



Long-term aerosol physical properties from AERONET monitoring in Thailand

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P.Pankaew, O.Aumporn, Y.Boonrod, S.Janjai

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Nakhon Pathom, Thailand**

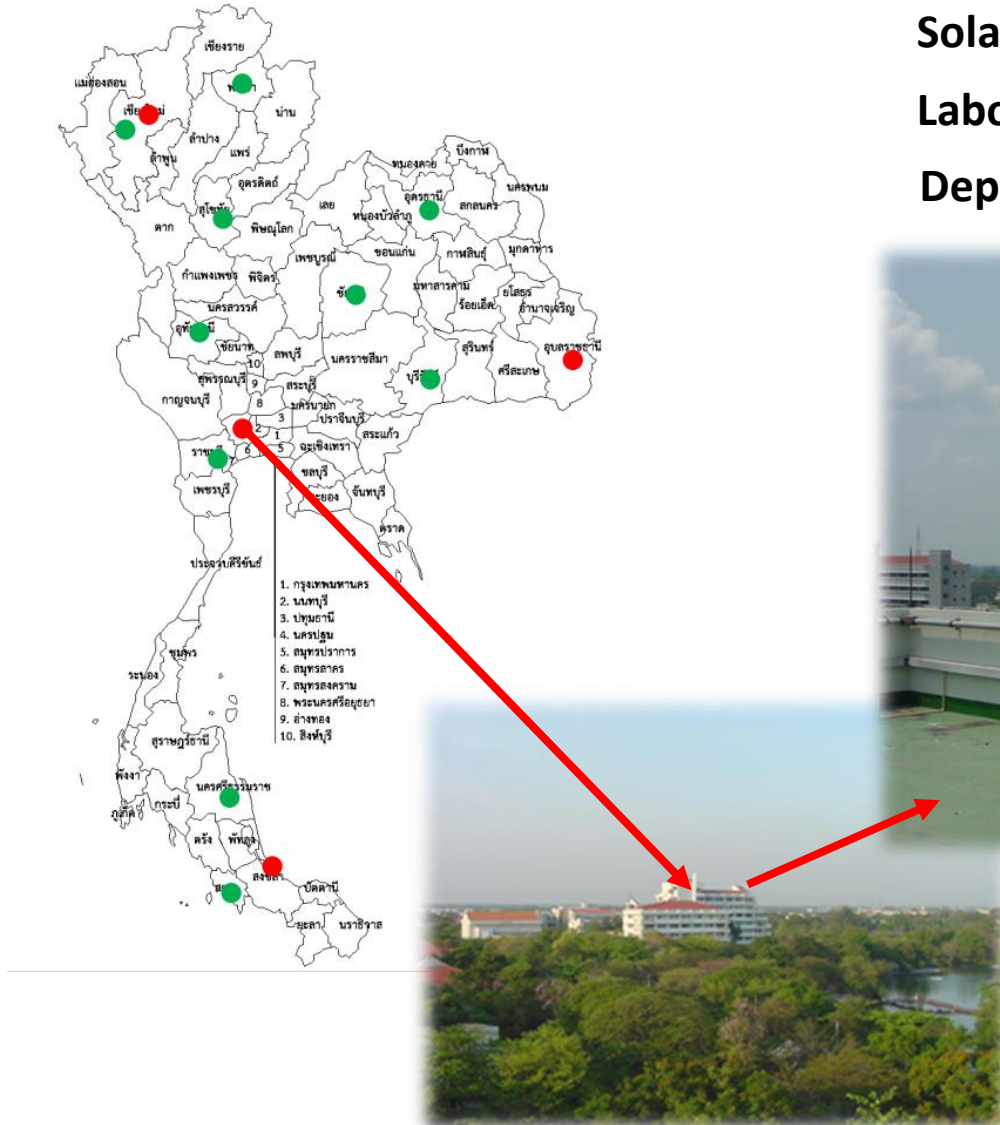
**AERONET Science and Application Exchange 2024
September 17-19, 2024
UMD Alumni Center, 7801 Alumni Dr., College Park, MD 20742**

Outline

- **Background of Our Research Group**
- **AERONET Sites in Thailand**
- **Variations in Aerosol Properties (AOD, SSA, Size distribution)**
- **Trends of AOD**
- **Classification of Aerosol Types**
- **Depletion of Solar UV Radiation Due to AOD**

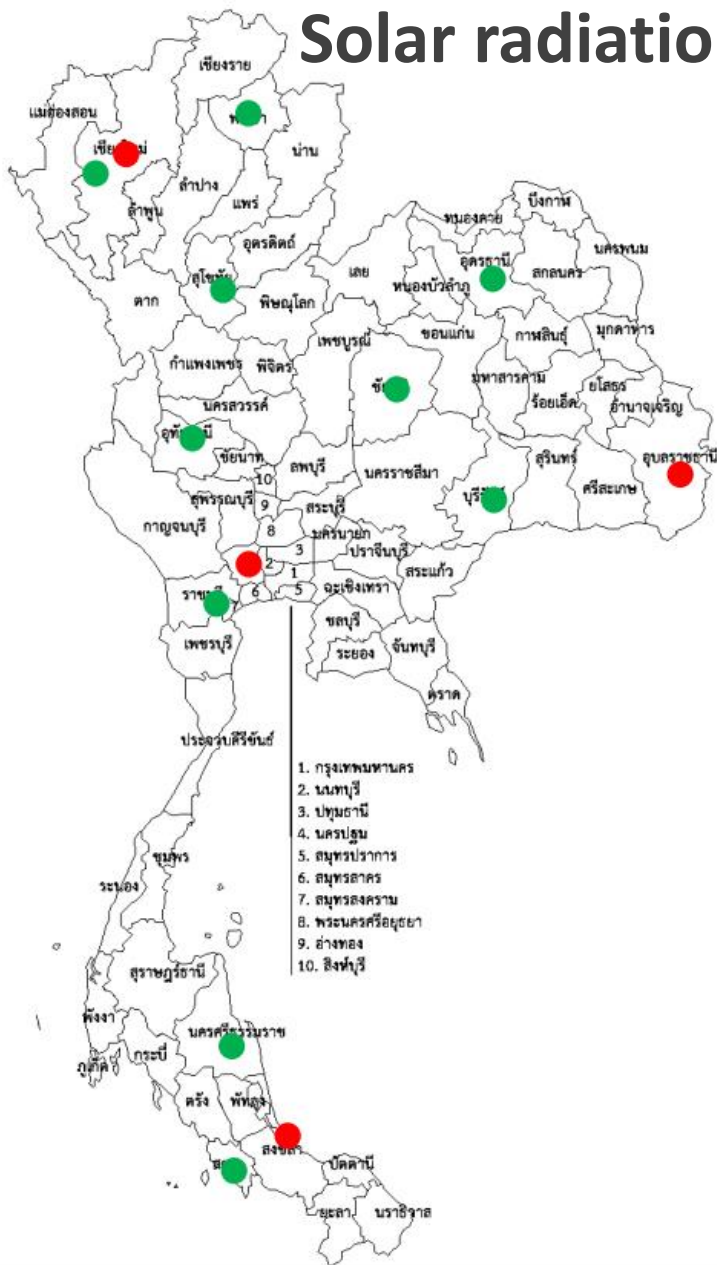
• Background of Our Research Group

**Solar Energy Research Laboratory &
Laboratory of Tropical Atmospheric Physics (1979)
Department of Physics, Faculty of Science, Silpakorn University**



- Academic staffs
- Technician staffs
- Master and Ph.D. students

Solar radiation monitoring sites of Silpakorn University



Chiang Mai
(at TMD)



Nakhon Pathom
(at Silpakorn University)



Ubon Ratchathani
(at TMD)



Songkhla
(at TMD)

- **The AERONET sites in Thailand**

Aerosol monitoring

MFR-7



1998

2006



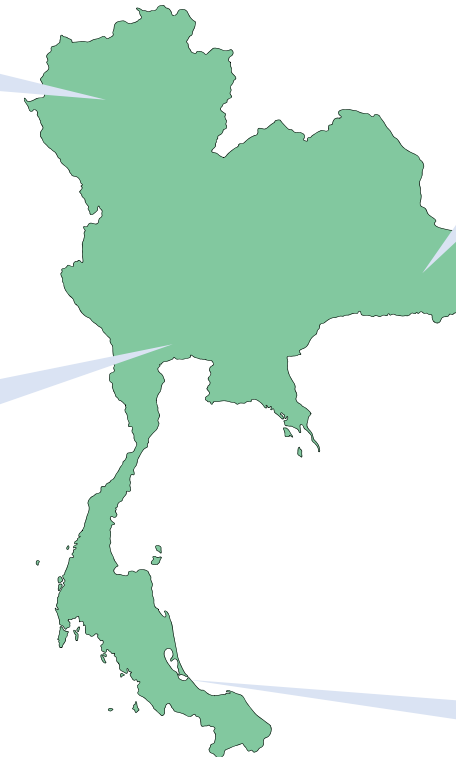
Chiang Mai

2006



Silpakorn University

Sunphotometer



2009



Ubon Ratchathani

2007



Songkhla

7SEAS (2007)



Agreement between NASA and Silpakorn University (2011)



- AERONET
- MPLNET



- The AERONET sites in Thailand



Chiang Mai



Chiang Dao



Doi Ang Khang



Nongkhai



Ubon Ratchathani



Nakhon Pathom



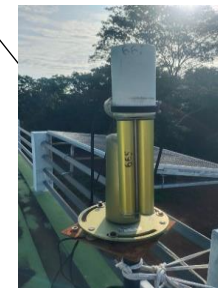
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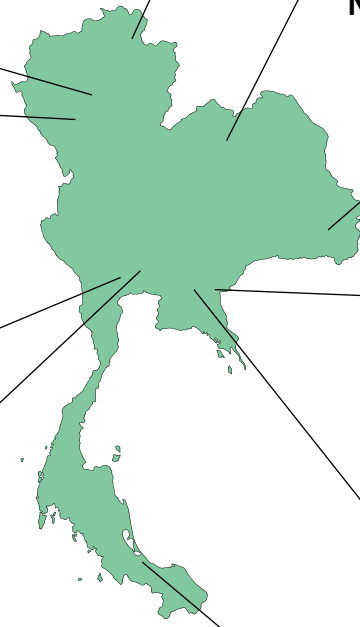
Bangkok



Songkhla



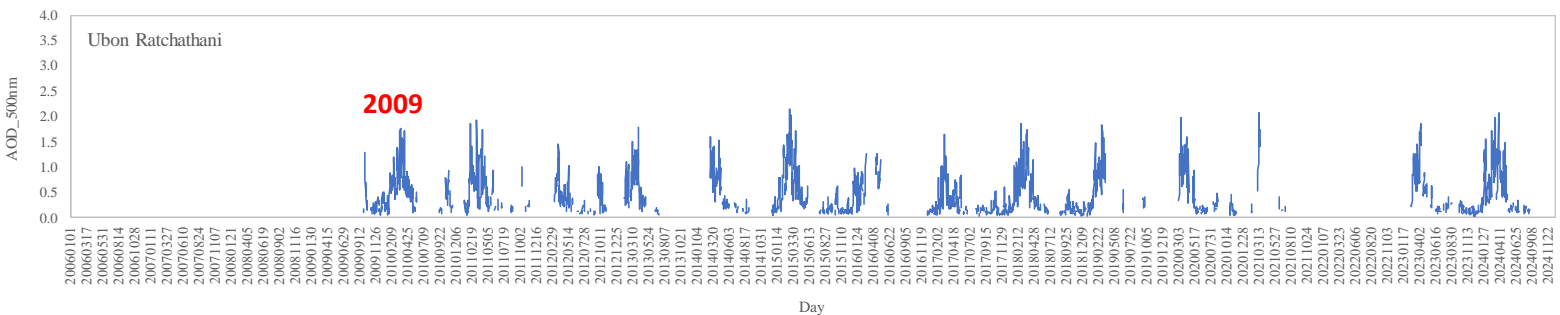
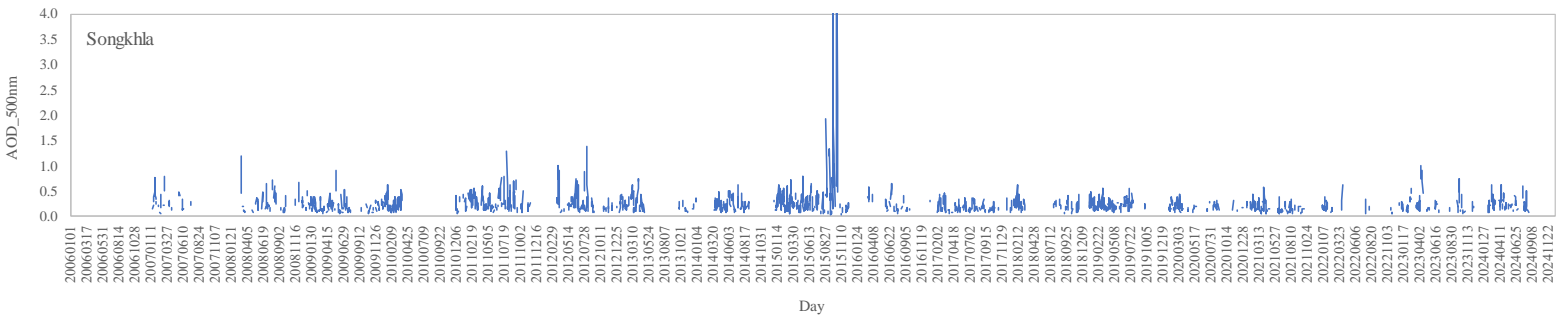
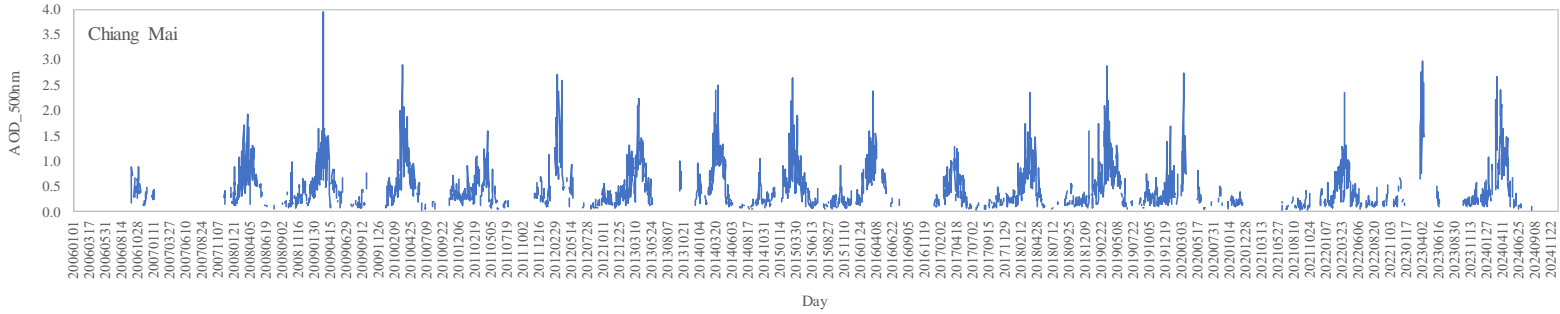
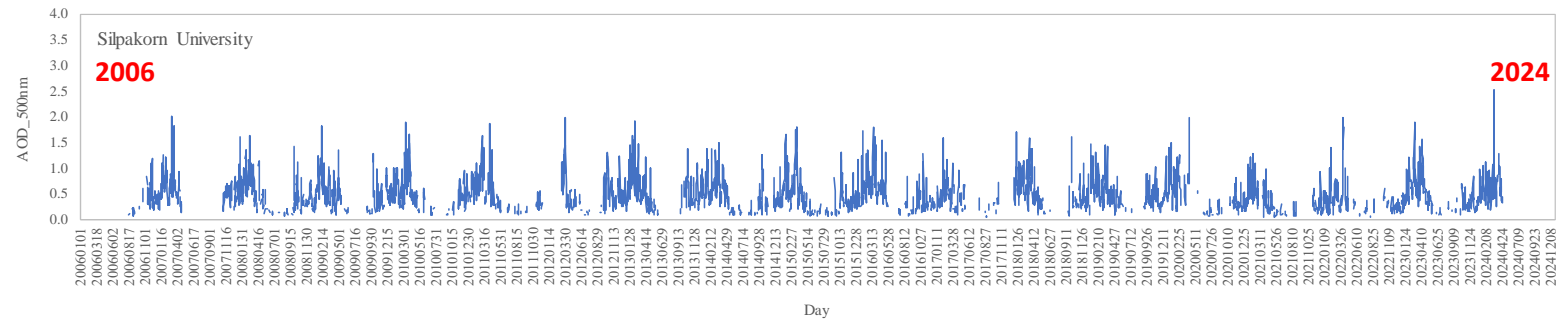
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Bangkok

