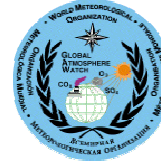




BMKG

BADAN METEOROLOGI, KLIMATOLOGI DAN GEOFISIKA
Indonesia Agency for Meteorology Climatology and Geophysics



World Meteorological Organization –
Global Atmospheric Watch Programme

Measurement of carbon dioxide and methane concentration by using Cavity Ringdown Spectroscopy in Bukit Kototabang

¹A.F. Ilahi, ¹A.C. Nahas, ²J. Klausen, ³C. Zelwegger, ³M. Steinbacher

1 Global GAW Bukit Kototabang, Indonesia Agency for Meteorology Climatology and Geophysics (BMKG)

2 Climate Division / Global Atmosphere Watch, Federal Office for Meteorology and Climatology MeteoSwiss

3 WMO/GAW World Calibration Centre (WCC-Empa), Empa (Swiss Federal Laboratories for Materials Science and Technology)

Introduction

Bukit Koto Tabang

- Sumatera Barat, Indonesia
- $0.202^{\circ}\text{S } 100.318^{\circ}\text{E}$ (864 m a.s.l.)
 - 17 km north of Bukittinggi (pop: 85'000)
 - 120 km north of Padang (pop: 480'000)
- Predominantly tropical forest, rice paddies, subsistence farming
- Established 1995 as global GAW station with UNDP GEF funding
- Large 1-storey building with 32 m tower, air-conditioned
- 13 permanent staff



Benefits And Opportunities

- Benefits
 - Provide baseline for Indonesian air quality.
 - Estimate national versus foreign contributions to air pollution
 - Estimate CO₂ sinks of Indonesia's vast forests.
 - Demonstrate responsibility towards mitigating global change in Indonesia and Regional.
- Opportunities
 - Bukit Kototabang is one of only few sites on the equator offering basic infrastructure as well as permanent operators.
 - Allows the study of air masses originating from the Indian Ocean, the tropical forest of Sumatra, as well as pollution transport from Asian mainland.
 - More collaborators are invited for campaigns or long-term monitoring.

GHG's Measurement in Bukit Kototabang

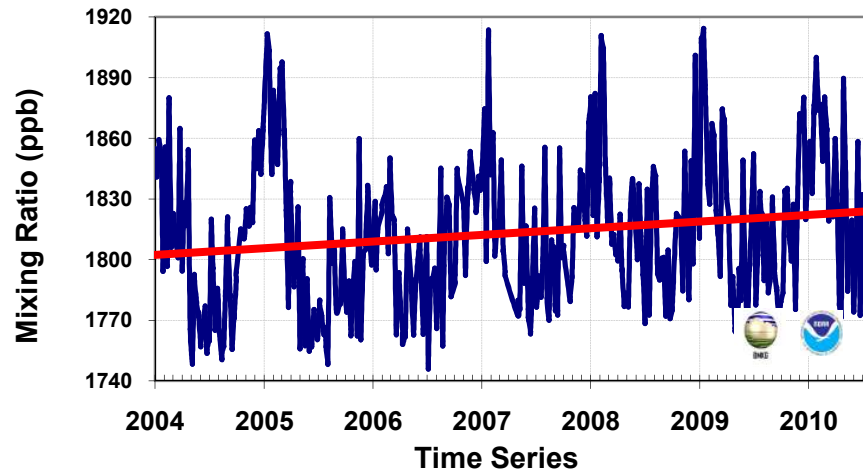
- Started in 2004 with collaboration between Indonesia Agency for Meteorology, Climatology and Geophysics (BMKG) and National Oceanic and Atmospheric Administration (NOAA).
- On 2011 continued with Picarro G1301 instrumentation.

Other Measurement Programs

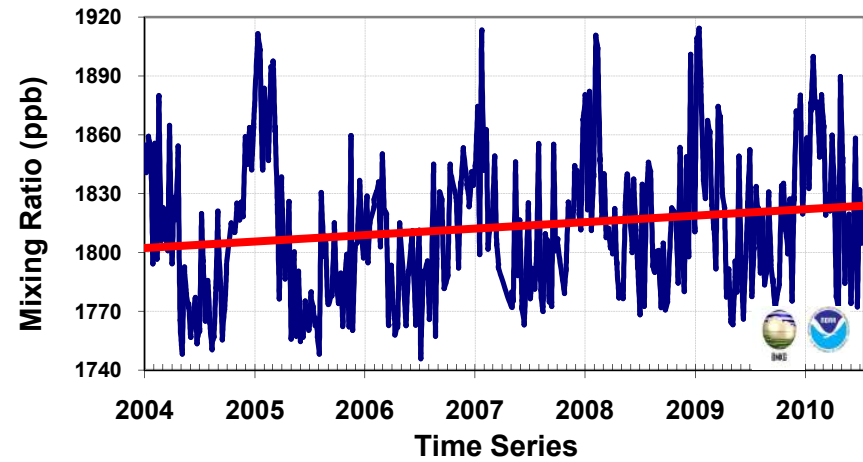
- Basic Meteorology
 - Automatic weather station (Vaisala)
- Aerosols
 - Light scat. Coeff. (integr. nephelometer)
 - PM10 (Beta-attenuation mass monitor)
- Reactive Gases
 - Surface ozone
 - Carbon monoxide
 - NO₂, SO₂
- Solar Radiation
 - Diffuse
 - Direct
 - Global
 - UV broadband

