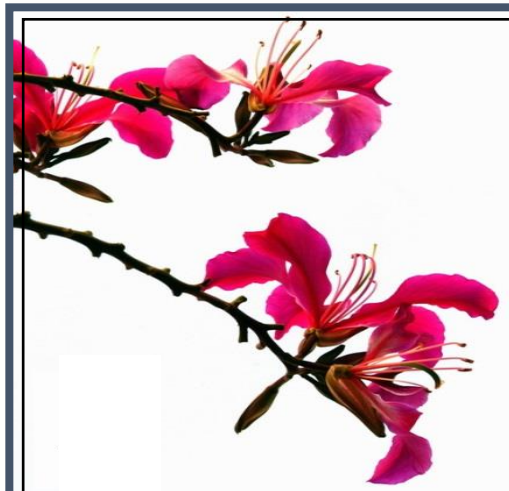


Activities and opportunities for POPs research in Africa and other developing countries

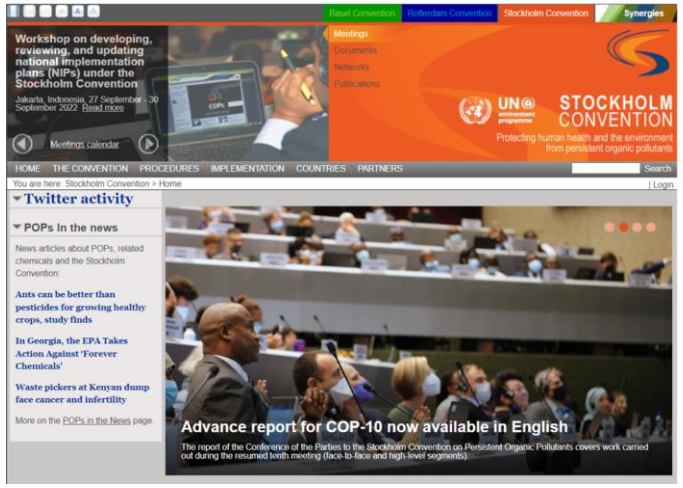
Gan Zhang （张干）
State Key Laboratory of Advanced Environmental Technology
Guangzhou Institute of Geochemistry
Chinese academy of Sciences

for ‘African round-table on POPs research’

2025.06.10 @Team

POPs is a global environmental challenge

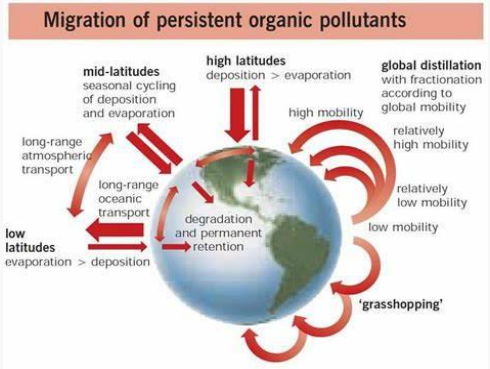
Stockholm Convention on persistent organic pollutants



- Signed in 2001
- Implemented since 2004

Key drivers of global dispersion of POPs

- Natural transmission via atmosphere, water and biota
- Global redistribution of industries
- Global transfer of solid waste
- Global trade of commodities and food
- Exemptions of POPs application in certain developing countries



Natural transmission of POPs

Hops and global distillation model

(Frank Wania and Don Mackay, 1983, 1986)

