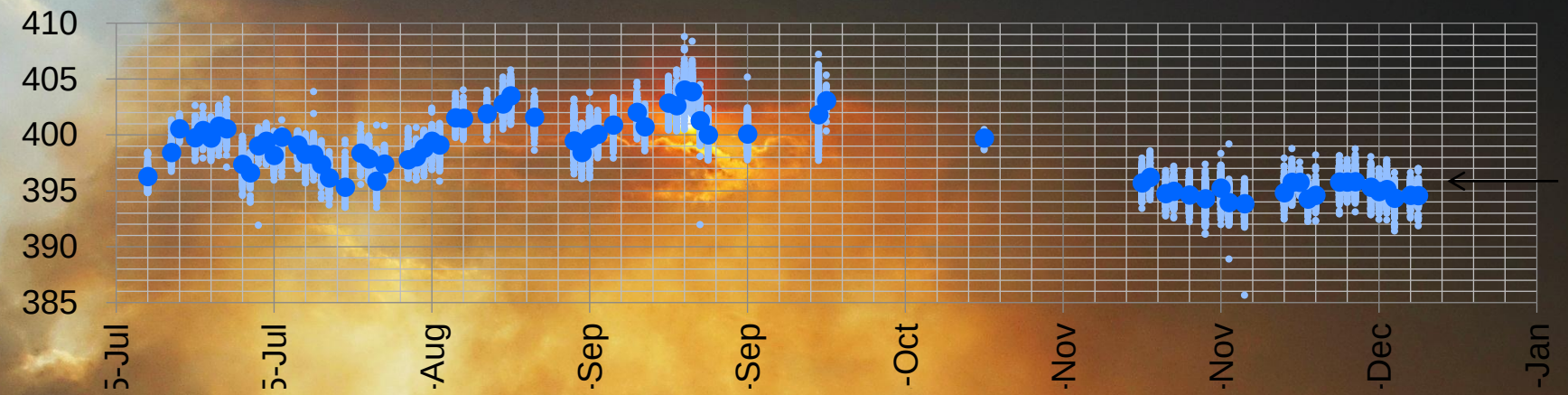
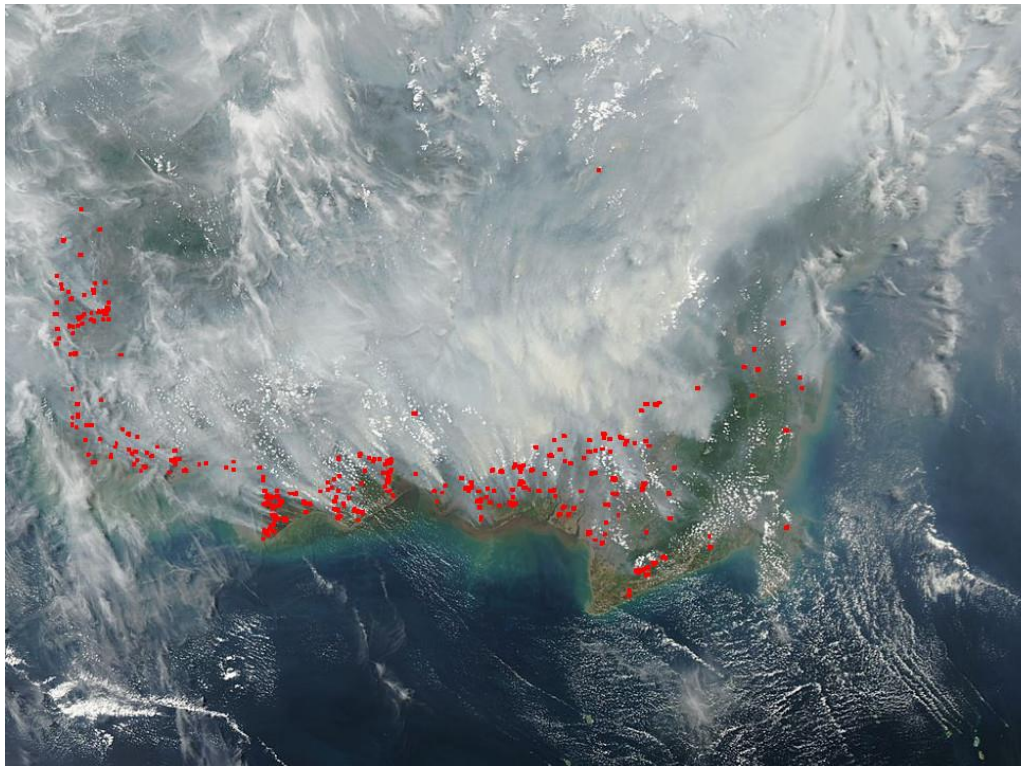
Measurements of XCO_2 and AOD in Fire-Prone Peatland of Central Kalimantan



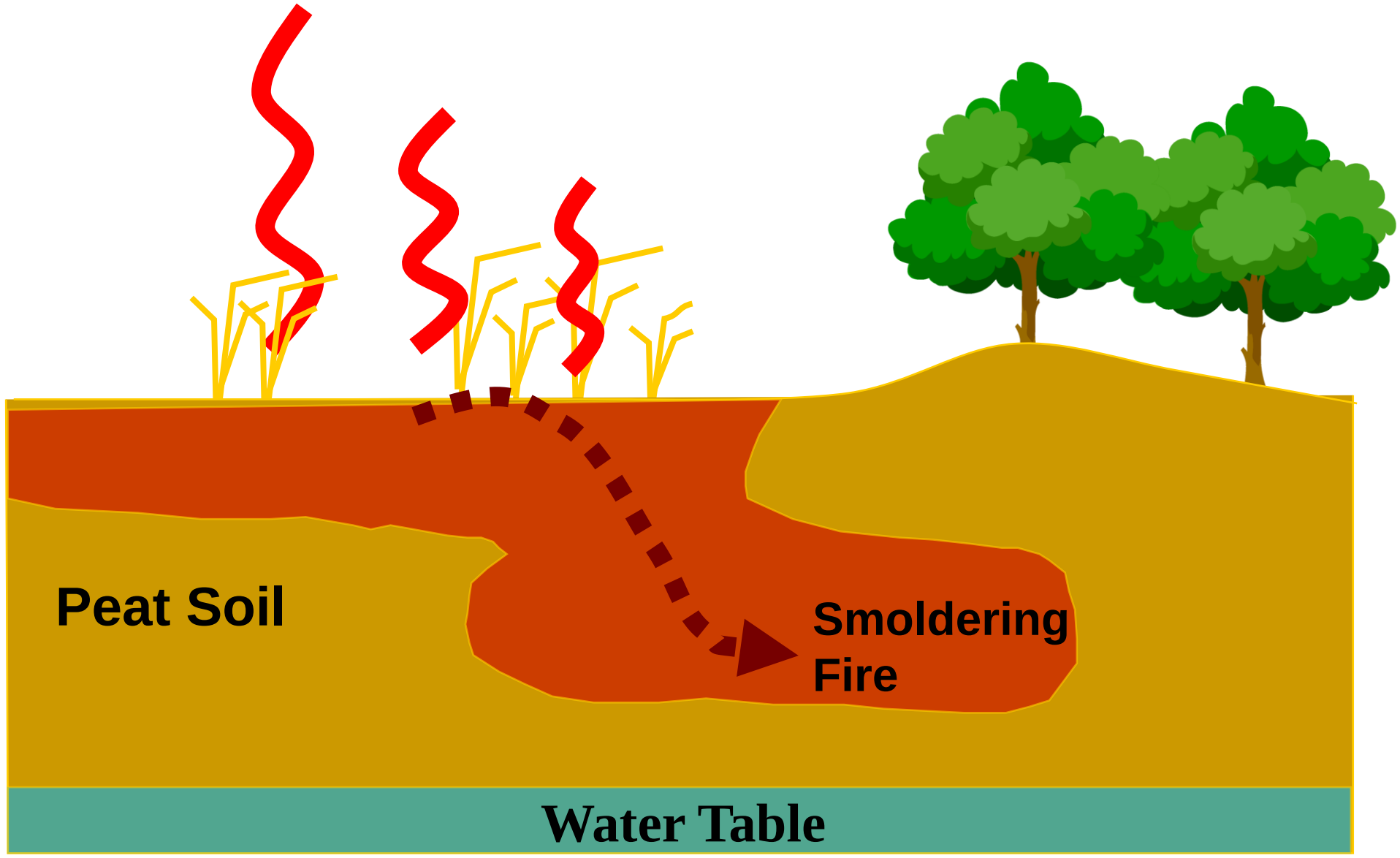
M. Kawasaki (KyU,RIHN), K. Tonokura (UT), M. Ohashi (KaU), M. Yamaguchi (IHI), G. Inoue (NIES), A. Rahman, D. Nugroho (BMKG), N. Yulianti, K. Kusin (UNPAR), W. Iriana (BIT)

Heavy haze caused by wild fires in the peatland of Palangka Raya, Kalimantan, Indonesia
Sept. 2015

