Experimental Atmospheric Forecasting System for Indochina and Southeast Asia

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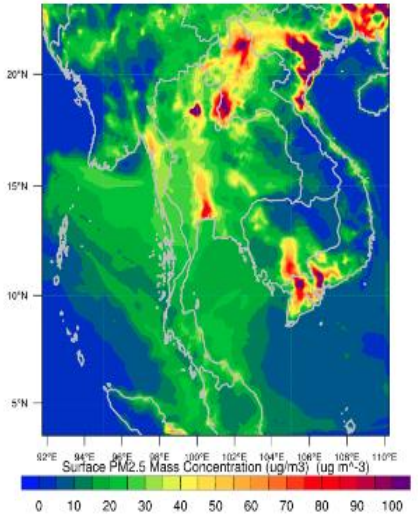
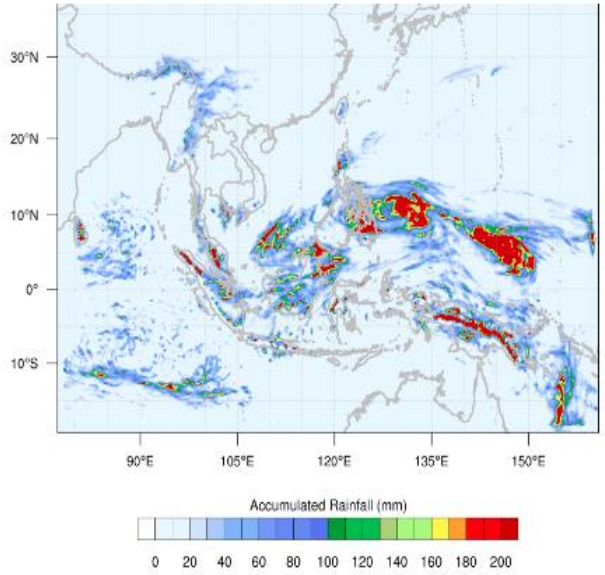
What's happening over the sky above you?

Click Here to See Forecasts

https://ronmcdo4.wixsite.com/atmos-predict

(currently halted for improvements)





TALK FOCUS

AQSEA: Building Air Quality Monitoring Capacity in

Despite Rains over Northern Thailand, PM2.5 Remained

Strong Rains Over Maritim
Southeast Asia Persist

Let's Chat!

Based on a Submitted Article to Atmospheric Research Journal
(will be out soon)

Surface $PM_{2.5}$ Mass Concentrations During the Dry Season over Northern Thailand: Sensitivity to Model Aerosol Chemical Schemes and the Effects on Regional Meteorology

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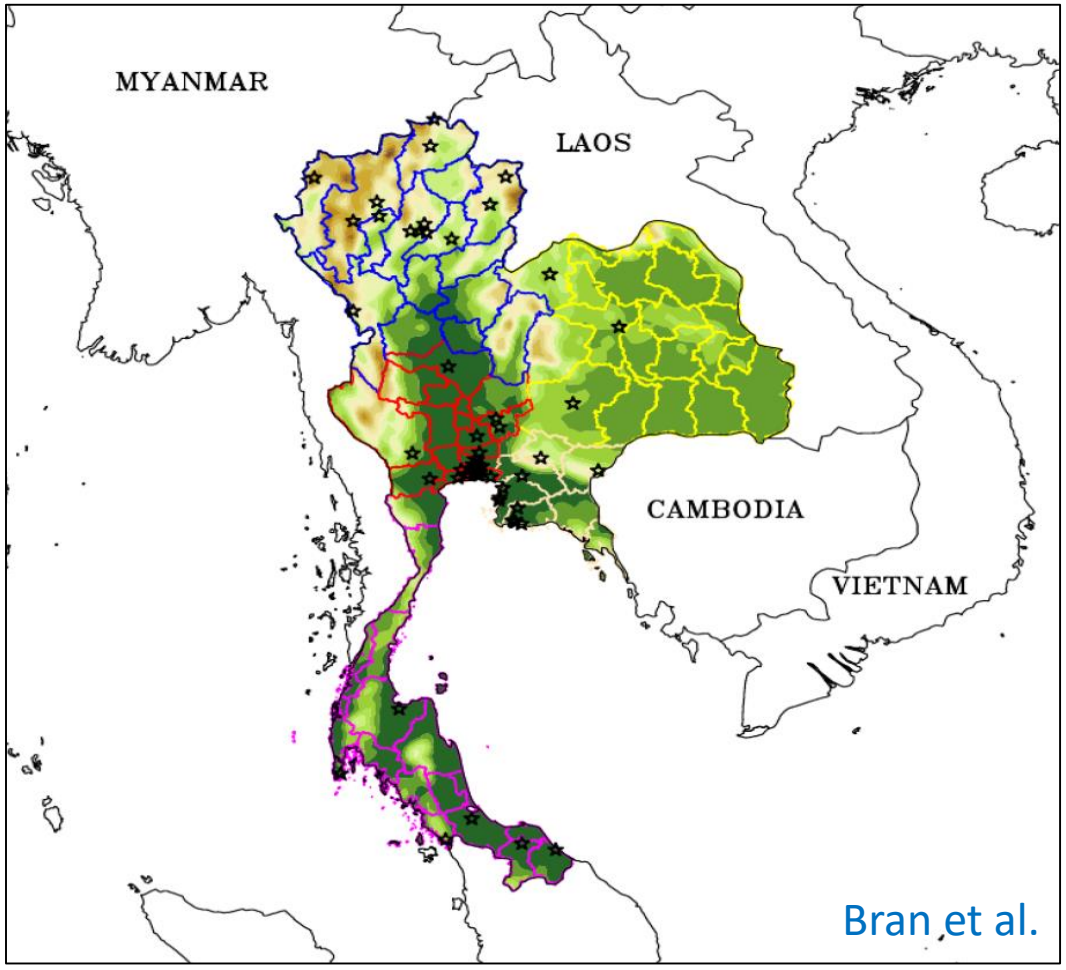
Indochina Domain



