4th Atmospheric Composition and the Asian Monsoon (ACAM) Workshop

Universiti Kebangsaan Malaysia
The National University of Malaysia

A warm welcome on behalf of the SSG and WG leaders

ACAM
ATMOSPHERIC COMPOSITION & THE ASIAN MONSOON

Hans Schlager, Mian Chin

Laura Pan, Jim Crawford, Hiroshi Tanimoto, Michelle Santee, Jianchun Bian, Klaus Gottschaldt, Gabi Stiller, Chang-Keun Song, Jonathon Wright, Xiaohua Pan, Bhupesh Adhikary, Federico Fierli, Ritesh Gautam , Fatimah Ahamad, Mohd Talib Latif

SPARC

Universiti Kebangsan Malaysia, 26-28 June 2019

IGAC
INTERNATIONAL GLOBAL ATMOSPHERIC CHEMISTRY

Asian Monsoon research area is very active and continues to expand

ACAM Science is multidisciplinary

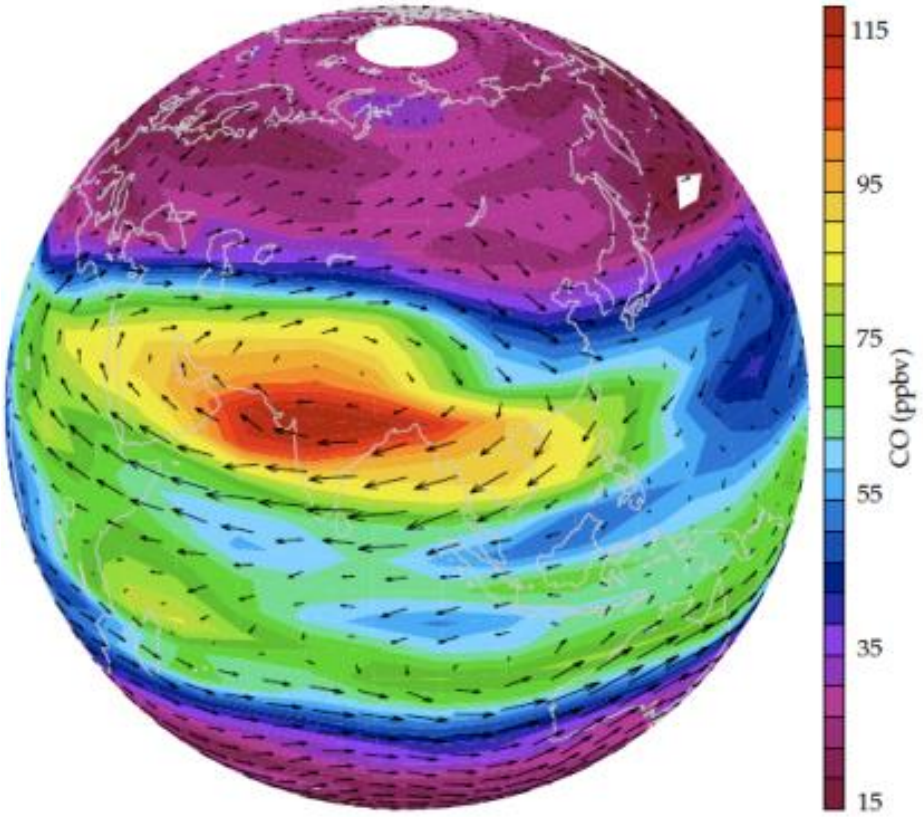
Emissions ↔ Monsoon ↔ UTLS Composition ↔ Climate

Workshop is structured according the four ACAM Science themes:

- Emissions and air quality in the Asian monsoon region
- Aerosols, clouds, and their interactions with the Asian monsoon
- Impact of monsoon convection on chemistry
- UTLS Response to the Asian Monsoon

Asian Summer Monsoon Anticyclone (ASMA)

Chemical signature from satellite obs



MLS 100 hPa

CO / ppb

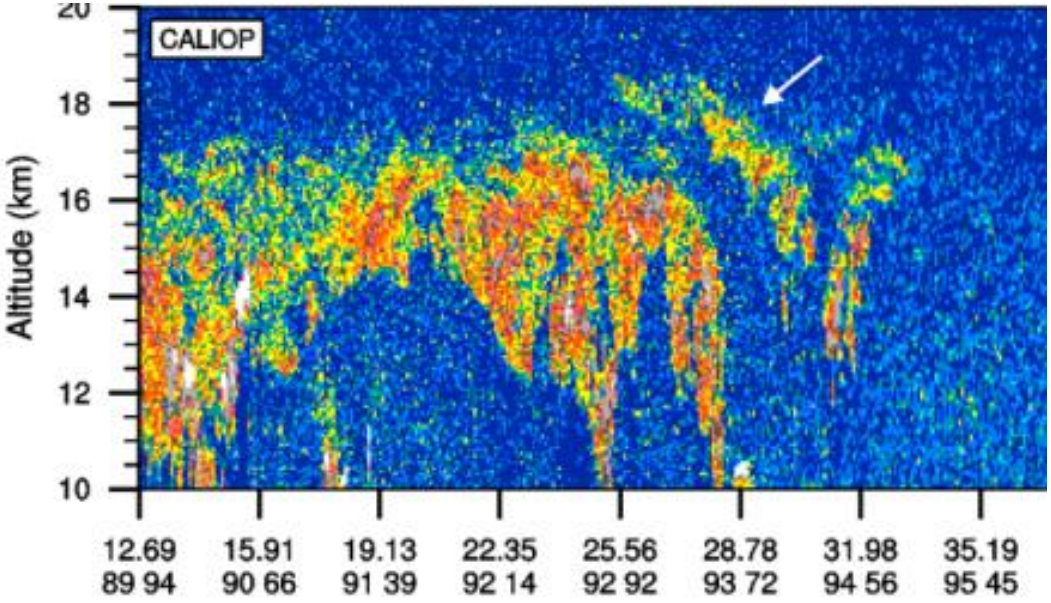
(Park et al. 2007)

Features:

- ASMA is one of the largest meteorological features on Earth
- Distinct air mass isolated by closed circulation in the UTLS
- Input of BL air by frequent deep convection
- Located over very polluted region
- ASM causes large-scale dispersion of pollution
- Important gateway for air to enter the stratosphere
- Region of a persistent aerosol layer (ATAL)
- Highest and coldest TP in JJA

Asian Summer Monsoon Anticyclone (ASMA)

CALIOP Backscatter at 532 nm
on 17 Aug. 2017, 20 UTC



(Lee et al., 2019)

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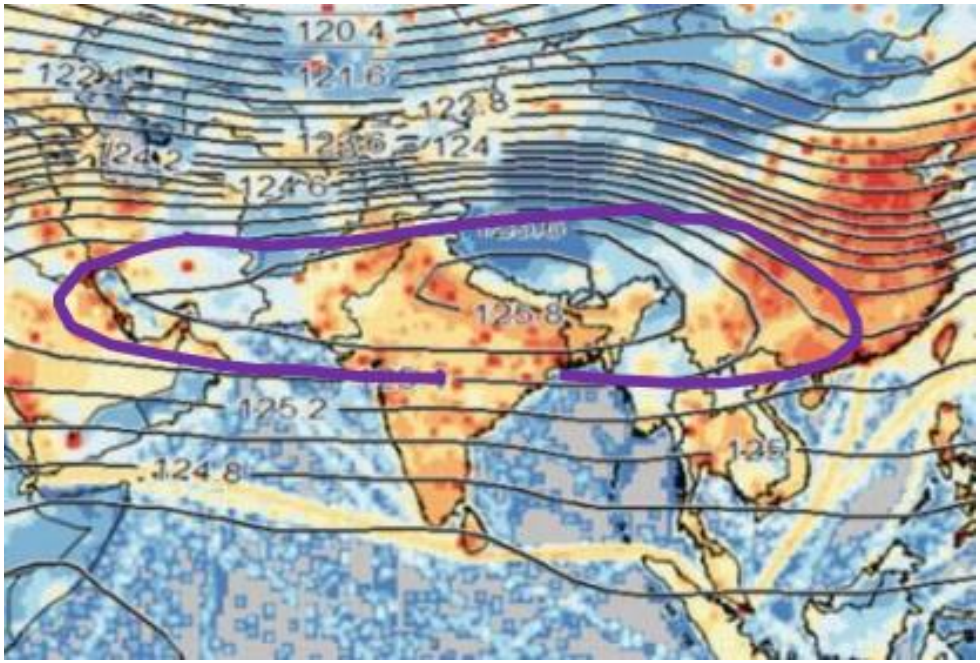

(MACCity, 2015)