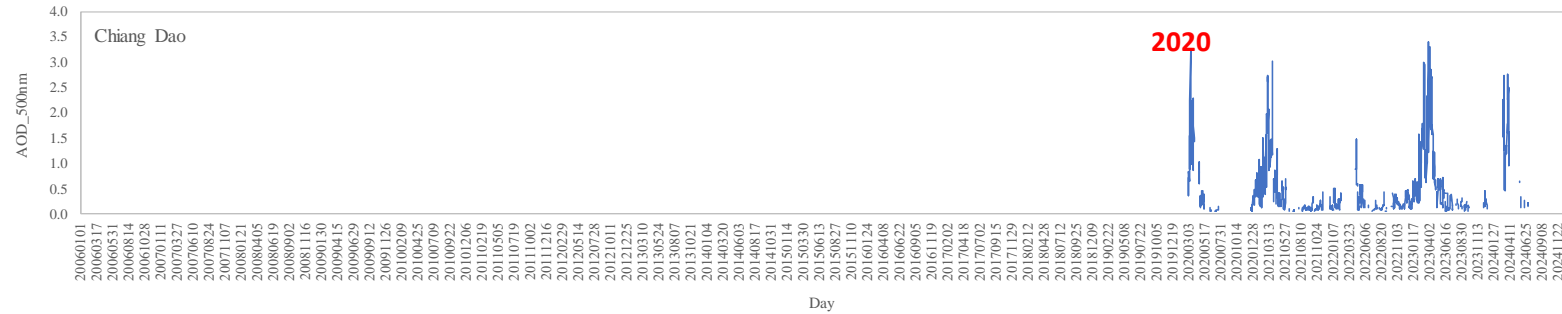
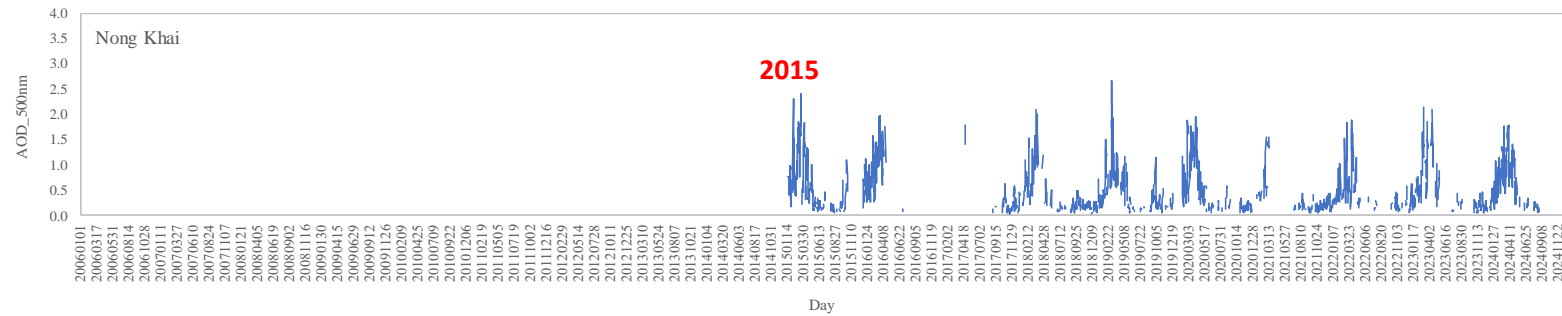
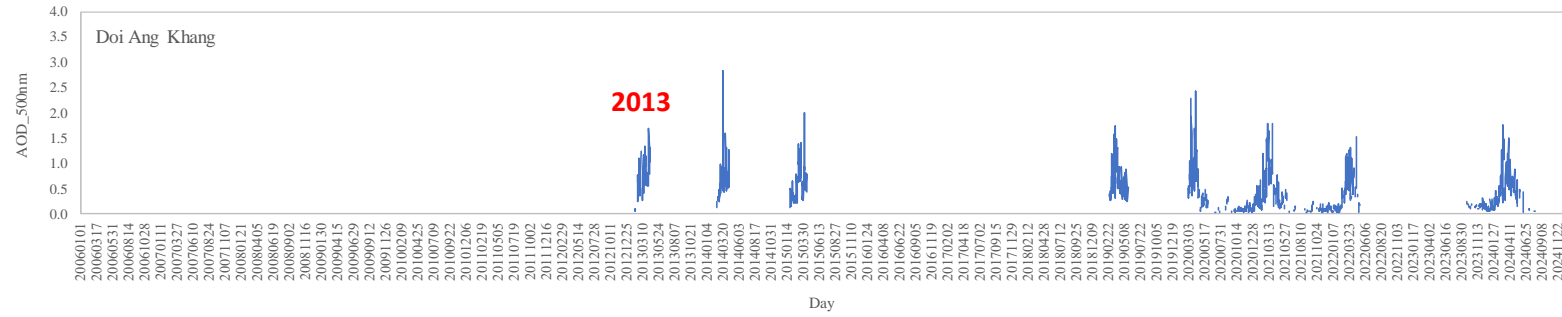
- The Variations in Aerosol Properties

Aerosol Optical Depth (AOD)



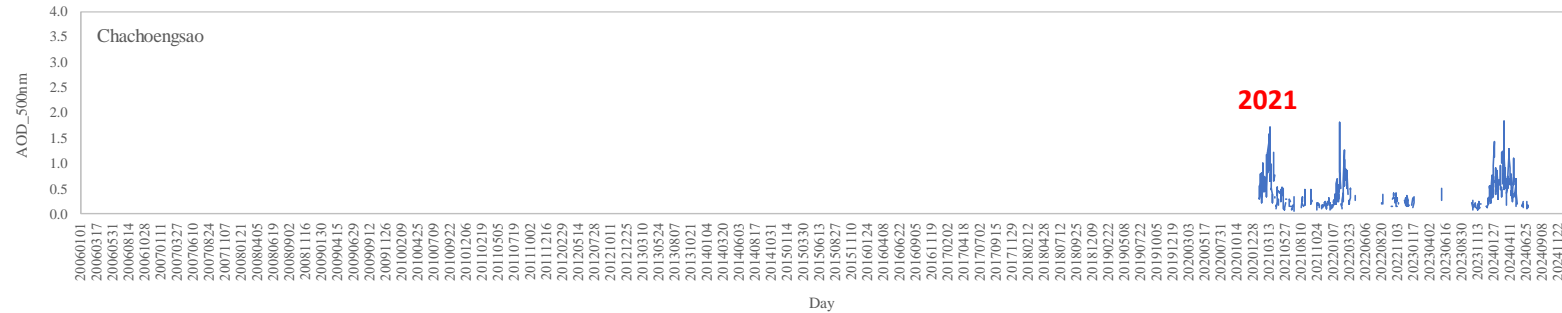
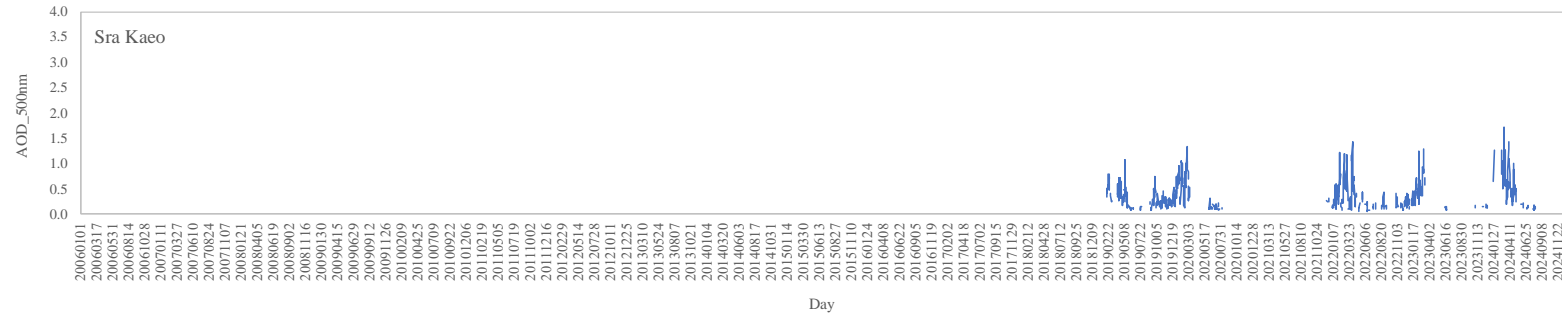
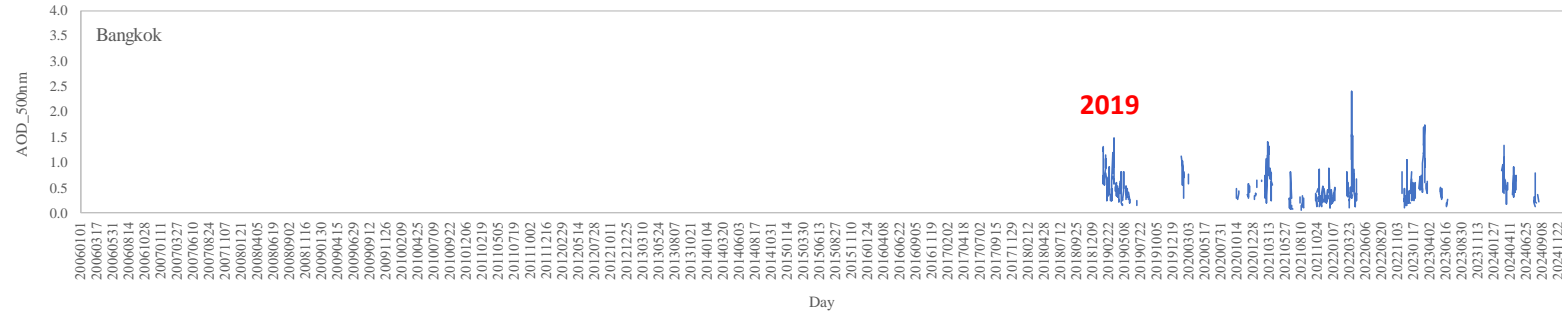
- The Variations in Aerosol Properties (cont.)

Aerosol Optical Depth (AOD)

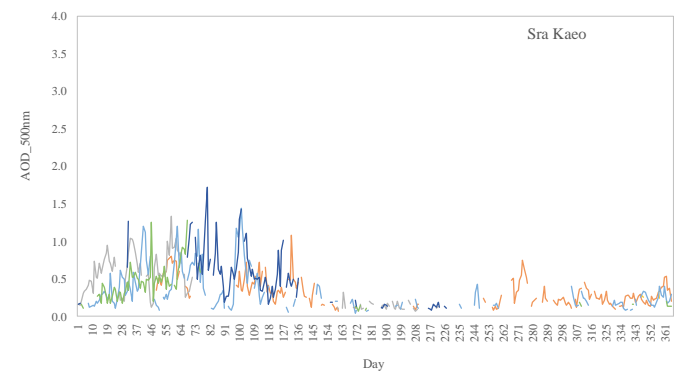
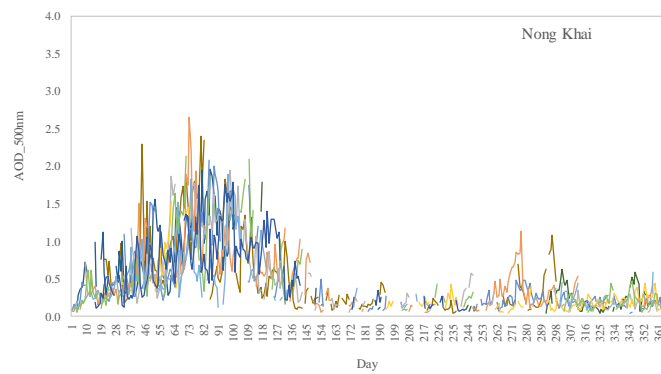
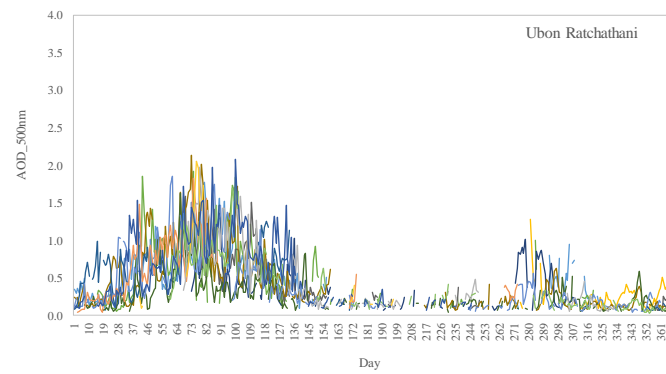
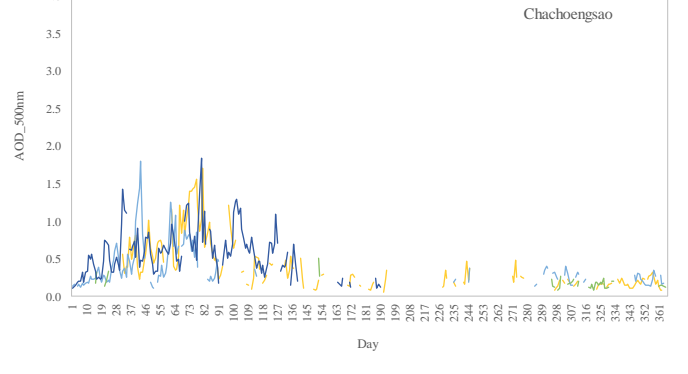
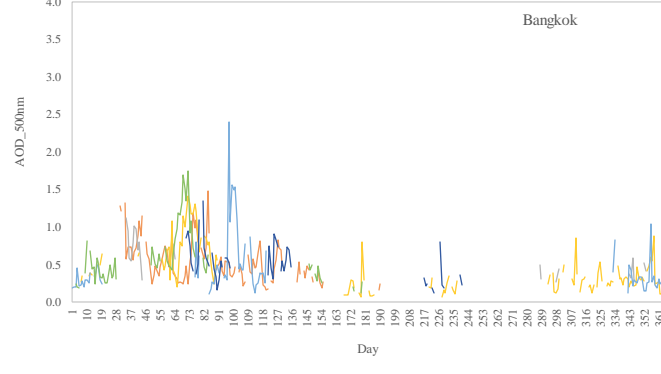
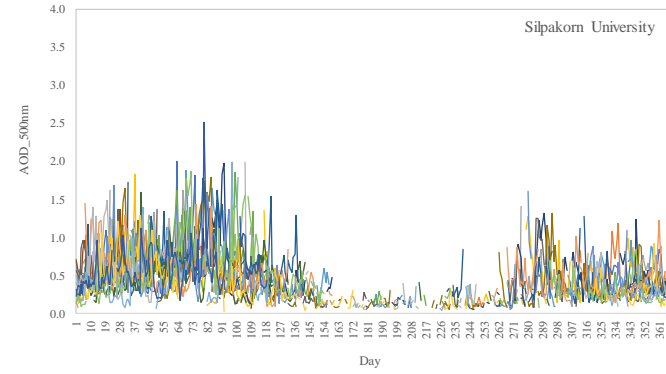
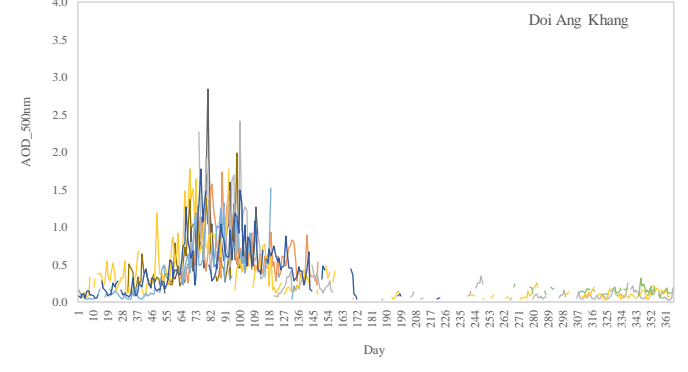
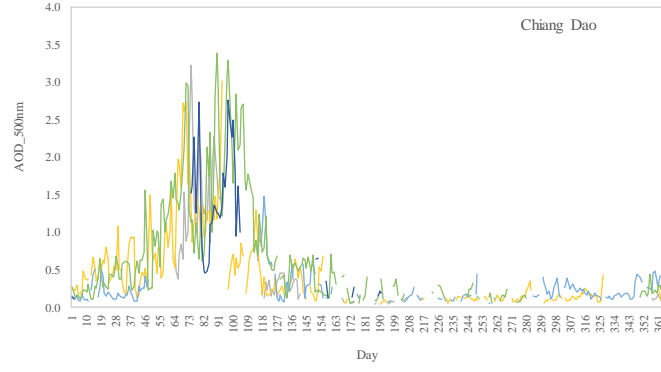
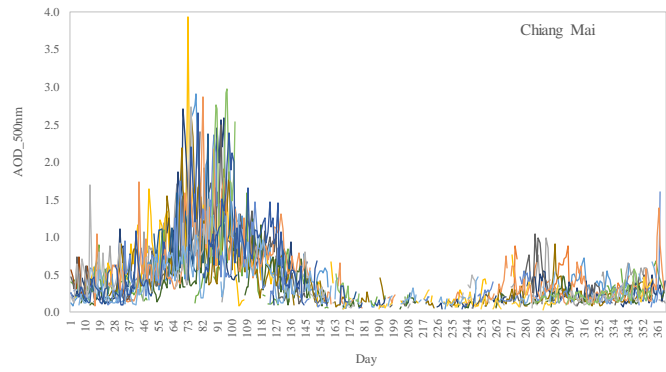