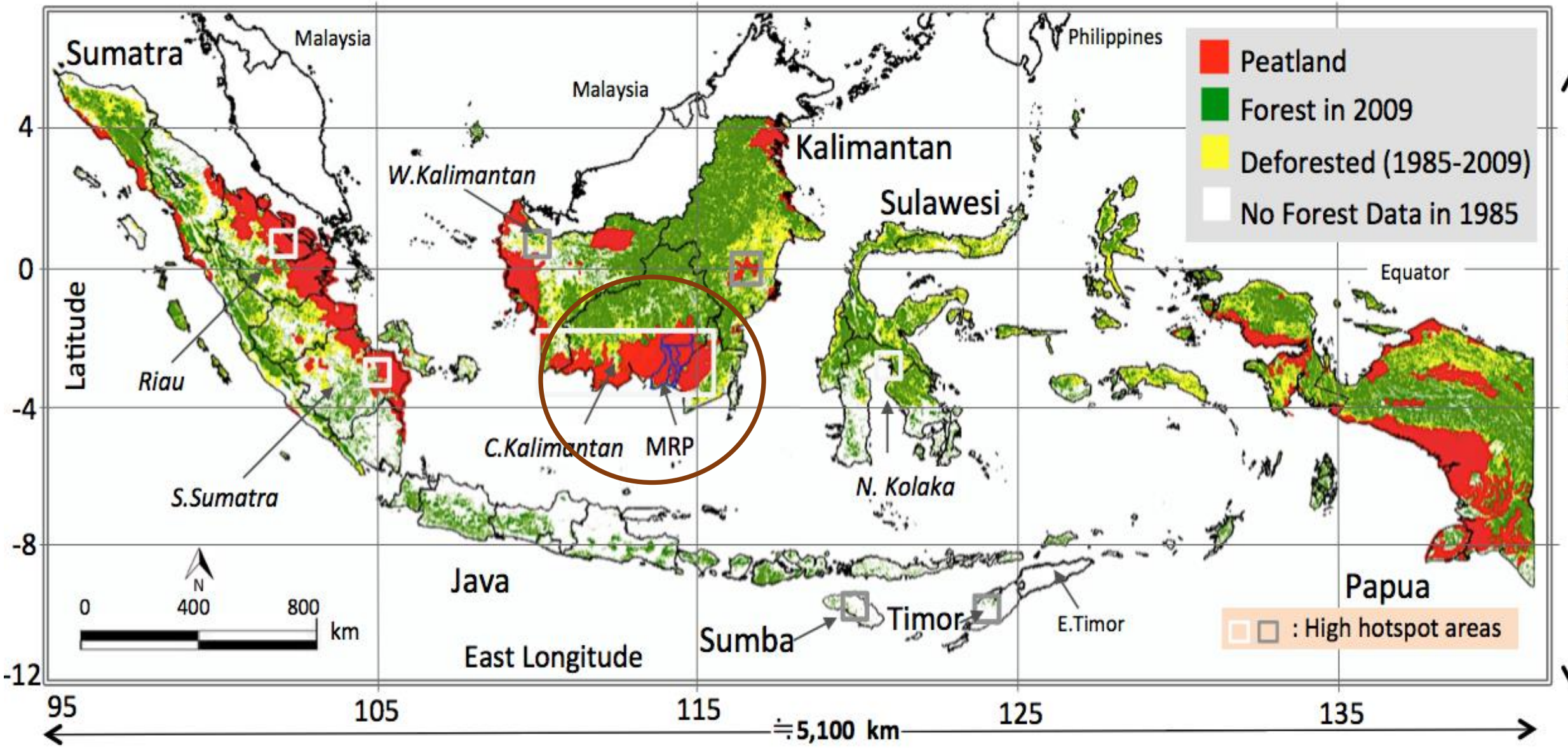
Hotspots and thick smoke
MODIS/NASA satellite data
Sept. 15, 2015

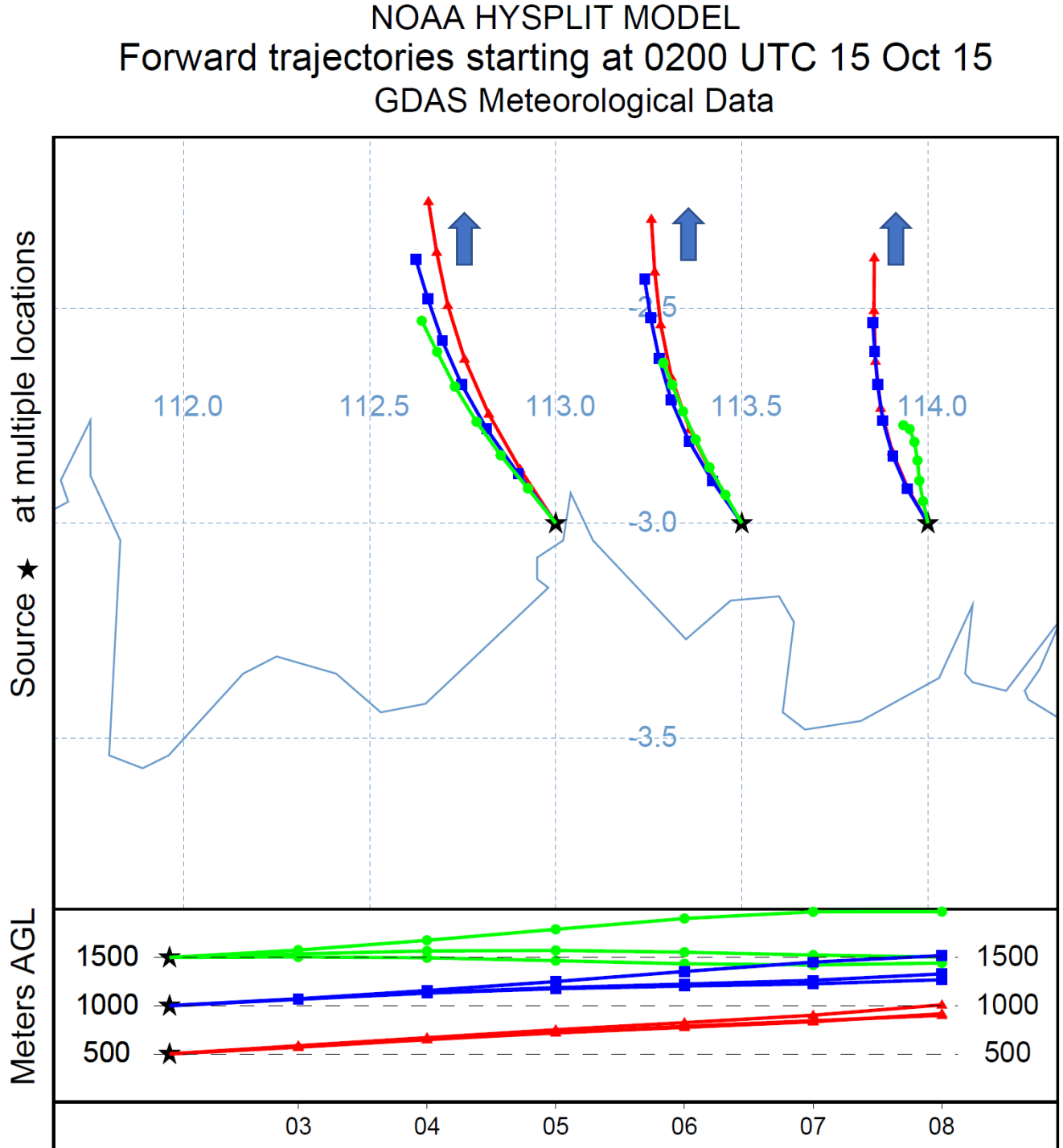


Surface and underground fire emits CO_2,CO and PM



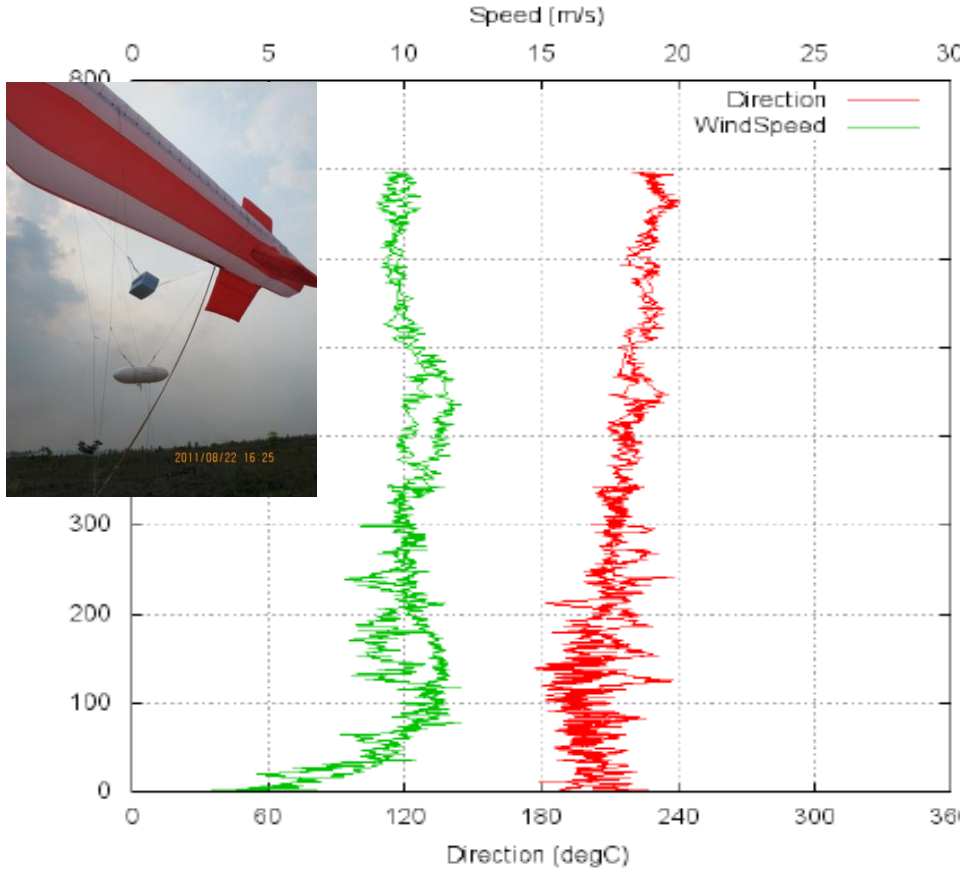
Our study area is a peatland in Central Kalimantan





