The 3rd International workshop on
Atmospheric Composition and the Asian Monsoon (ACAM)

Introduction

Laura Pan and Jim Crawford
ACAM co-chairs

ACAM and the Third Workshop

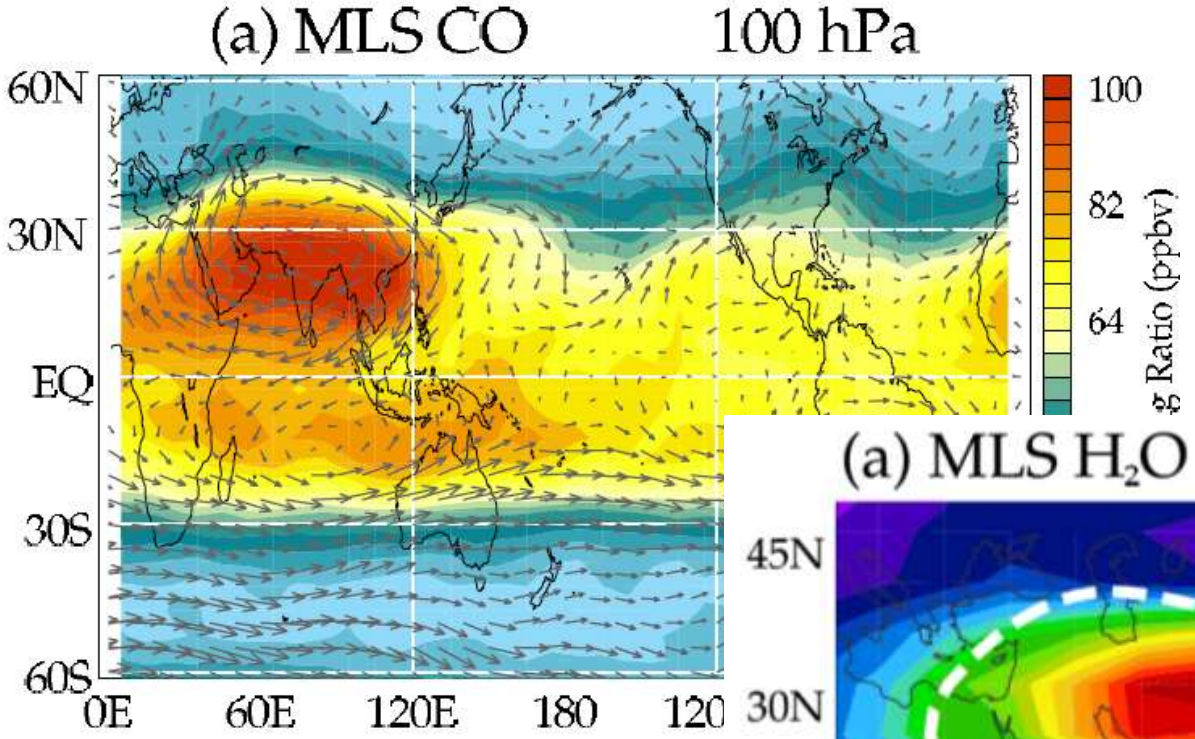
What is ACAM:

- Scientific interests that connect us
- Goals and Milestones
- Leadership and Community

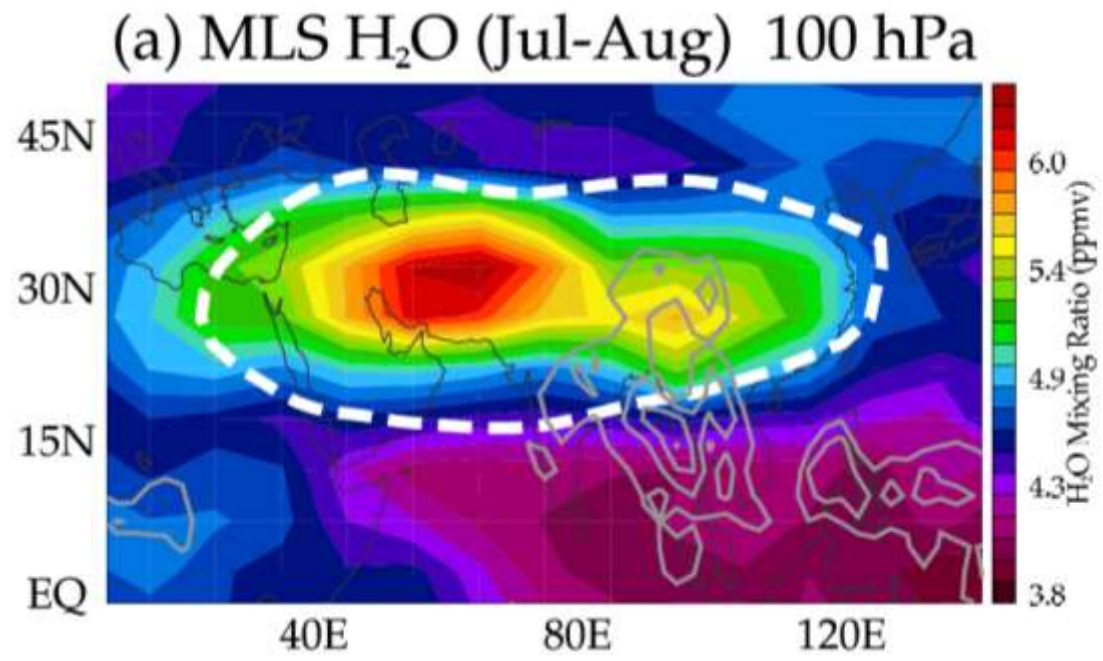
Highlights of the 3rd workshop

- New ACAM observations
- Collaboration opportunities
- The 2nd training school

ACAM From Space



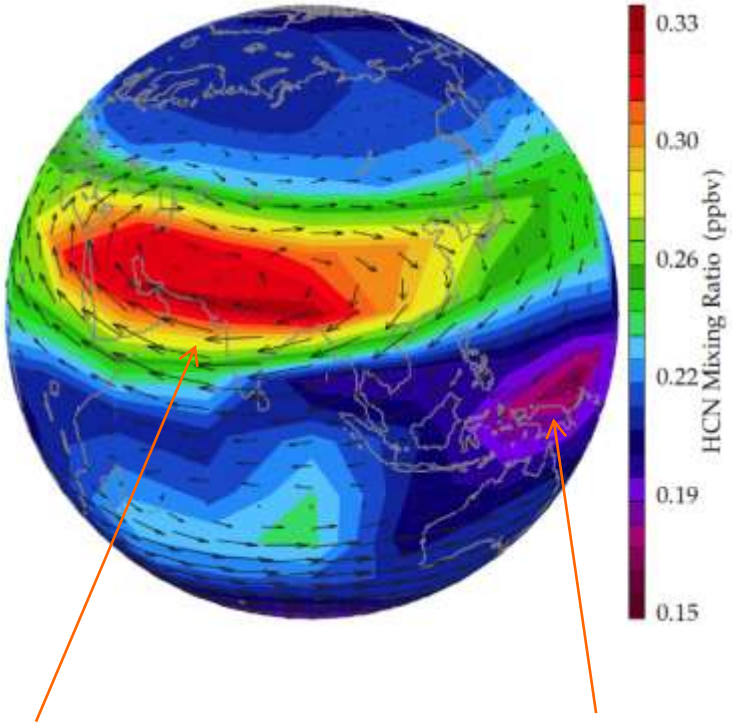
See talks by Michelle Santee and Michael Schwartz

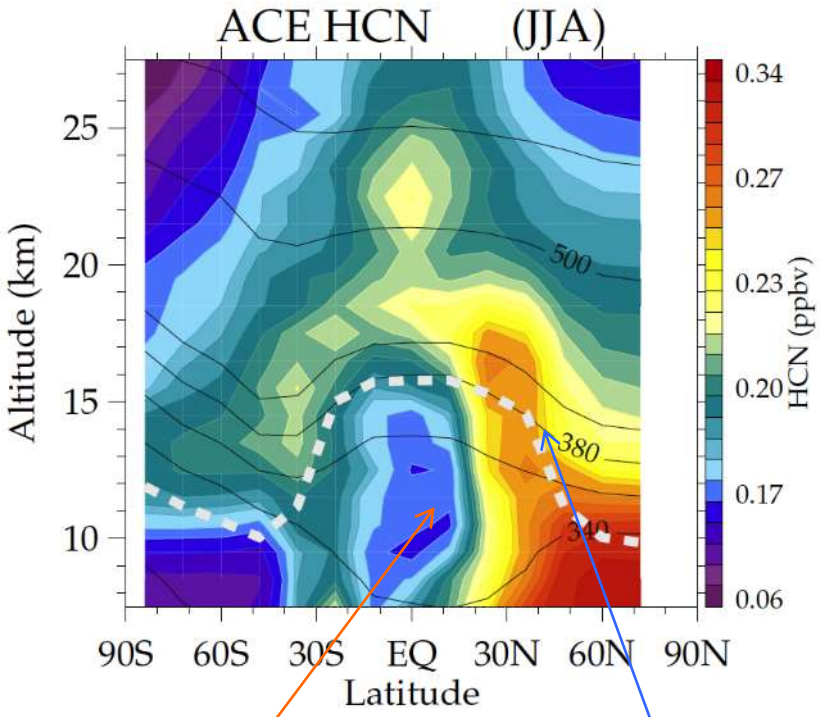


Park and Randel, 2007, 2008

A Unique Transport Pathway for Surface Emissions to Enter the Stratosphere

HCN from ACE Satellite (JJA, 16.5 km)