Operational Period: December 2021 (start of cool dry season) – March/April 2022 (peak biomass burning) – May 2022 (monsoon onset / early and more intense rains this year – La Nina)

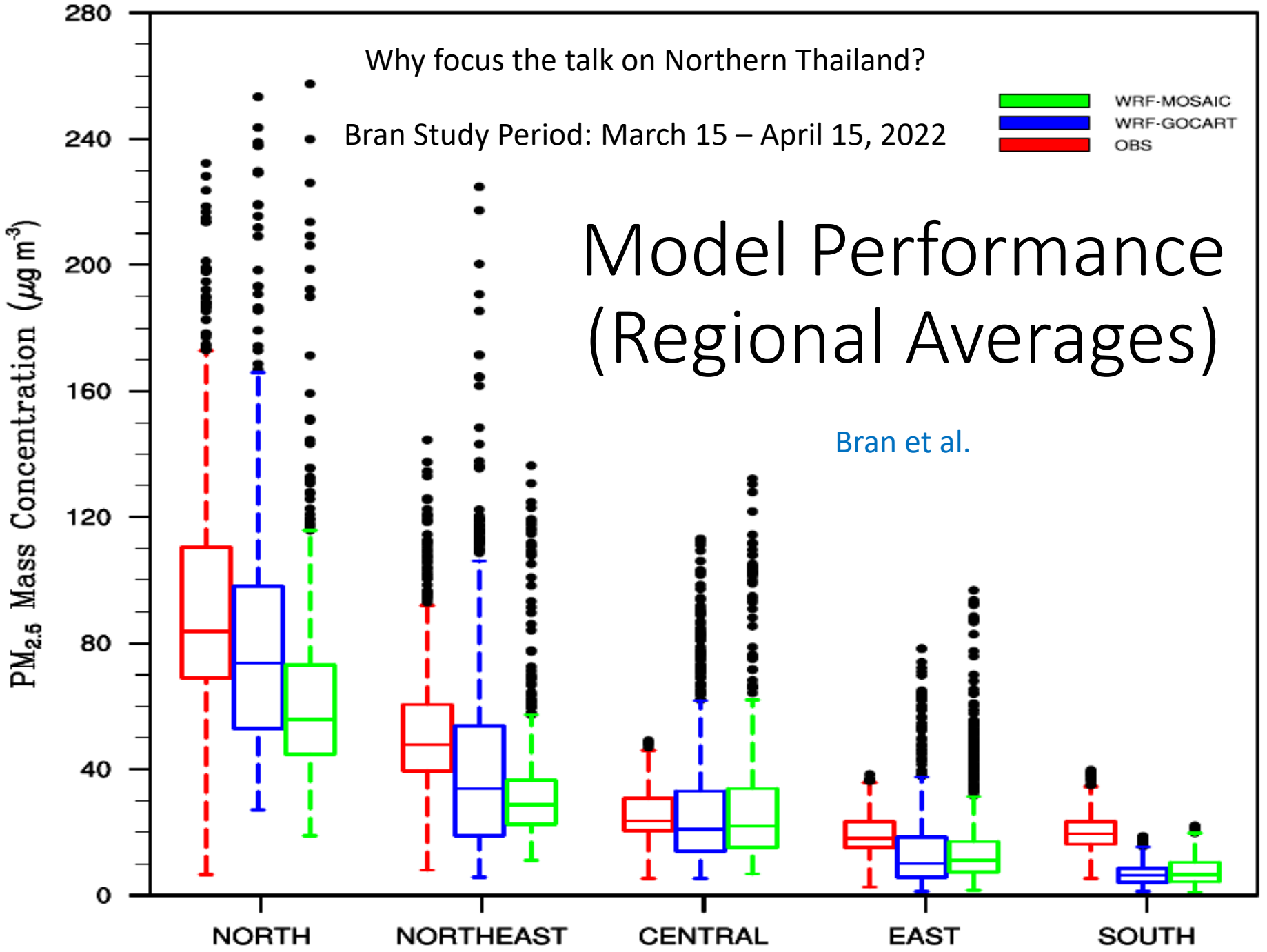
Talk Focus: Chiang Mai City, Northern Thailand (stars – reference air pollution stations)

Why focus the talk on Northern Thailand?

Bran Study Period: March 15 – April 15, 2022

Model Performance (Regional Averages)

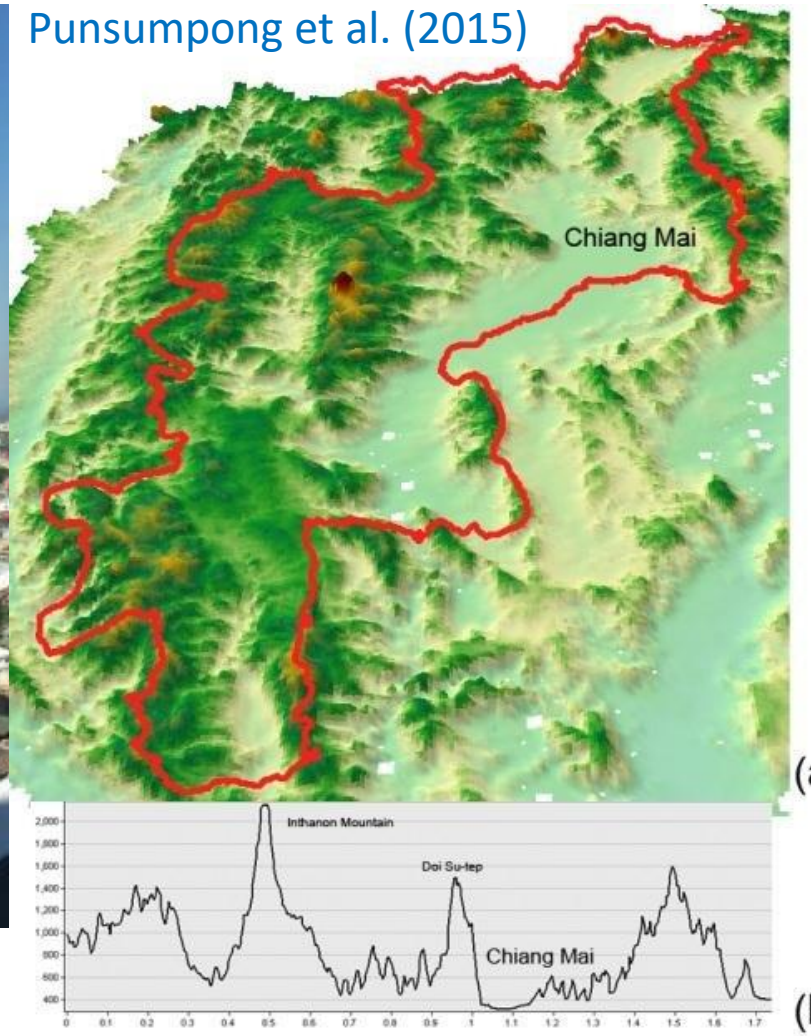
Bran et al.