- The Variations in Aerosol Properties (cont.)

Aerosol Optical Depth (AOD)



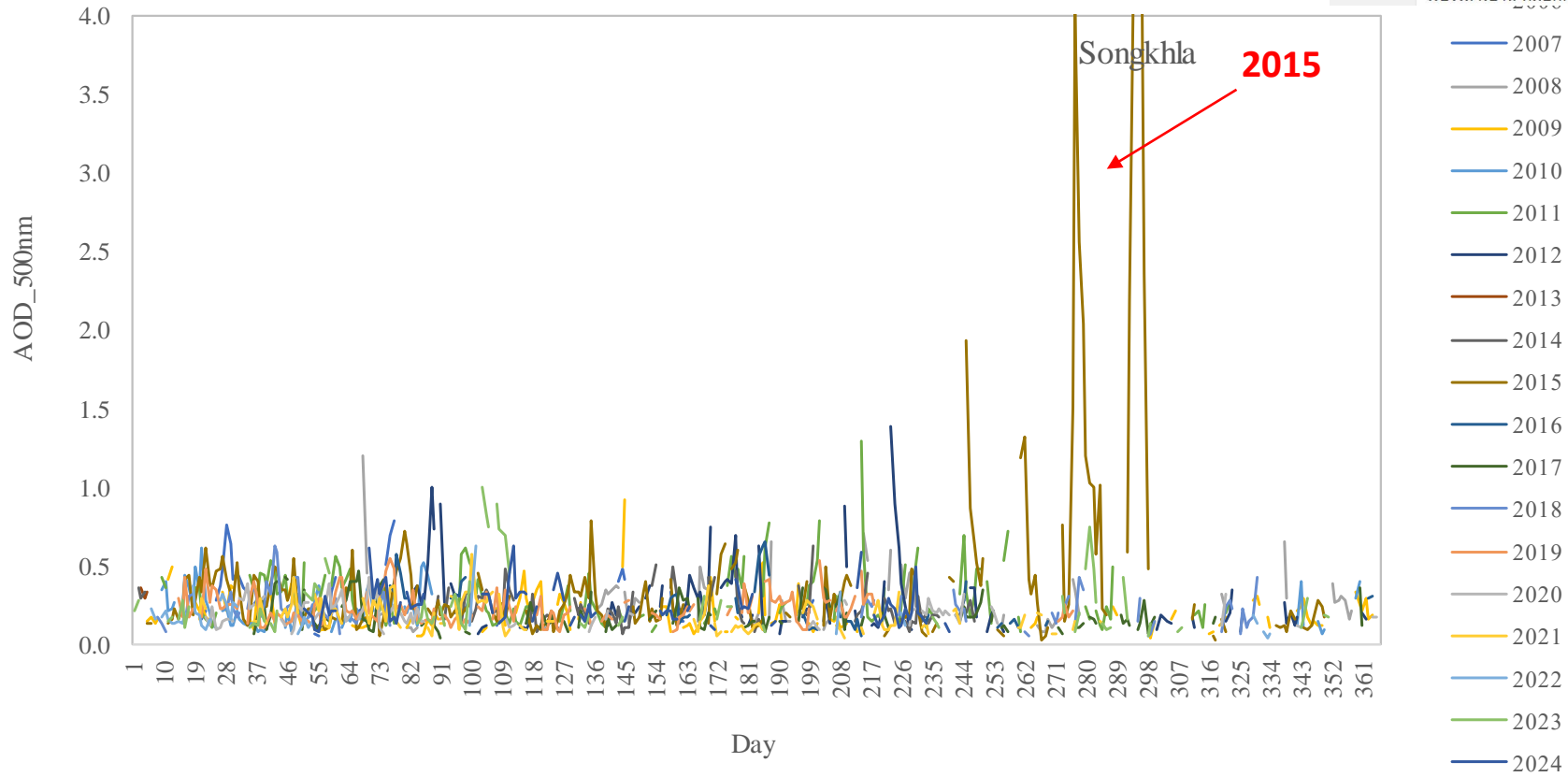
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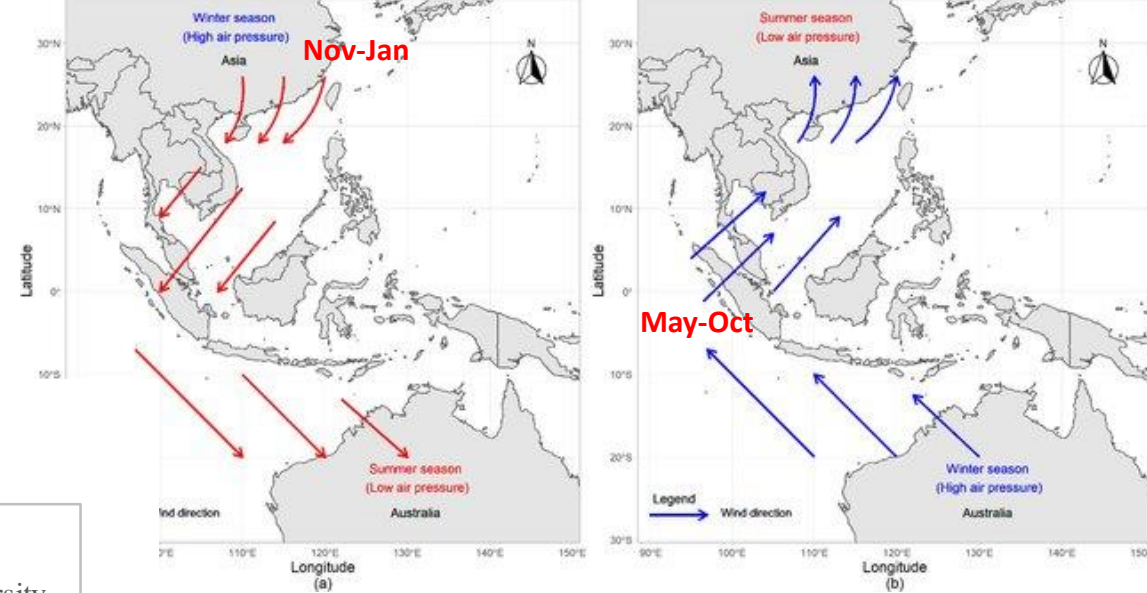
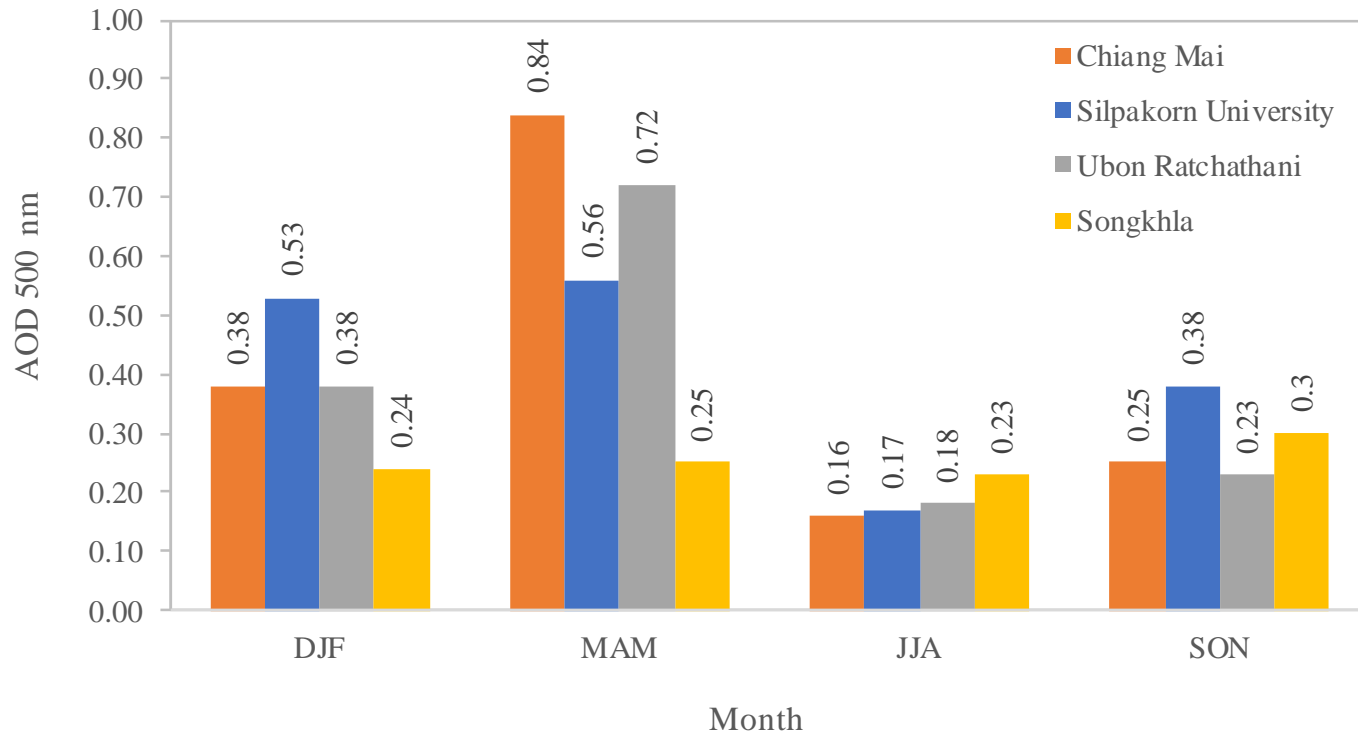
The Variations in Aerosol Properties (cont.)