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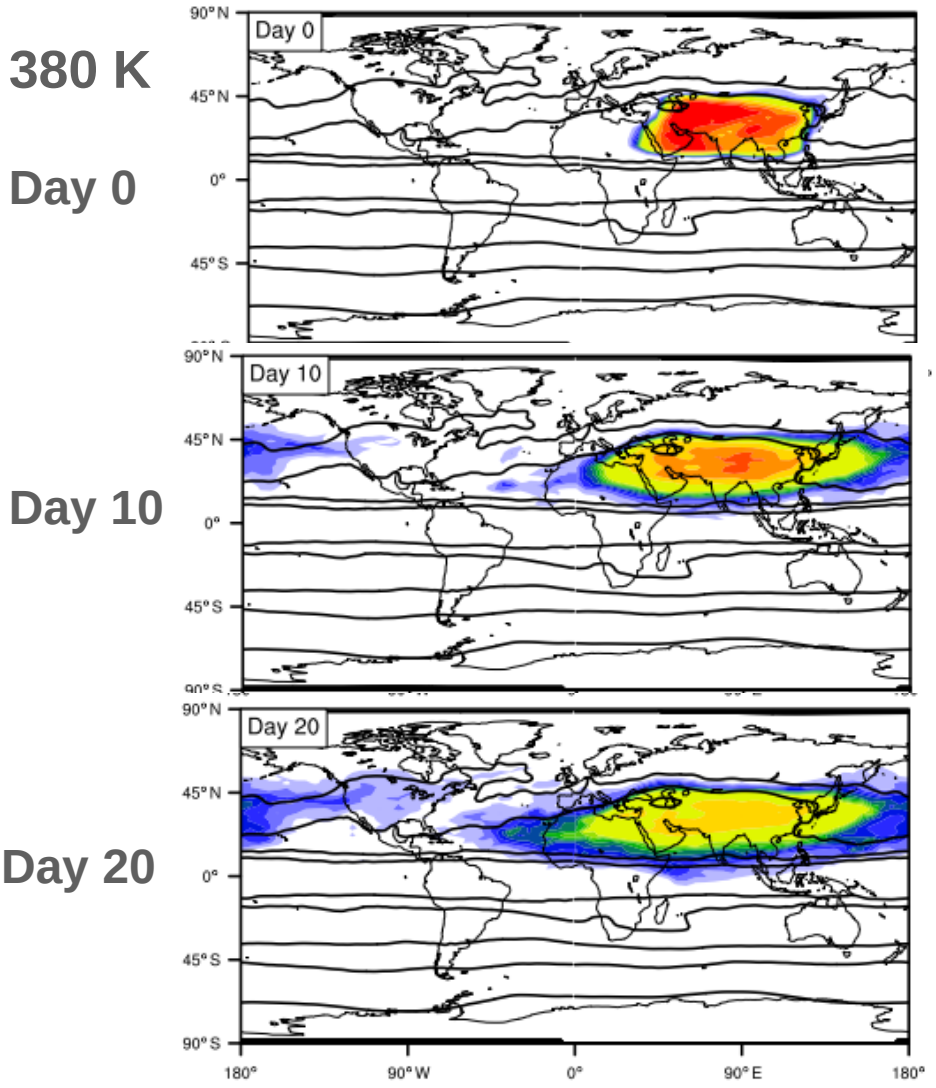

(Garney & Randel, 2016)

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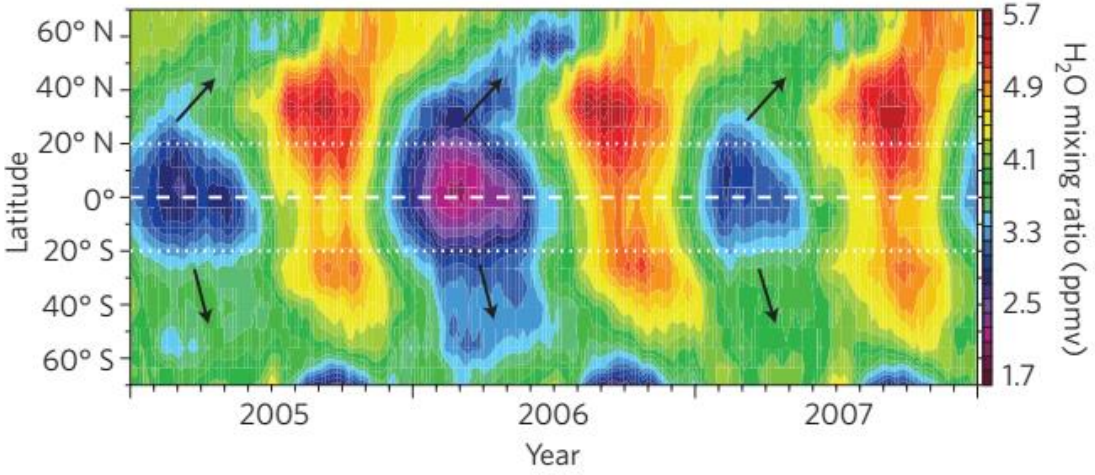
Asian Summer Monsoon Anticyclone (ASMA)

Satellite (MLS) oberservation of H_2O in the lower stratosphere



(Randel & Jensen 2013)

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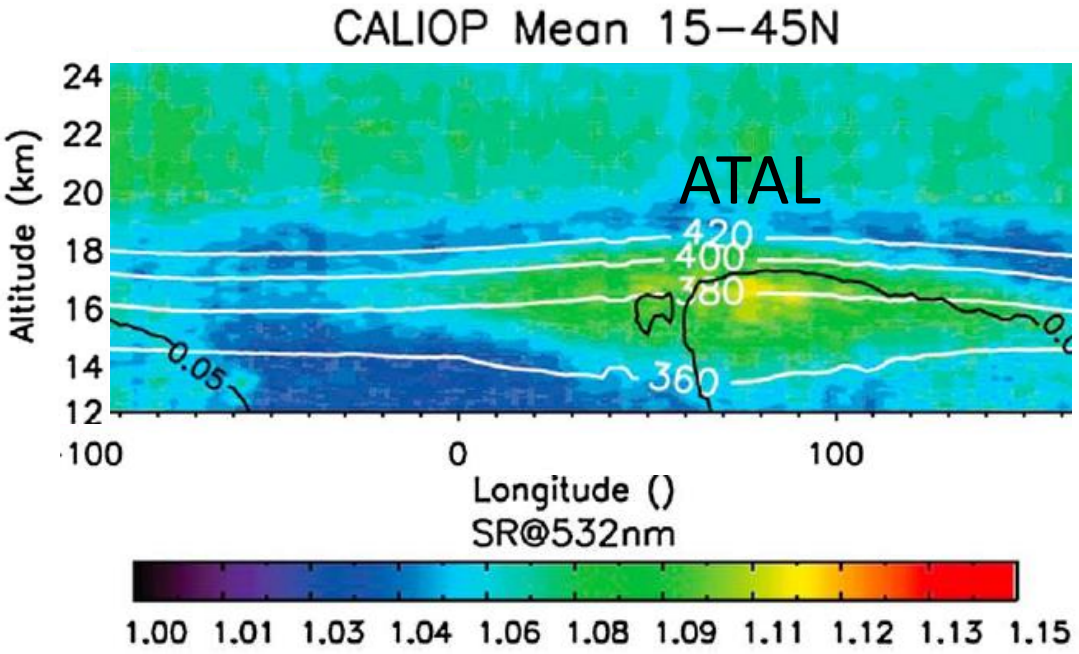

(Vernier et al. 2011)

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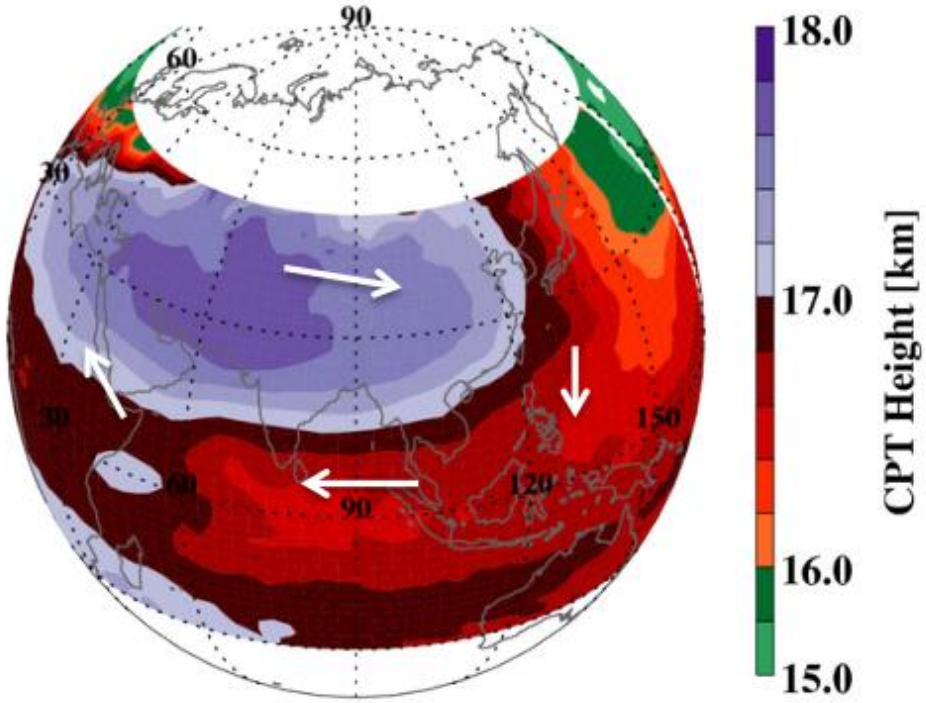