ASM maximum

minimum for air with recent ocean contact

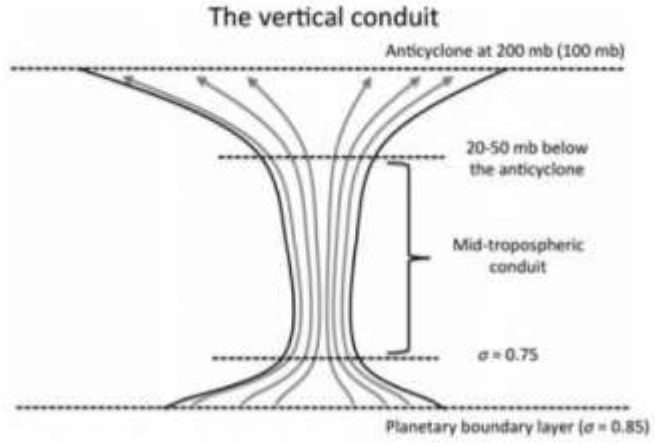
tropical minimum

transport to stratosphere via monsoon

Randel et al. 2010, Science

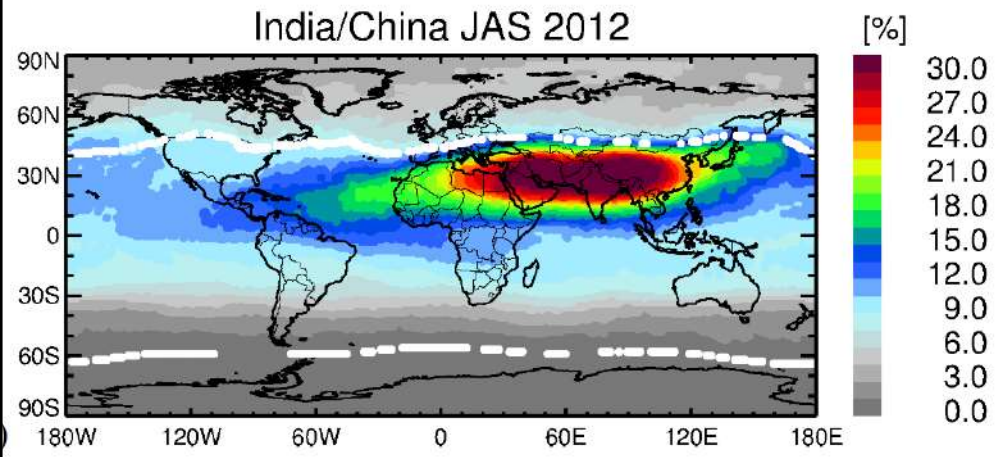
Model Studies of Convective Transport

Trajectory studies



Bergman et al 2013

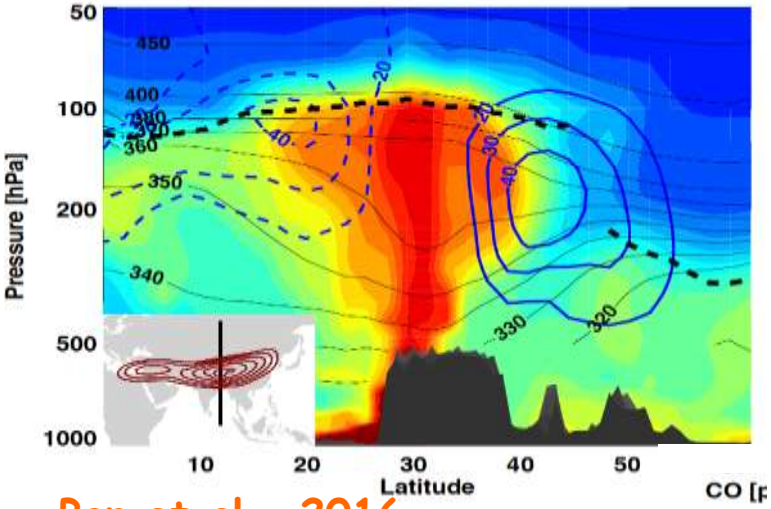
Convective transport couples boundary layer and UTLS