เรื่องเล่าเช้านี้ หมอกควันไฟป่าอินโดนีเซียปกคลุมภาคใต้ (5 ต.ค.58)

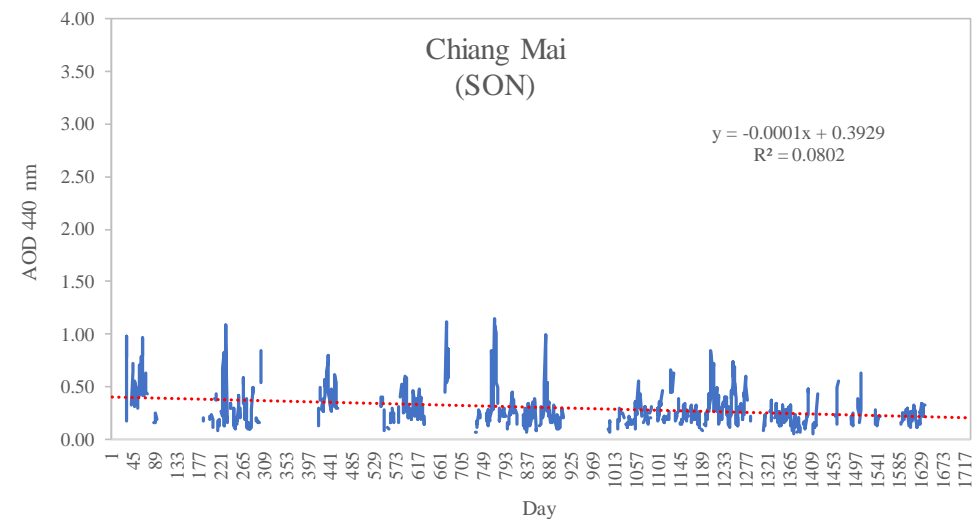
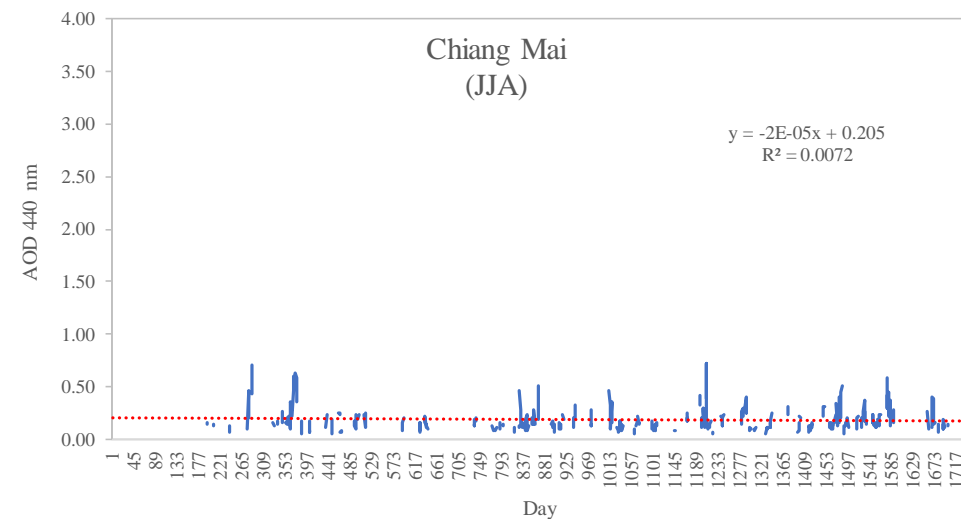
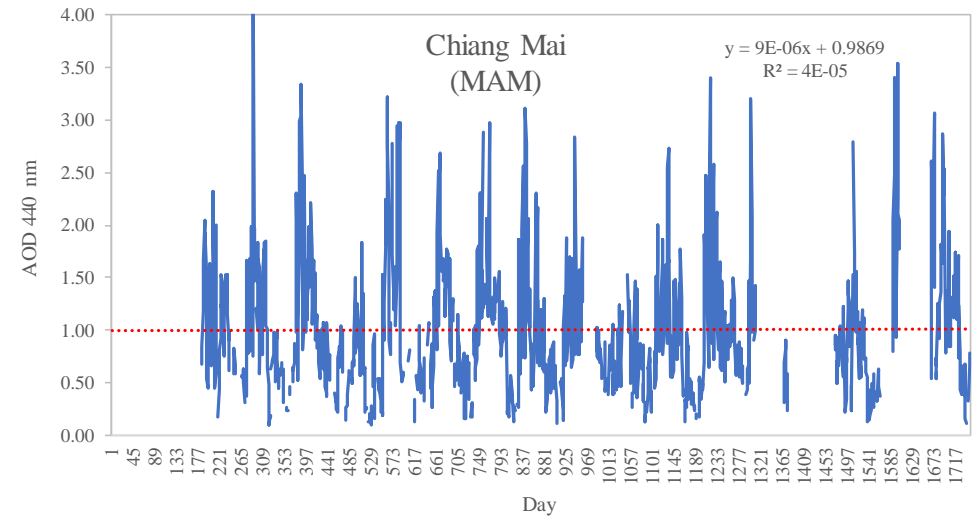
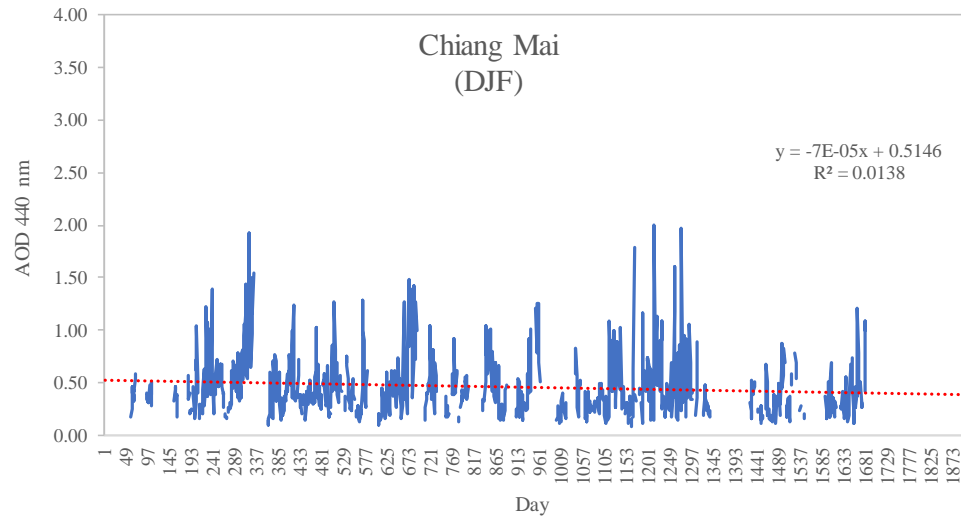


The Variations in Aerosol Properties (cont.)

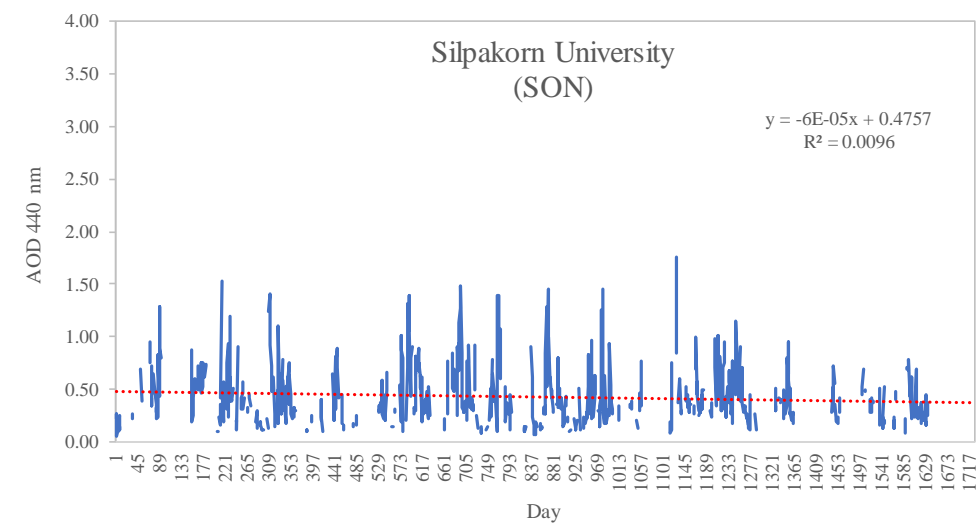
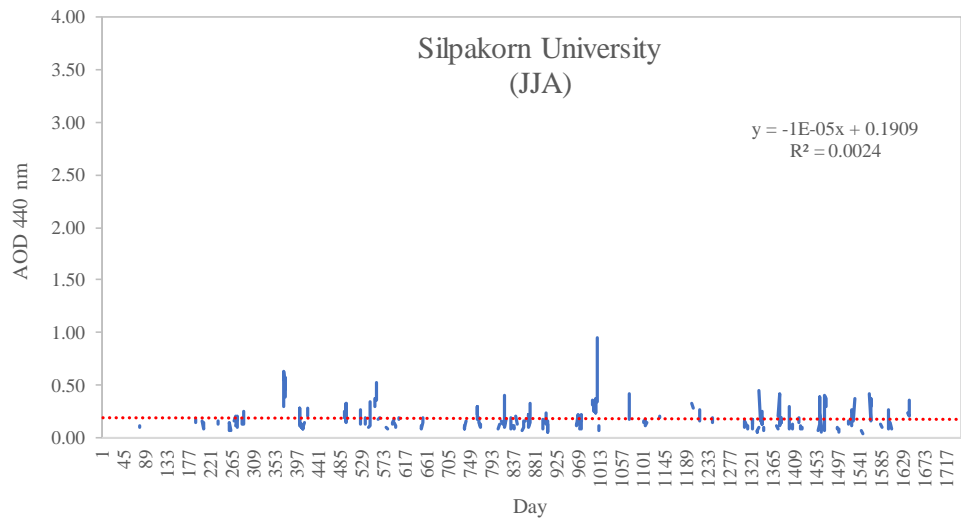
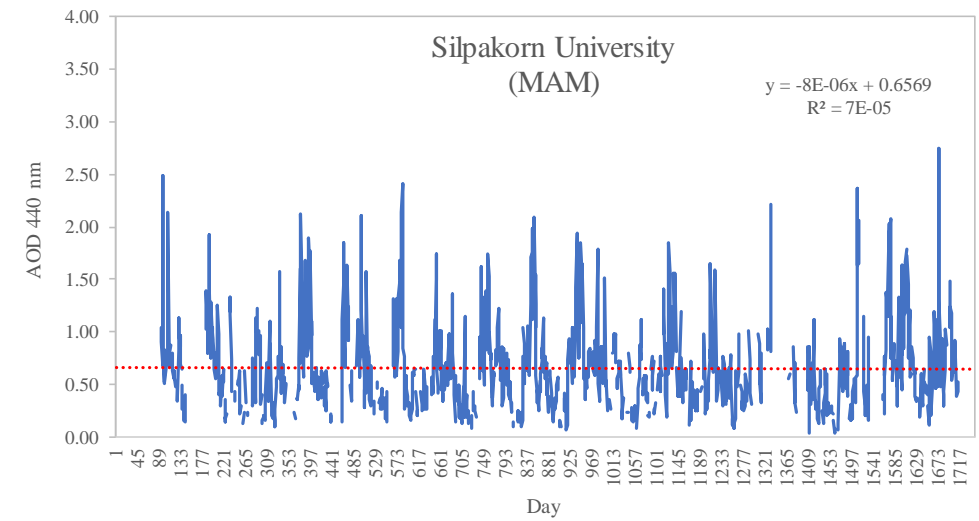
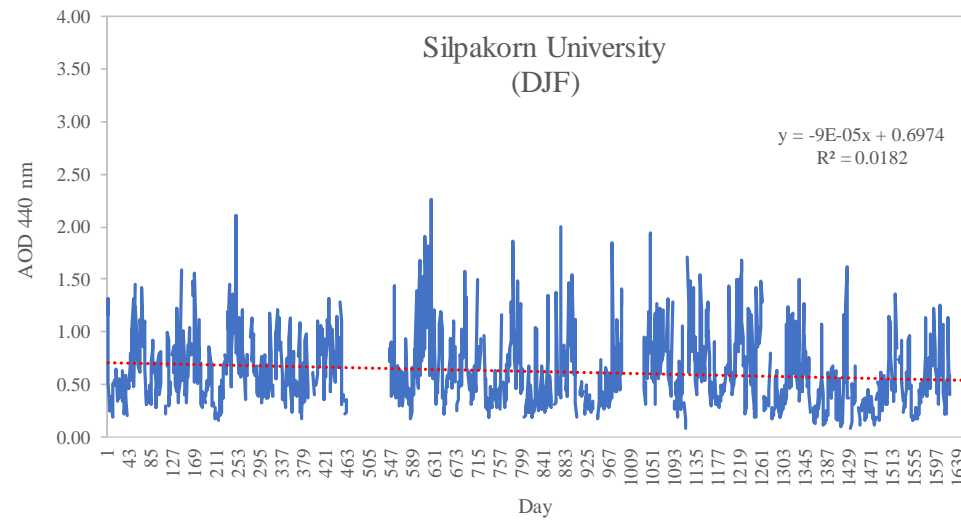


- Local monsoons in Thailand**
- Northeast monsoon (Nov-Jan)
 - Southwest monsoon (May-Oct)

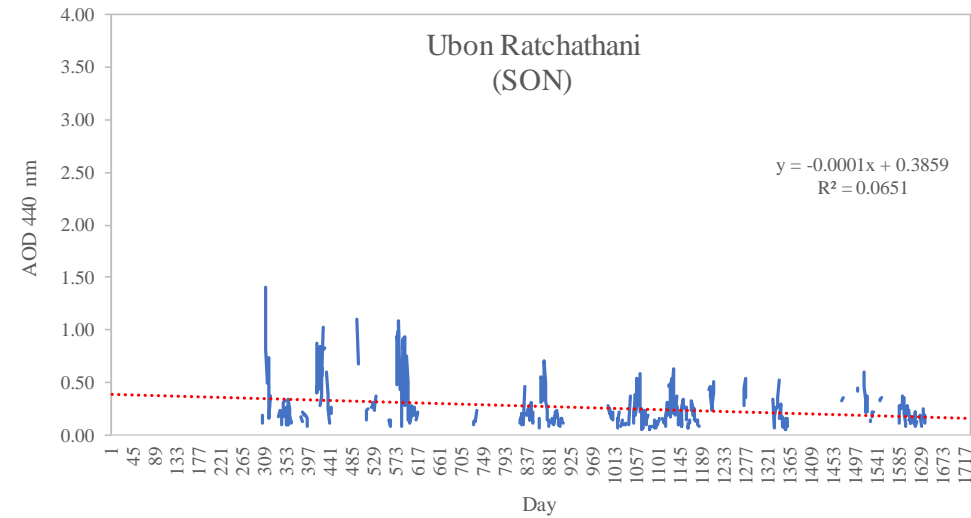
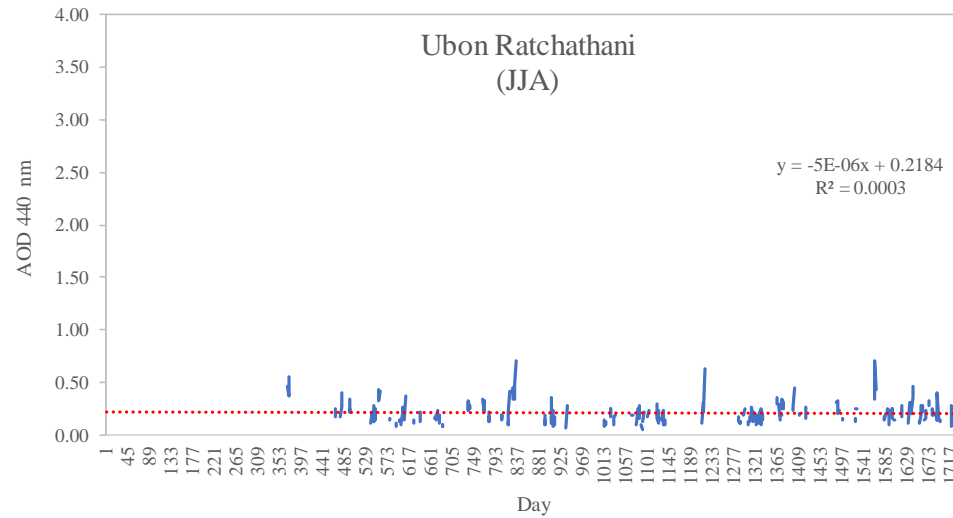
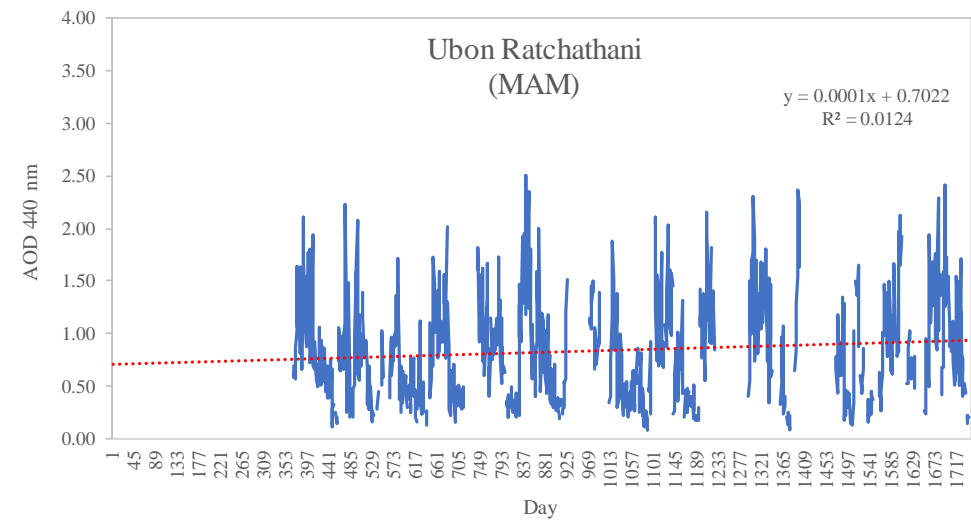
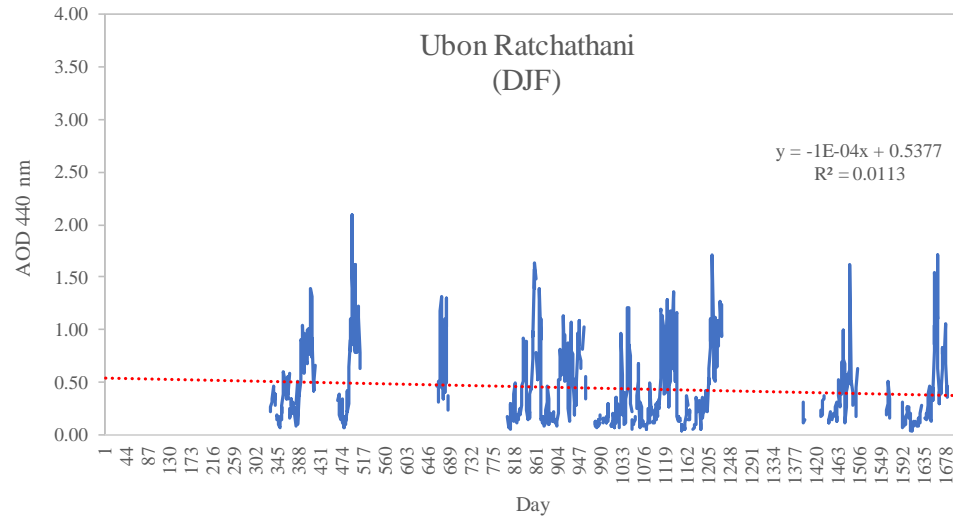
- Trends of AOD