(Munchak & PAN, 2013, Pan et al. 2016)

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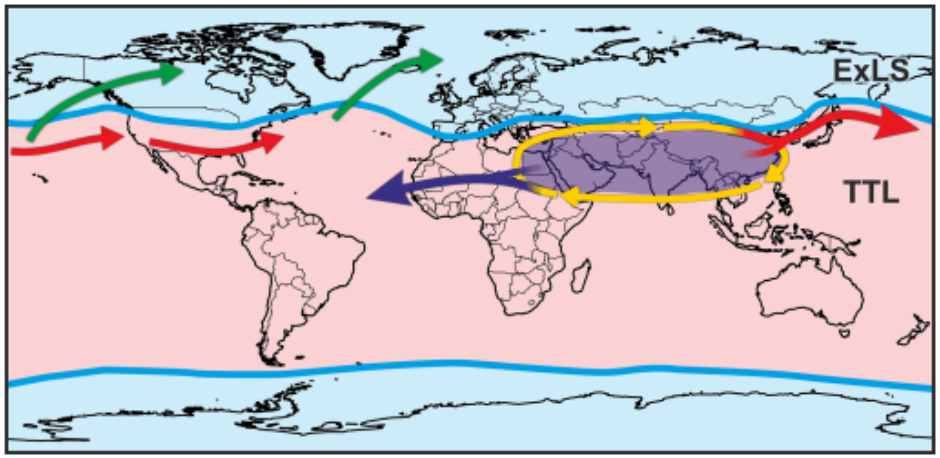
Asian Summer Monsoon Anticyclone (ASMA)

Horizontal transport pathways from the ASMA



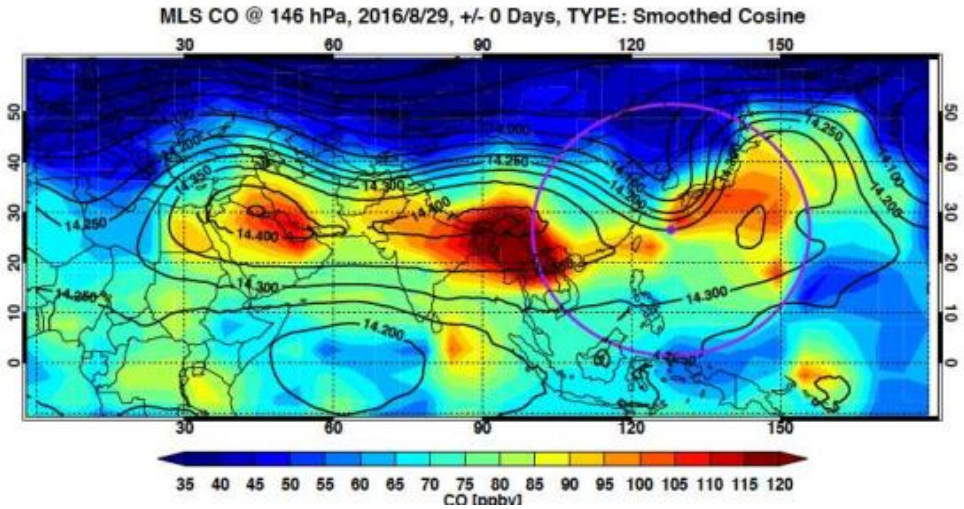
(Vogel et al. 2016)

Scientific Questions:

- Which source regions contribute to the air in the ASMA?
- How sharp is the chemical egde of the ASMA?
- Is there enhanced photo-chemistry in the ASMA?
- Which are the key transport pathways from the ASMA
- What is the composition of air exported from the ASMA
- Role of reactive nitrogen in the ASMA and importance of LNOx
- What is the nature of the ATAL aerosol and precursor gases ?
- What are the properties of ice clouds; can we observe uptake of HNO_3?

Asian Summer Monsoon Anticyclone (ASMA)

Eddy shedding event to the western Pacific region (MLS CO)



(Laura Pan, ACCLIP)

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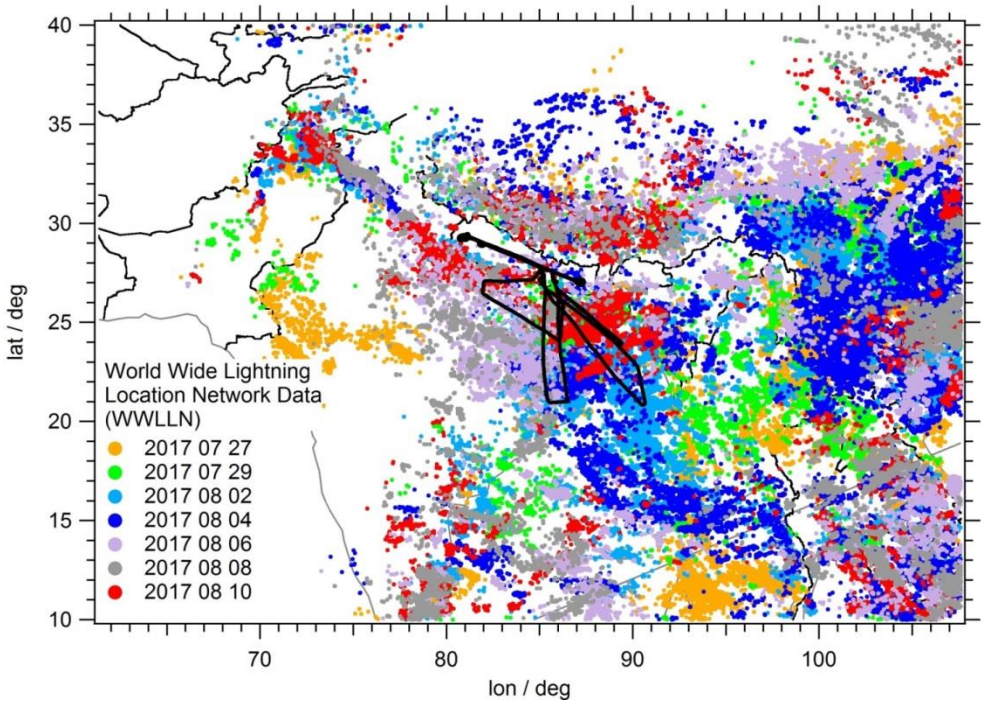
Asian Summer Monsoon Anticyclone (ASMA)

World Wide Lightning Location Network Data (during Stratoclim campaign)



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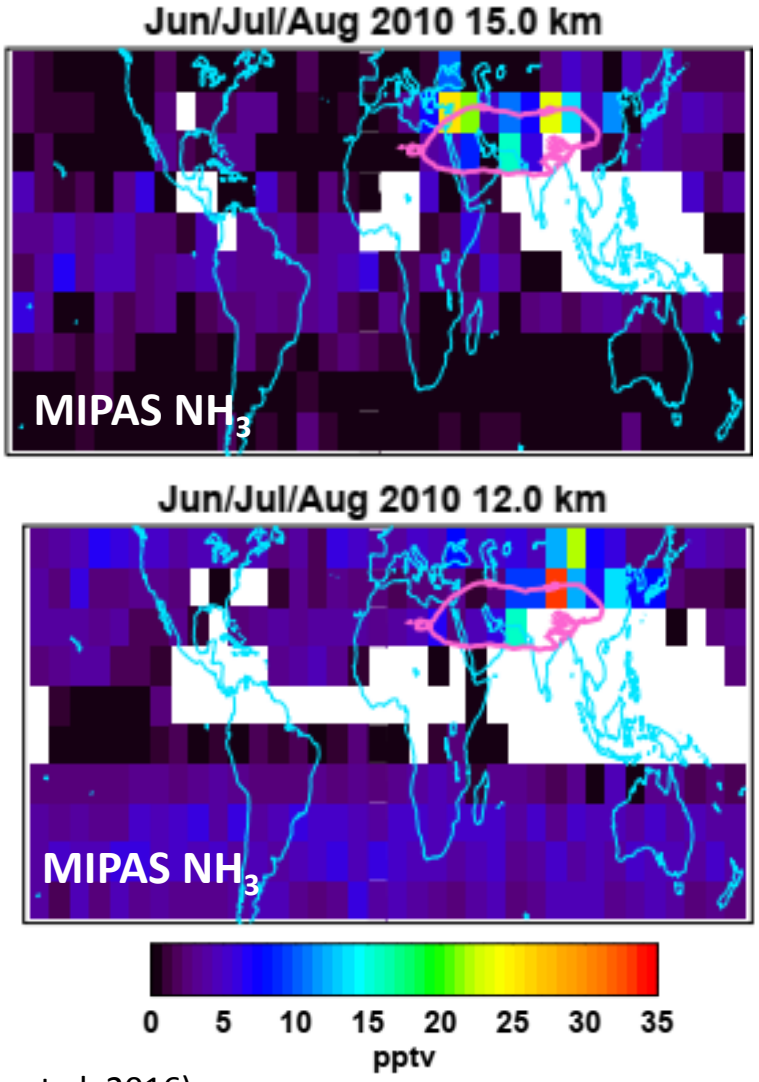