NOAA/CMDL some result

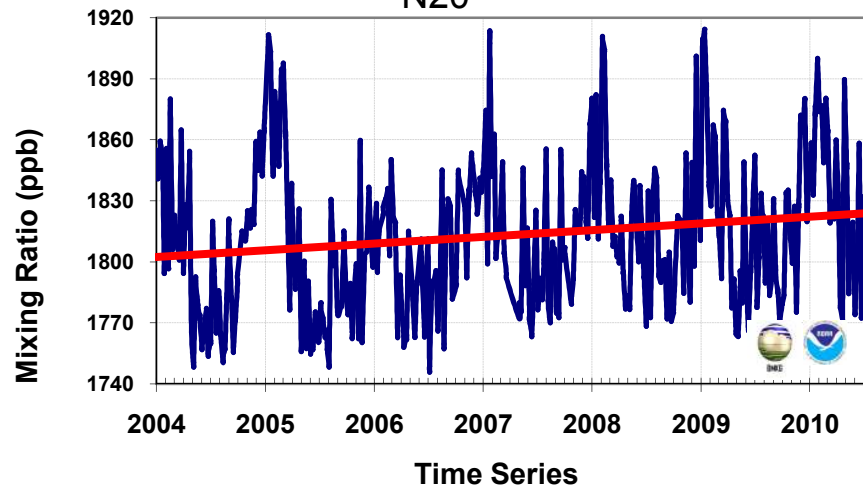
CO₂



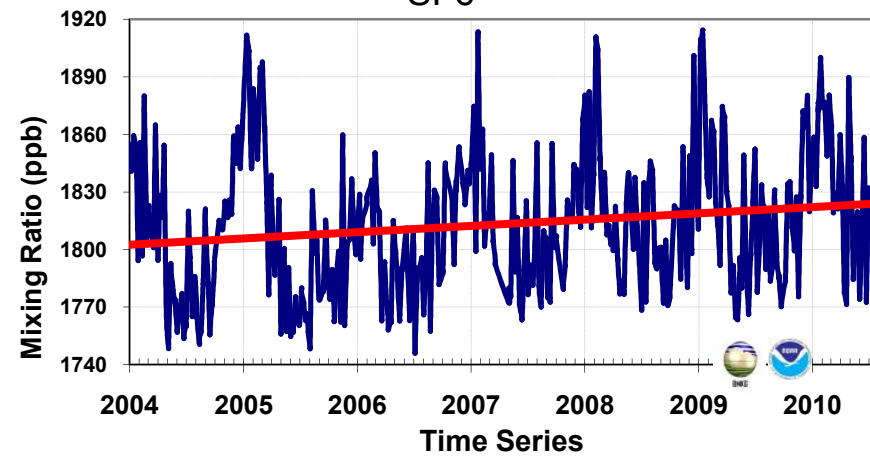
CH₄



N₂O



SF₆



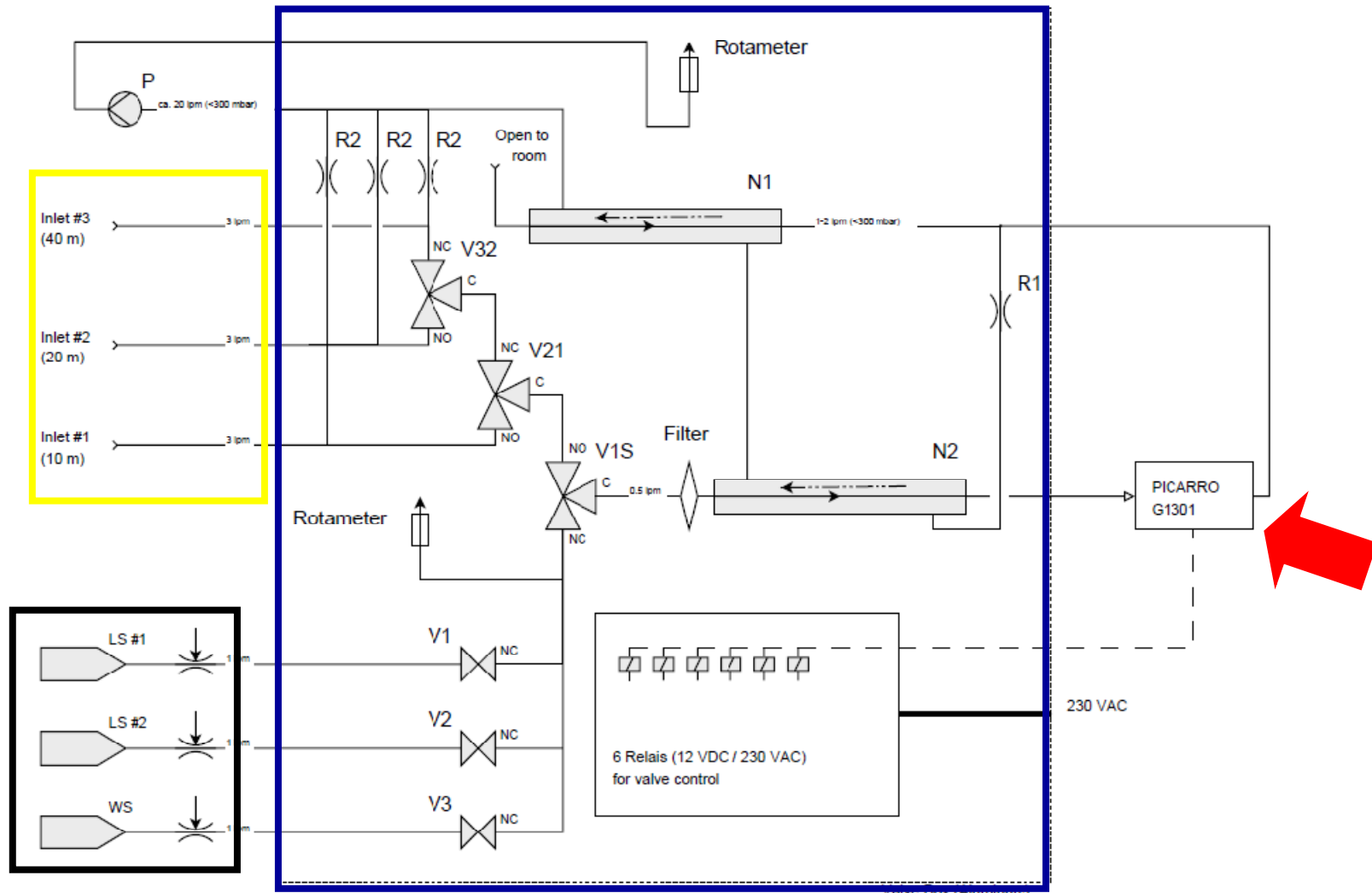
Recent GHGs Measurement

Picarro G1301 – CO₂-CH₄-H₂O Analyzer
NOAA's Standard Gases (CO₂ and CH₄)
Calibrator Unit (modified by Empa)