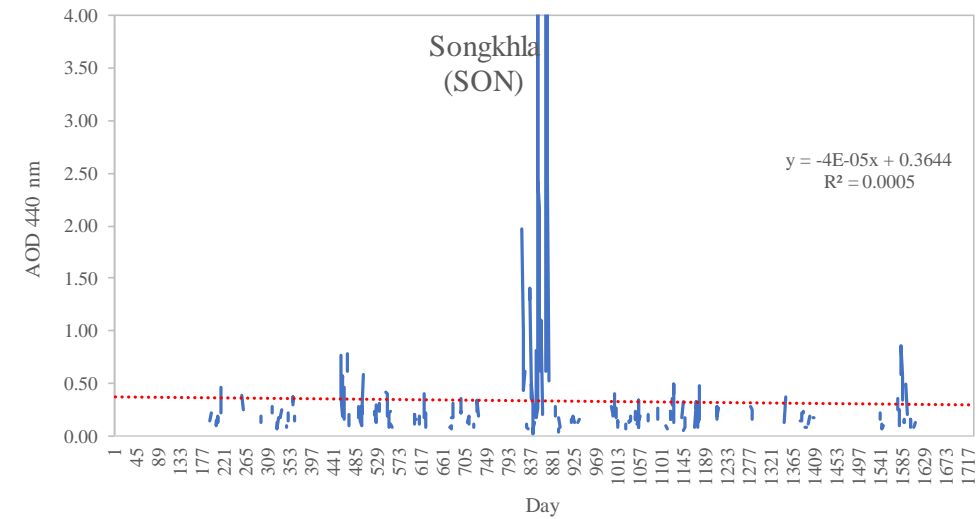
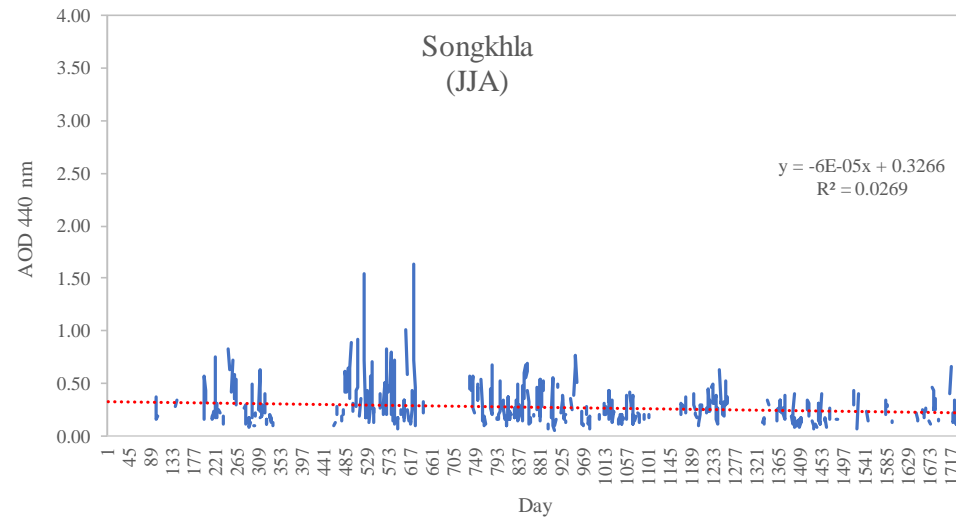
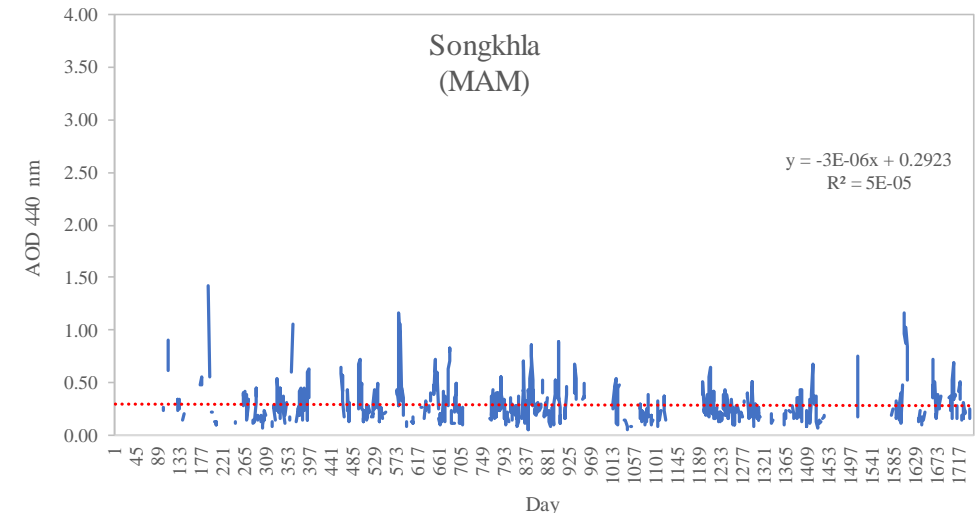
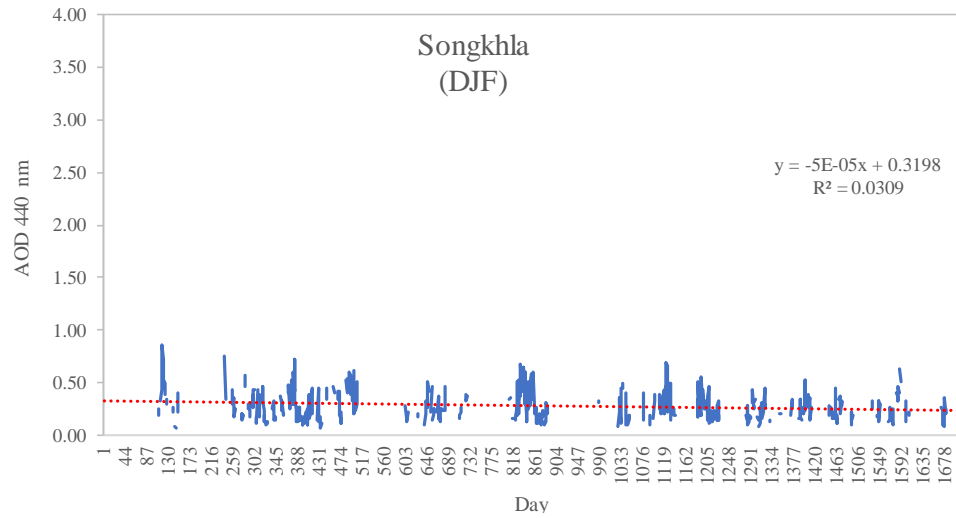
Trends of AOD



Trends of AOD

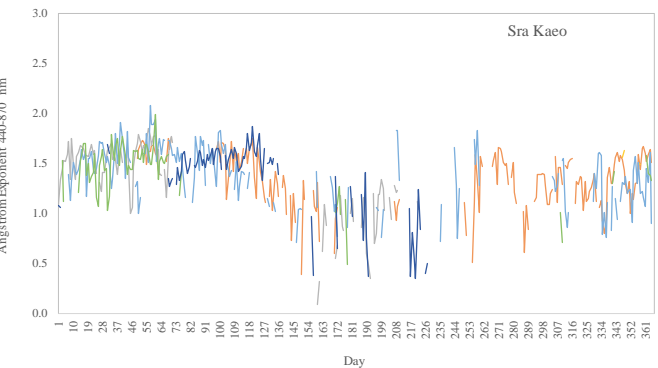
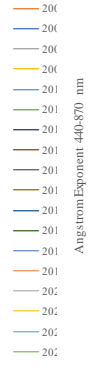
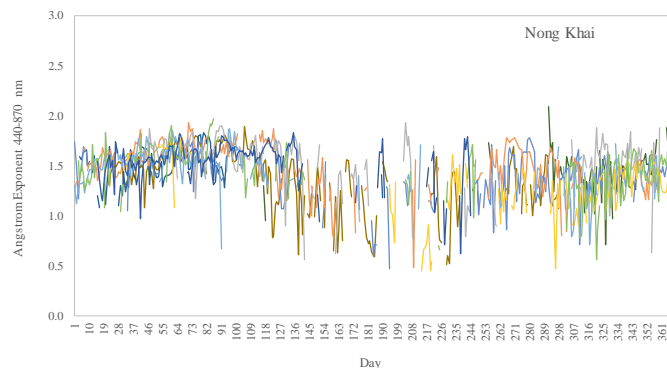
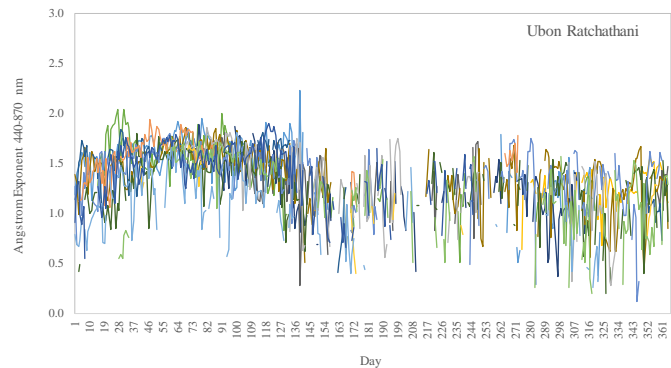
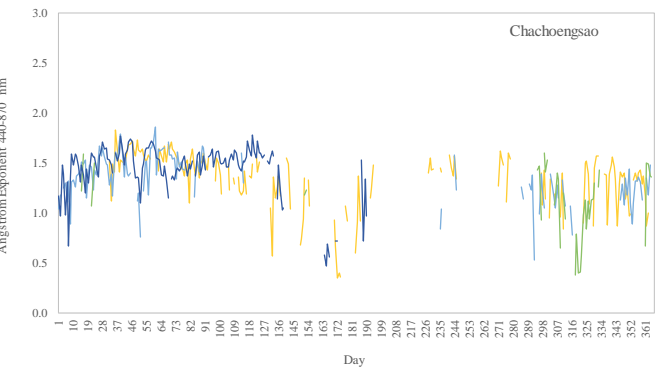
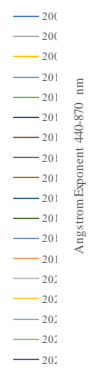
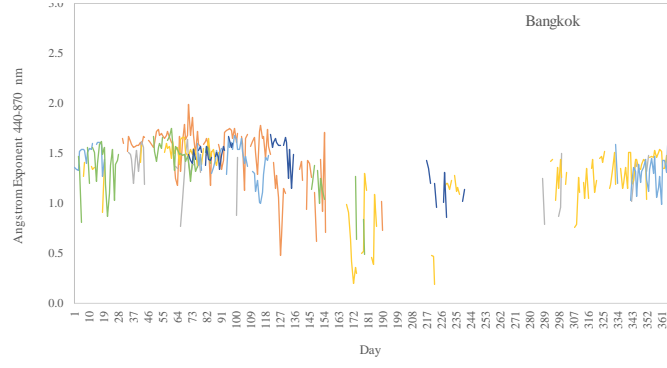
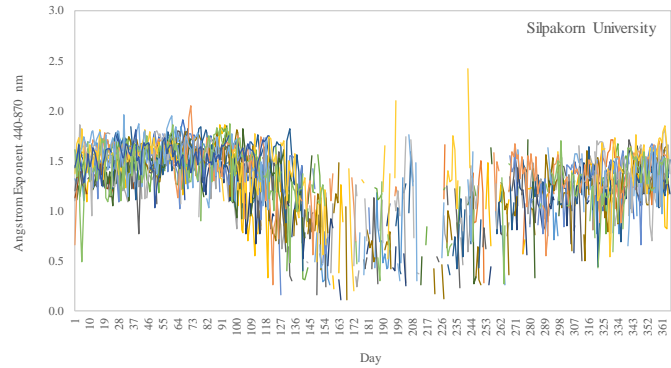
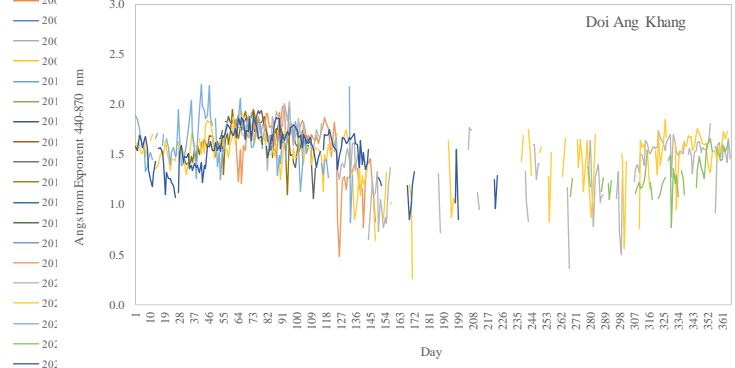
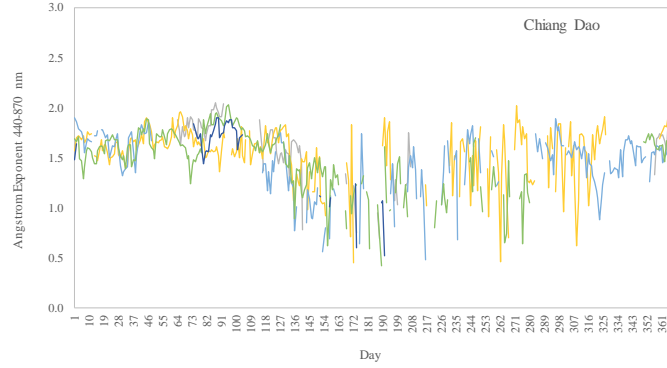
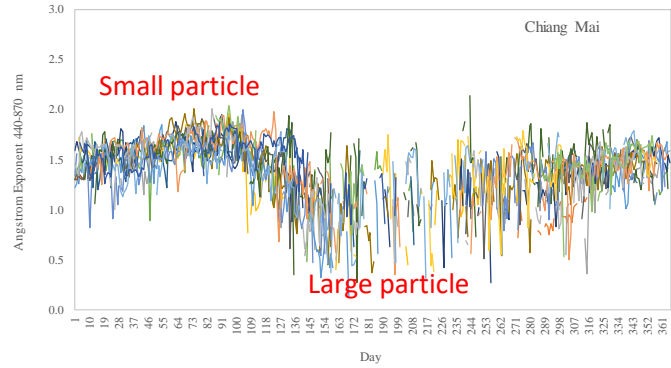