(Höpfner et al. 2016)

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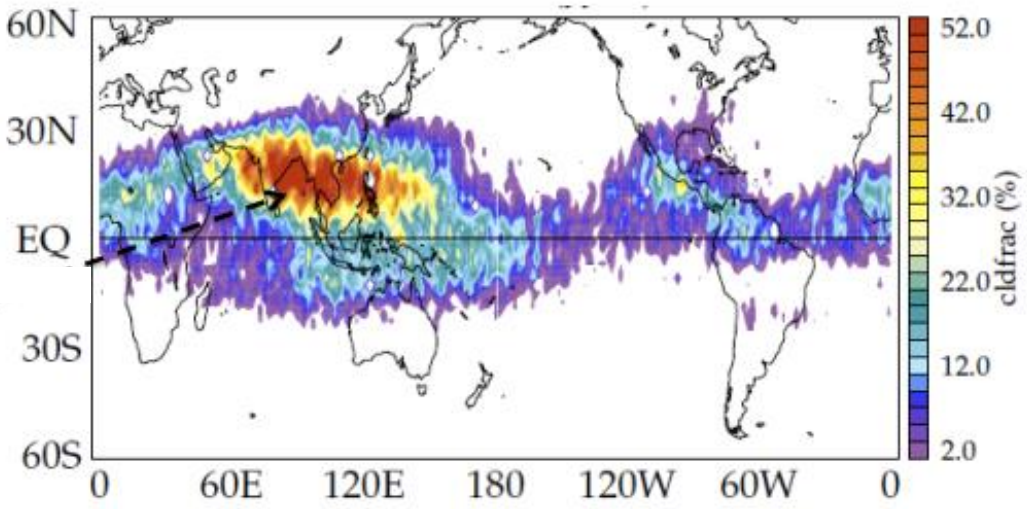
Asian Summer Monsoon Anticyclone (ASMA)

Calipso cloud fraction in 16 Km



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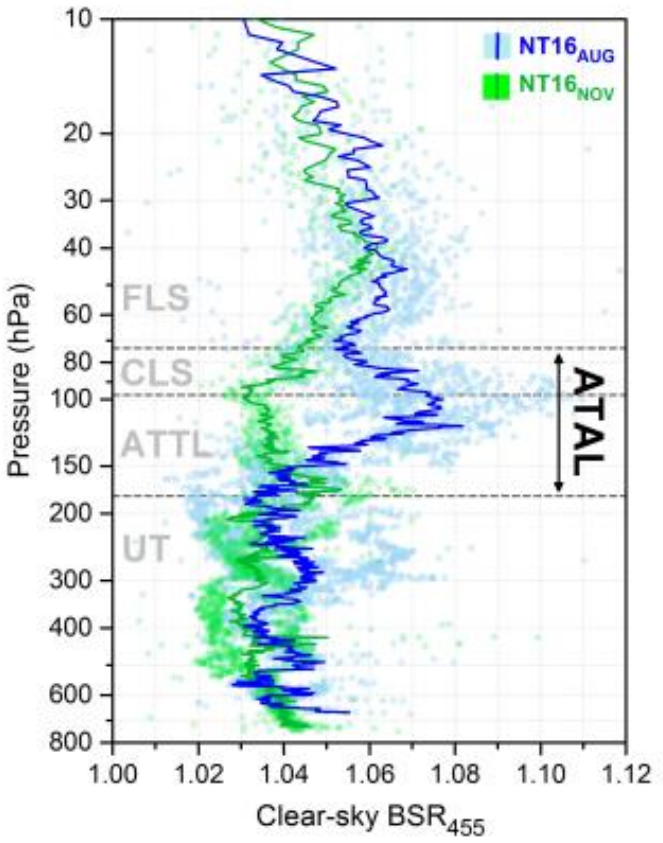
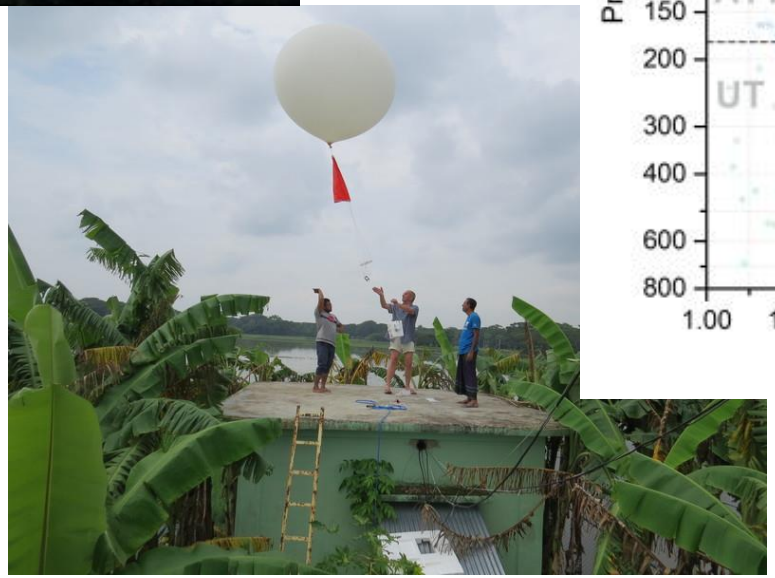
Balloon campaigns (BATAL, India; SWOP, China; StratoClim, India, Bangladesh, Palau)

Balloon Launch in Hyderabad (Vernier et al. 2017)

Aerosol backscatter at 455 nm

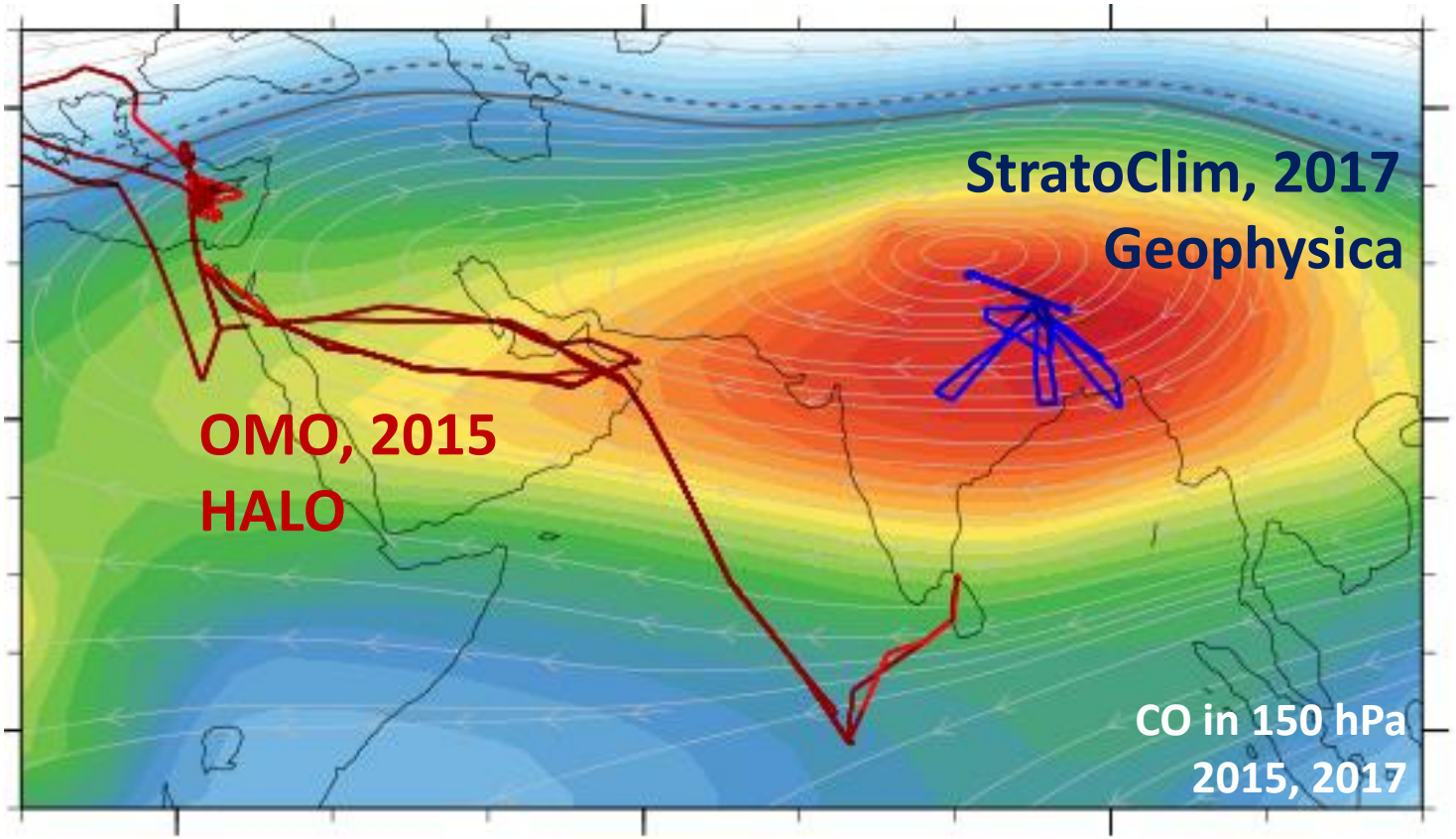


(Brunamonti et al., 2018)