Rendering more concerns in colder places

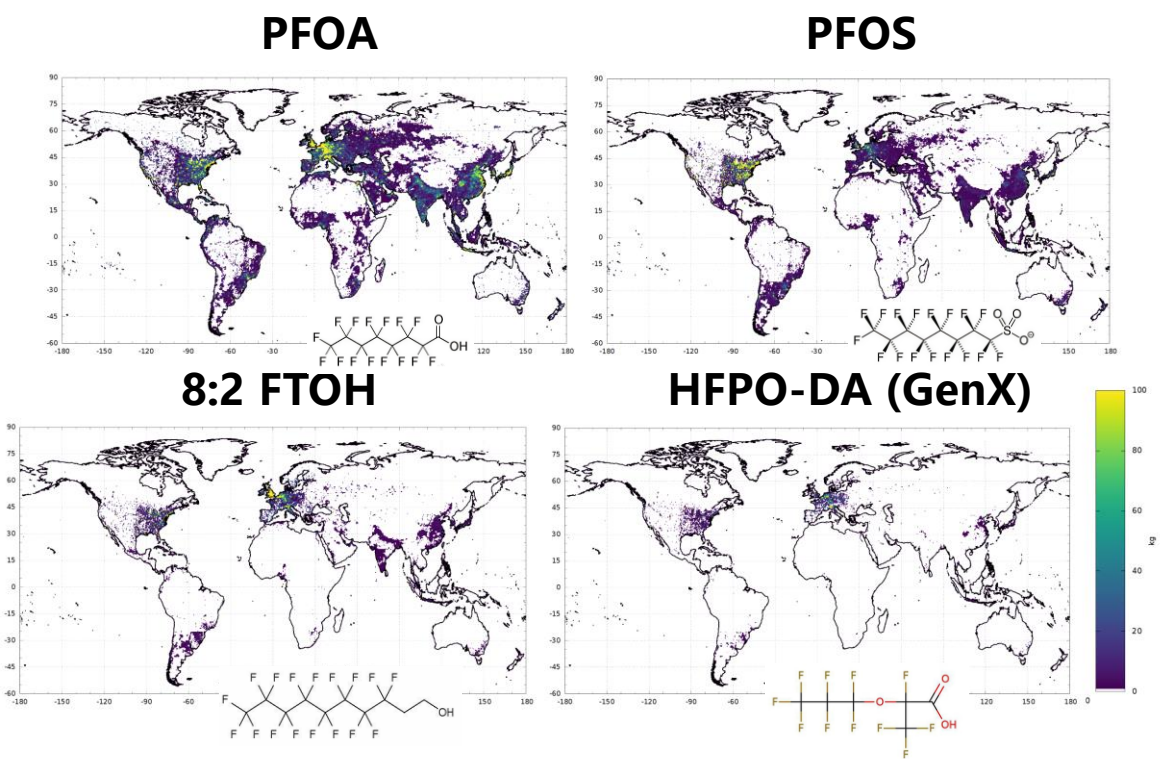
The Arctic, Antarctic

Tibetan plateau

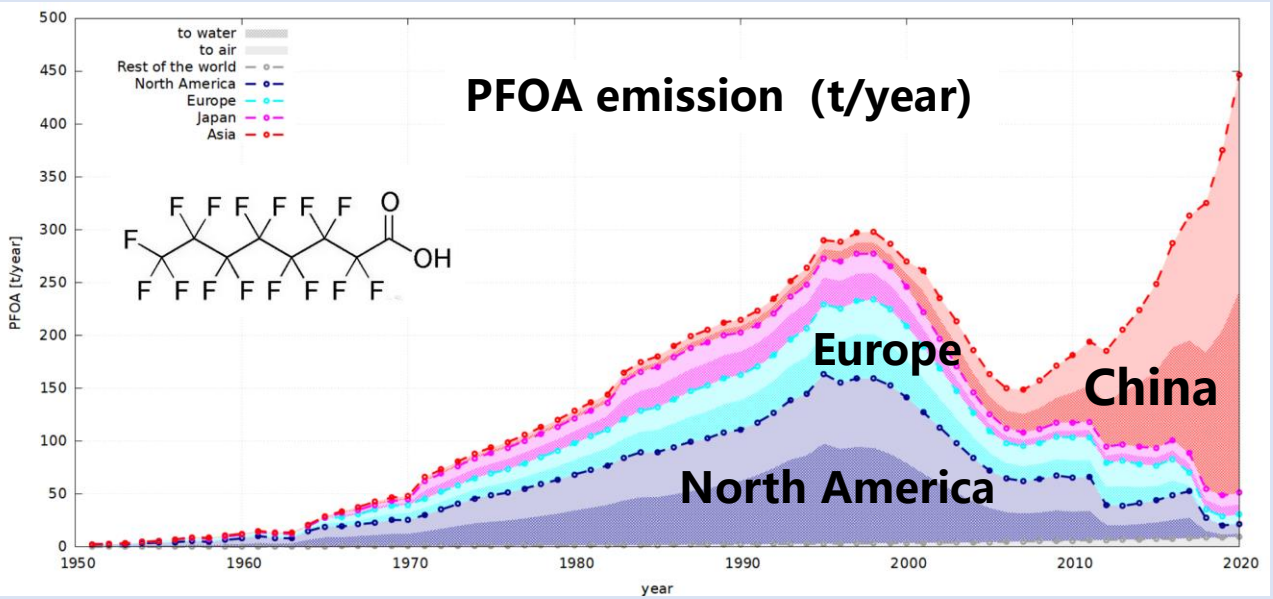
What about the warmer 'global south'?