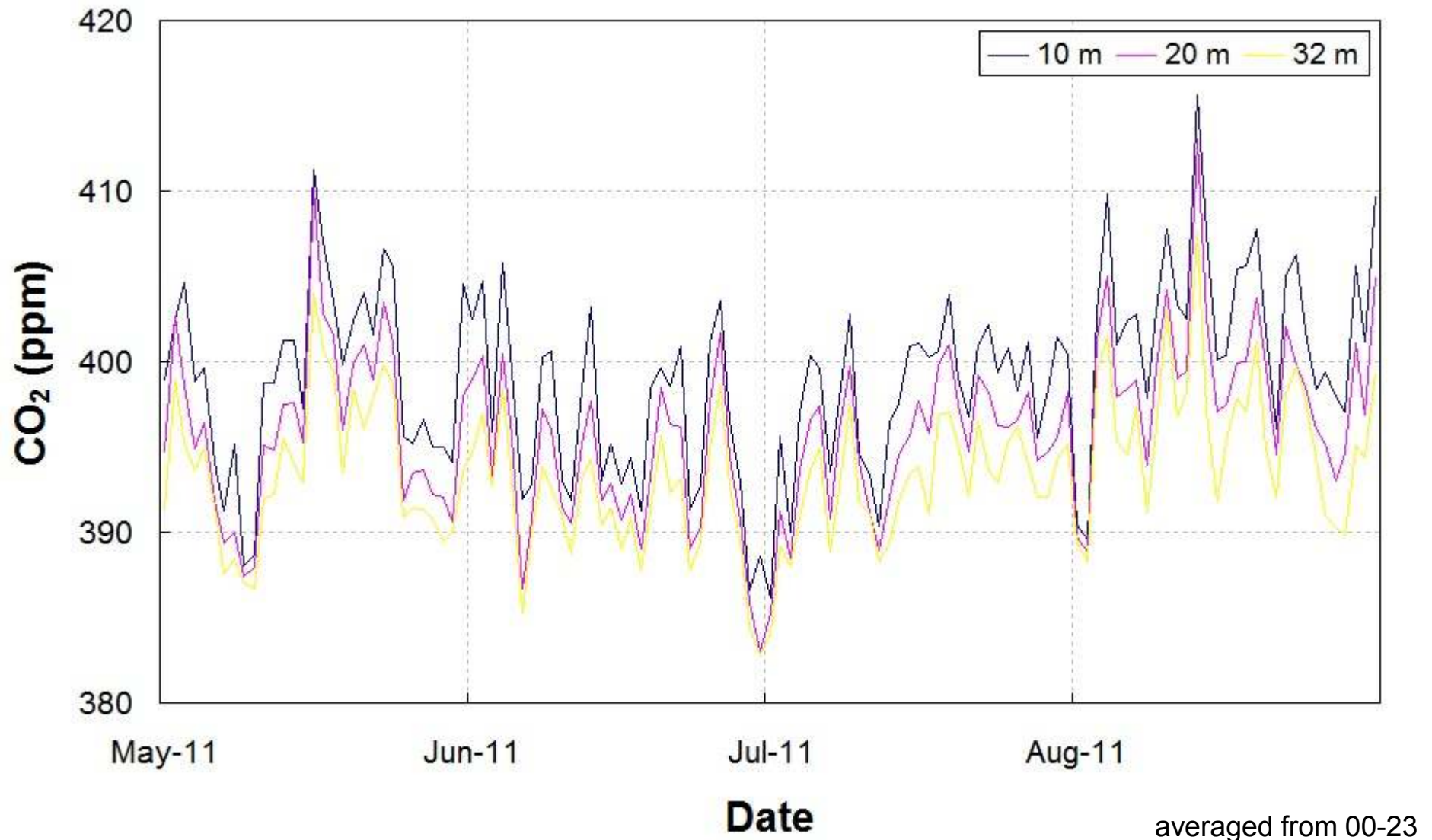
- Commenced in October 2008
- Collaboration between BMKG (instrument), Empa and MeteoSwiss (standard gases and calibration unit), with extensive guidance directly from Picarro, Inc.
- As of May 2010, instrument was temporary terminated for technical maintenance by the manufacturer