In the study area, seasonal wind enhances local pollution at Palangka Raya city

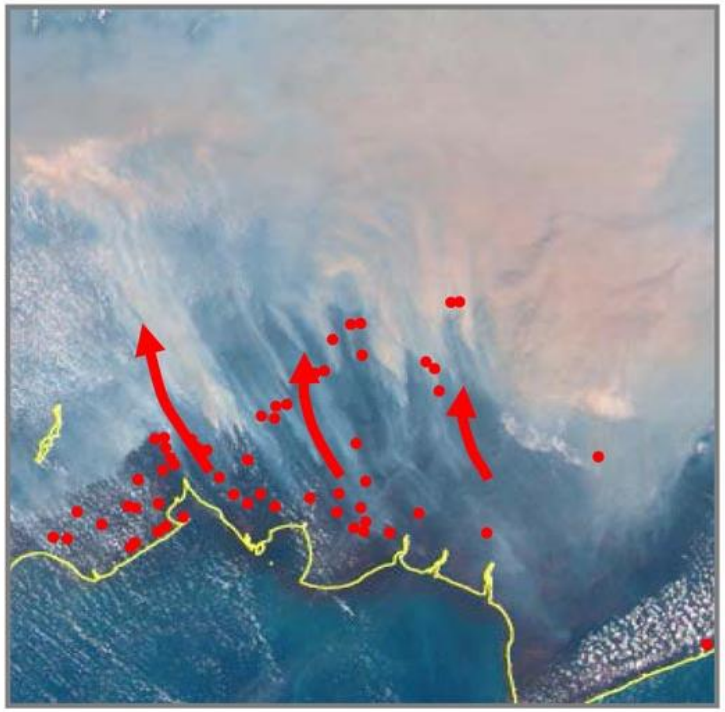
Wind speed and direction are uniform up to 700 m

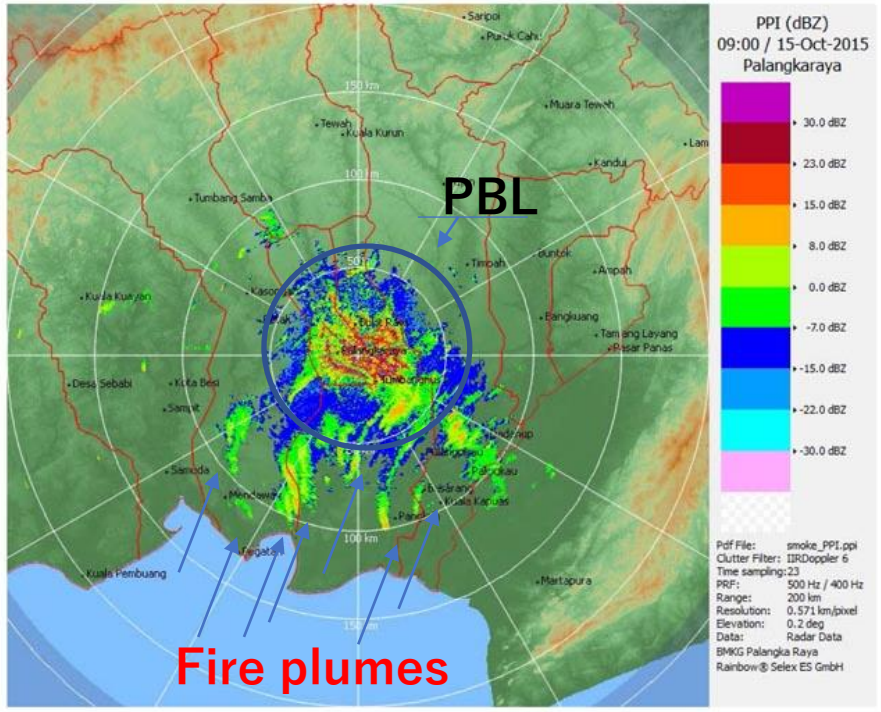


Iriana et al., *Sci. Rep.*, (2018) **8**:8437

#1 Weather-radar and satellite observations of fire plumes in the peatland

Radar image gives real time information about wild fires





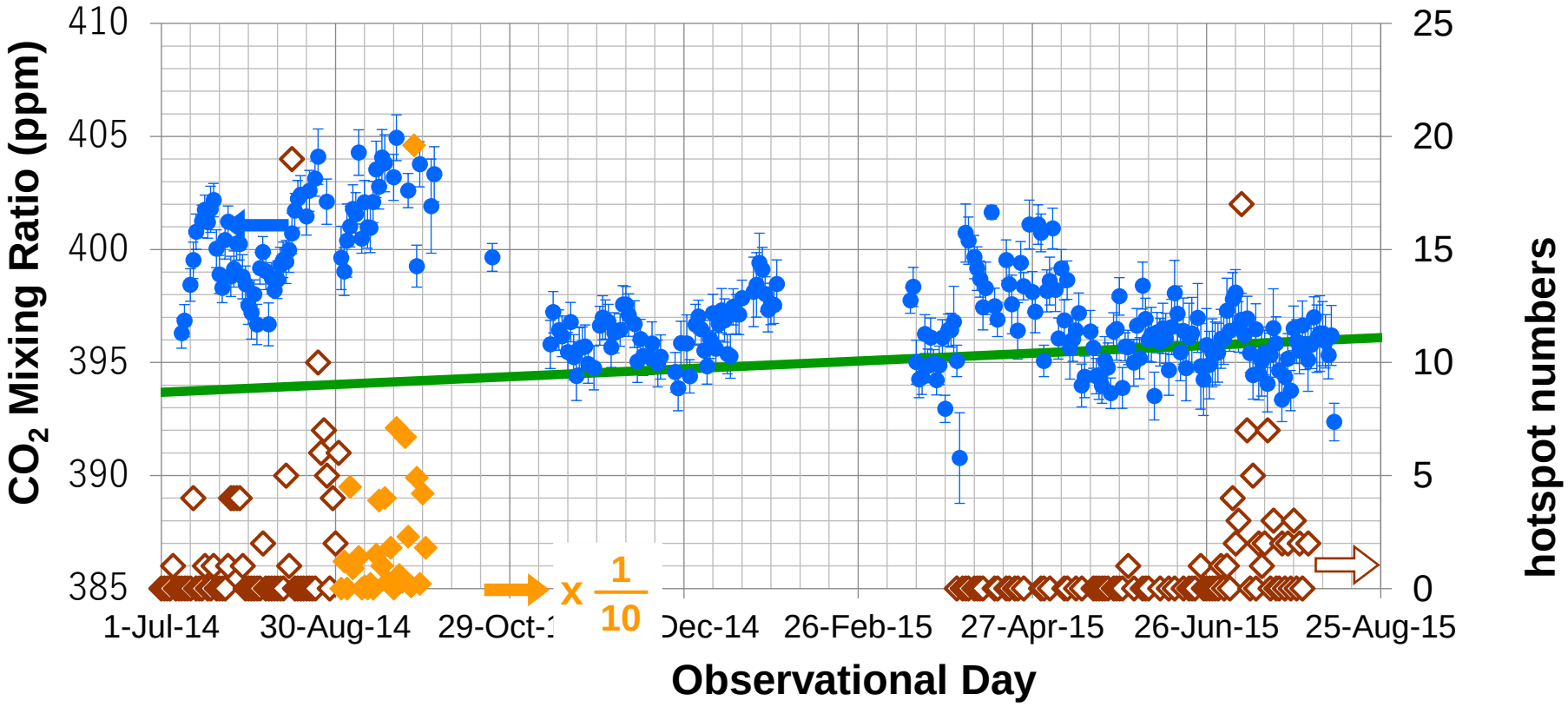
Right: radar image for hotspots and smoke plumes. The circle shows a PBL region. 09Z Oct 15, 2015

Left: trajectory calculation on 15th Oct. 2015 with BMKG facility

Rahman et al., *Sci. Rep.* **11**, 367 (2021)