Balloon launch during StratoClim

Recent Aircraft Measurements in the ASMA



- OMO: sampling across the boundary of the ASMA
- StratoClim: sampling of the vertical structure and fresh convective outflow in the ASMA

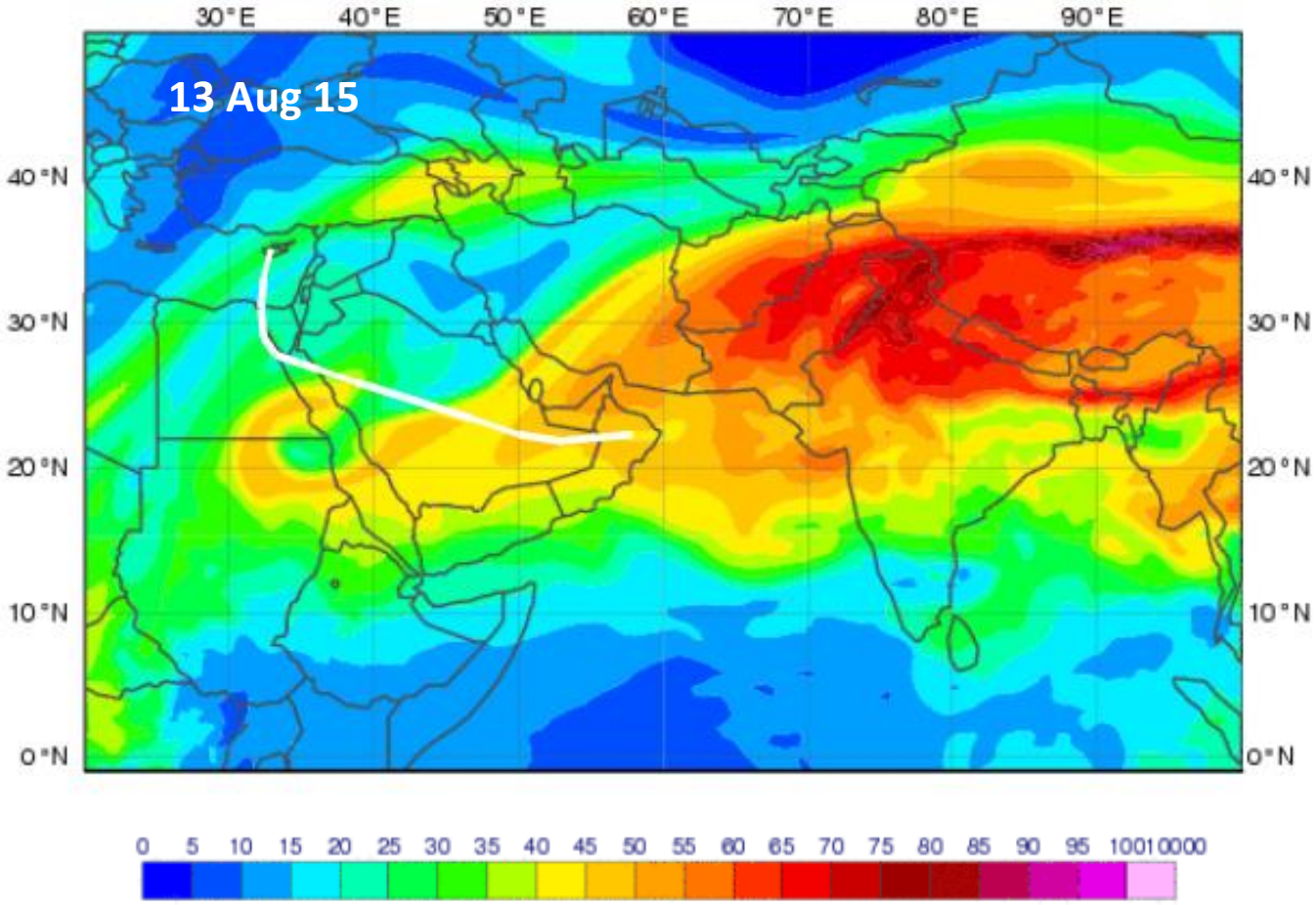
Aircraft instrumentation

In-situ	**OMO**	**StratoClim**
Chemistry/tracer:	O_3, NO, NOy, CO, CH_4, OH, HO_2, RO_2, VOC, OVOC	O_3, NO, HNO_3, NO_y, CO, VSLS, CH_4, N_2O, SF_6, CFC11/12
Water :	H_2O	H_2O, HDO, total H_2O
Sulfur species:	SO_2	OCS, SO_2, H_2SO_4
Aerosol:	Aitken aerosol (CN)	total/non-volatile CN, size distribution, chemical composition
Clouds:		size distribution, particle shape particle-NOy
Remote sensing		
Trace gases:	O_3, NO_2, VSLS (DOAS)	O_3, H_2O, HNO_3, PAN, NH_3 (Gloria)
Clouds:		optical properties (micro lidars)