Why focus the talk on Chiang Mai City, Northern Thailand?

big city / tourist destination in a complex terrain / valley atmosphere (have reference sensors and LiDAR)

Punsumpong et al. (2015)



Validation data presented in the talk: PM2.5 reference sensor data and LiDAR PBL height estimates

Configuration

WRF-Chem v. 4.1 at 9 km x 9 km horizontal resolution for Indochina (talk focus) and 27 km x 27 km for Southeast Asia

- IGBP-MODIS land use
- NCEP GFS 0.25 deg
- WACCM (ACOM)
- EDGAR-HTAP
- NRT fire emissions (ACOM)
- MEGAN
- GOCART Aerosol Scheme
- No data assimilation yet

Process Parameterized	Scheme Used	Reference
Microphysics	Morrison double moment scheme	Morrison et al. (2009)
Convection	Grell-Freitas scheme	Grell et al. (2013)
Surface Layer	Revised MM5 Monin-Obukhov scheme	Jimenez et al. (2012)
Land Surface	NOAH Land Surface model : unified NCEP/NCAR/AFWA scheme	Chen and Dudhia (2001)
Boundary Layer	Yonsei University scheme	Hong, Noh and Dudhia (2006)
Short-wave Radiation	Rapid Radiative Transfer Model for General Circulation Models (RRTMG)	Iacono et al. (2008)
Long-wave Radiation	RRTMG	Iacono et al. (2008)

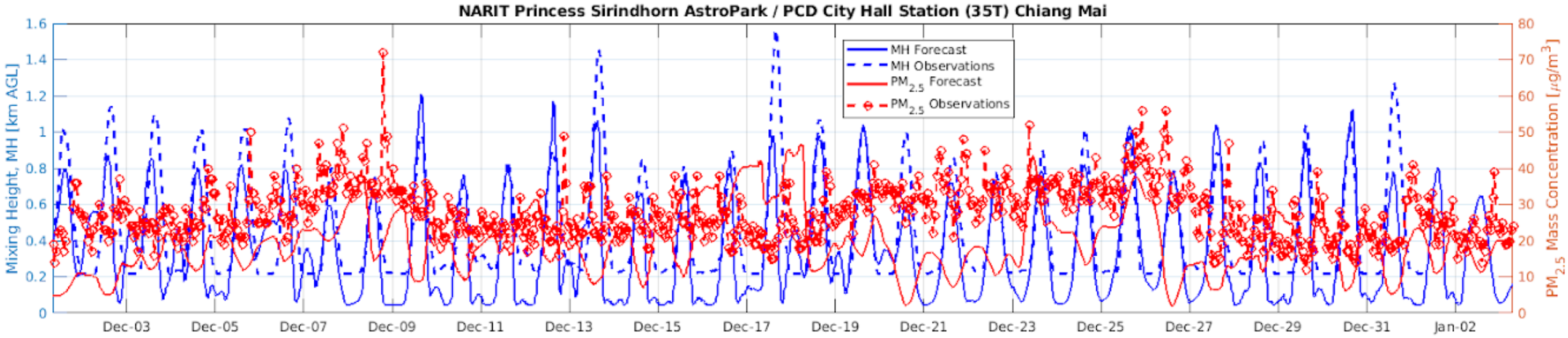
Bran et al.

This Year's (Dec 2021 – May 2022) Haze Situation in Chiang Mai City

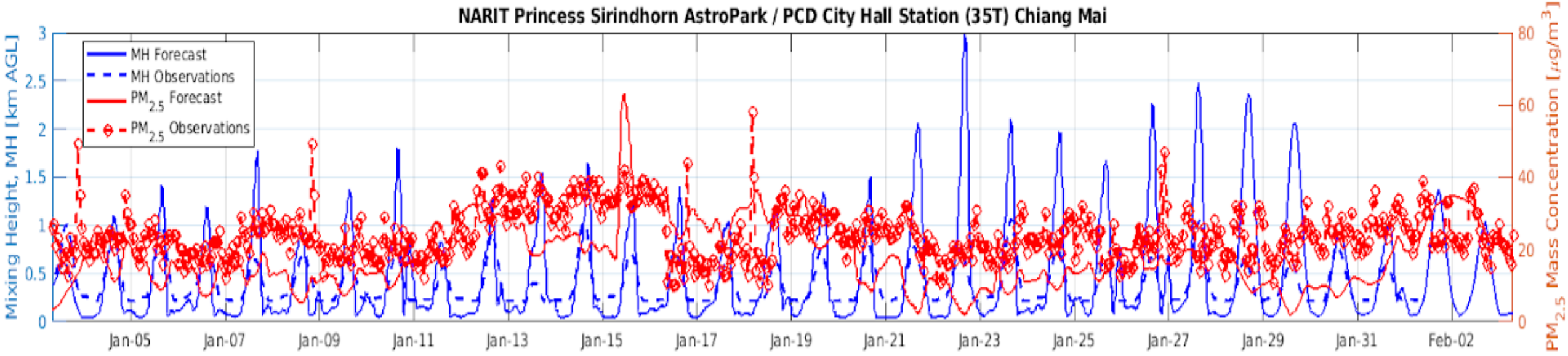
From the Perspective of the Experimental Atmospheric Forecasting System for Indochina and Southeast Asia