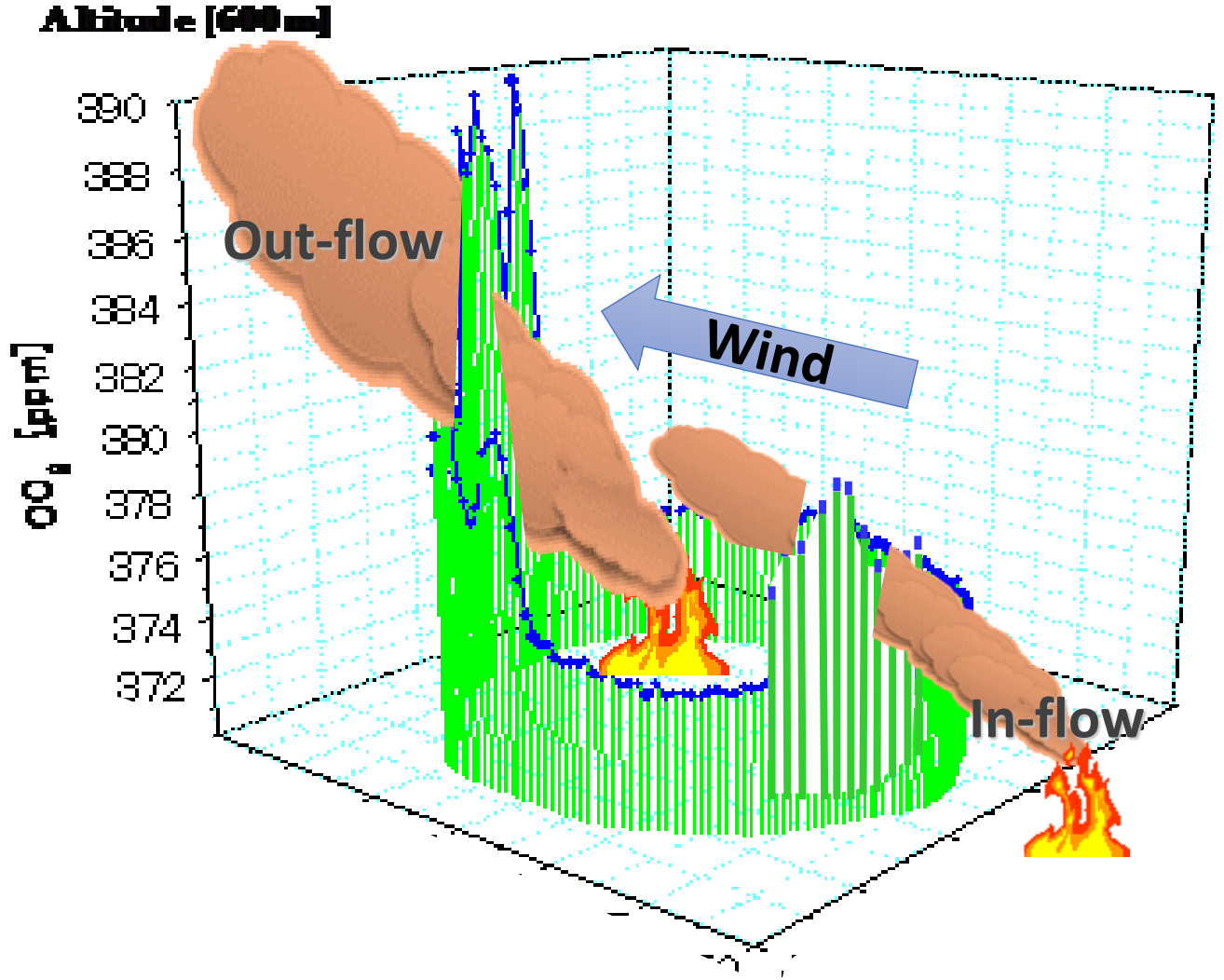
#2 XCO_2 and hotspots in Palangka Raya area

CO_2 emission from hotspots can be directly estimated

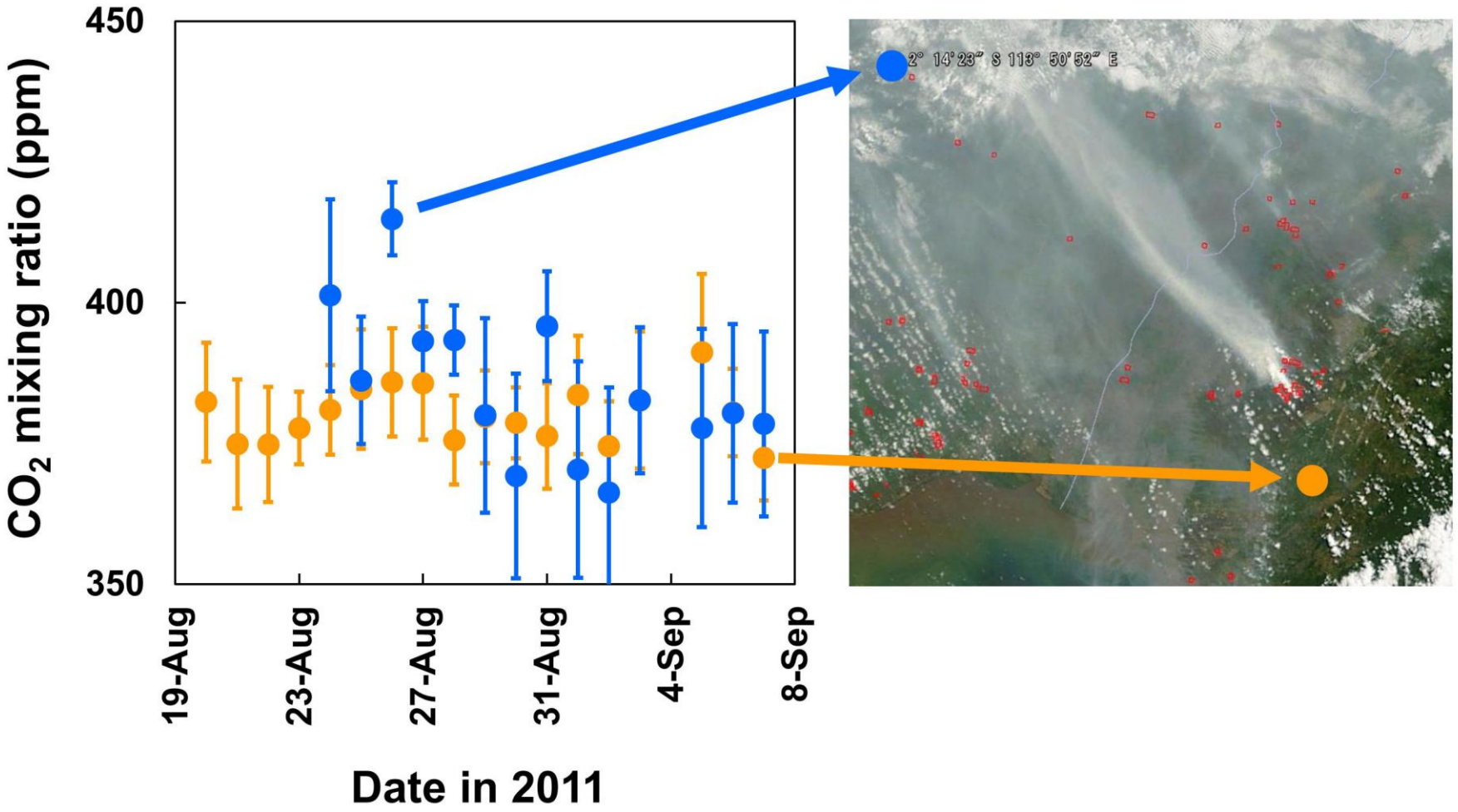


Iriana et al., *Sci. Rep.*, (2018) **8**:8437

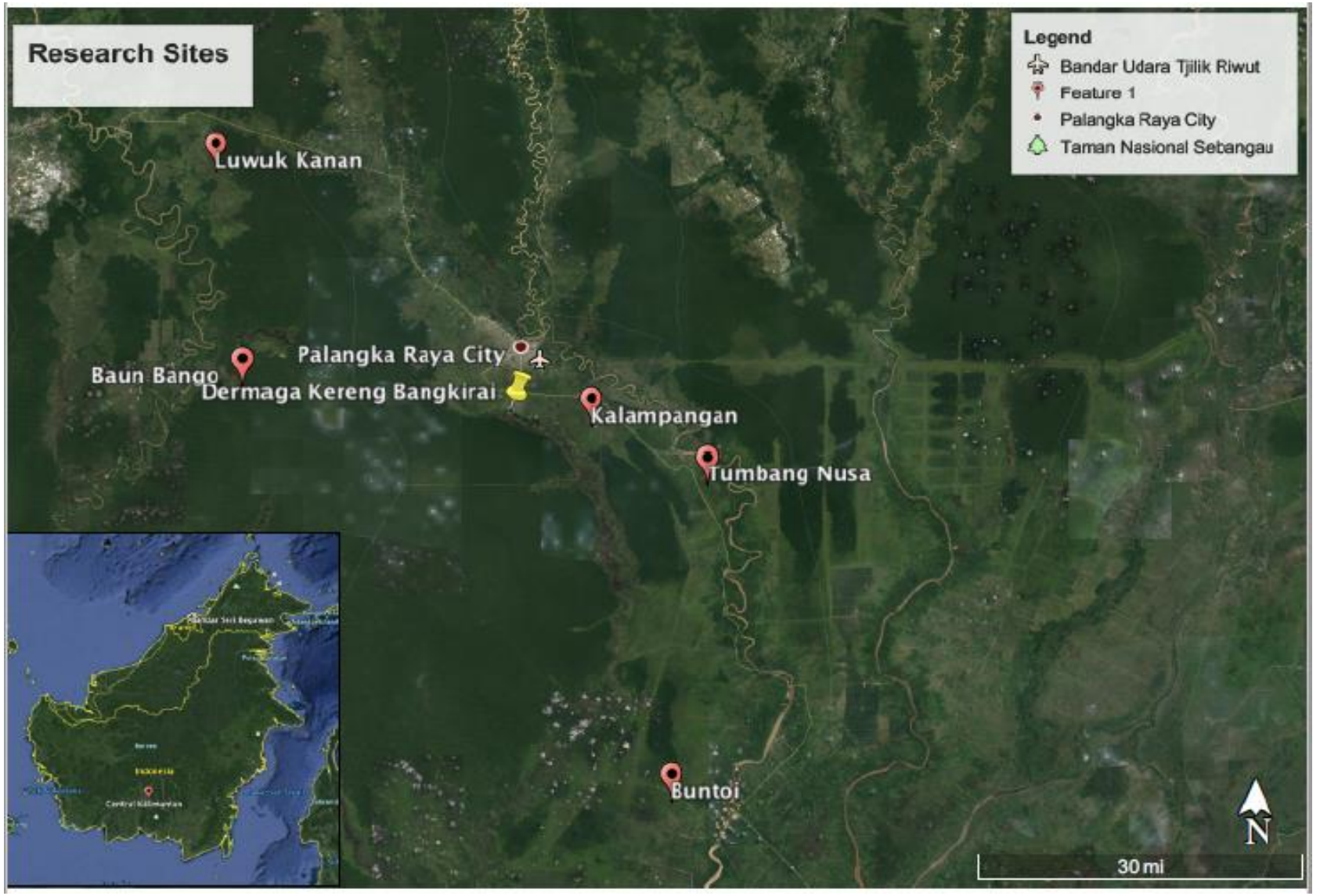
#3 Latent flux measurement estimates CO_2 emission from both surface and underground fires