Trends of AOD



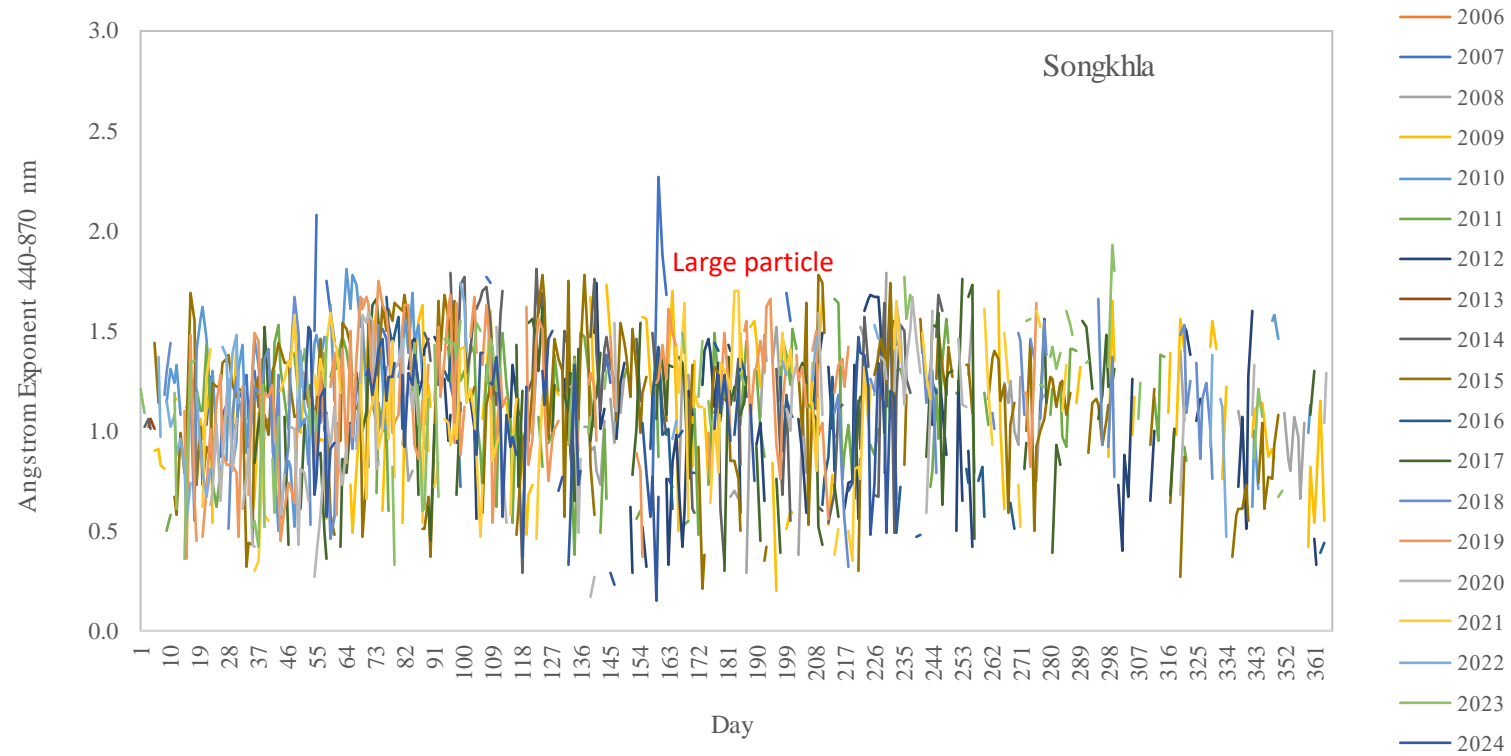
The Variations in Aerosol Properties (cont.)

Aerosol Angstrom Exponent ($\alpha_{440-870nm}$)



- The Variations in Aerosol Properties (cont.)

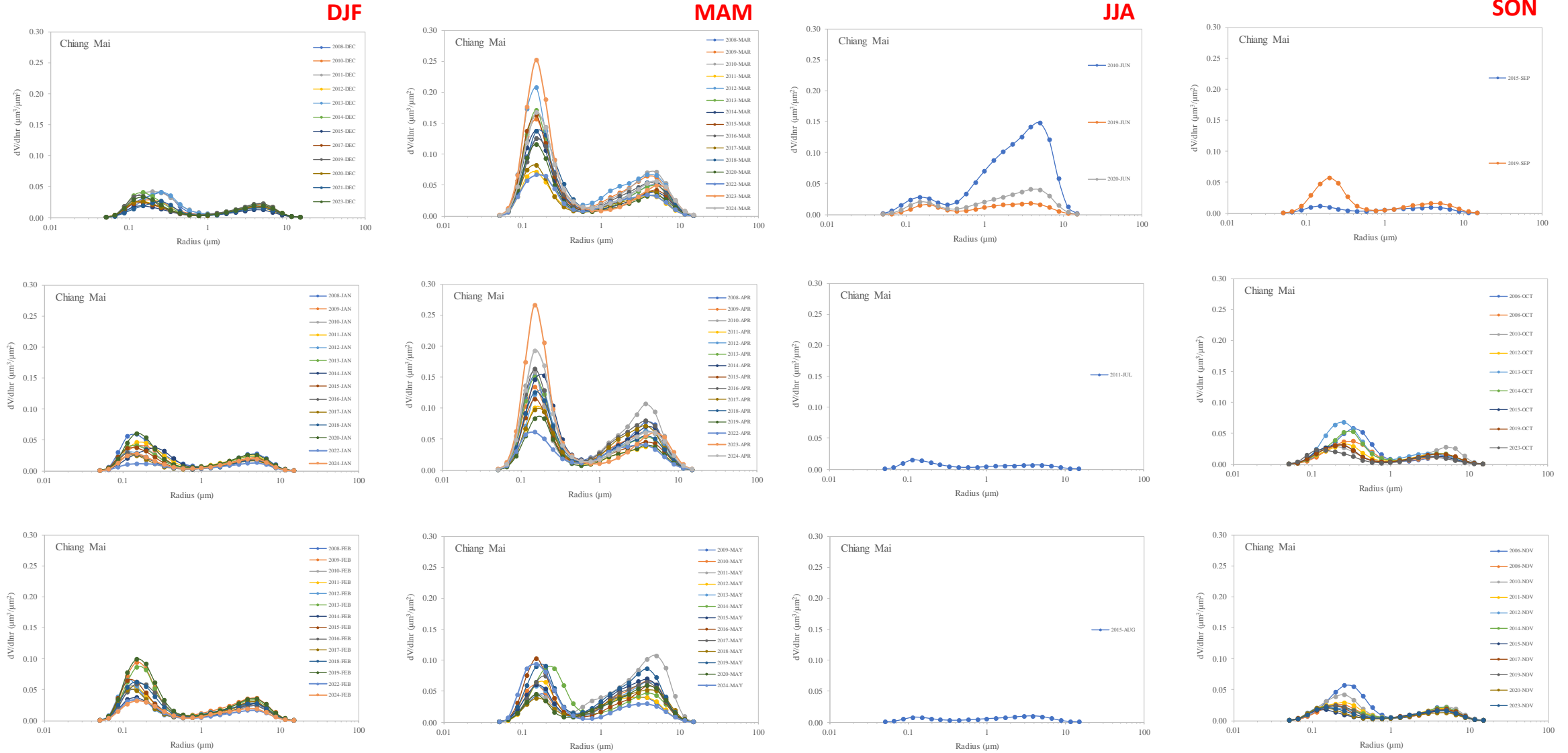
Aerosol Angstrom Exponent ($\alpha_{440-870\text{nm}}$)



The Variations in Aerosol Properties (cont.)

Aerosol Size Distribution

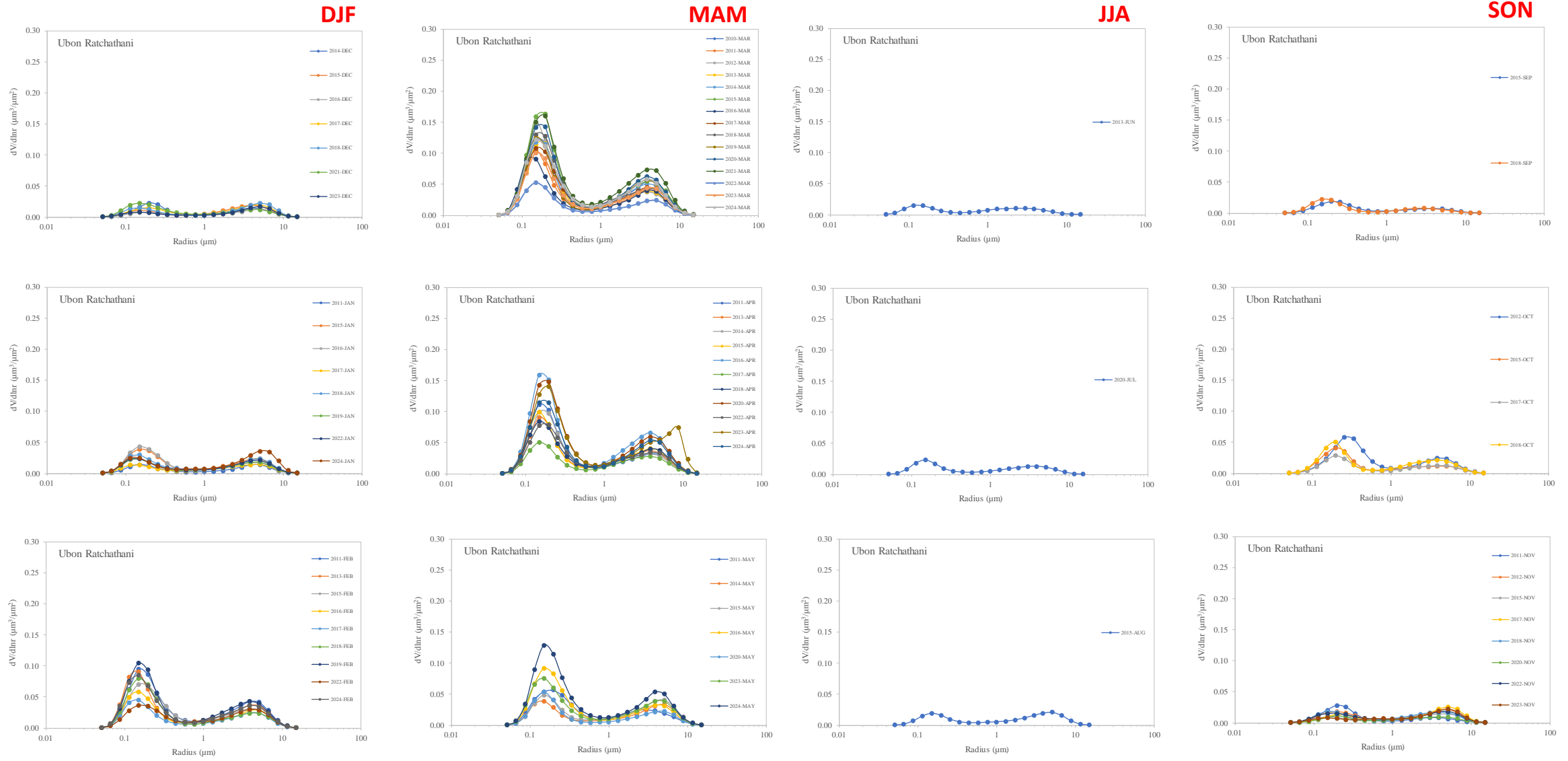
Chiang Mai



The Variations in Aerosol Properties (cont.)

Aerosol Size Distribution

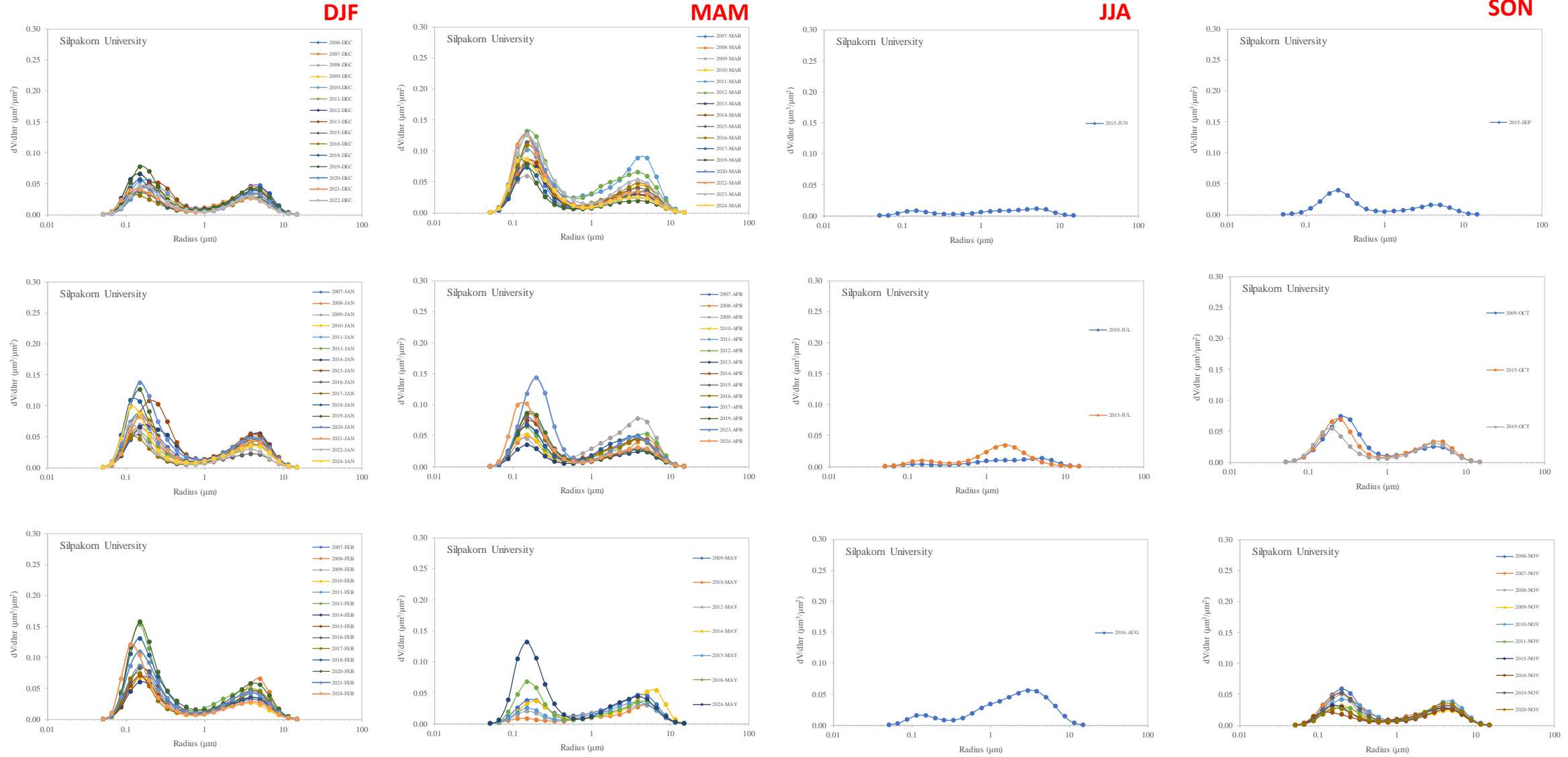
Ubon Ratchathani



The Variations in Aerosol Properties (cont.)