Vogel et al., 2015, 2016

See talks by Bärbel Vogel and Rolf Müller

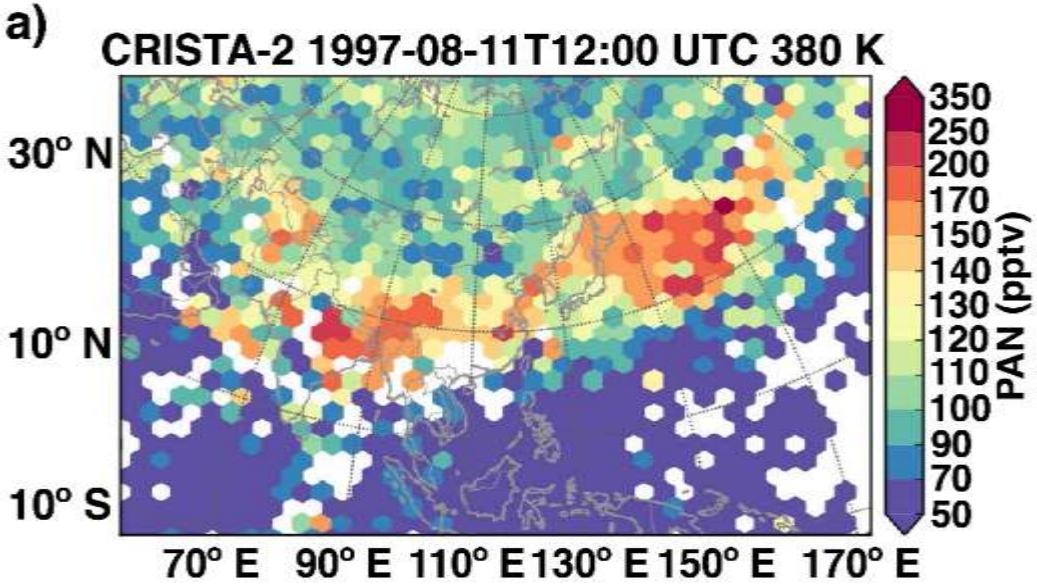
Chemistry transport models



Pan et al., 2016

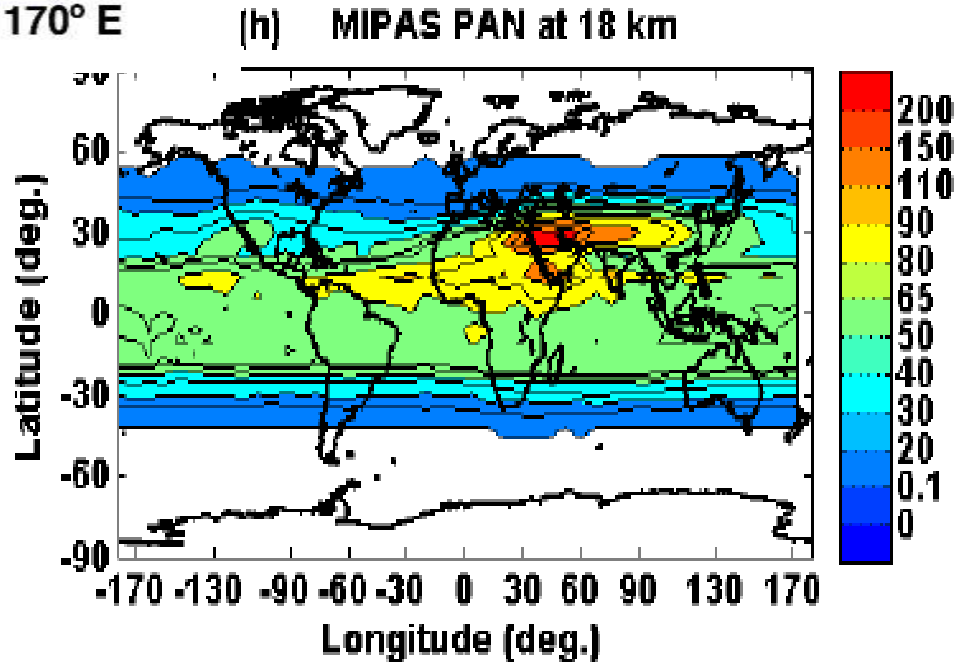
Additional species

PAN from Space Shuttle



Ugermann et al., 2015

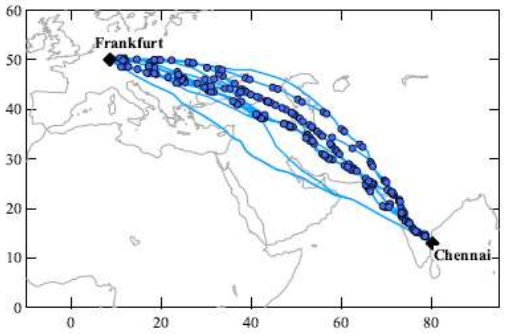
Fadnavis et al 2015



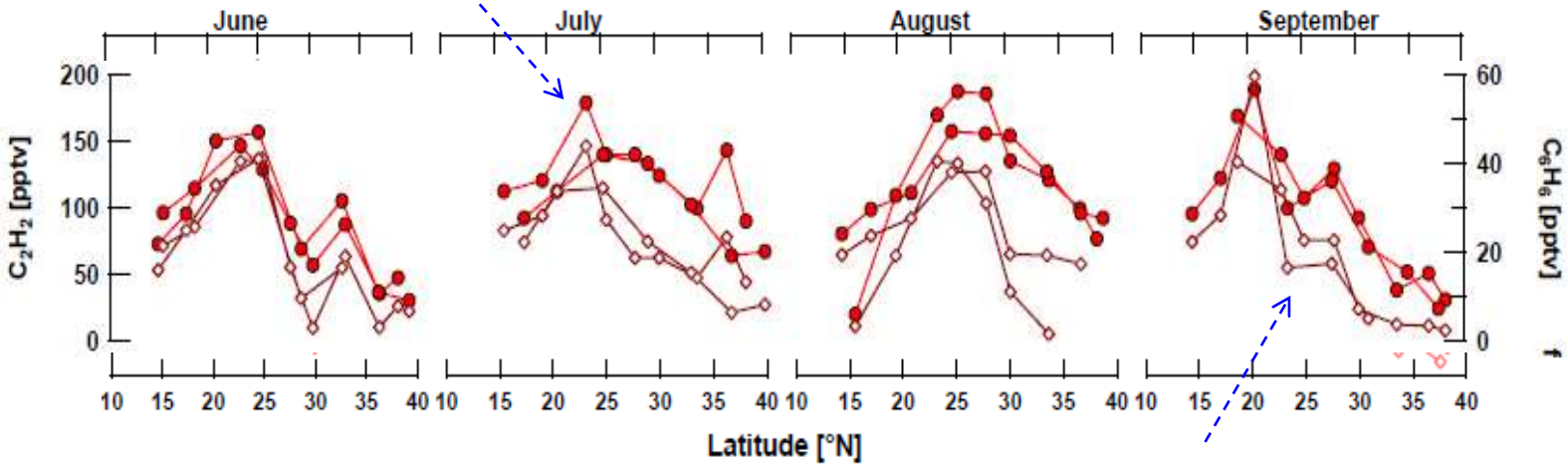
Convective impacts on upper tropospheric chemistry

short-lived species demonstrate rapid transport to anticyclone

Aircraft measurements



acetylene C_2H_2

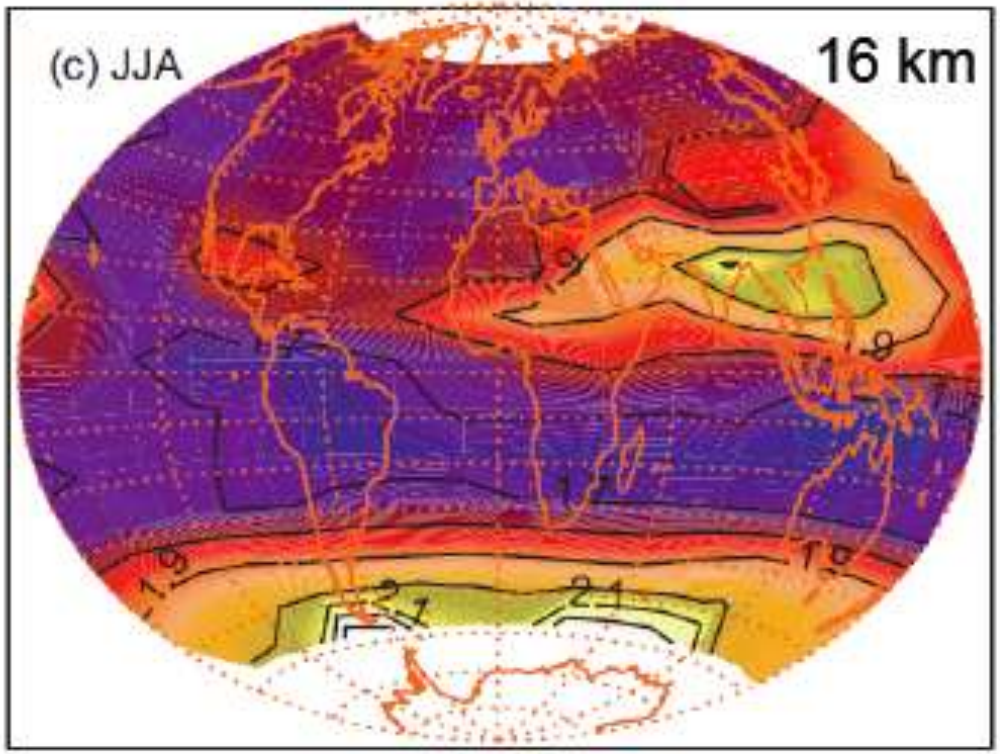


benzene C_6H_6

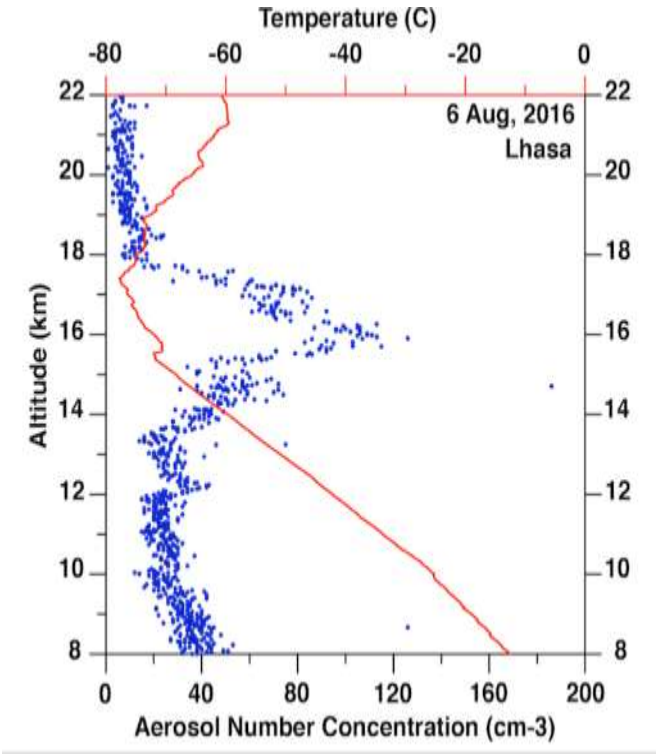
Baker et al., ACP, 2011

New targeted airborne campaign results from invited talks by Hartwig Harder and Elliot Atlas

Asian Monsoon – a significant source of aerosols into the stratosphere?



SAGE II measurements 1999-2005, Thomason and Vernier, 2013

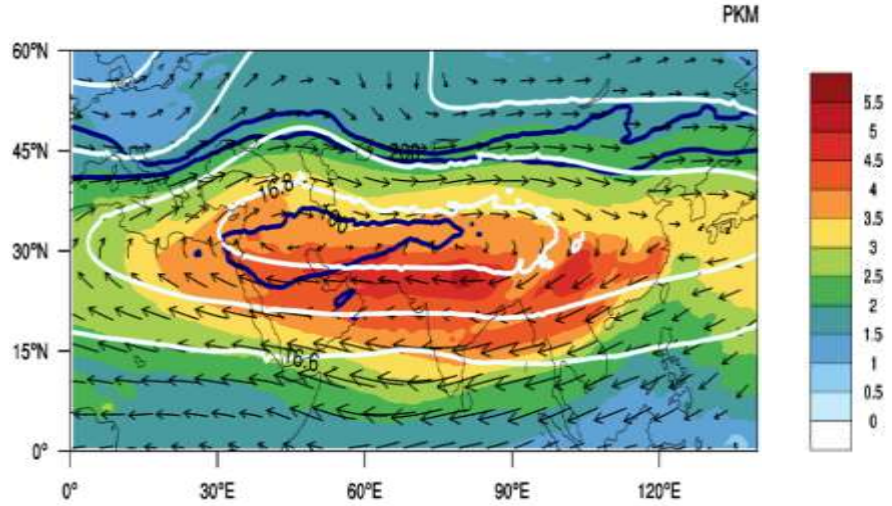


Sounding of particle profiles from Tibetan Plateau (Bian et al.)

See invited talks from Ru-shan Gao, Duncan Fairlie, and Simone Brunamonti

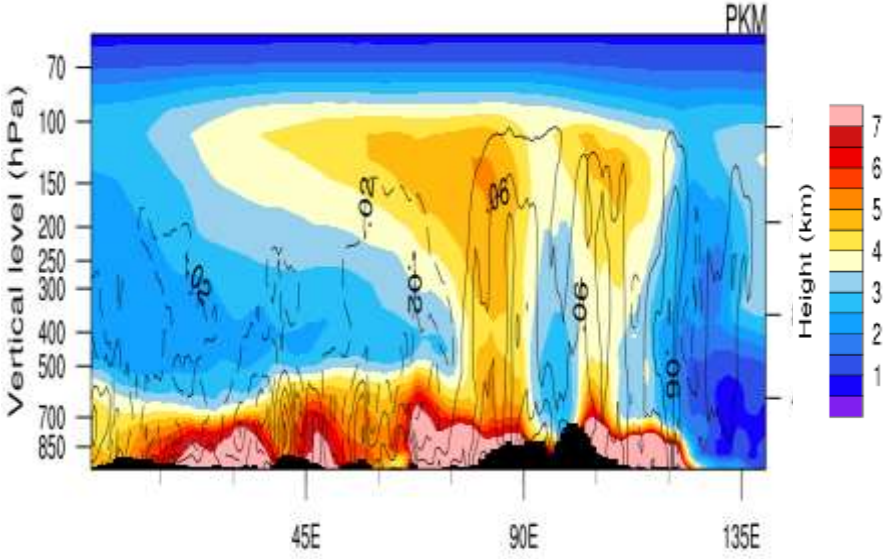
Jianchun Bian collaboration opportunity talk