OMO flight across boundary of ASMA

OMO
OXIDATION
MECHANISM
OBSERVATIONS

CAMS: CO at 150 hPa



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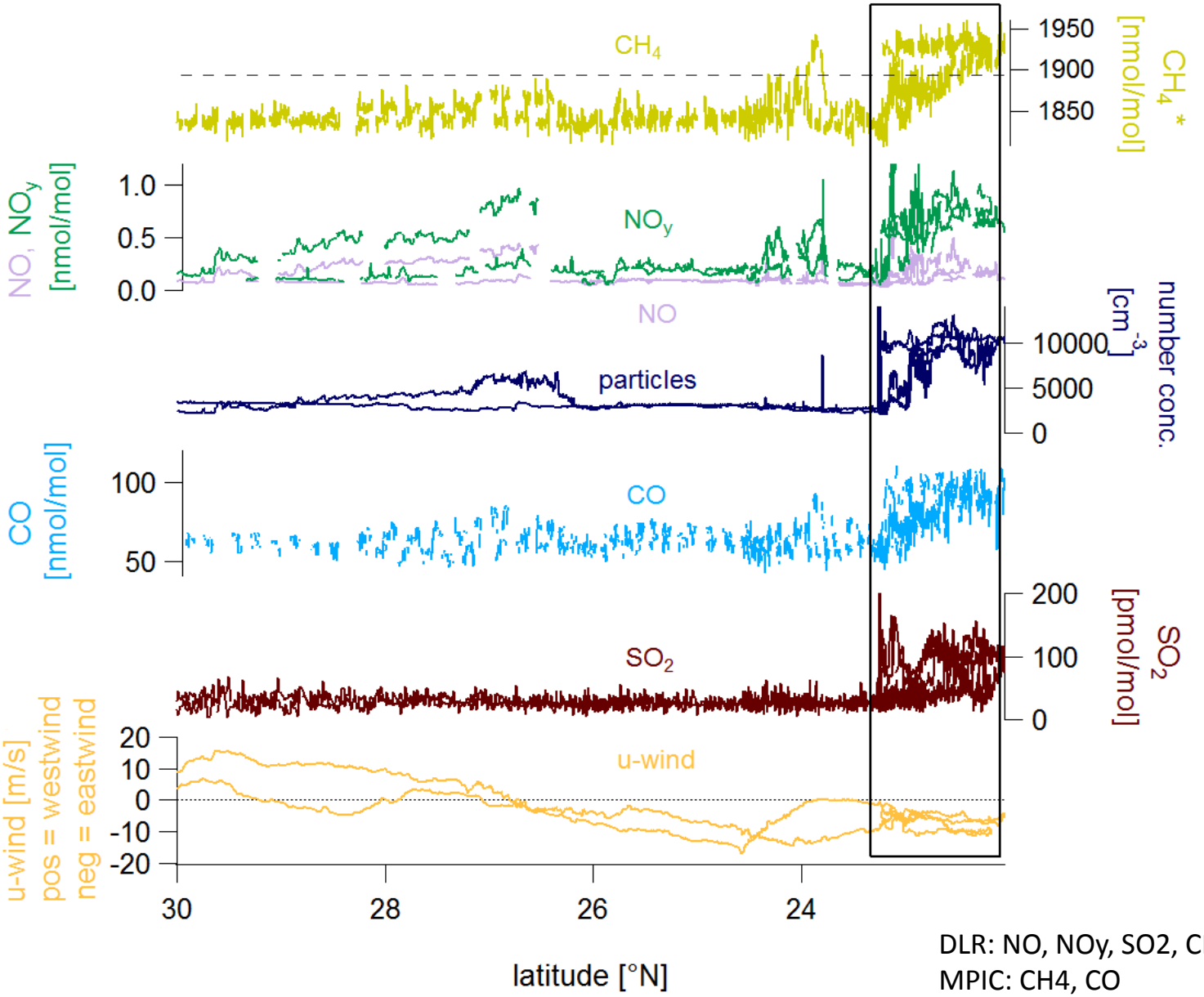
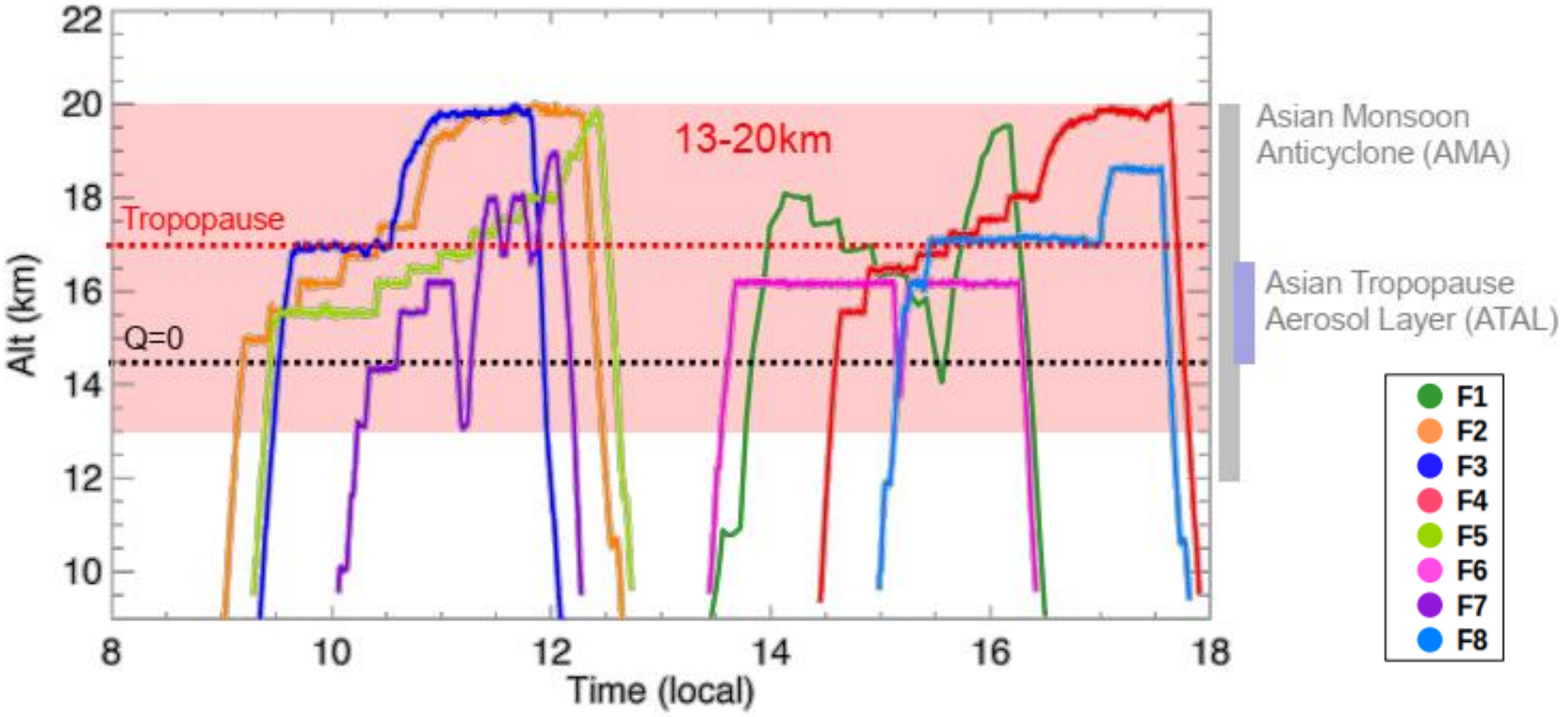