https://ronmcdo4.wixsite.com/atmos-predict

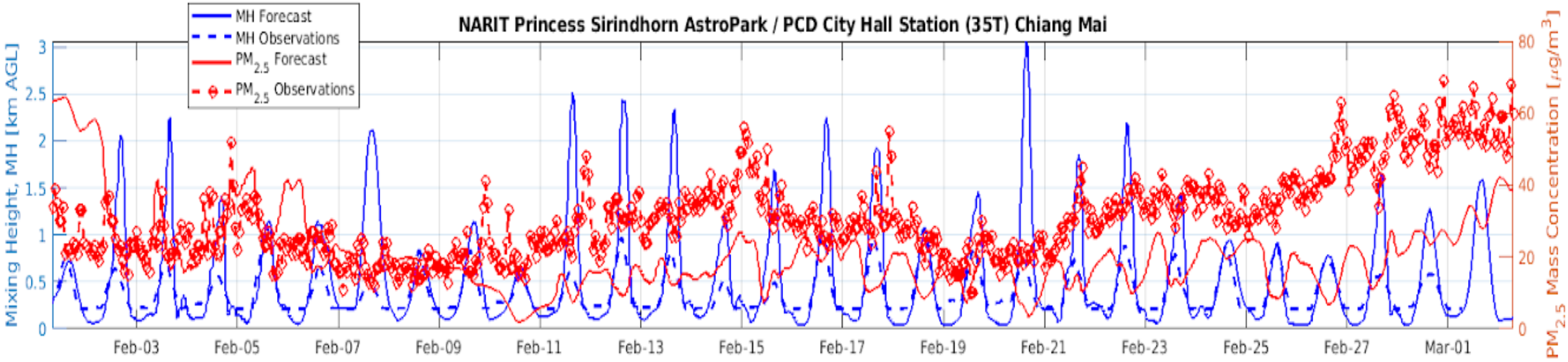
December 2021



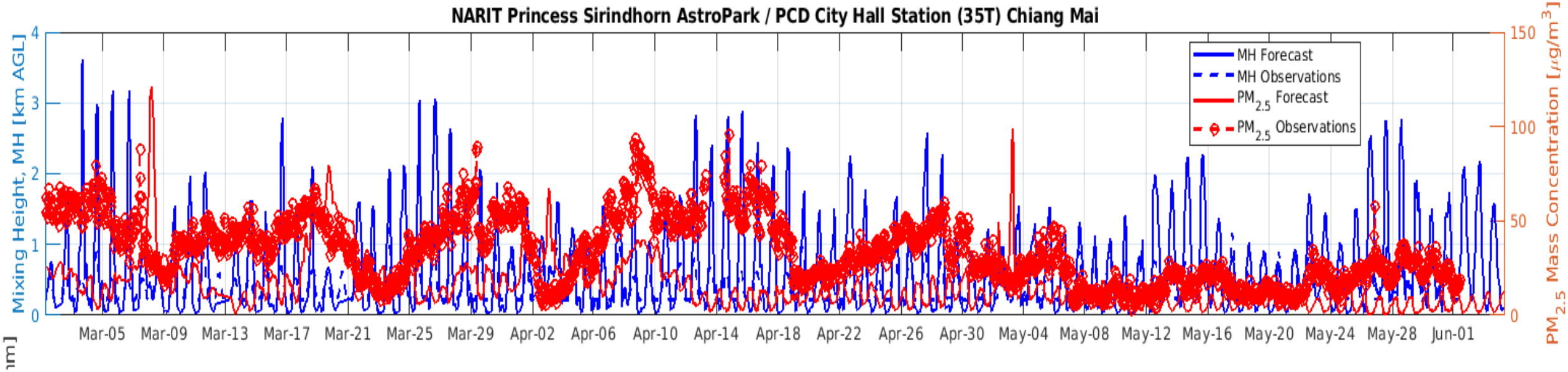
January 2022



February 2022



March – May 2022



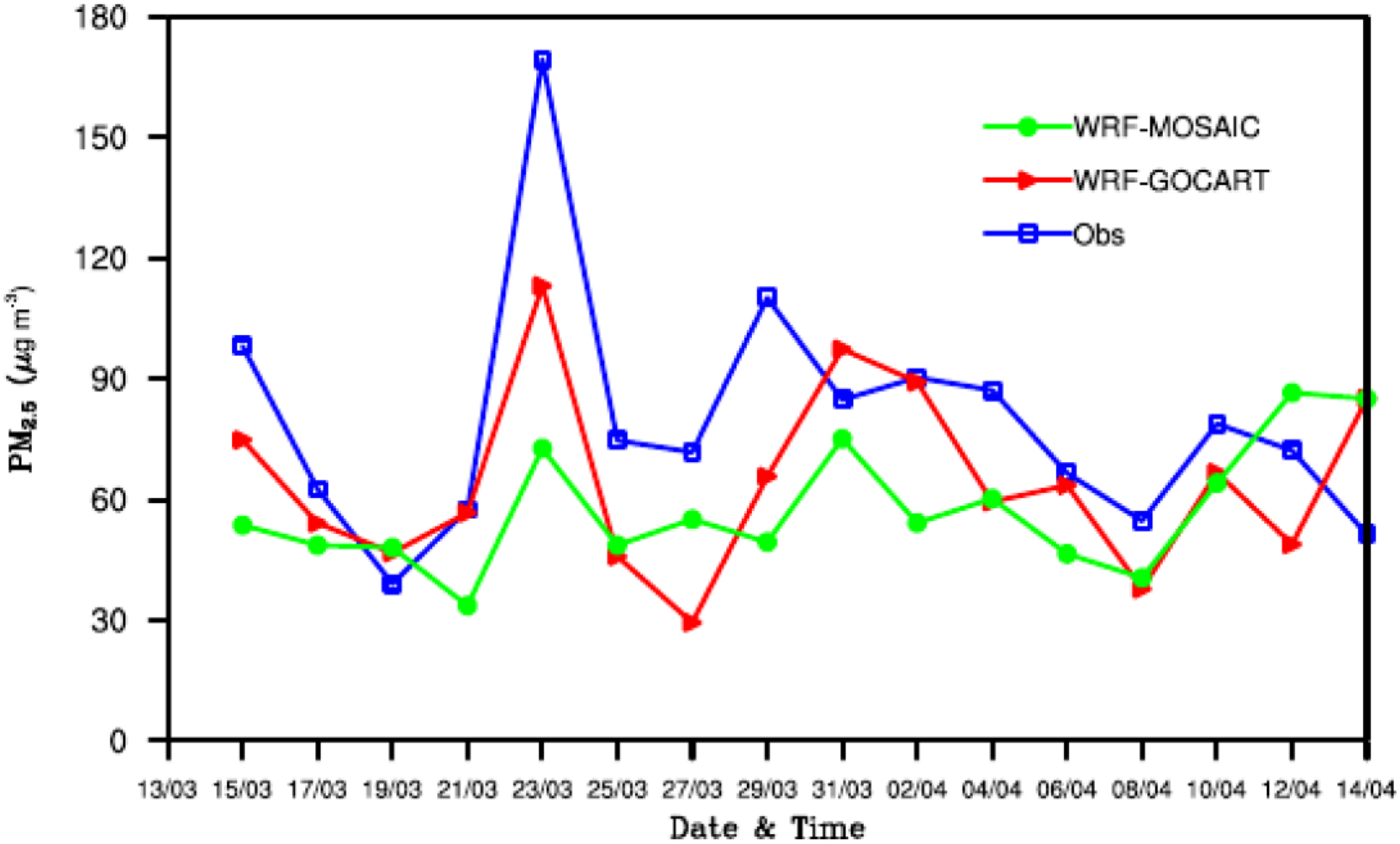
Sources of error:

- Unable to capture some chemical compositions (Bran et al., next slides)
- Unable to capture the PBL height during March and April (related to the first error and propagates to inaccurate aerosol-radiation-PBL-cloud-rainfall interactions)