Model Studies of Convective Transport
Carbonaceous Aerosol



100 hPa

During peak monsoon phase



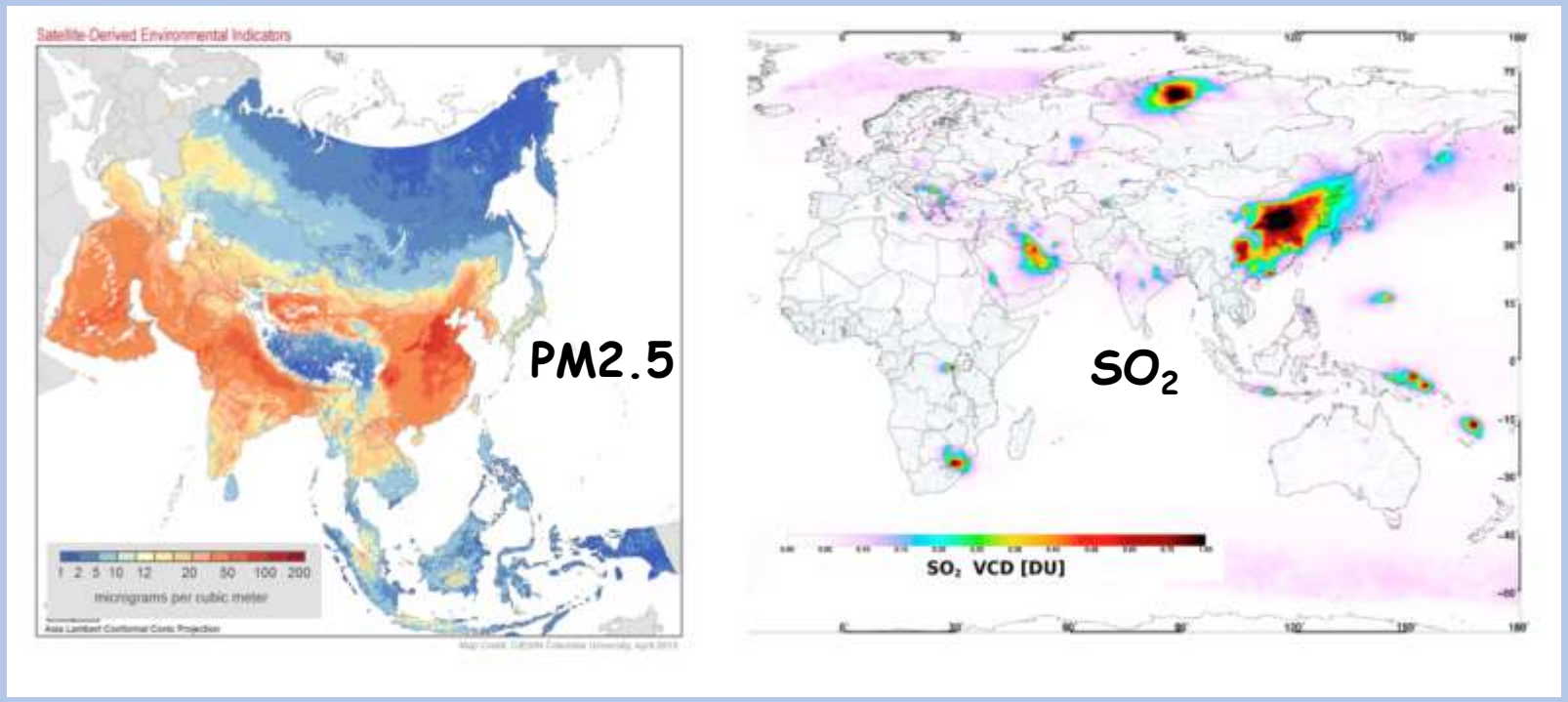
Two prominent source regions:
Northern India & Sichuan Basin

Advanced Research WRF
Lau et al., in preparation

See talk by Mian Chin

Asian Emissions, Air Quality ↔ Climate

Pollution and Anthropogenic emissions seen from space

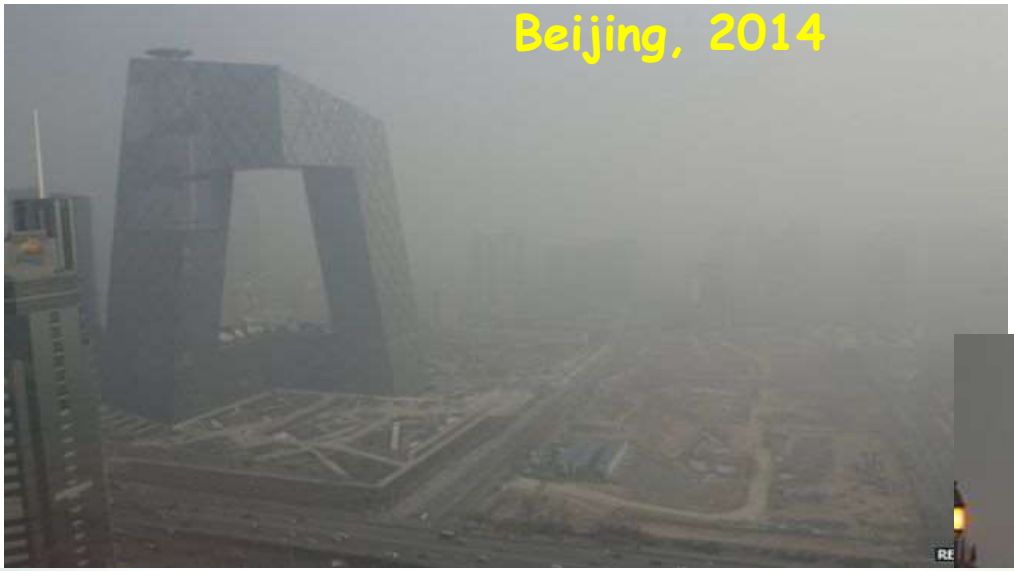


Asian PM2.5 (left, 2001-2010) and SO_2 (right, 2004-2009) from satellite data illustrate intense emissions in ASM uplift regions.

→ Helen Worden, Liangfu Chen, and Juying Warner Talks

Asian Emissions, Air Quality ↔ Monsoon

Widespread pollution in Asia

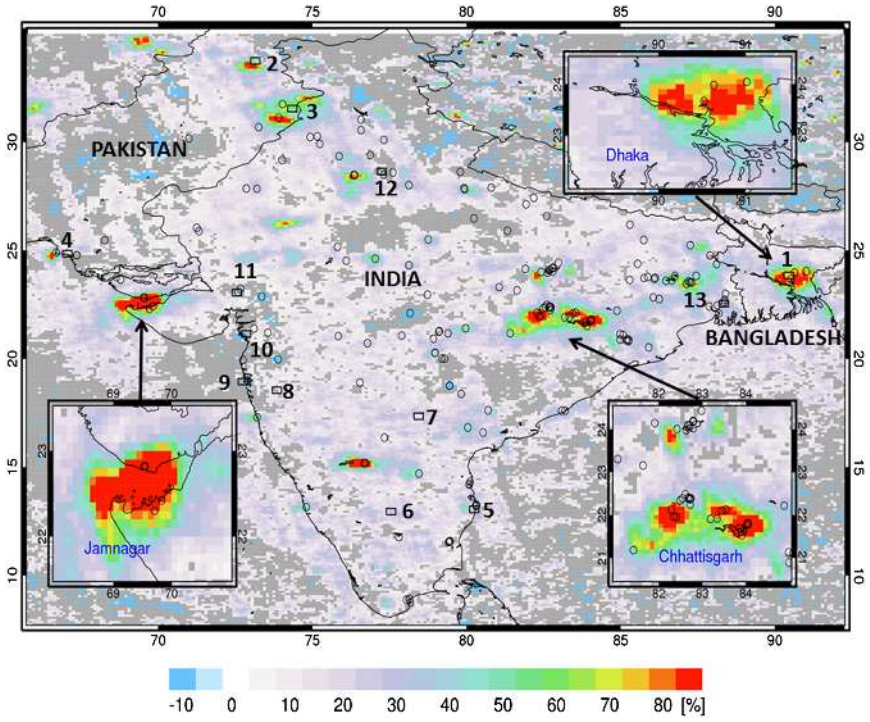


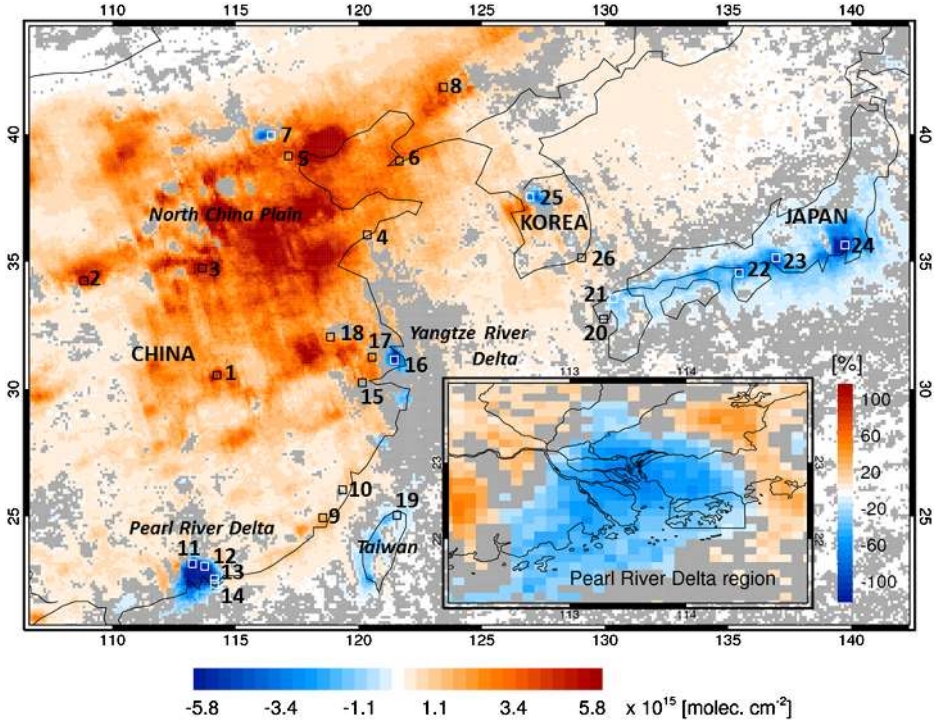
Invited Talks by Gehui Wang, Candice Lung, Sachin Ghude, and Md Firoz Khan