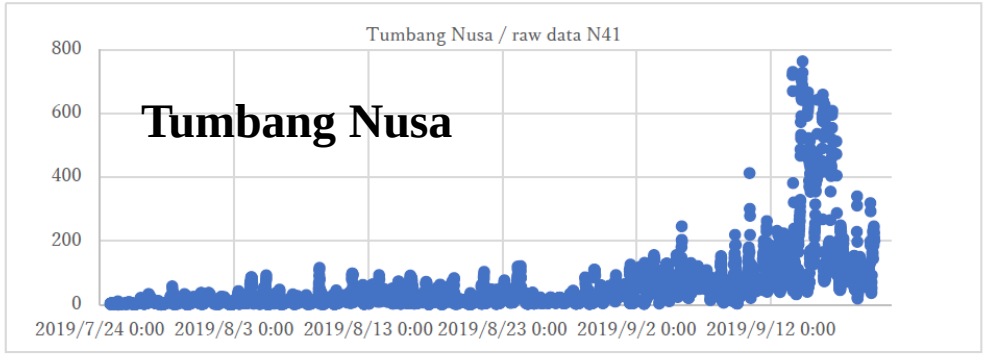
Latent flux measurement between PKY and BRB

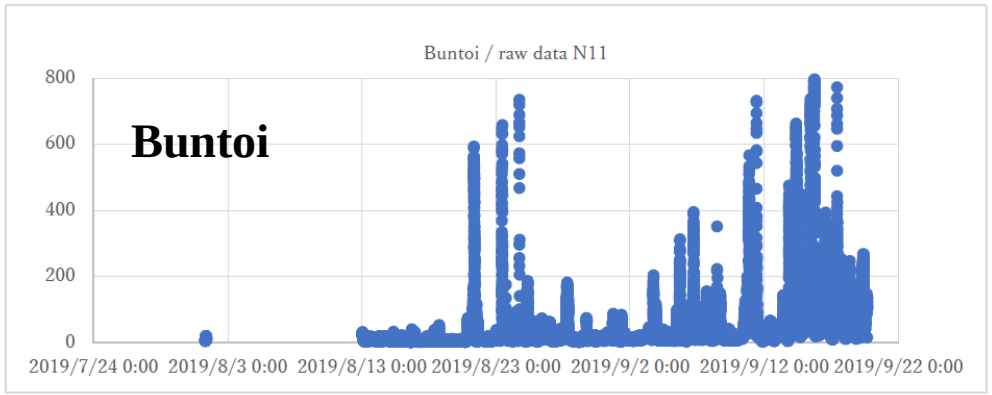


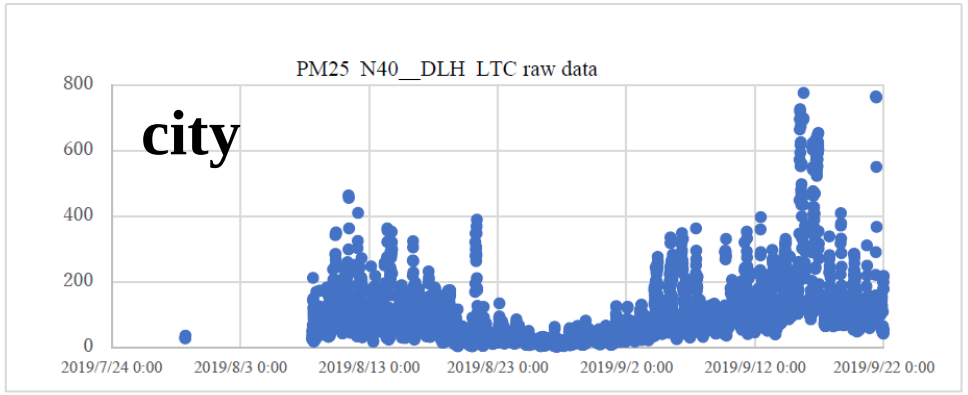
#4 Measurement of CO and PM with ground-based sensors and satellite data



Local $PM_{2.5}$ in Tumbang Nusa, Buntoi and PKY city area for Aug-Sept, 2019







※ロットにより色がグレーの場合があります

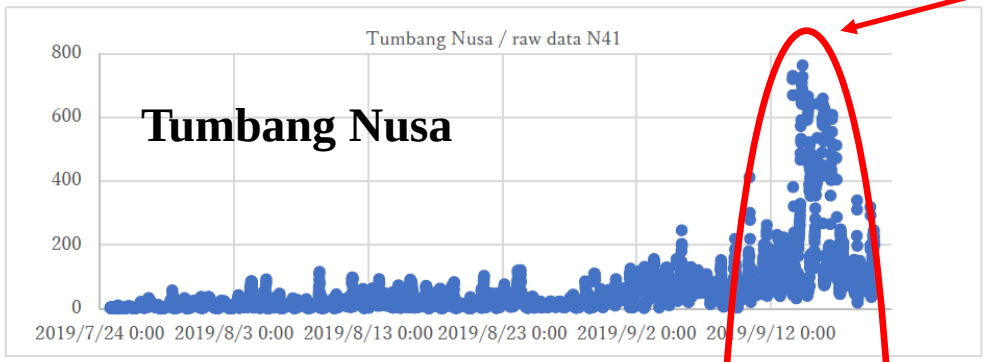
low-cost and handy air quality monitoring sensors

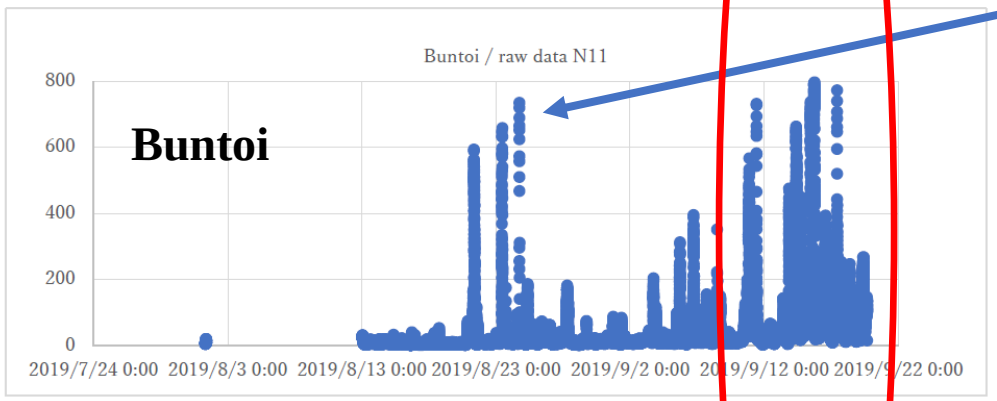
Ohashi et al. in a book (Vadrevu and Ohara, Ed. 2023)

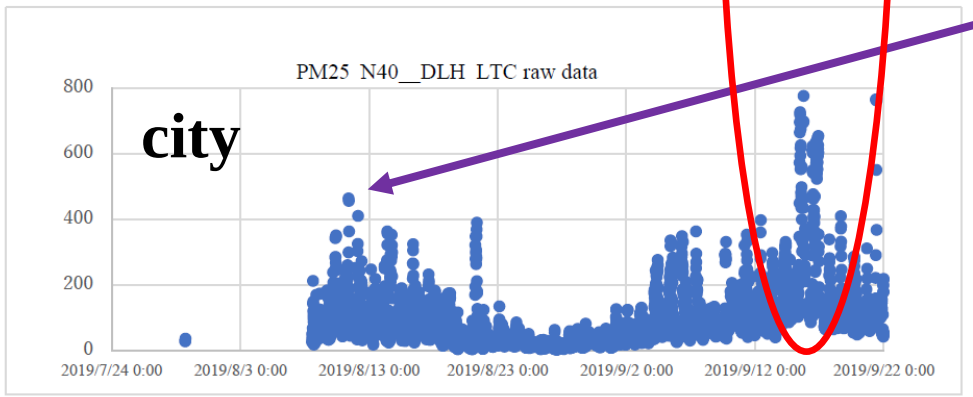
Local $PM_{2.5}$ in Tumbang Nusa, Buntoi and PKY city areas for Aug-Sept, 2019