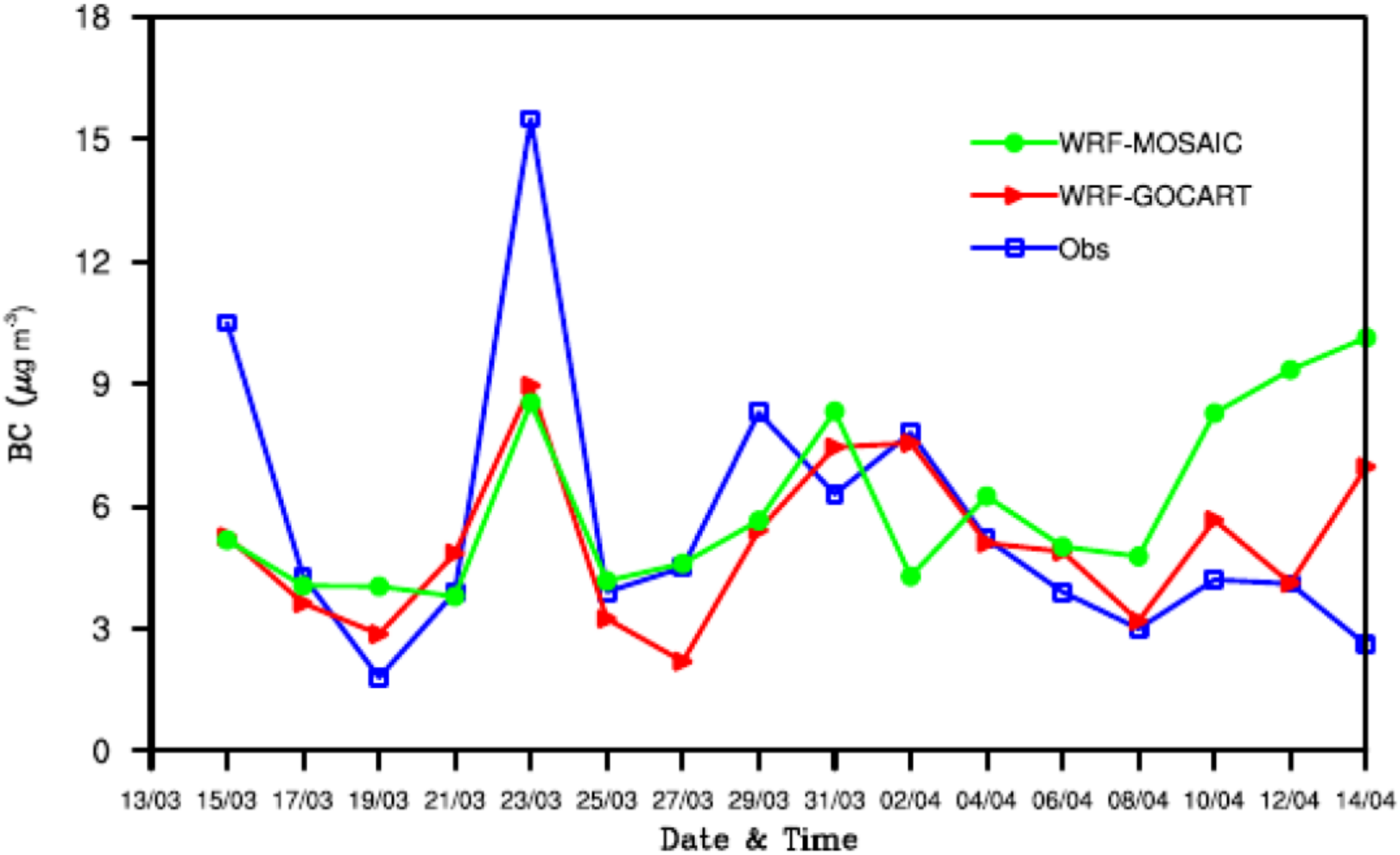
Chemical Compositions

Over Chiang Mai City in 2019 (Tao et al., 2020 and Bran et al.)

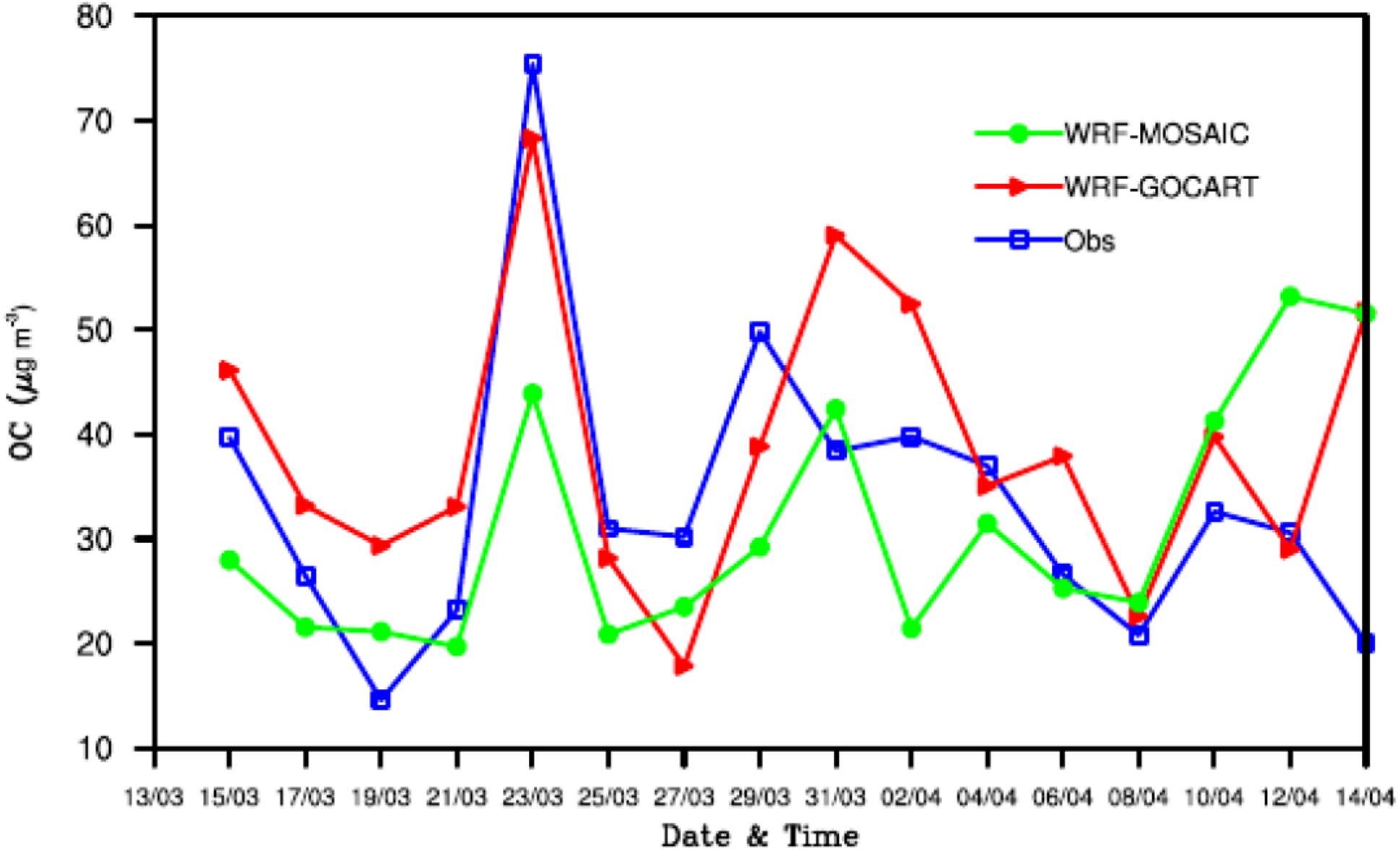
PM2.5 (Chiang Mai City)