Asian Emissions, Air Quality ↔ The Future

Conditions across Asia are dynamically changing

Notable changes in OMI NO_2 (2005–2014) Duncan et al., 2016





For future plans and opportunities, see talks by CK Song, Guy Brasseur, and Jim Crawford

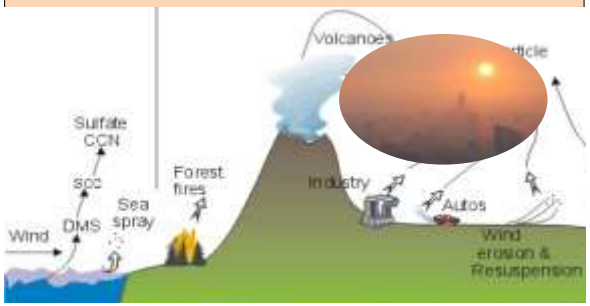
Asian Emissions, Air Quality ↔ Monsoon

Pollution impact on monsoon

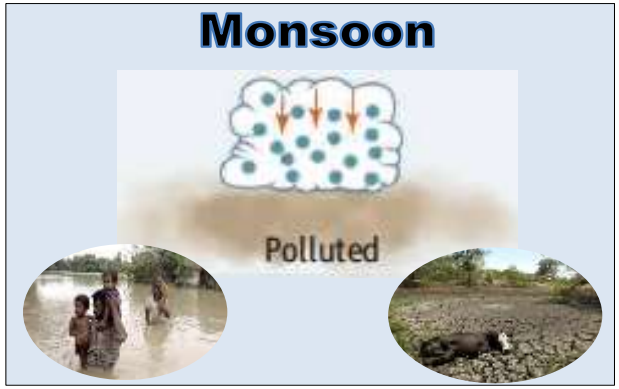
1. Scatter/absorb solar radiation
2. Warm atmosphere/Cool surface
3. Serve as CCN
4. Change cloud property

Strengthen/weaken the monsoon

Aerosol



Monsoon



Change aerosol concentration/distribution

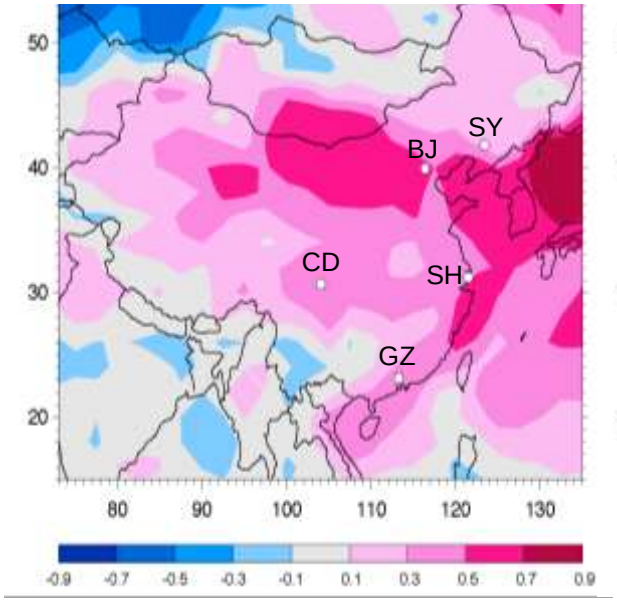
1. Wet scavenging
2. Convection/advection
3. Emission/chemistry

See invited talks by Sachchida Tripathi and Teppei Yasunari

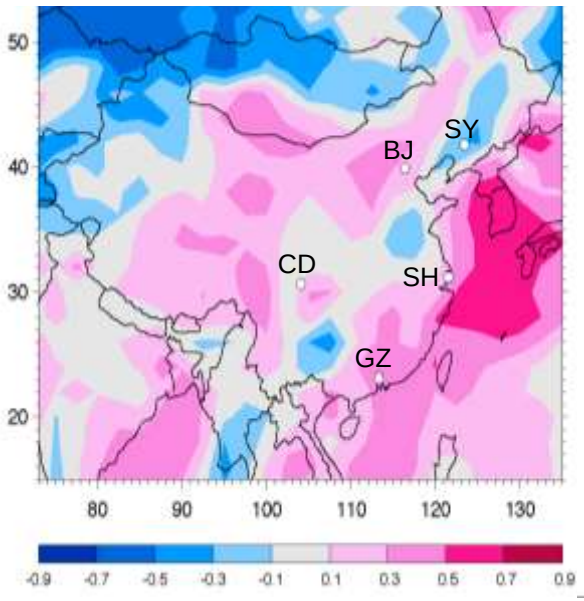
Air Quality ↔ Monsoon

There is a significant correlation between the East Asian Winter Monsoon Index (EAWMI) and PBLH, Surface wind and PM

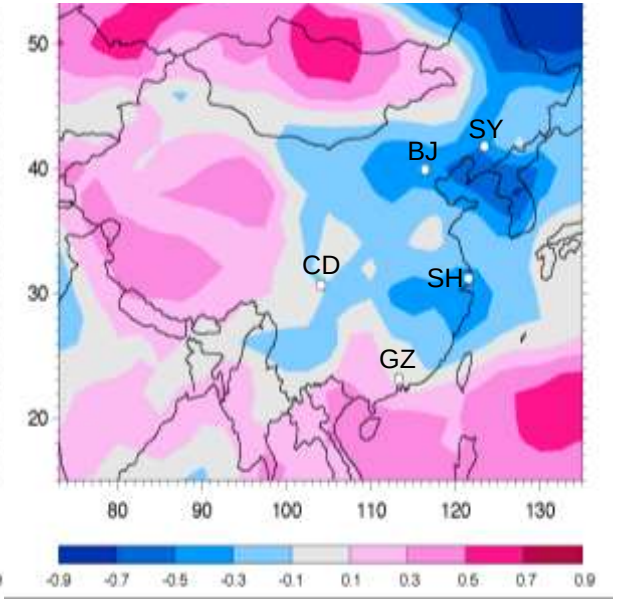
(a) PBLH and EAWMI



(b) W10m and EAWMI



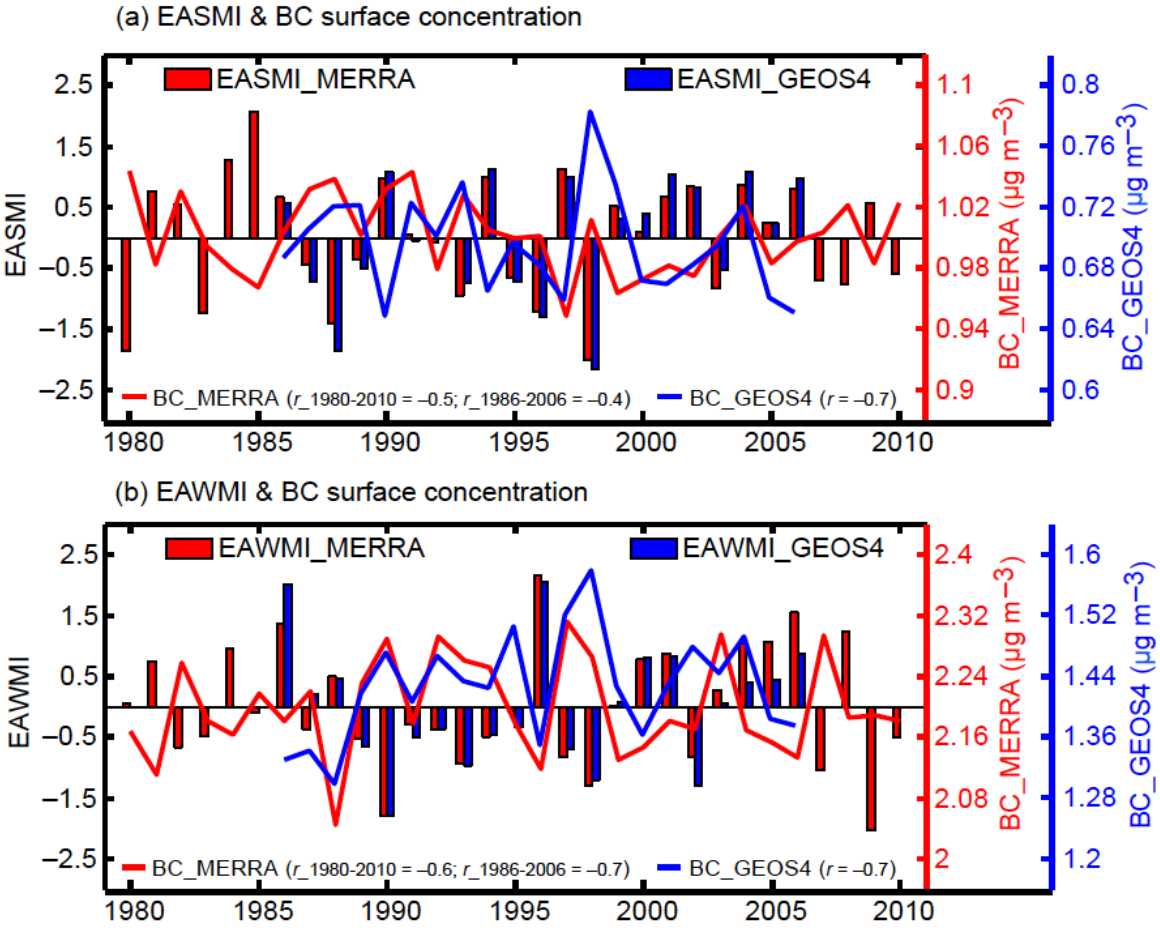
(c) PM_an and EAWMI



SY = Shenyang, BJ = Beijing, SH = Shanghai, CD = Chengdu, GZ = Guangzhou

Relationships among pollution PM, PBLH, winds, and EAWMI: model results with fixed anthropogenic emission (meteorology-induced changes of pollution PM), winter 1980-2009