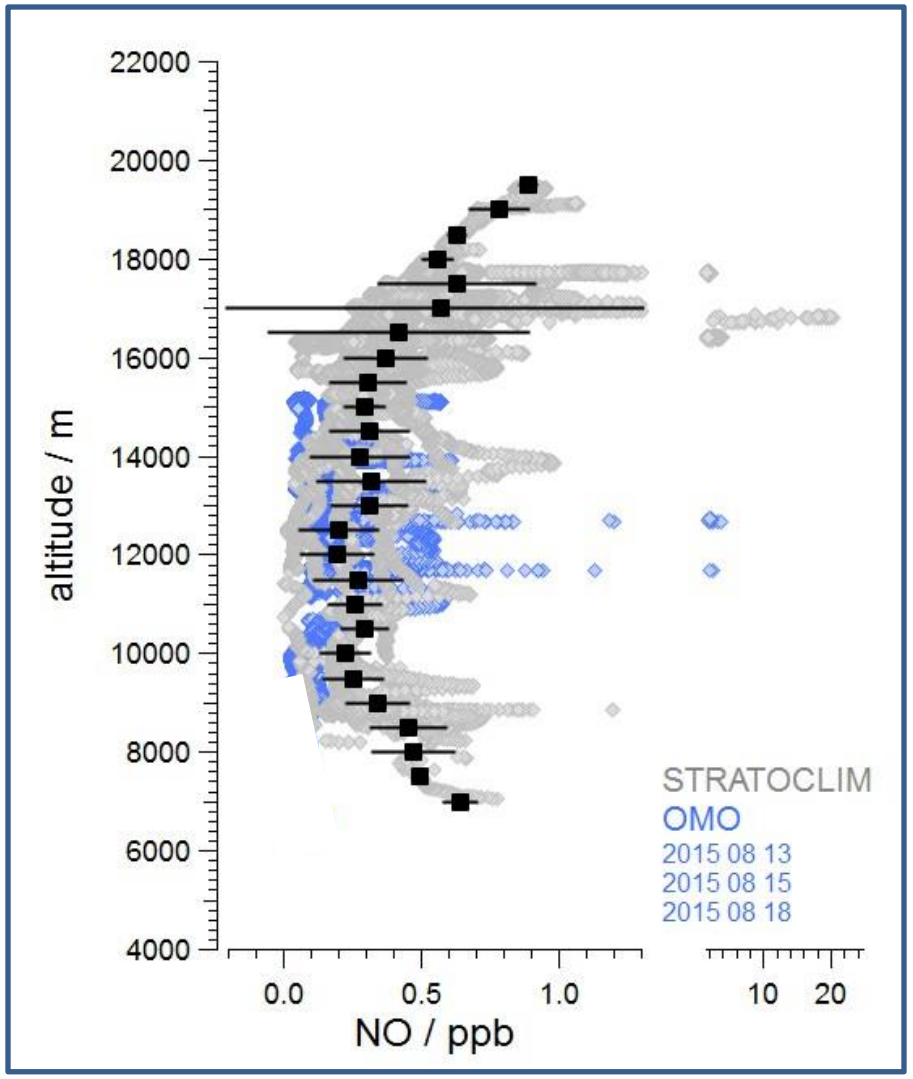
DLR: NO, NOy, SO2, CN
MPIC: CH4, CO

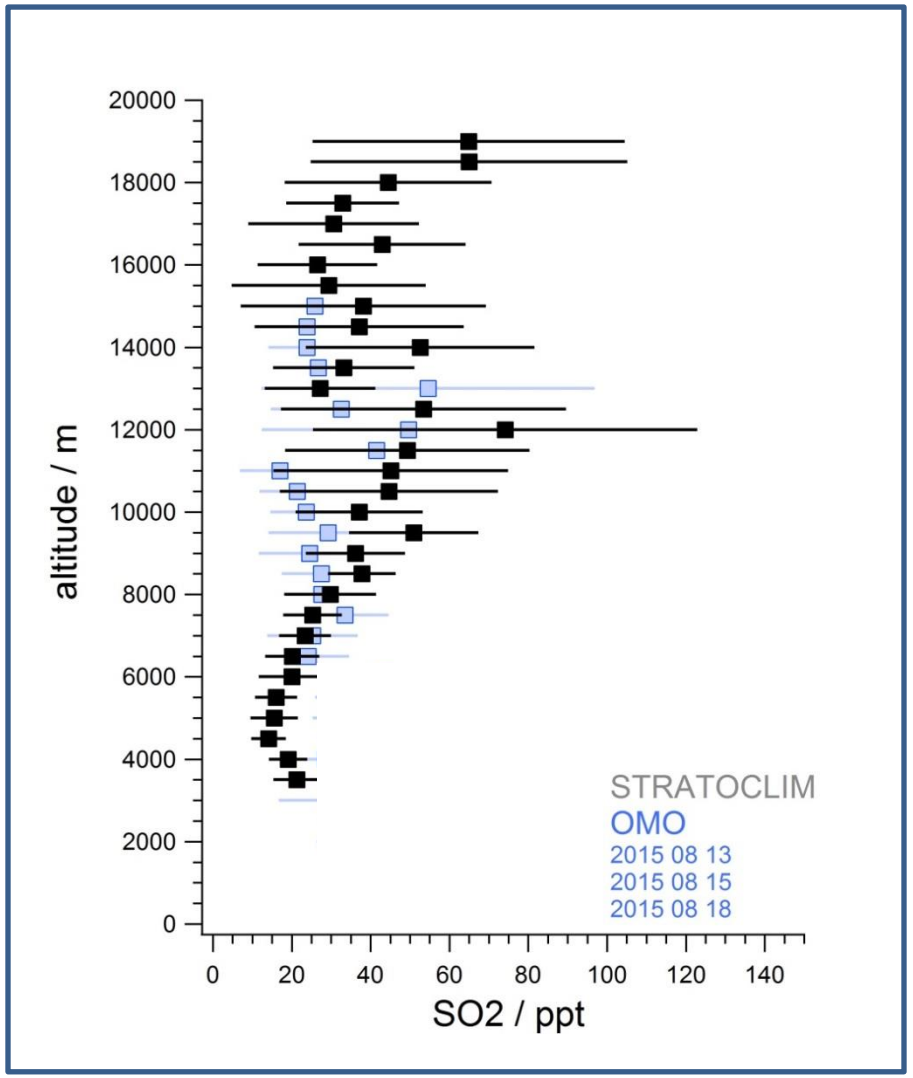
Vertical coverage of Geophysica flights



(courtesy of Markus Rex)

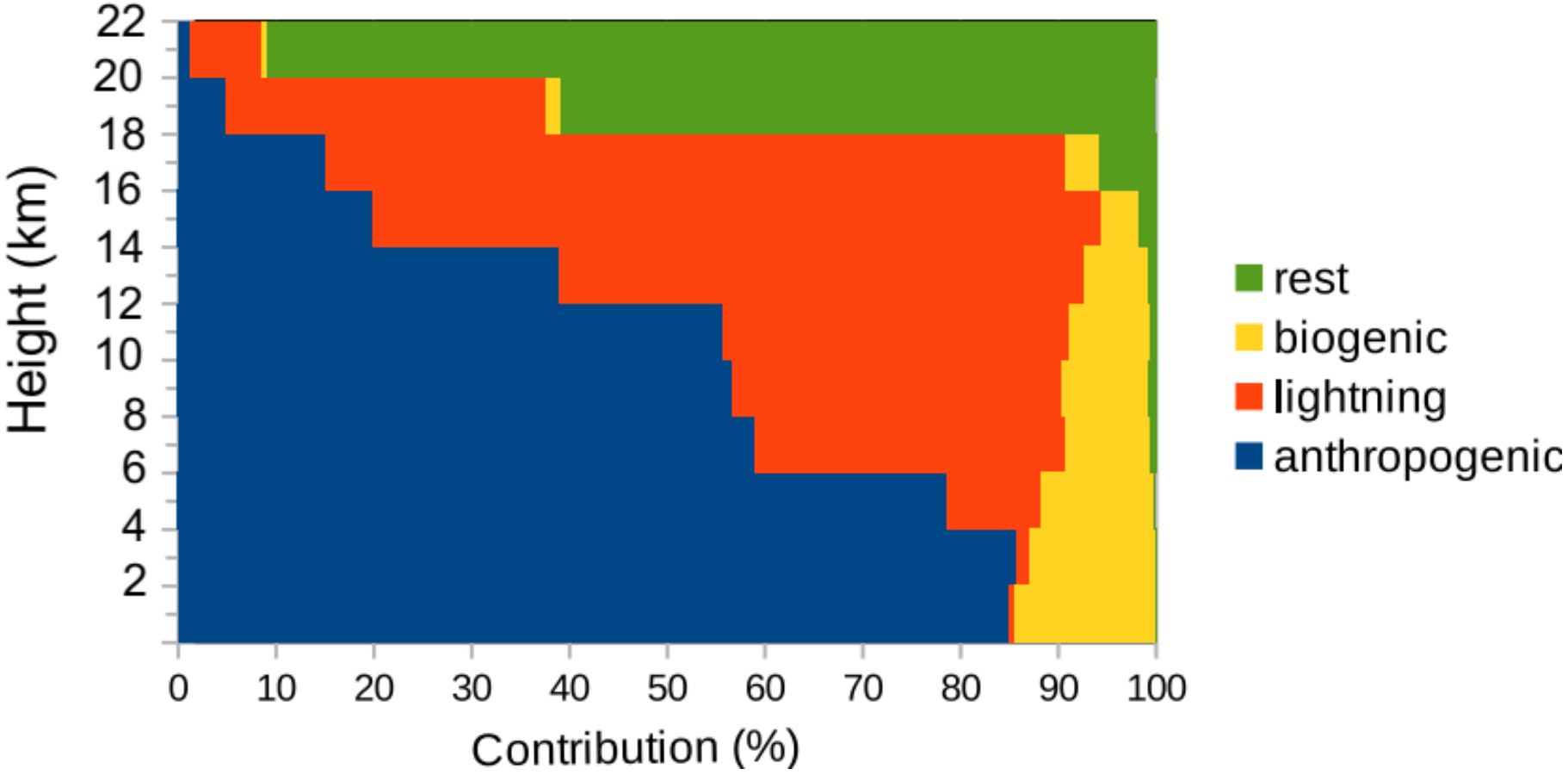
NO and SO_2 profiles from StratoClim and OMO





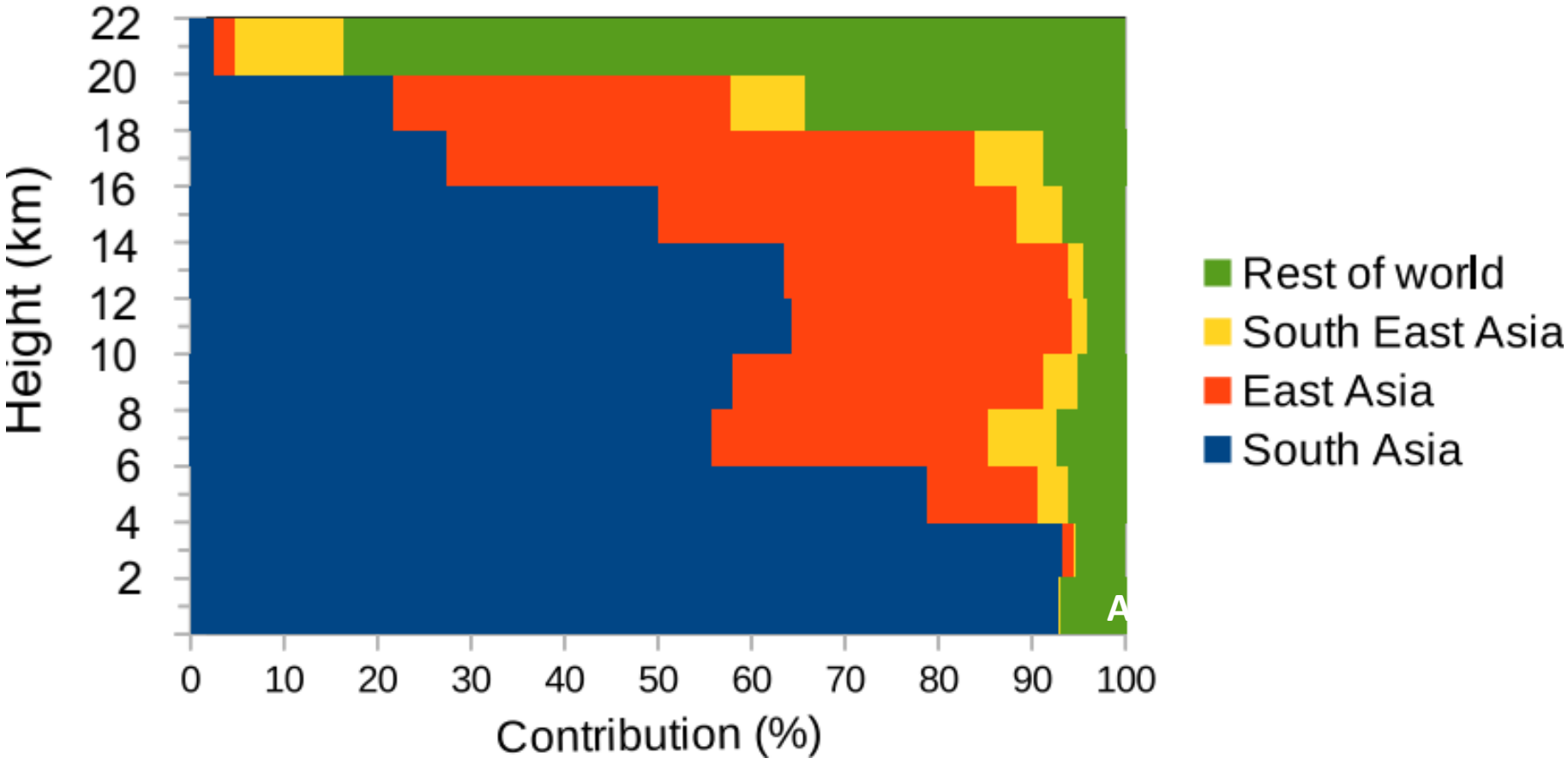
(Stratmann, Schlager et al., in prep. 2019)