Aerosol Size Distribution

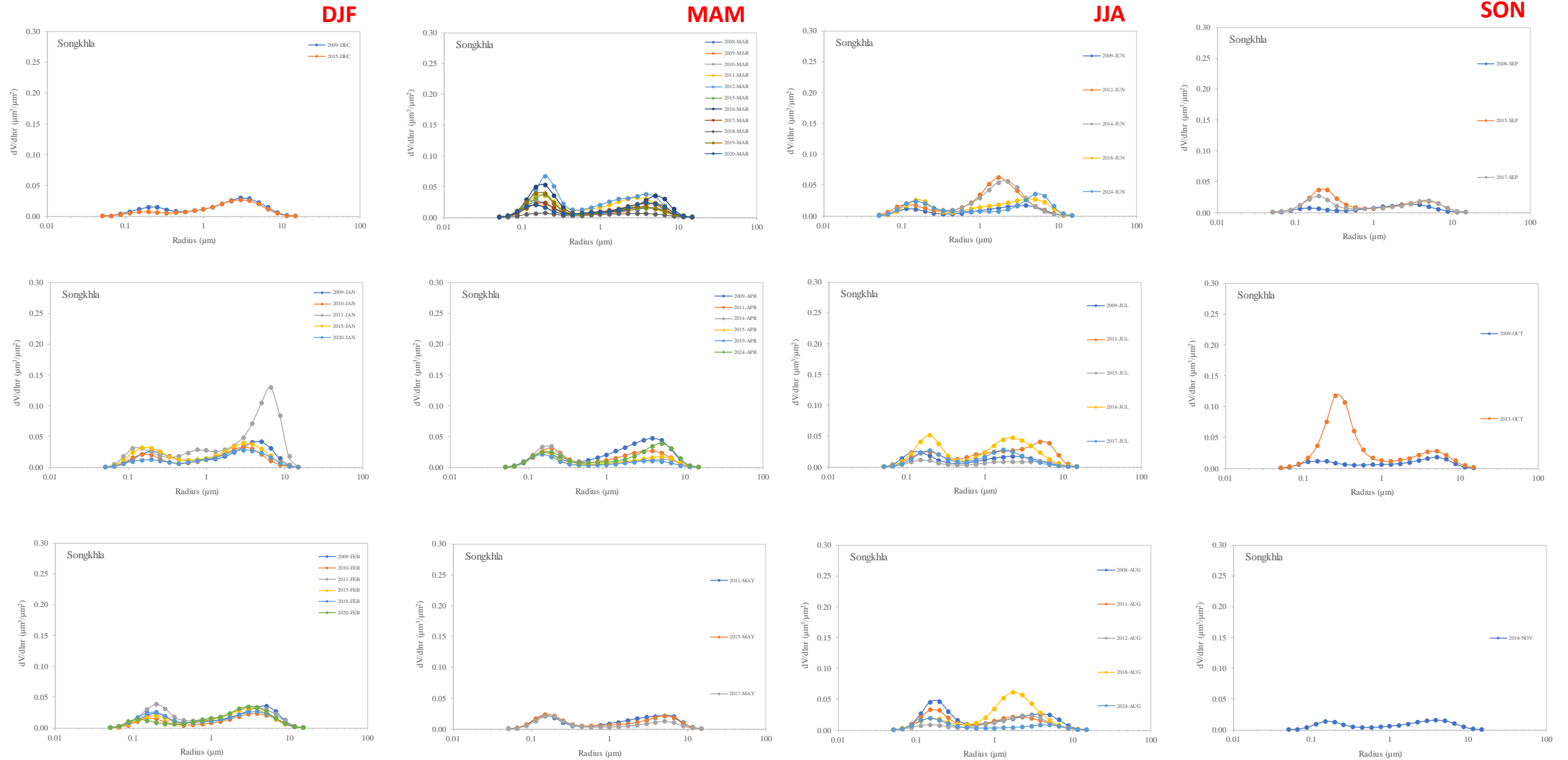
Nakhon Pathom



The Variations in Aerosol Properties (cont.)

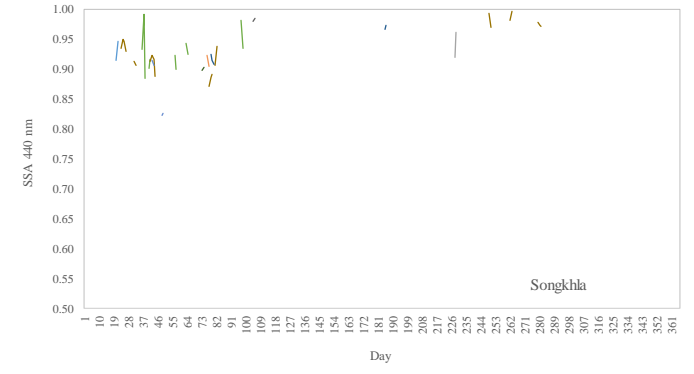
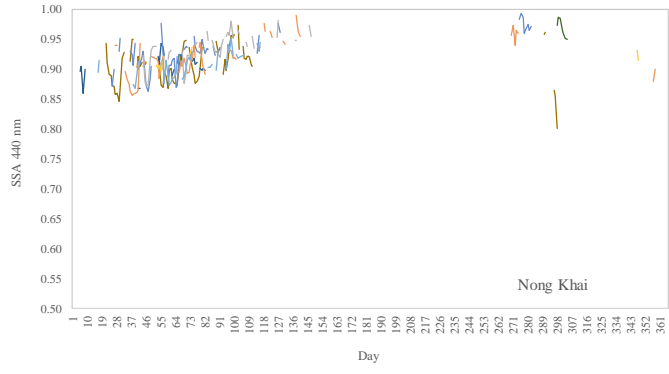
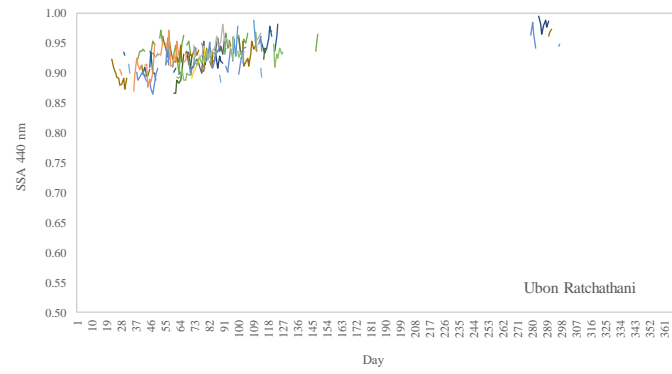
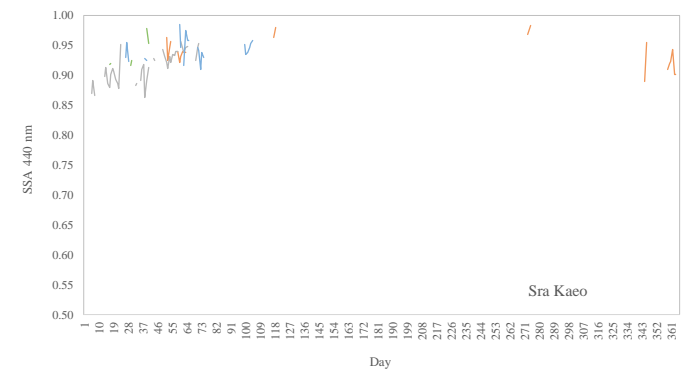
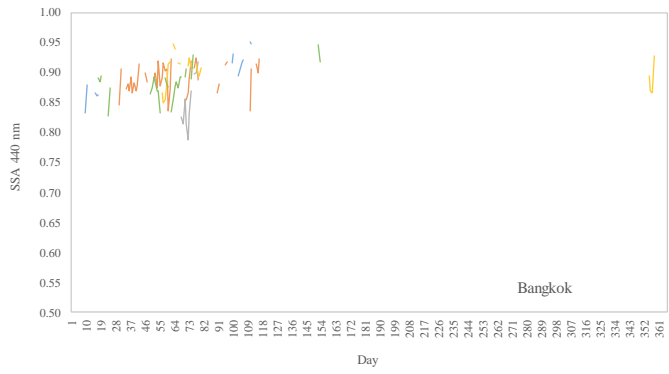
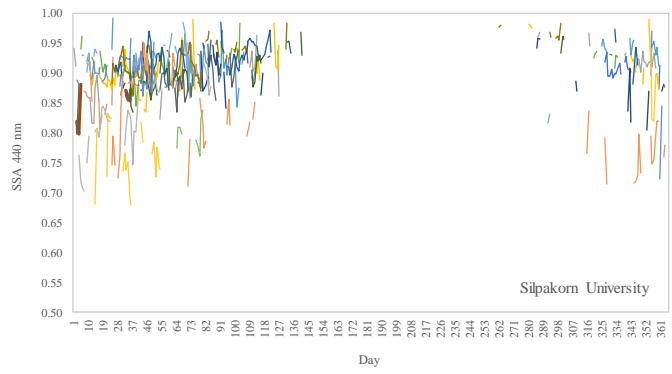
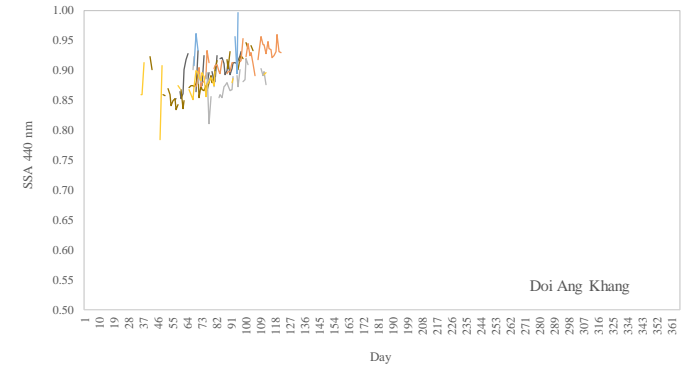
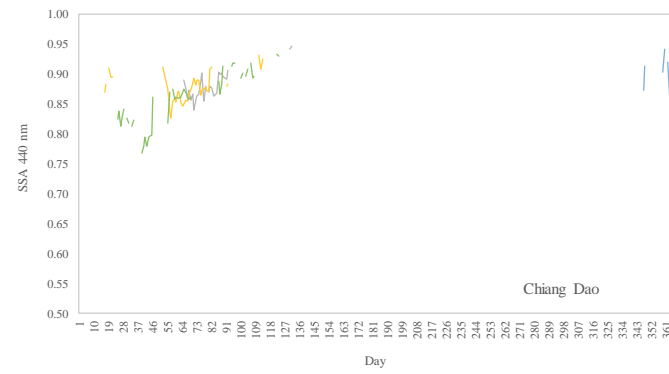
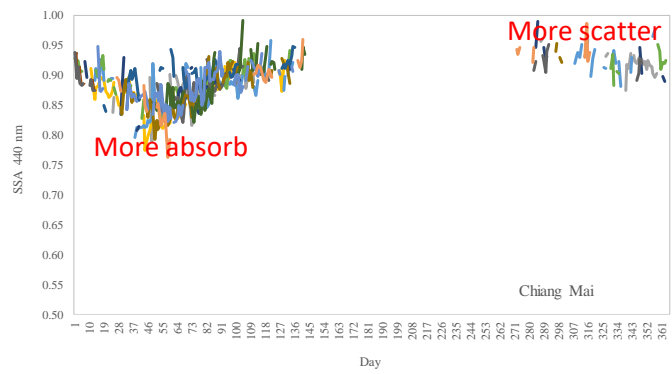
Aerosol Size Distribution

Songkhla



The Variations in Aerosol Properties (cont.)

Aerosol Single Scattering Albedo (SSA_{440nm})



• Classification of aerosol Types

- **Clean continental aerosols (CC)**

$$AOD_{440} < 0.2$$

- **Long-range transport desert dust aerosols (DD)**

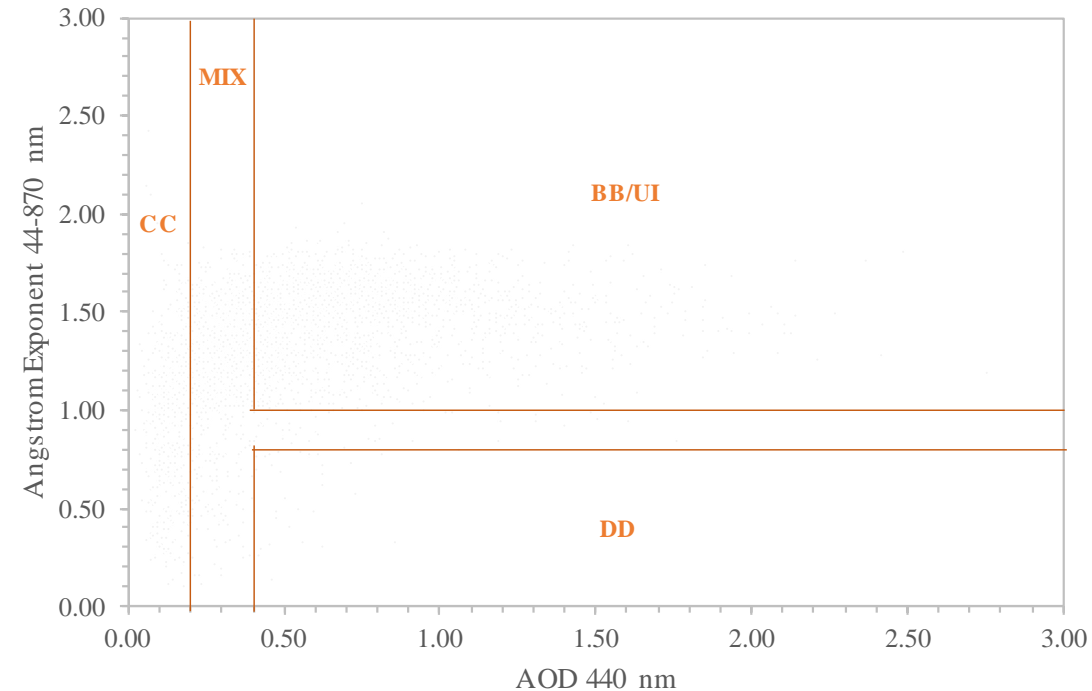
$$AOD_{440} > 0.4 \quad AE_{440-870} < 0.8$$