Monsoon variability may have strong impact on surface air quality



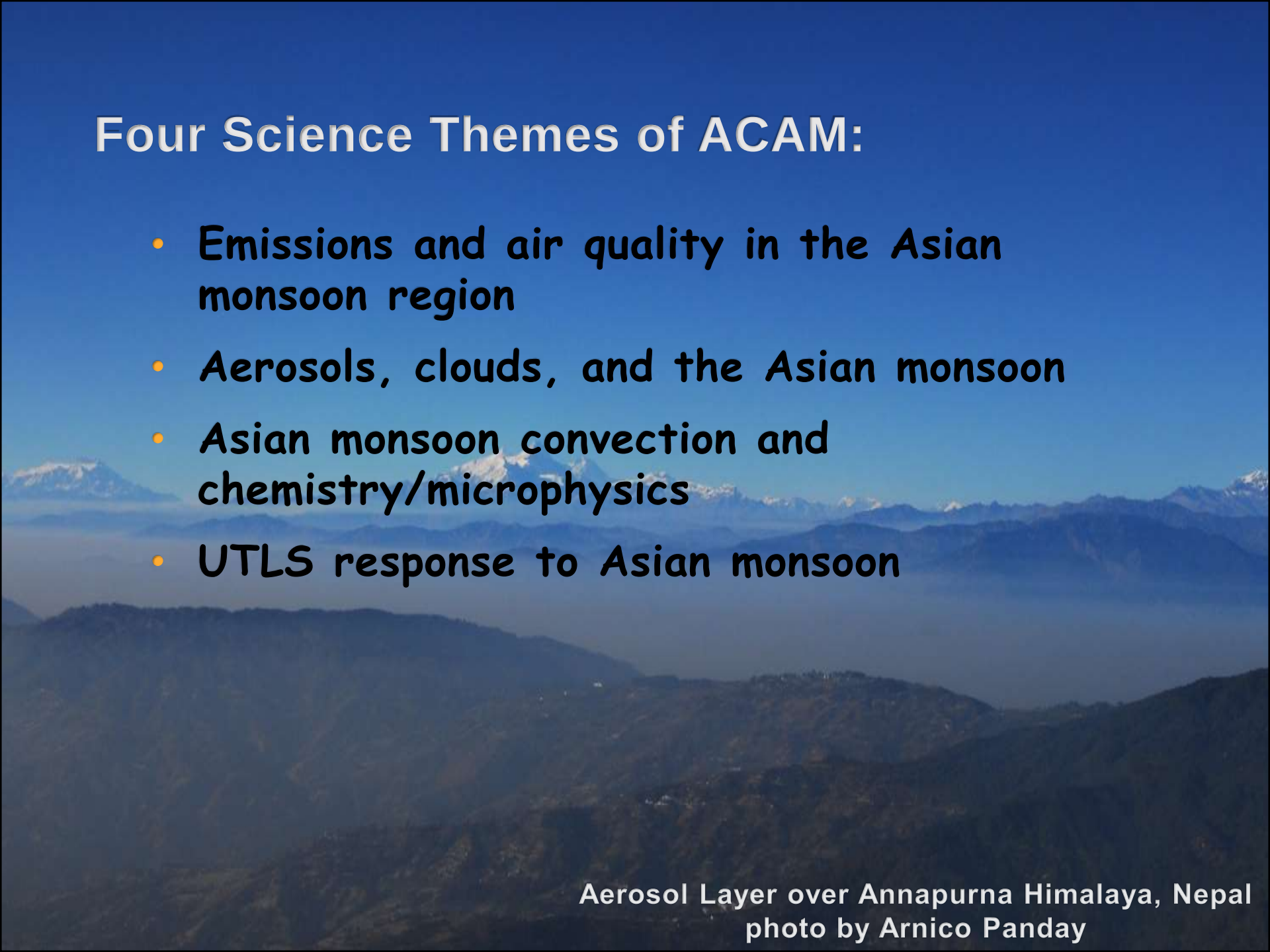
Mao et al., 2017

See Hong Liao Invited talk

Also see talks by Rokjin Park, Abdus Salam

Four Science Themes of ACAM:

- Emissions and air quality in the Asian monsoon region
- Aerosols, clouds, and the Asian monsoon
- Asian monsoon convection and chemistry/microphysics
- UTLS response to Asian monsoon



Aerosol Layer over Annapurna Himalaya, Nepal
photo by Arnico Panday

ACAM Milestones and Goals

- 2014 - Received joint sponsorship from IGAC and SPARC as an "Emerging Activity"
- 2015 – Became a jointly-sponsored Activity
- March 2016 - Transitioned the Activity Formation Committee (AFC) into a formal Scientific Steering Group (SSG)
- ACAM works on both a set of scientific problems and capacity building through biennial workshops held in June 2013, 2015, and 2017 (planned)
- Community building and capacity building are essential in advancing ACAM science goals given the politically diverse region and emerging scientific communities

Beijing 2012 : ACAM Side Meeting during 12th IGAC Conference

- A side meeting on Atmospheric Composition and the Asian Monsoon was held at the 12th IGAC Science Conference in Beijing.
- The meeting was attended by thirty-one scientists representing seven different nations
- The discussion led to the planning of the 1st ACAM workshop in Kathmandu, 2013

Biennial ACAM workshops

The 1st ACAM workshop
Kathmandu, Nepal
June 2013

The 2nd ACAM workshop
Bangkok, Thailand
June 2015

The 3rd ACAM workshop
Guangzhou, China
June 2017

1st ACAM Workshop:

June 9-12, 2013, Kathmandu, Nepal, 120 scientists, representing 17 countries (12 Asian and 5 European/N. American)

ICIMOD 30 · IGAC · GLOBAL IGBP CHANGE International Geosphere-Biosphere Programme · SPARC · WCRP World Climate Research Programme · ileaps · NSF · NCAR

2nd ACAM Workshop:

June 8-10, 2015, Bangkok, Thailand,
170 scientists, representing 22 countries

ACAM WG4: THE 1ST ACAM TRAINING SCHOOL

"Satellite and Model Data Use for Aerosols and Air Quality"

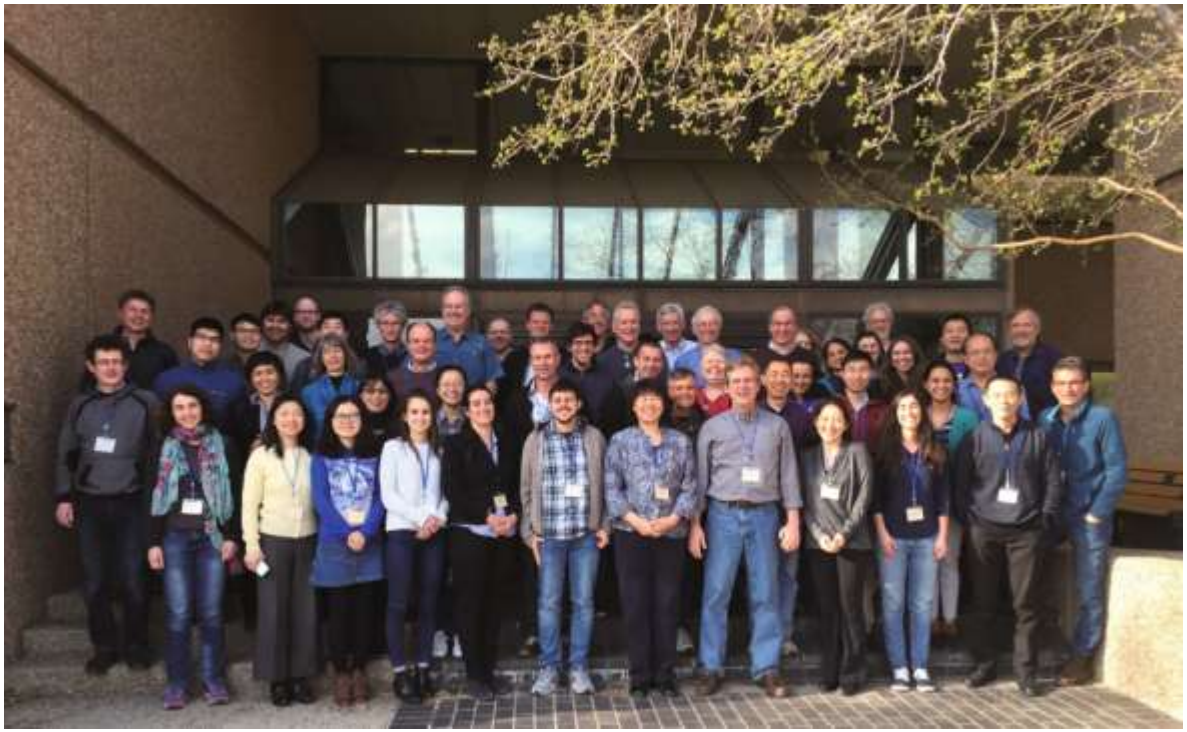
11-12 JUNE 2015, ASIAN INSTITUTE OF TECHNOLOGY, BANGKOK

Workshop on Dynamics, Transport and Chemistry of the UTLS Asian Monsoon

March 7-10, 2016 NCAR, Boulder, CO, USA

Organizing committee:

Bill Randel, Laura Pan, Rolf Mueller, Michelle Santee, Jianchun Bian, Chiara Cagnazzo



- 4-day workshop engaged ~ 50 people who are actively engaged in Asian monsoon UTLS research
- Interactive workshop to bring together a picture of state of science
- Topic including dynamics, transport, composition including aerosol
- Latest observations and modeling
- Identified outstanding science questions
- Discussed the possibility of a review paper

For presentations and the workshop report:
https://www2.acom.ucar.edu/asian-monsoon

Highlights of the 3rd ACAM Workshop

Coordinated ground based observation:

- Balloon measurement campaign of the Asian Tropopause Aerosol Layer (BATAL)
- Sounding Water vapor, Ozone, and Particle (SWOP) campaign
- StratoClim Balloon activity

Airborne 2016:

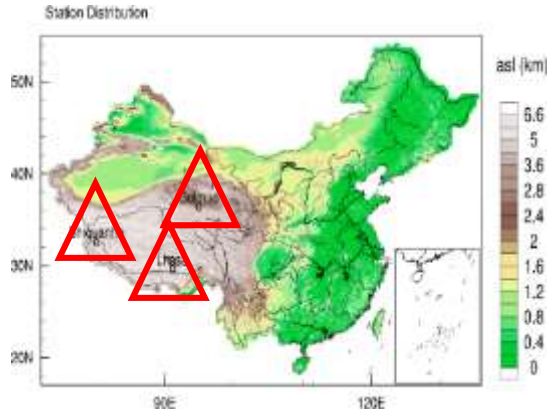
StratoClim (EU project Geophysica)

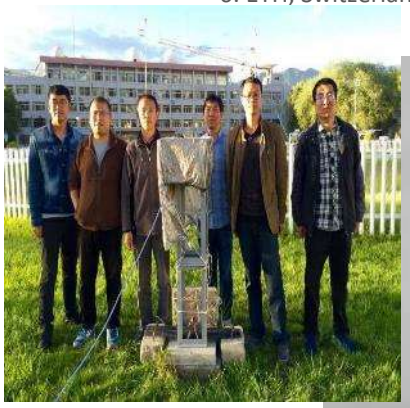
(flights cancelled the last minute, but balloon launches occurred)

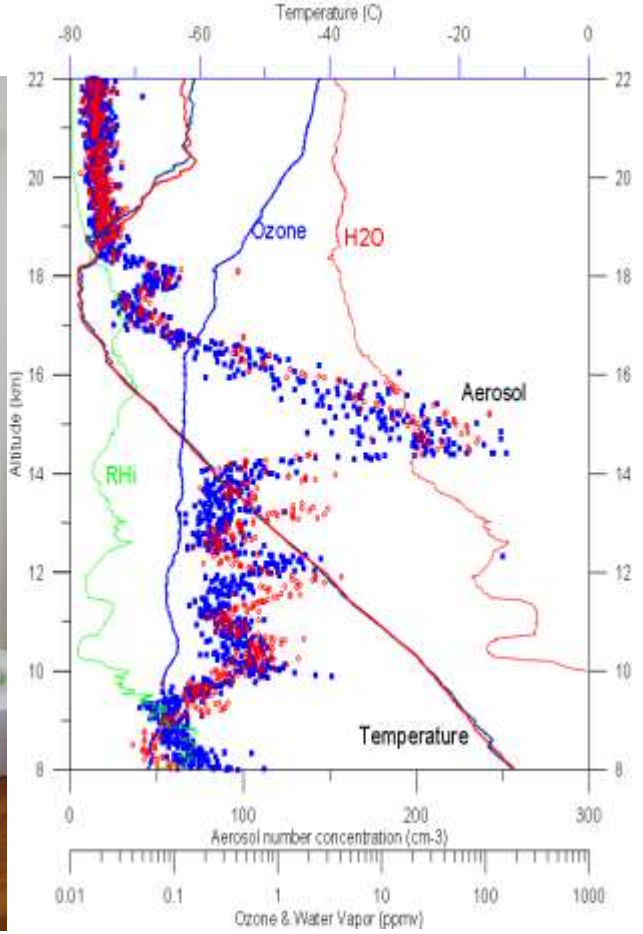
Sounding Water vapor, Ozone, and Particle over the Tibetan plateau in 2016

J. Bian[1], Z. Bai[1], K. Fan[1], H. Wang[1], N. Tang[1] D. Li[1] , S. Liu[2], R. Gao[2], X. Wan[1], W. Sang[3], Y. Li[3], X. Zheng[4], H. Voemel[5], B. Luo[6], F. Wienhold[6]

1. IAP/CAS, China; 2. ERSL/NOAA, USA; 3. Lanzhou University, China; 4. CAMS/CMA, China; 5. NCAR, USA; 6. ETH, Switzerland







Balloon launch locations:

Lhasa, July-August, 14 flights

Golmud, July-August, 15 flights

Shiquanhe, June-September, 25 flights

Payloads:

COBALD backscatter sonde , Ozonesonde,

Cryogenic frostpoint hygrometer, POPS

-Example of enhanced aerosol layer from Lhasa on August 14, 2016, and its peak is ~ 4 times that of Kunming observation in 2015 summer.

-During the campaign, coordinated by Beiping Luo from ETH, four times of matching sounding were conducted between (three times) Lhasa and Nainital (India) and (once) Lhasa and Shiquanhe .

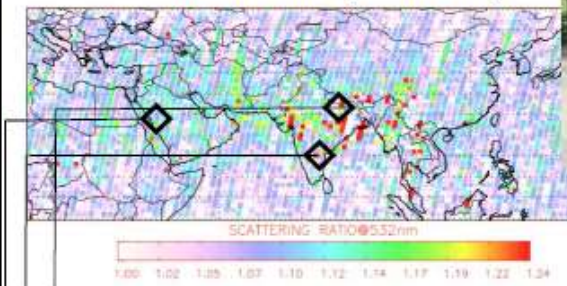
See Duncan Fairlie invited talk

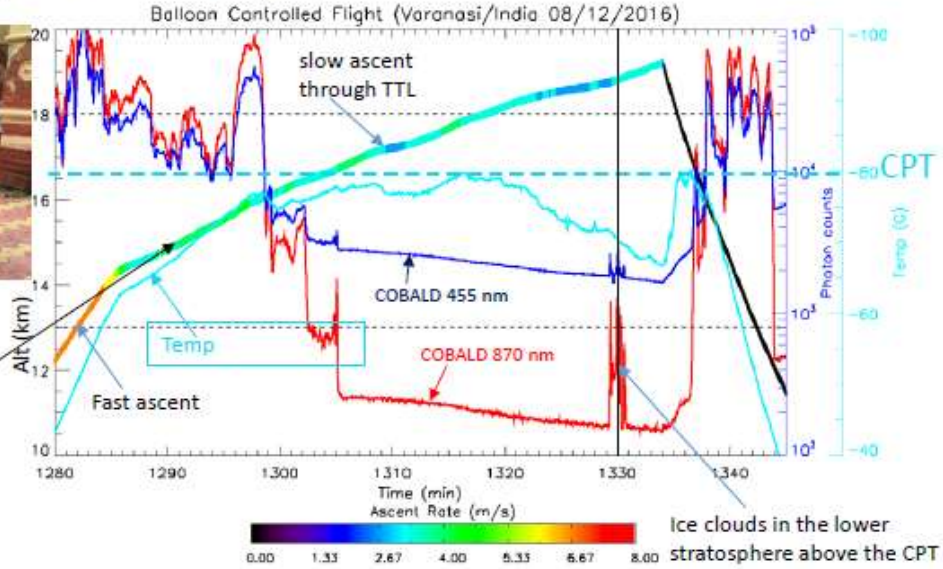
Balloon measurement campaign of the Asian Tropopause Aerosol Layer (2016)

J.-P. Vernier[1,2], T.D. Fairlie[2], M. Natarajan[2], A. K. Pandit[3], M. V. Ratnam[3] ,H. Gadhavi[3], T. Wegner[1], N. Baker[1], A. Jayaraman[3], A. Singh[4],S. Kumar[4], G. Stenchikov[5], J. Smith[6], M. Williamson[6], F. Wienhold[7]

1. Science Systems and Applications, USA; 2. NASA Langley Research Center, USA; 3. National Atmospheric Research Laboratory, Gadanki, India; 4. Banaras Hindu University, India; 5. King Abdullah University of Science and Tech., Saudi Arabia, 6. Smith and Williamson, USA ; Swiss Federal Institute of Tech., Zurich, Switzerland

CALIPSO lidar : 11-27 July-2016
UTLS aerosol (15-18 km)





Balloon launch Locations :
- Thuwal, Saudi-Arabia, August 2016, 5 flights
- Gadanki, India, July-Sept 2016, 5 flights
- Varanasi, India, August 2016, 4 flights, 2 controlled flights

Payloads :
- COBALD backscatter sonde
- Cryogenic Frost Point Hygrometer
- Ozonesonde
- Optical Particle Counter, 8 channels, [0.15-2.5μm]
- Aerosol filter and cascade impactor
- Boomerang flight controlled system

- Example of controlled balloon flight through the TTL from Varanasi (North India, Indo-Gangetic Plain). Fast ascent up to 12 km (6m/s) followed by slow ascent near 2 m/s between 14-18 km, termination flight at 19 km. ~1 h in the TTL instead of ~20 min for regular balloon flight.
- Layers were present in the lower stratosphere above the CPT as the balloon flew in the vicinity of a deep convective system. Ice cloud or aerosol layer ?