Multiply a factor 2 to obtain PM concentrations in ug/m³

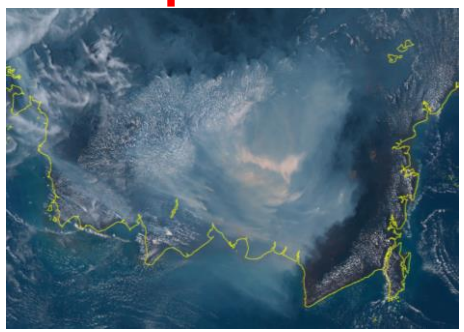
Max.measurable PM = 1000 units







15th September

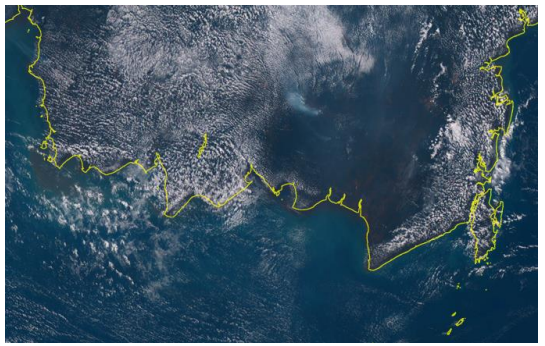


Smoky on entire region

23rd August

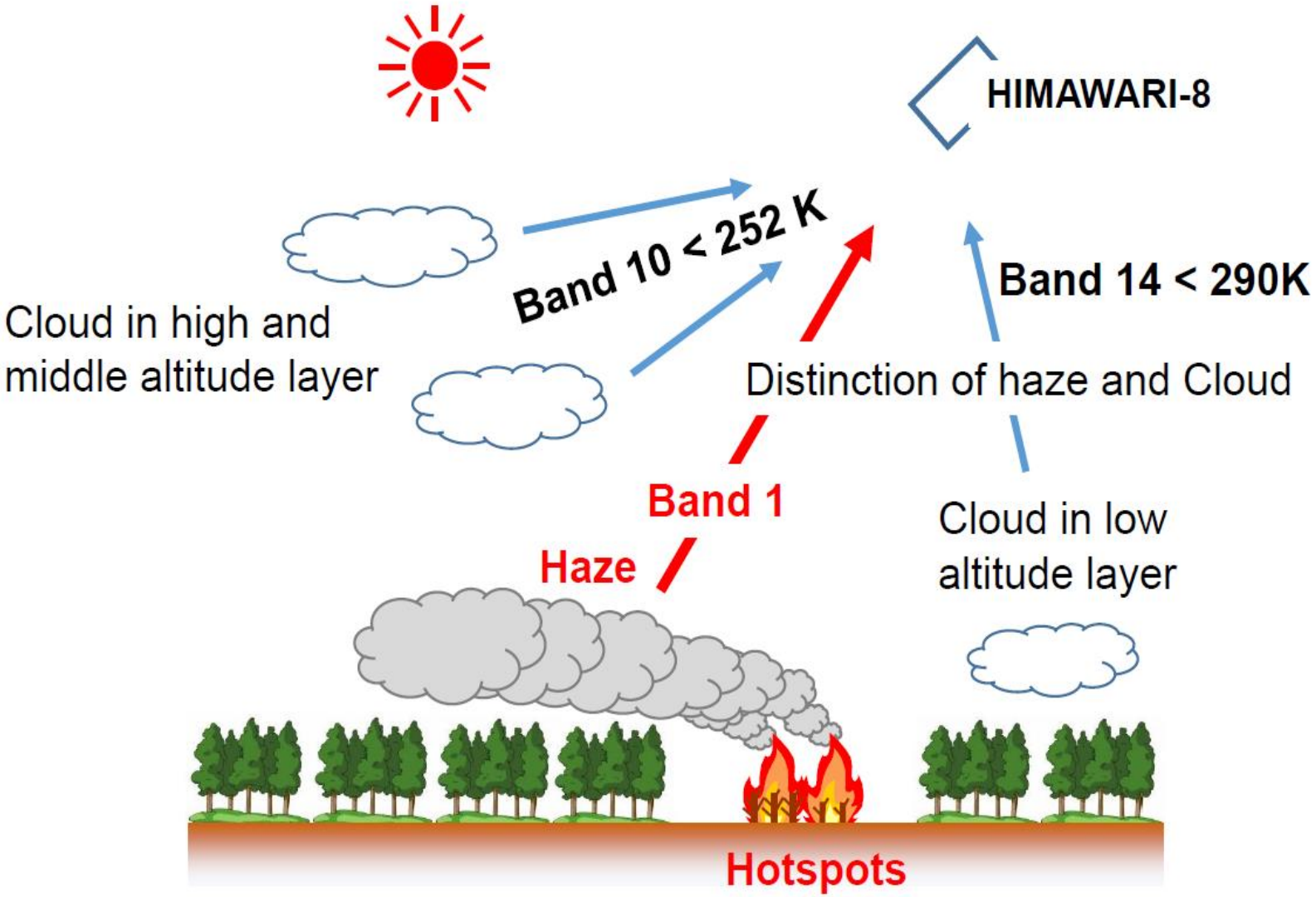
Smoky on Buntoi

14th August



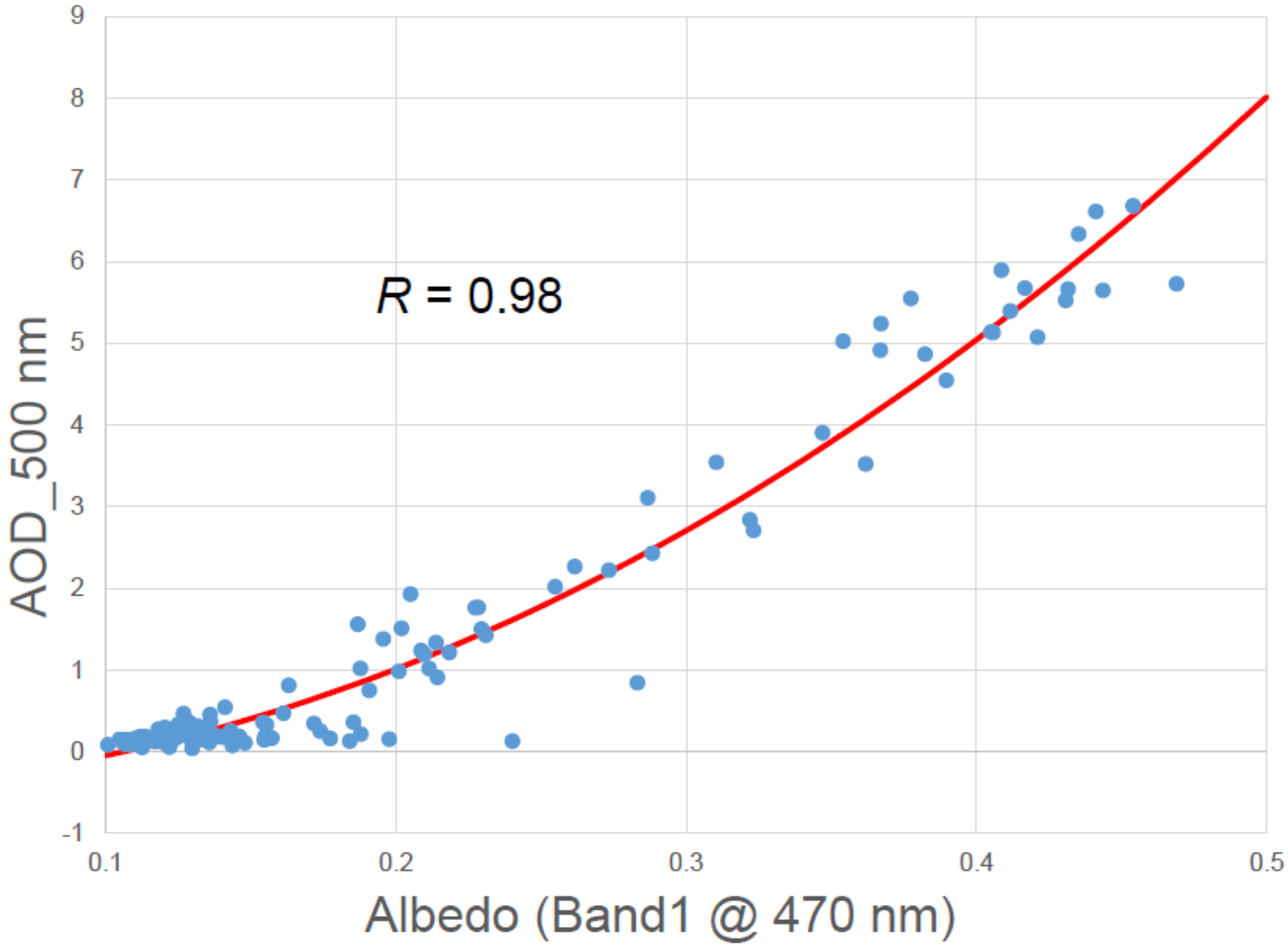
Smoky on city

Classification of pixels by brightness temperatures of HIMAWARI-8 imager data for albedo measurement