EMAC: Relative contributions of sources to NOy



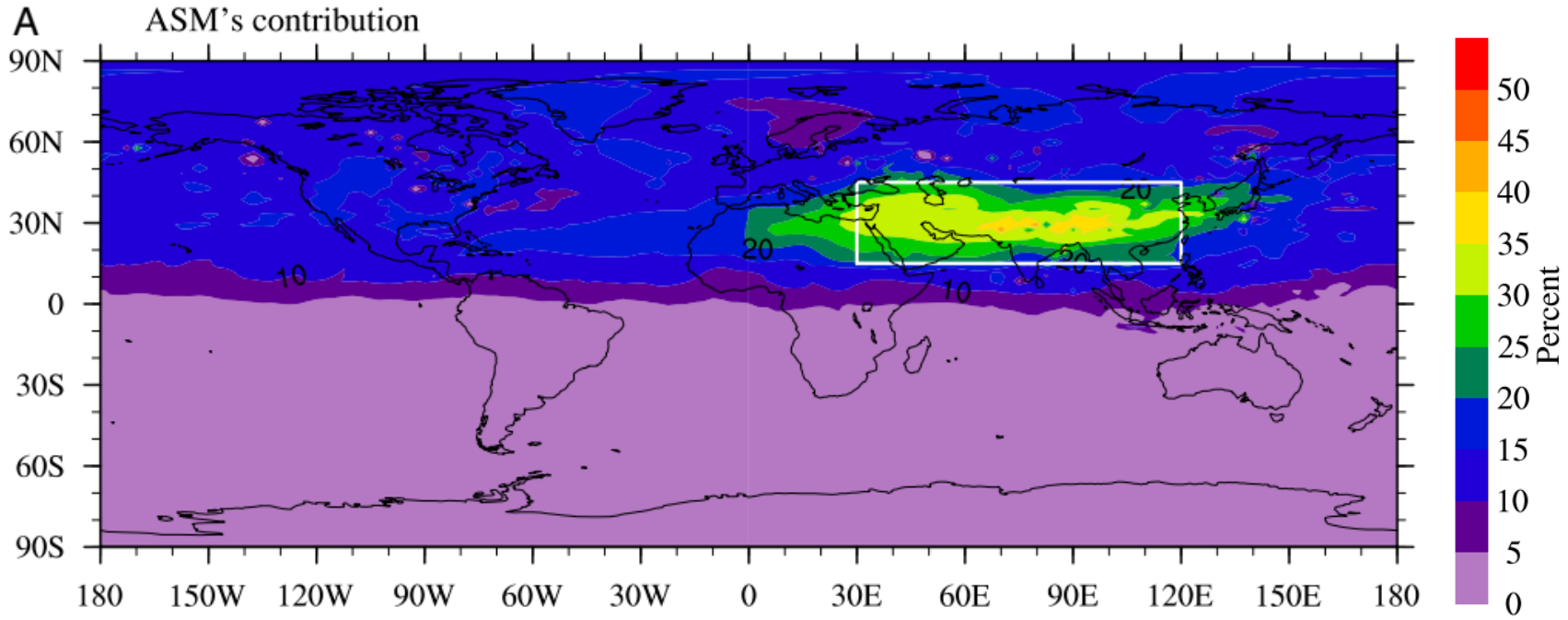
(Stratmann, Schlager et al., DLR, in prep. 2019)

EMAC: Relative contributions of source regions to SO_2



(Schlager et al., in prep. 2019)

ASM Contribution to Stratospheric aerosol surface area



(Yu et al., 2017, PNAS)

ACAM Working Groups

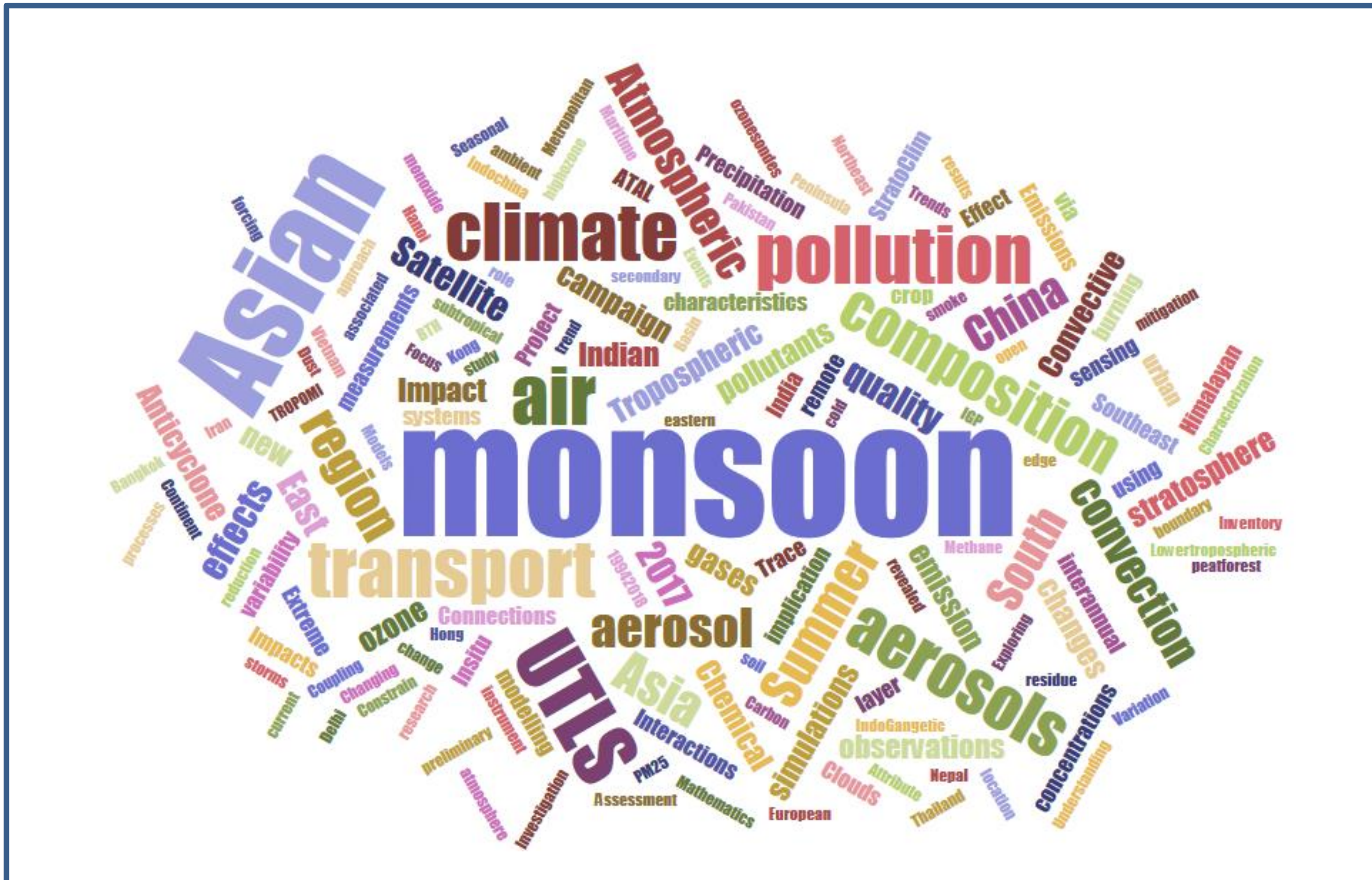
ACAM activities are coordinated through working groups

WG1: Observations and Data Sharing
Leads: Jianchun Bian, Gabriele Stiller, Klaus-Dirk Gottschaldt, Chang-Keun Song
Focus: Identify ACAM-relevant datasets, organize data sharing, encourage future campaings and coordinated observations

WG2: Modeling and Analysis
Leads: Jonathon Wright, Xiaohua Pan
Focus: Foster interactions with global and regional modeling communities, and to organize ACAM-related modeling and analysis

WG3: Training School
Leads: Federico Fierli, Ritesh Gautam, and Bhupesh Adhikaryi
Focus: Develop training opportunities for early career scientists on observations and modeling

Word Cloud generated from ACAM 2019 Abstract Titles



Thank you for being here and enjoy the workshop!