Schematic of analyzer with calibrator unit

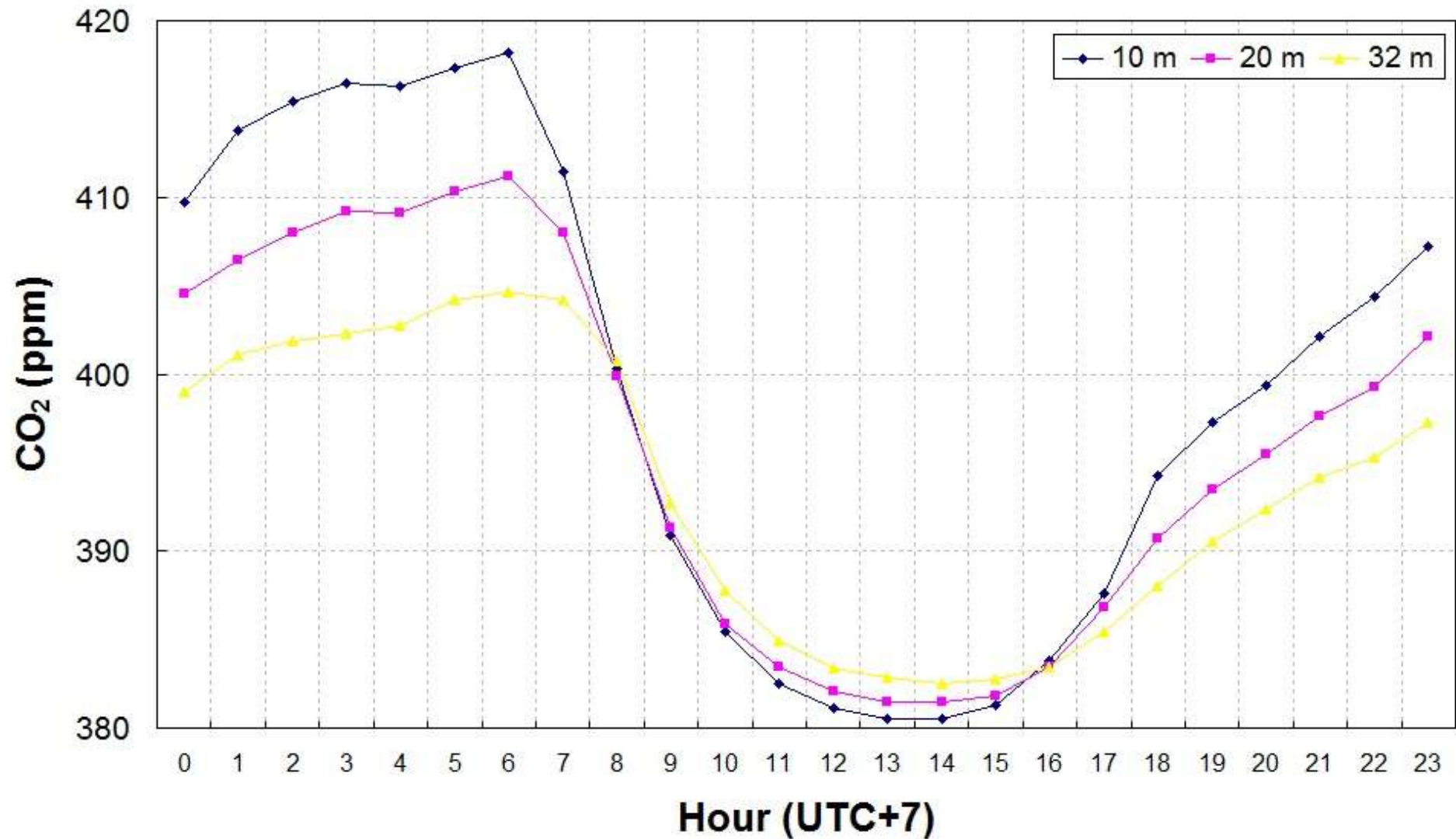


Courtesy of: Empa

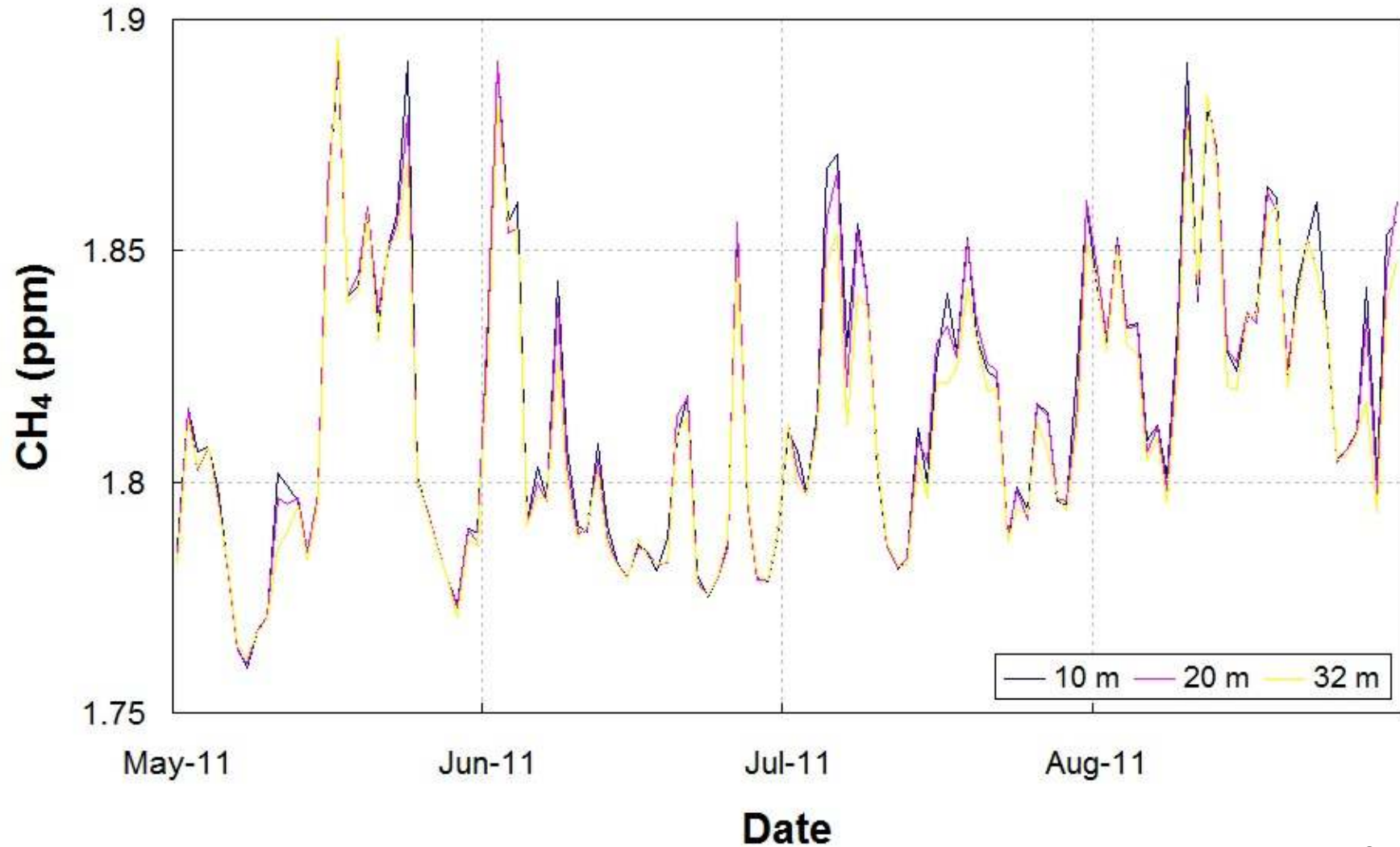
CO₂ Daily Profile



CO₂ Diurnal Profile

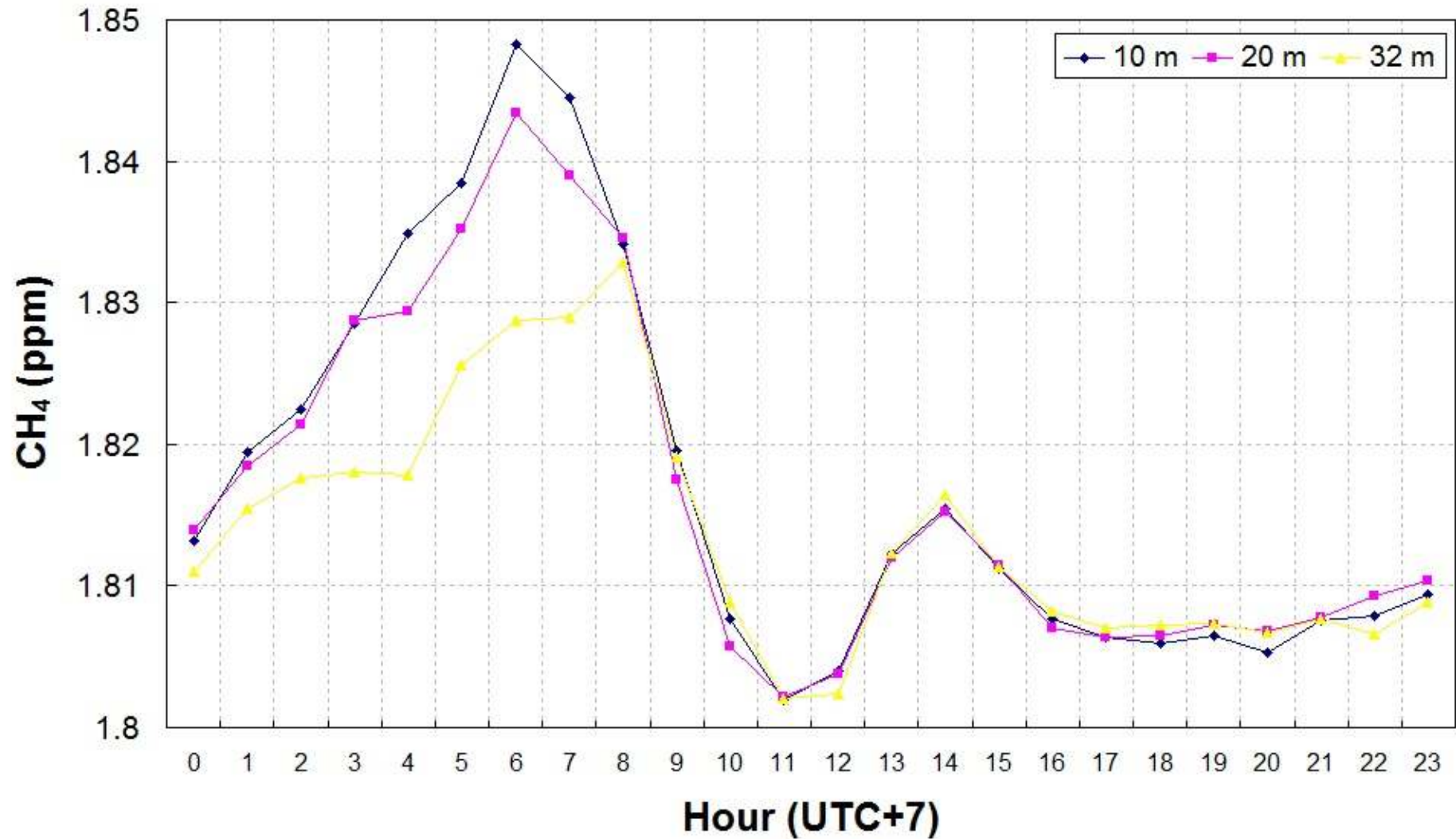