- **Biomass burning/urban/industrial aerosols (BB/UI)**

$$AOD_{440} > 0.4 \quad AE_{440-870} > 1.0$$

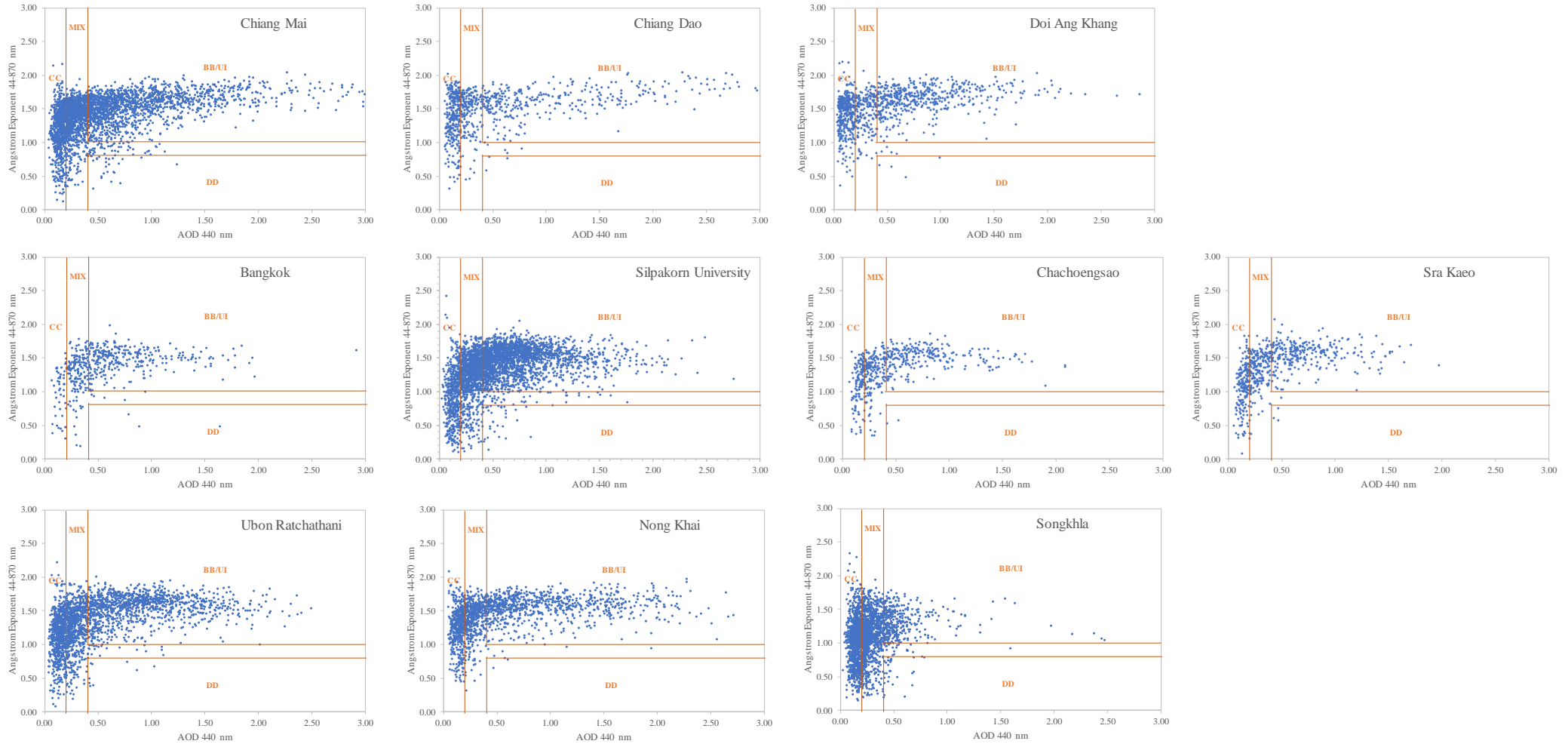
- **Mixed type aerosols (MIX)**

Others

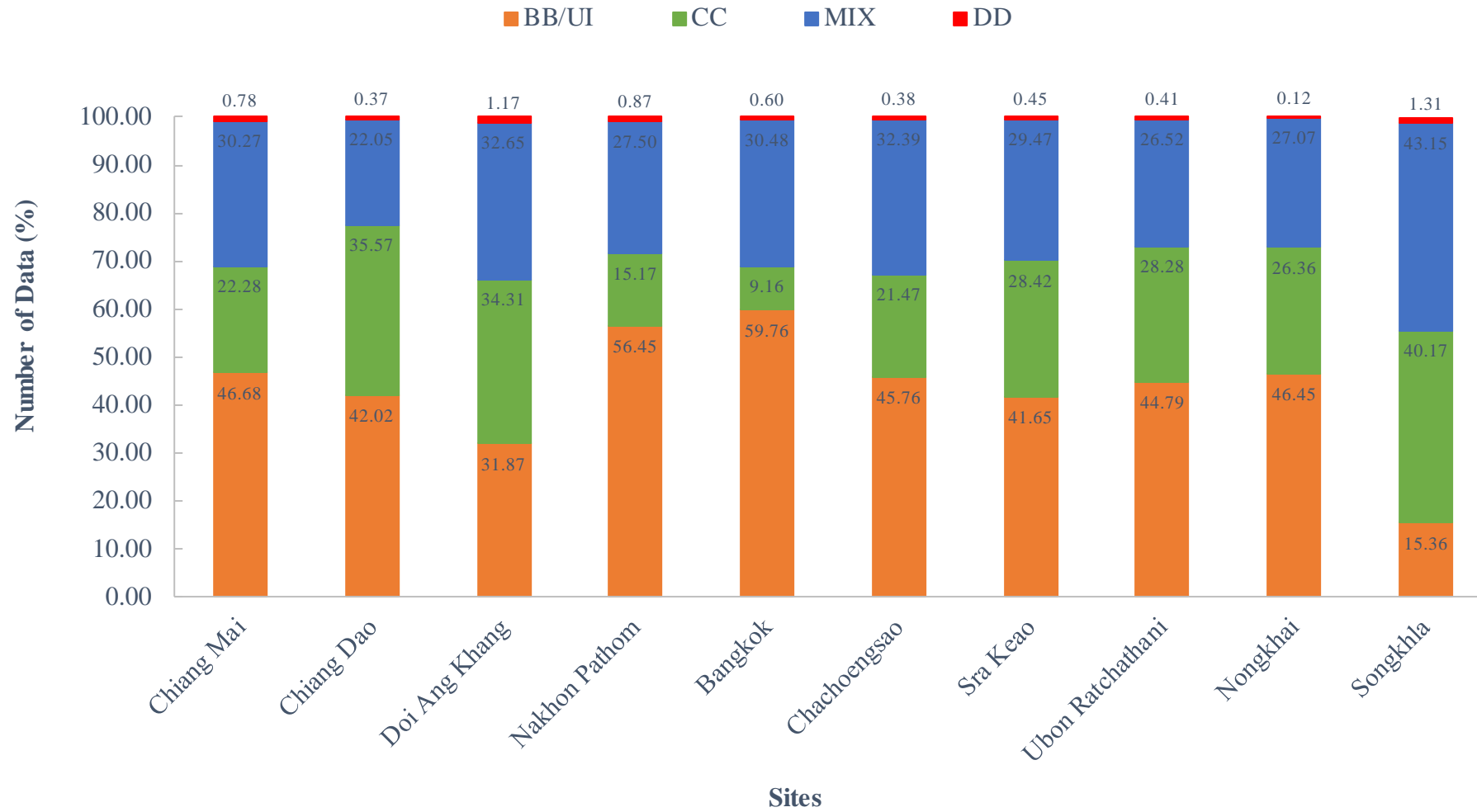


Zeb, B., Alam, K., Khan, R. *et al.* Characteristics and optical properties of atmospheric aerosols based on long-term AERONET investigations in an urban environment of Pakistan. *Sci Rep* **14**, 8548 (2024). <https://doi.org/10.1038/s41598-024-58981-0>

Classification of aerosol Types (cont.)

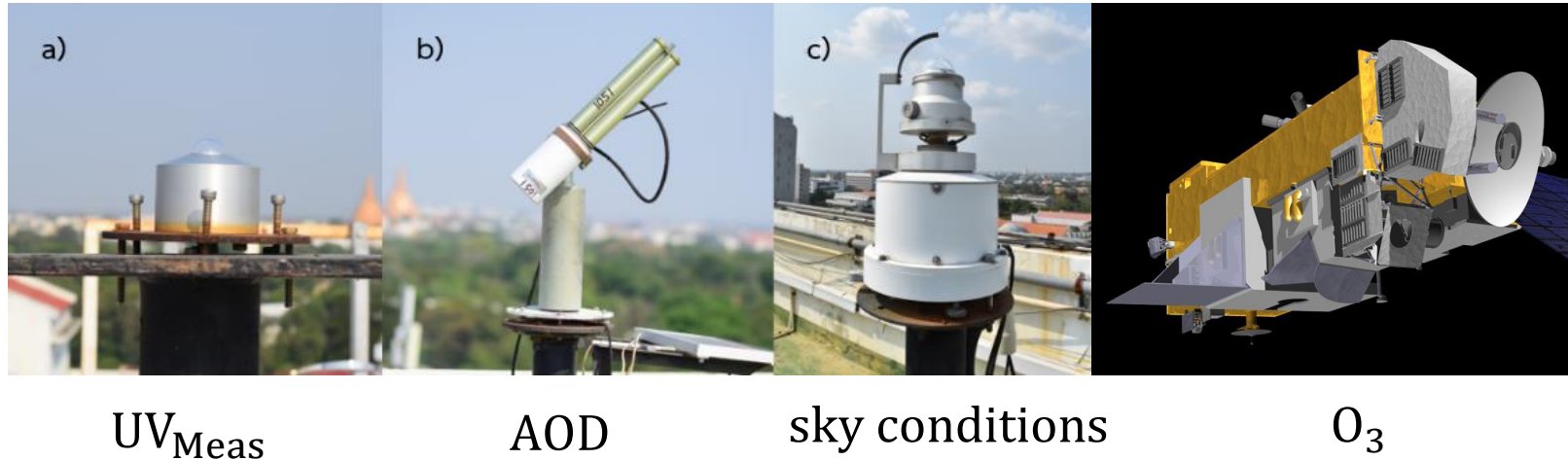


- Classification of aerosol Types (cont.)



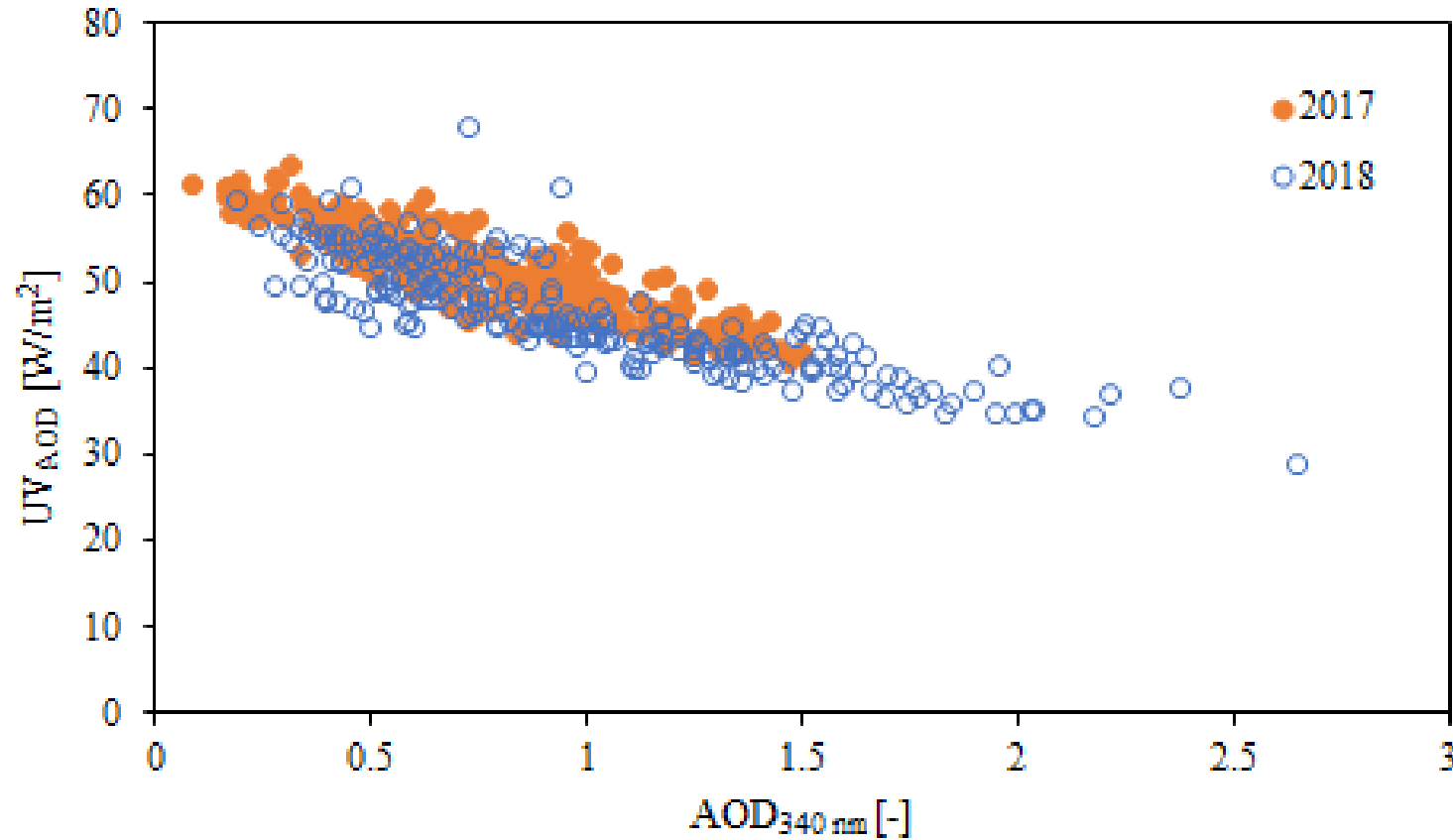
- Depletion of solar UV radiation Due to AOD

Location : Silpakorn University
Period : 1 Jan 2017 – 31 Dec 2018



$$UV_{AOD} = UV_{Meas}(z, AOD, O_3) \times \frac{UV_{Model}(30, AOD, 300)}{UV_{Model}(z, AOD, O_3)}$$

- Depletion of solar UV radiation Due to AOD (cont.)



Conclusion

- The variations in aerosol properties are similar for the Northern, Northeastern, and Central regions of Thailand, where there are high aerosol loads during the summer. In contrast, the southern region experiences low aerosol loads year-round.
- Over the past 15 years, AOD trends in Thailand have shown a decrease.
- Aerosol sizes in Thailand are mainly fine particles : continental, biomass burning, urban, and mix aerosols.
- AOD can decrease solar UV radiation linearly.



Thank you very much for your attention