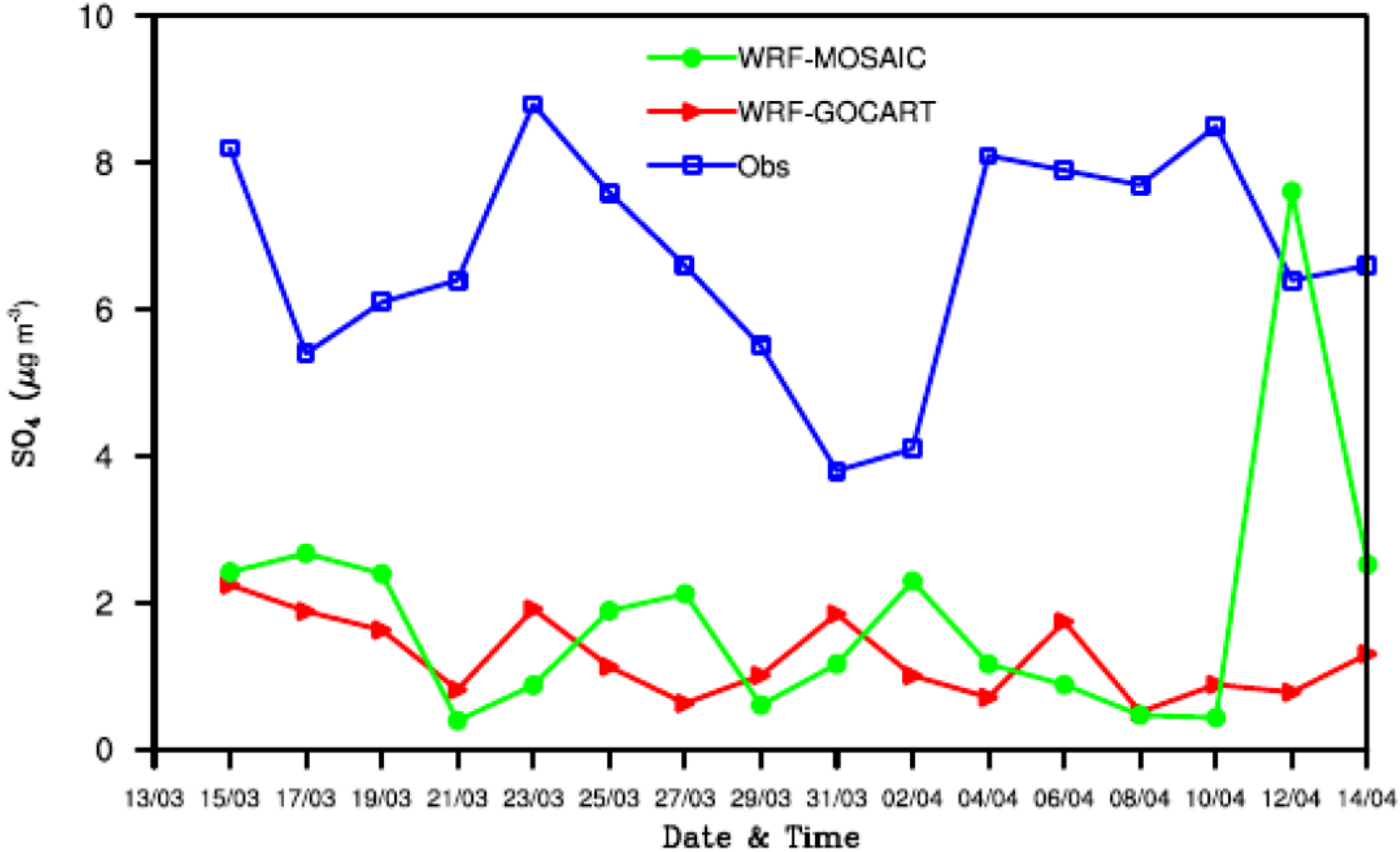
Black Carbon (Chiang Mai City)



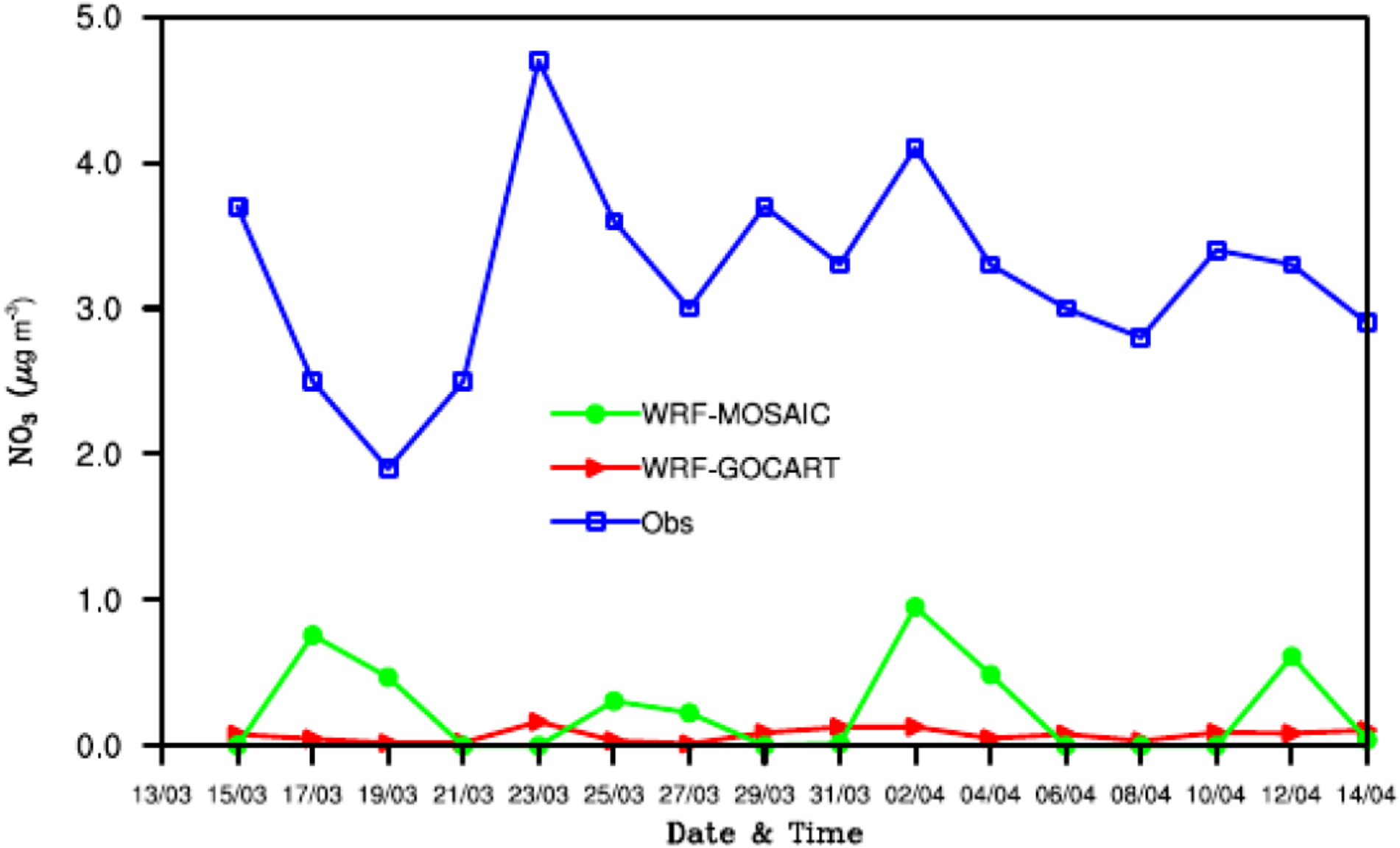
Organic Carbon (Chiang Mai City)