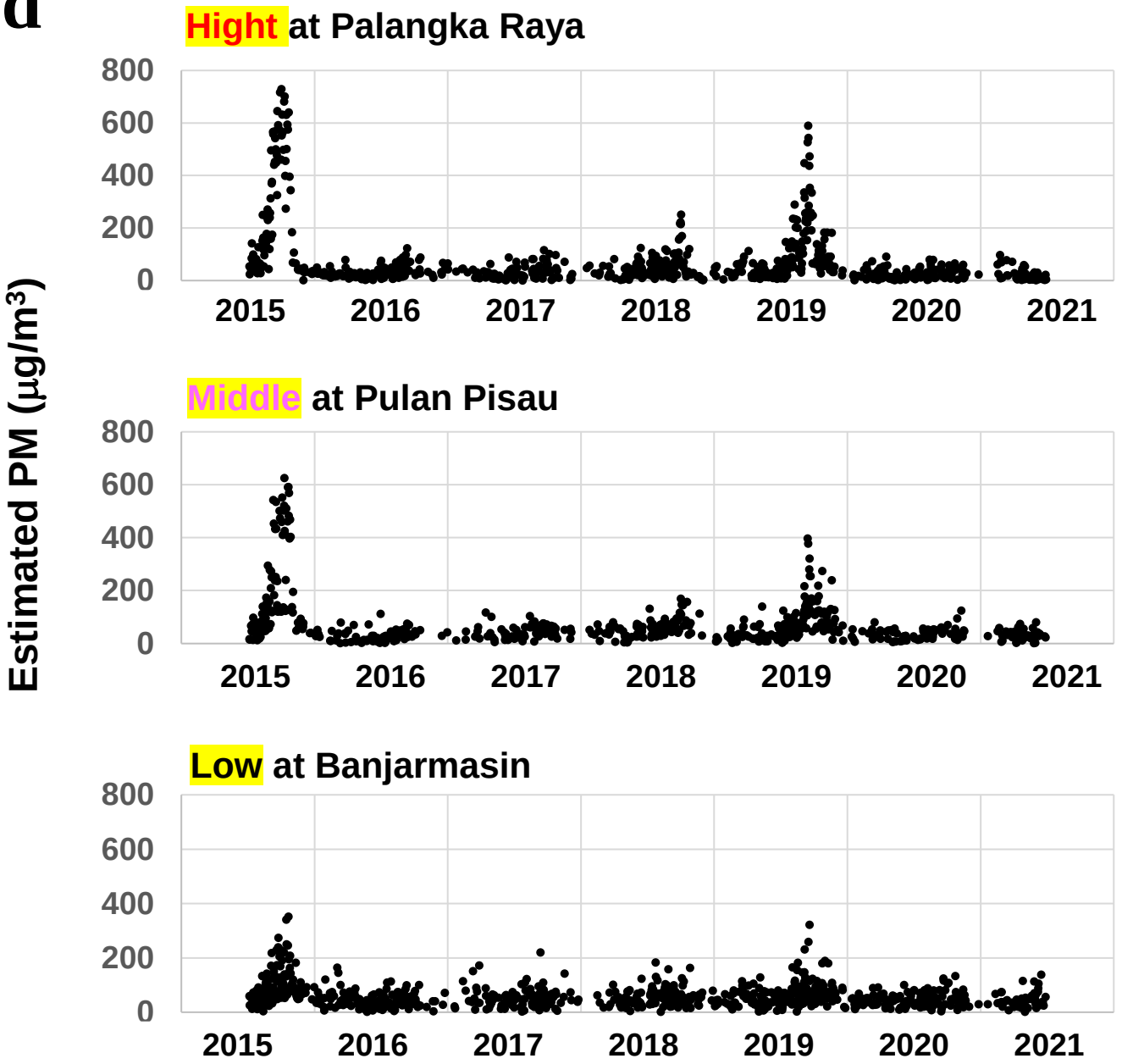


Ohashi et al. in a book (Vadrevu and Ohara, Ed.)

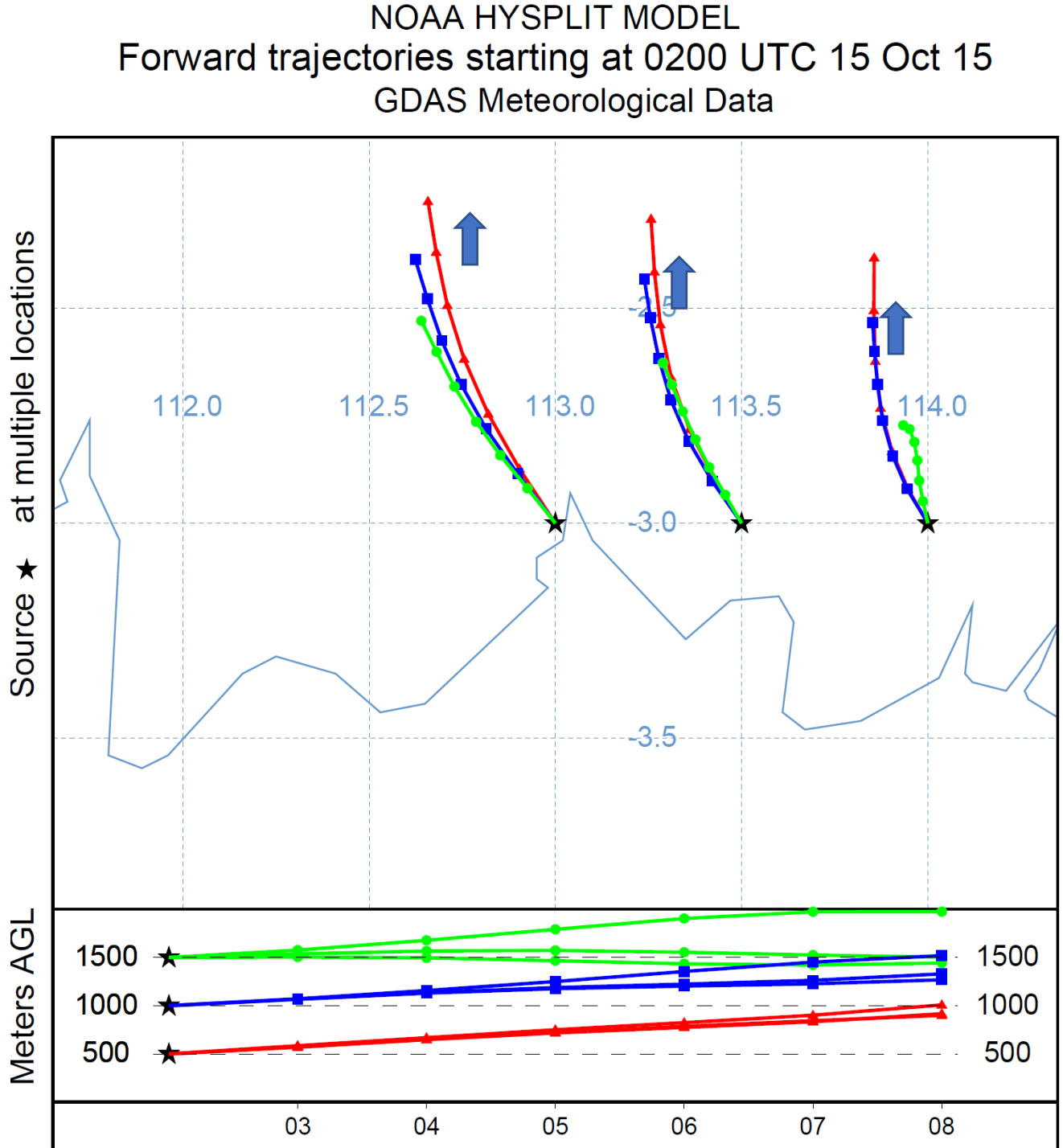
Conversion curve of Himawari albedo data to AOD with use of NASA AERONET AOD data



PM concentration estimated from satellite AOD



Conversion factor from Syafrijon et al., *Oriental. J. Chem.*, **34**, 2163 (2018)

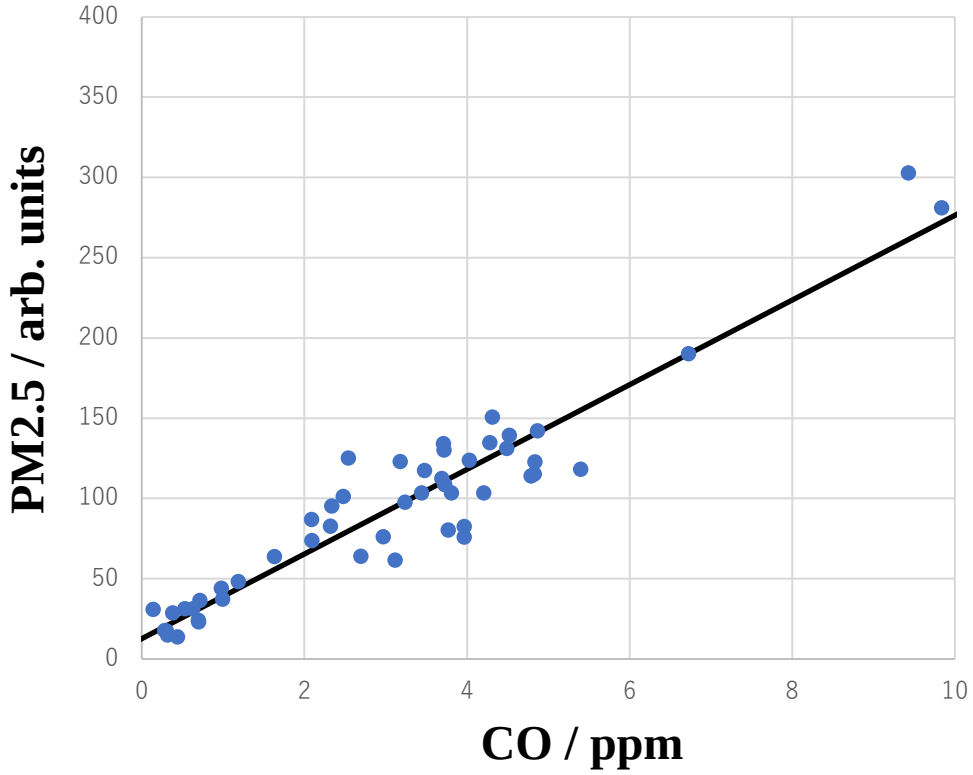


Seasonal wind blows PM toward Palangka Raya from fire area, which enhances pollution