See Simone Brunamonti invited talk

STRATOCLIM Balloon Activities in 2016

(Info from Tom Peter et al., ETH Zürich and Manish Naja, Nainital India)

- The STRATOCLIM balloon campaign in India was accomplished despite postponement of the main Geophysica flight campaign
- A total of 30 balloons from Nainital, India, launched from 2-31 Aug. 2016 (17 nighttime, 13 daytime).

- Launches were closely coordinated with simultaneous soundings from Lhasa and Shiquanhe (Tibet), Gadanki and Varanasi (India), and Bhola Island (Bangladesh). Six Lagrangian matches.
- Planned balloon launches from Nagpur/Pune had to be cancelled (no ATC approval obtained)
- Payload: COBALD backscatter sonde, frost point hygrometer, ECC ozone sonde , met. probe
- Rich data set sampled (ATAL, ice clouds above CPT, ….)

Highlights of the 3rd ACAM Workshop

Research and Collaboration Opportunities:

1. Jim Crawford: HAM-AQ
2. Rolf Mueller: StratoClim
3. Hans Schlager: HALO data
4. Gao Chen: NASA TropChem Data
5. Jianchun Bian: SWOP data
6. Mian Chin: AeroCom
7. Jessica Neu: CCMi
8. Chiara Cagnazzo: CMIPS

ACAM Leadership

- Co-leads: Laura Pan (NCAR, US) and Jim Crawford (NASA, US)
- SPARC Liaison: Michelle Santee (JPL, US)
- IGAC & MANGO Liaison: Hiroshi Tanimoto (NIES, Japan)
- ICIMOD Liaison: Arnico Panday (ICIMOD, Nepal)
- WG1 co-leads: Vinayak Sinha (IISER, India)
  Data sharing Gabi Stiller (KIT, Germany)
- WG2 co-leads: Jessica Neu (JPL, US)
  CCMi/AeroCom Chiara Cagnazzo (ISAC-NRC, Italy)
  Mian Chin (GSFC, US)
- WG3 co-leads: Hans Schlager (DLR, Germany)
  Campaigns Jianchun Bian (IAP/CAS, China)
- WG4 co-leads: Mary Barth (NCAR, US)
  Training school Ritesh Gautam (IIT-Bombay, India)
  Federico Fierli (ISAC-CNR, Italy)
- 1st/2nd/3rd ACAM workshop local chairs:
  Arnico Panday, Sachiko Hayashida and Xuemei Wang

Working Group Structure and Philosophy

Working Groups are an unique aspect of the ACAM activity and are important to its community building aspirations.

Working groups serve to facilitate collaborations and build capacity.

Working Group leads serve as points of contact and welcome input and contributions from working group members.

Recently, each WG has established a dedicated webpage.

Membership is encouraged. If you are not yet a member, please consider where you could best contribute and contact the relevant WG leads.

Thursday afternoon is devoted to open discussions led by the WG leaders to understand your needs. We need everyone to participate!

ACAM Working Group on Data Sharing (WG1)

This working group on data sharing (WG1) addresses the following tasks:

- Identify relevant observational datasets for the study of the Asian monsoon
- Organize data sharing
- Improve online access to observational datasets
- Individual arrangements for data access, no common data protocol!

Aircraft measurements: ARFI, ESMVal, INDOEX, OMO, OP3, SHIVA, SusKat
Balloon soundings: ASM soundings, SHADOZ, TAPTO
Ground-based measurements: IISER Mohali, Malaysia-Mead, NAMaSTE, SusKat
Long-term records: CARIBIC, IAGOS-MOZAIC
Satellite data records: ACE-FTS, MIPAS, IASI/MetOP, IASI-SOFRID, MLS, SAGE
(in blue: information and links to data available via ACAM WG1 website)

If you feel that datasets relevant for ACAM are missing please contact us:
Gabriele Stiller (KIT, Germany) – gabriele.stiller@kit.edu
Vinayak Sinha (IISER, India) – vsinha@iisermohali.ac.in
Klaus Gottschaldt (DLR, Germany) – klaus-dirk.gottschaldt@dlr.de

https://www.pa.op.dlr.de/ACAM_WG1/

Partnership with global and regional modeling communities (WG2)

Objectives:

- Establish connections between the ACAM community the global and regional modeling communities
- Foster the use of existing, state-of-the-art modeling tools for ACAM-related studies
- Coordinate modeling and data analysis activities focused on ACAM topics

Current and Proposed activities:

- Define a common set of **diagnostics** and **metrics** linking different typologies of observations and Global Models for model evaluation, model improvements, interpretation of model predictions
- Communicate with other WGs on **data sharing** and in-situ/remote sensing data analysis, data needs, and **training activities** on using models for ACAM
- Create an **ACAM-Model-Intercomparison Project** (ACAM-MIP), which is connected to the AeroCom/HTAP existing or proposed model experiments

List of ongoing international relevant Projects: CCMI, AeroCom, AerChemMIP, CMIP6, HTAP, MICS-Asia, StratoClim, SSiRC, PRIMAVERA, C3S

Please contact us if you are interested : Chiara Cagnazzo (Italy), c.cagnazzo@isac.cnr.it; Jessica Neu (USA), Jessica.L.Neu@jpl.nasa.gov; Mian Chin (USA), mian.chin@nasa.gov

Group 3: Field campaign concept development

Working group goals:

1. To gather and categorize all available information about ACAM-related field campaigns and to share it with the ACAM community;
2. To set up a platform under the ACAM Activity for all teams involved in ACAM-related field campaigns and scientists interested in field campaigns to communicate with each other;
3. To provide potential ideas for future field campaigns by summarizing the group's collective inputs.

Ongoing activities:

1. To promote coordination and collaboration among ACAM-related field campaigns when practical;
2. To update working group members.

More information for getting involved in WG3 activities:

1. Current and planned field campaigns
2. Current membership

Contacts of the working group leads:

1. Hans Schlager (DLR, Germany); 2. Jianchun Bian (IAP/CAS, China)

WG4: ACAM Working Group on Capacity Building

https://www2.acom.ucar.edu/acam/acam-working-group-training

Goals

- To develop training opportunities for young Asian scientists on the use of models and satellite observations
- To create a network of ACAM scientists through the ACAM workshops, ACAM training schools, and this web page
- To provide resources for improving science and communication skills

Activities

1. ACAM Training Schools
   - **2015 Asian Institute of Technology, Bangkok**
   - **2017 Jinan University, Guangzhou (new- longer training school, getting more deeper into fundamentals, lectures on atmospheric instrumentation)**
2. Disseminate information via ACAM web page
3. **Future plans of forming an ACAM mentoring program, continue capacity building focused on ACAM-relevant science and communication, enhanced training resources dissemination via ACAM web, collaborate with other training networks**

Contacts: Ritesh Gautam rgautam.iitb@gmail.com,

Mary Barth barthm@ucar.edu, Federico Fierli f.fierli@isac.cnr.it

2nd ACAM Training School

Observations & Modeling of Atmospheric Chemistry & Aerosols in the Asian Monsoon region

10-12 June 2017, Jinan University, Guangzhou, China

Agenda

10 June (Saturday)

9:00am	**Introduction to the Training School** *Mary, Federico, Ritesh*
9:10 - 10:40am	**Asian Monsoon** *Tianjun Zhou, LASG, China*
10:45 - 12:45pm	**Intro to CCMI and Satellite Remote Sensing of Atmospheric Composition** *Jessica Neu, JPL/CalTech, USA*
12:45 – 2:15pm	**Group Photo and Lunch**
2:15 - 4:15pm	**Atmospheric Instrumentation (focus on airborne instrumentation)** *Elliot Atlas, U. Miami, USA*
5:00 - 9:00pm	**Science & Communication Café (with Dinner)**

1st ACAM Training school, AIT, Bangkok

11 June (Sunday)

9:00 - 10:30am	**Ocean-Atmosphere coupling** *Tianjun Zhou, LASG, China*
10:30 - 12:30pm	**Transport/Dynamics-Chemistry** *Federico Fierli, ISAC/CNR, Italy*
12:30 - 1:30pm	**Lunch**
1:30 - 3:30pm	**Chemistry-Climate Interactions** Chiara Cagnazzo, *ISAC/CNR, Italy*
3:30 - 3:45pm	**Break**
4:00 - 6:00pm	**Atmospheric Instrumentation/Measurements** *Sachin Ghude, IITM, India*

12 June (Monday)

9:00 - 11:00pm	**Observational and Modeling analysis of Asian Monsoon & Aerosols** *Mian Chin, NASA/GSFC, USA*
11:00 - 12:00pm	**Regional Climate Chemistry modeling** *Mary Barth, NCAR, USA*
12:00 - 1:00pm	**Lunch**
1:00 - 2:00pm	**Regional Climate Chemistry modeling** *Mary Barth, NCAR, USA*
2:00 - 4:00pm	**Aerosol-Radiation Remote Sensing** *Ritesh Gautam, IIT Bombay, India*
4:00 - 5:00pm	**General Outlook, Feedback, *Adjourn***