Sulfate (Chiang Mai City)



Nitrate (Chiang Mai City)

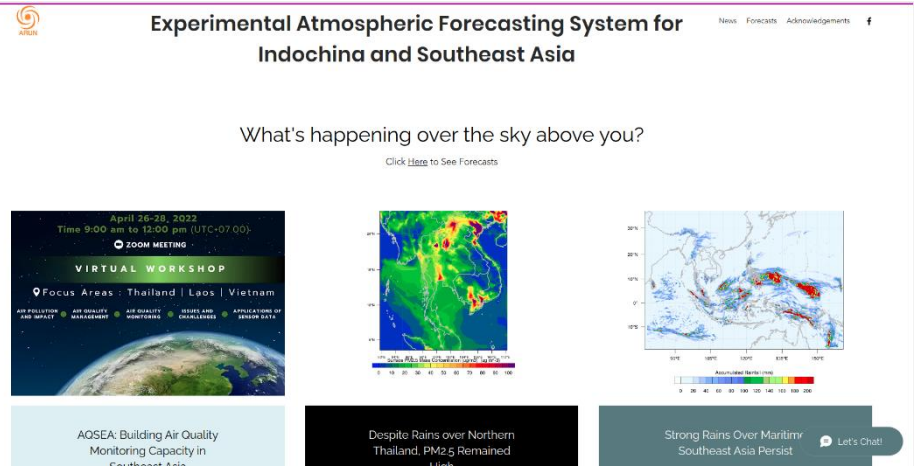


Next Steps….

- Use local Thailand land use
- Use local emission inventories (Thanapat et al., in preparation)
- Use local biogenic emission data (Radshadaporn et al., in preparation)
- Explore data assimilation

Submitted Proposal to NASA Servir (Pfister, Kumar, Barth, Surapipith, Macatangay, Bran, Pollution Control Department of Thailand and ADPC)

Start from….



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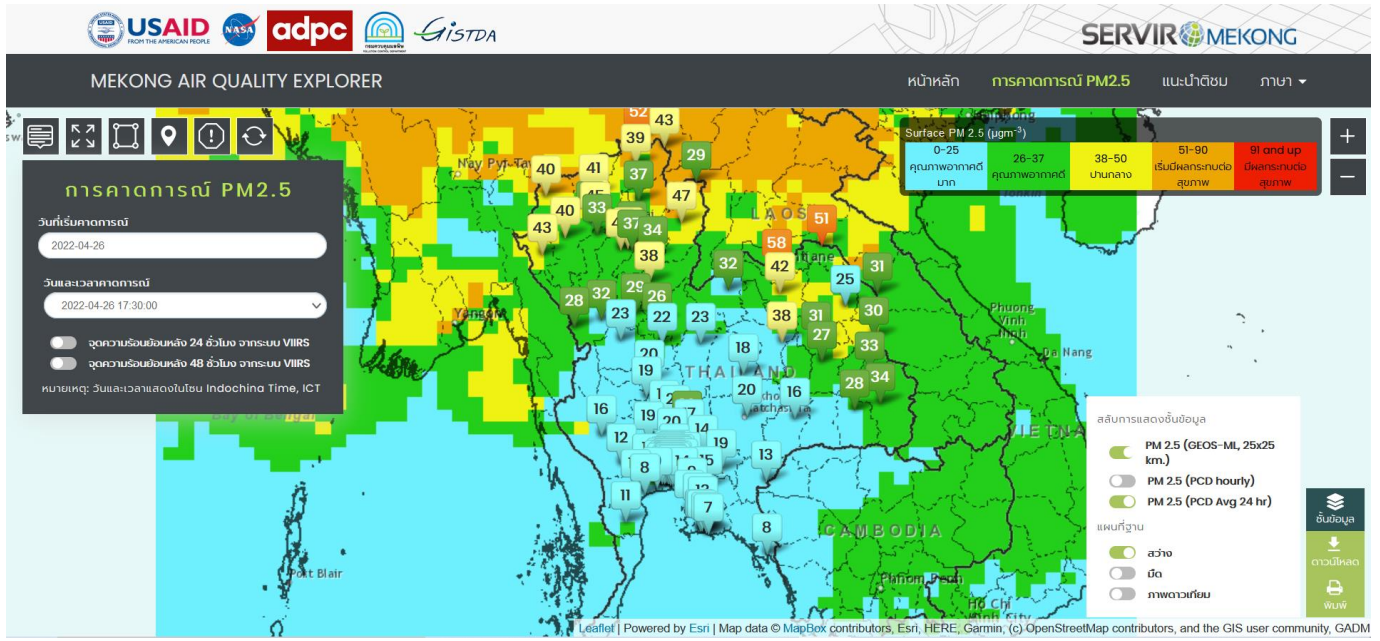

https://aqatmekong-servir.adpc.net/en/mapviewer/

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NCAR ACOM SERVIR MEKONG

- GEOS / WACCM-WRF-Chem
- High resolution
- Data assimilation capabilities
- Source attribution system

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