CH₄ Daily Profile

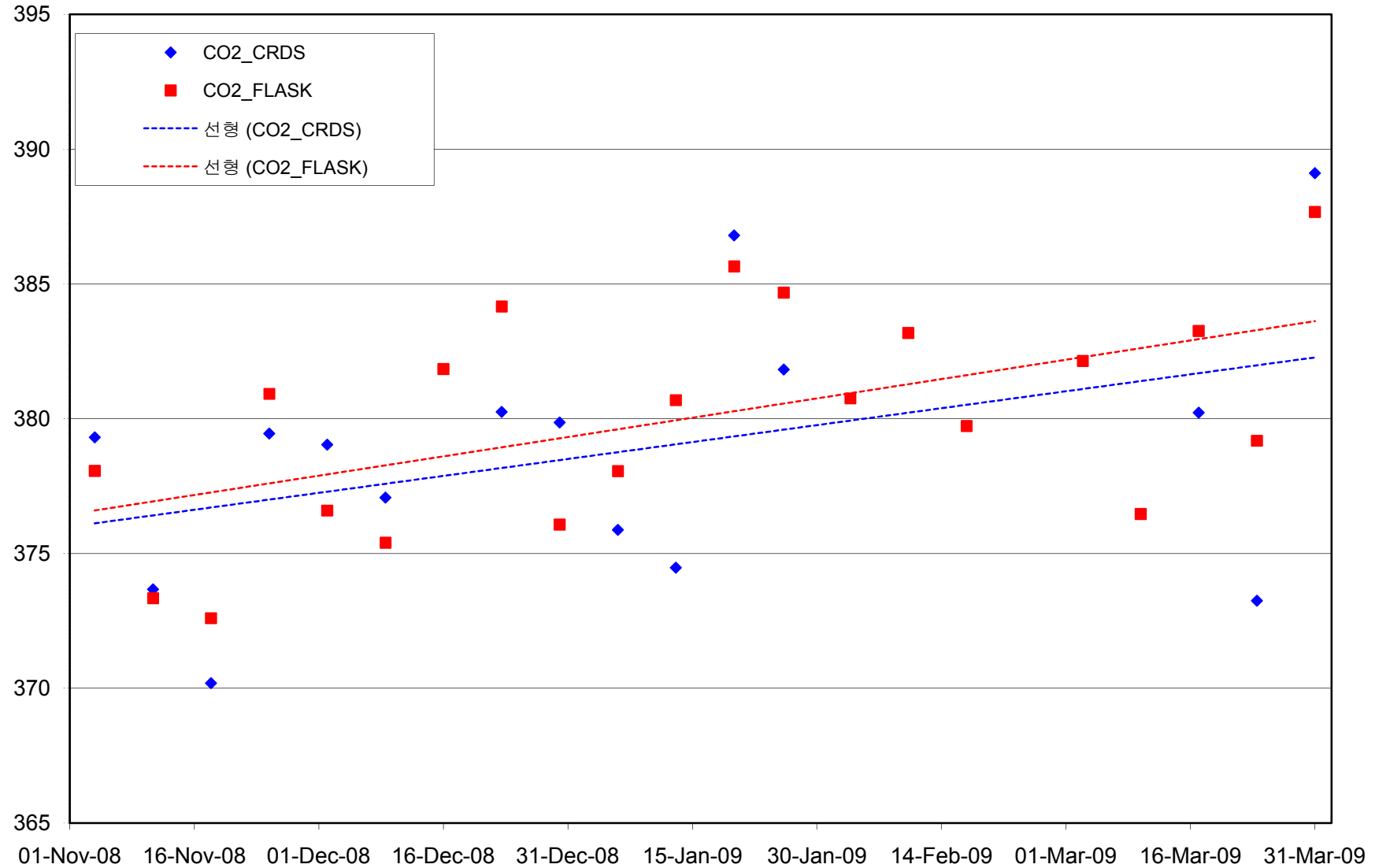


averaged from 00-23

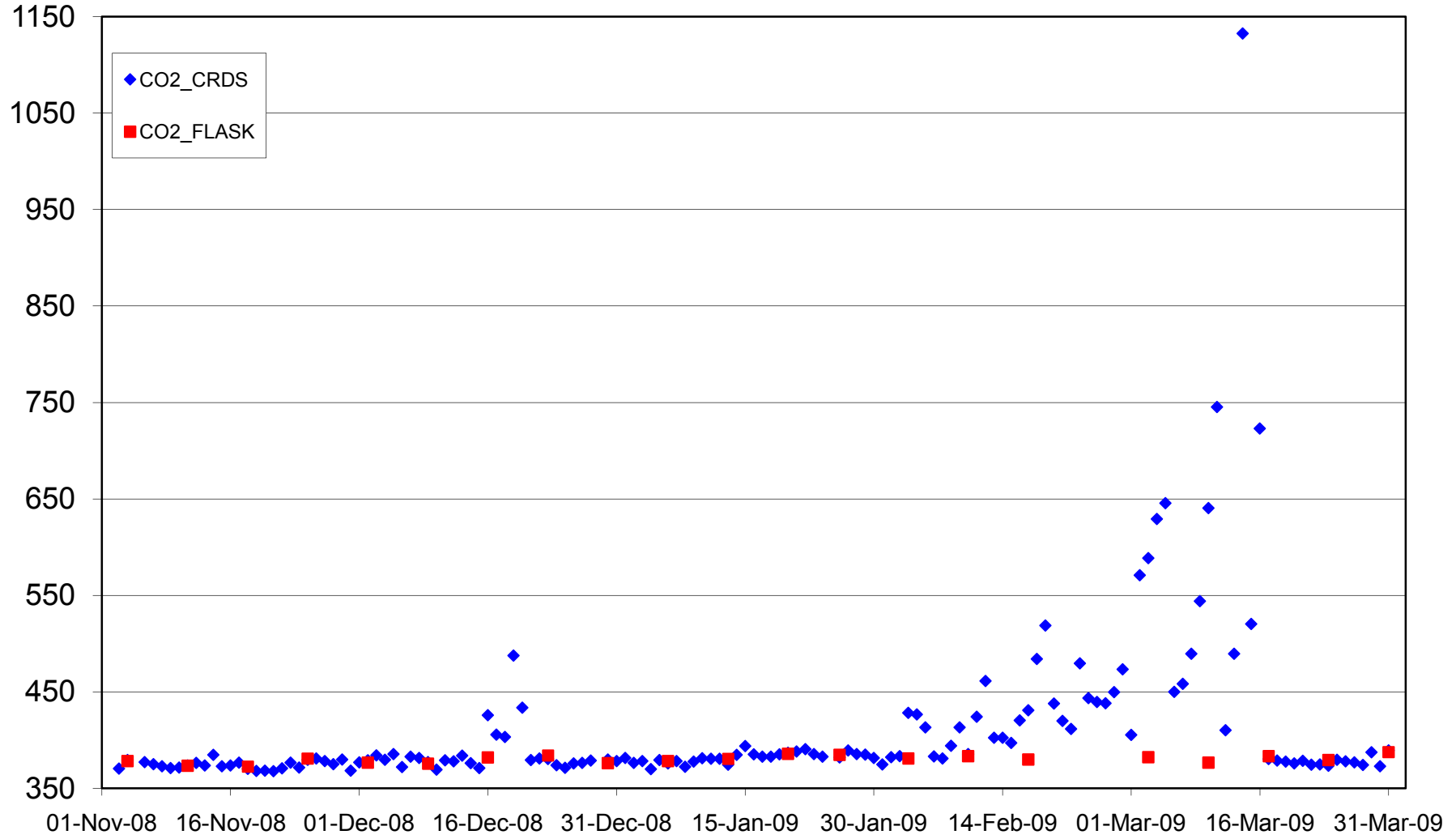
CH₄ Diurnal Profile



COMPARISON BETWEEN CO₂ PICARRO & AIR FLASK AT 2:00 PM



COMPARISON BETWEEN CO₂ PICARRO & AIR FLASK Cont.



Challenges

- Better link and compare different measurement methods, especially regional ground based in-situ measurements and satellite remote sensing information
- Scientific capacity, expertise, independence of operators
- Data management (QA/QC)
- Supplies and spare parts
- Land-use changes
- Finding international cooperation
- Development of station to meet requirements for Global GAW station

Terima Kasih

Thank You

