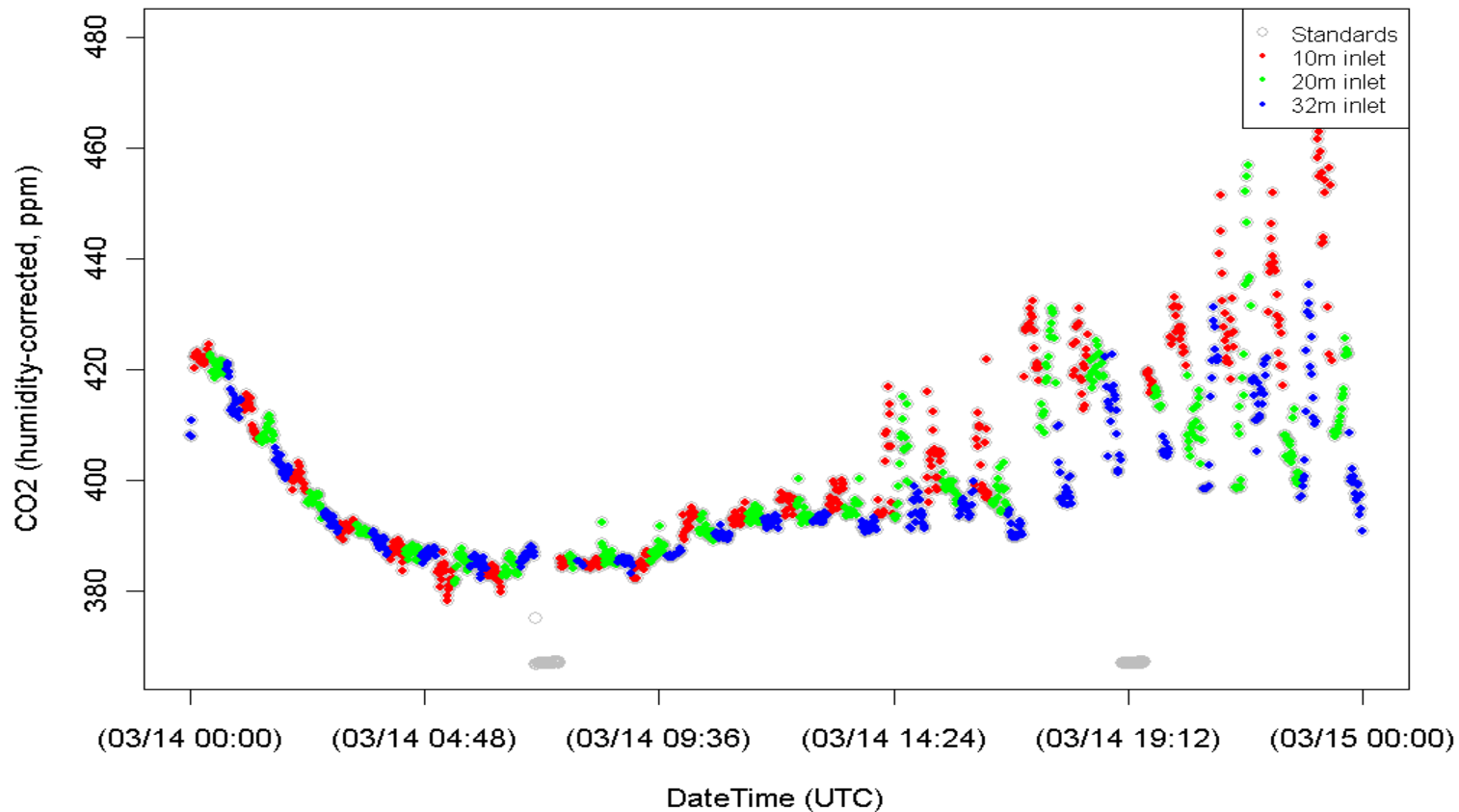
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Result: Monitoring CO₂ – CH₄ – H₂O

CFADS27 (BKT)

1-minute aggregates



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Challenges on conducting GHGs Measurement

- Maintaining the site (against change in land use, wildfires)
- Self-monitoring activity
- For NRT measurement, providing standard gases and QA/QC
- Need more experts and devoted people



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WHAT'S NEXT?

- Call for collaboration to Asian (and The Pasific) countries
- Asian GHGs Network, involving more locations
- Workshops, seminars, scientific and technical meetings



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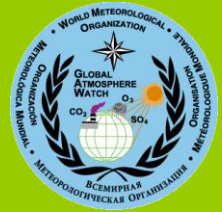
THANK YOU

감사합니다

TERIMA KASIH



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