Emission factor (ground data)

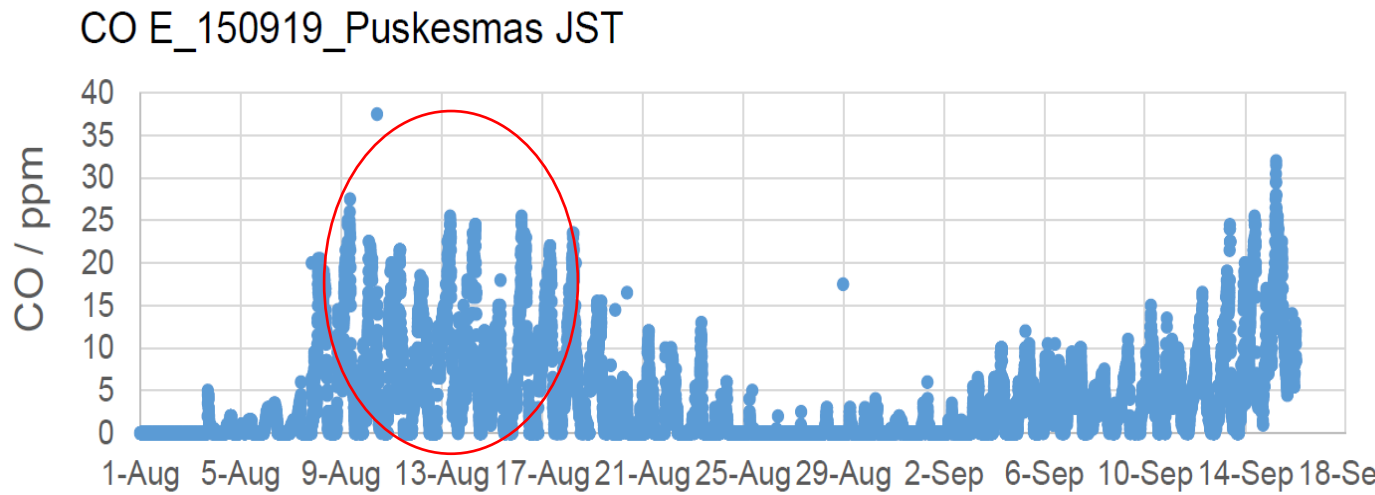
$PM_{2.5}$ (raw data) *vs* CO (ppm) @DLH

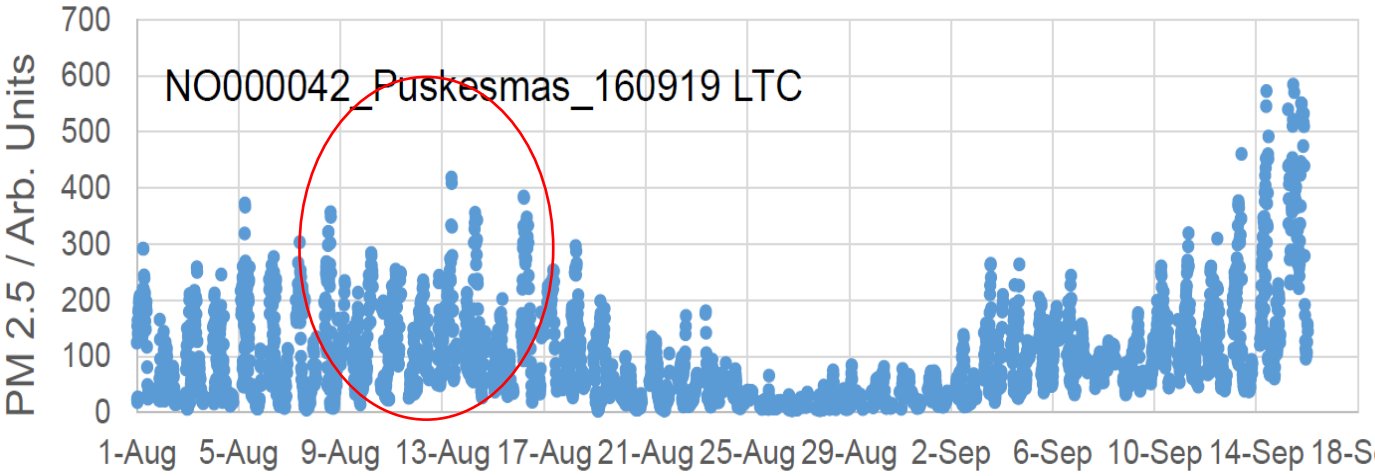
$R = 0.95 +- 0.02$



Ohashi et al. in a book (Vadrevu and Ohara, Ed.)

CO & PM at DLH in PKY city area





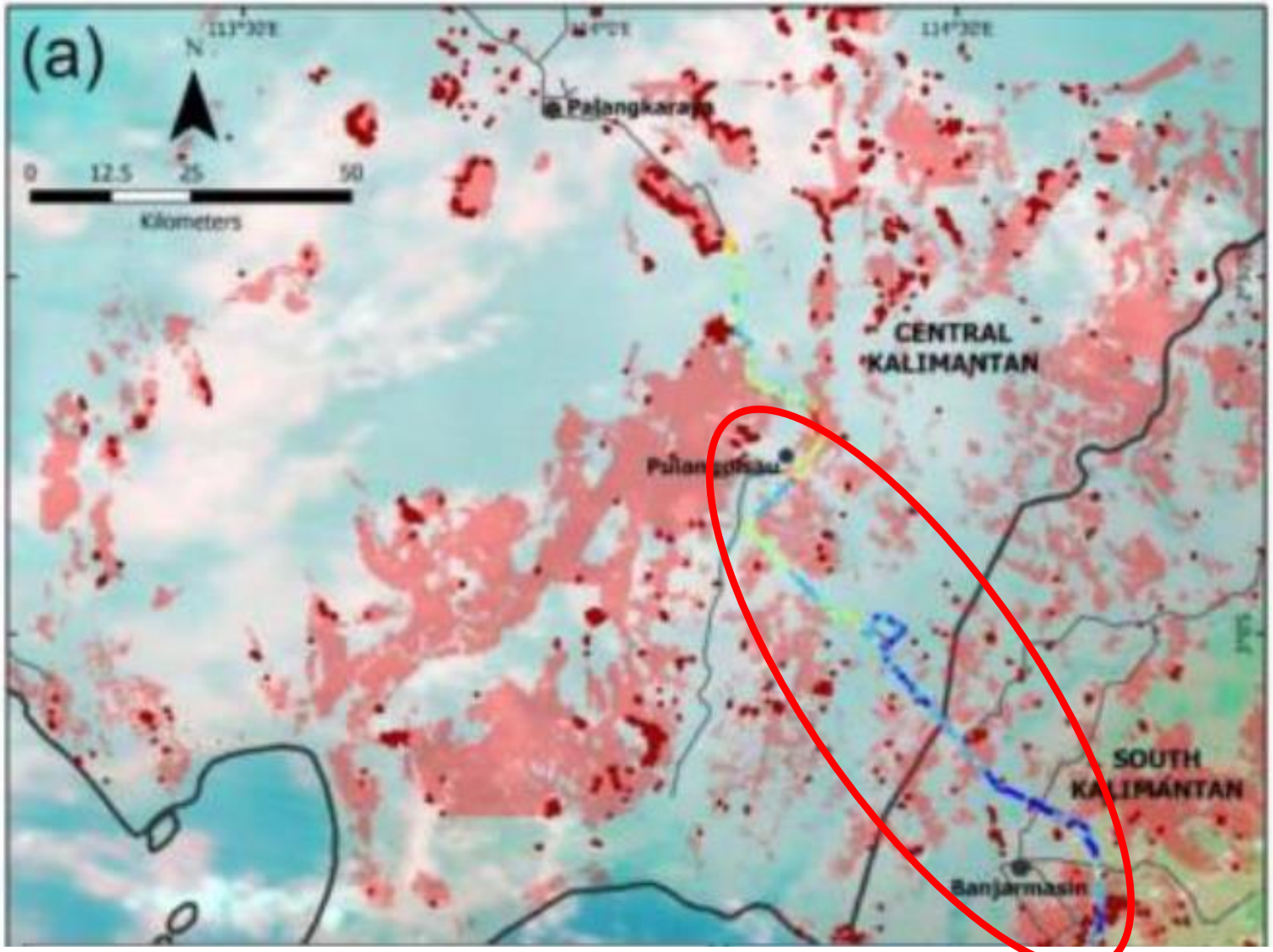


Figure 11. Transect-based measurements of trace gases and particulates conducted on 11 October 2015 during a 9-h drive from Banjarmasin to Palangkaraya. (a) CO measures made along the transect,

M.J. Wooster et al., *Remote Sens.*, 10, 495 (2018)

Summary and Acknowledgments

Air quality has been measured in Central Kalimantan with ground-based and satellite sensors.

We thank JMA Japan, BMKG Indonesia and NASA & NOAA USA for data use.

This research was financially supported by RIHN, JST, Sumitomo Co. and IHI.