Global redistribution of industrial capacity: PFAS

Global PFAS emission inventory (1950-2020)

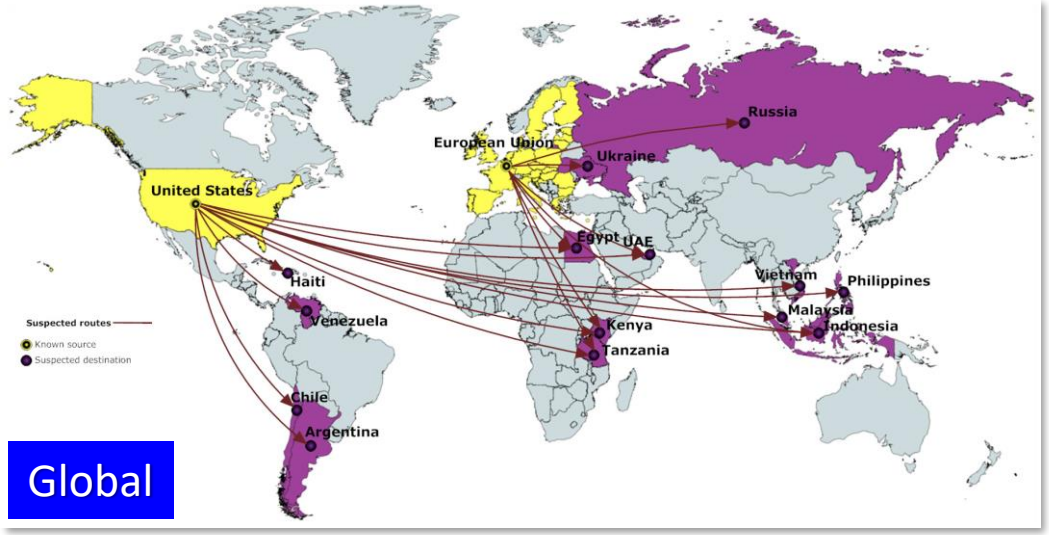


Global PFOA emission: production shift



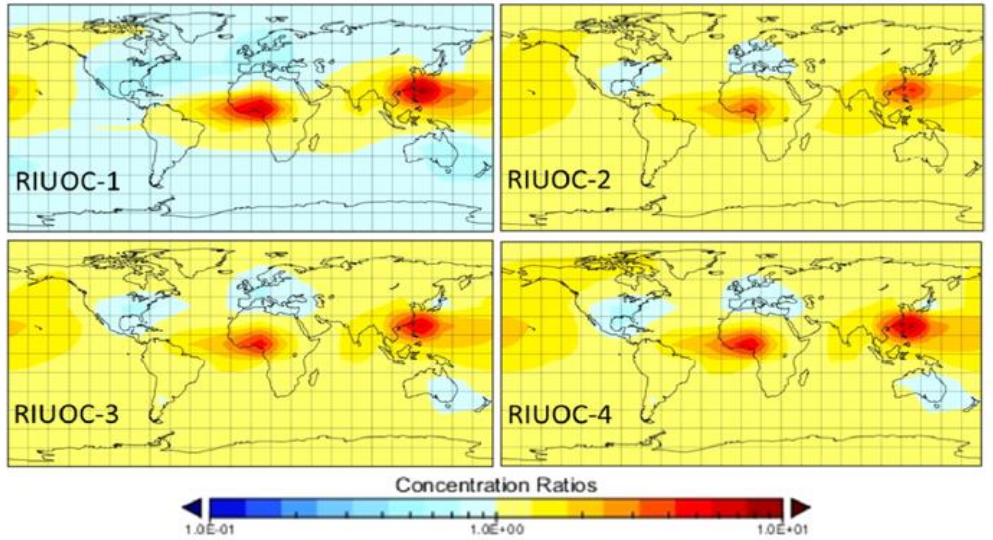
Source:
Simon P, Ramacher M, Hagemann S, Matthias V, Joerss H, and Bieser J. 2024. Earth System Science Data, https://doi.org/10.5194/essd-2024-236;
Wang, Z., Boucher, J. M., Scheringer, M., Cousins, I. T., and Hungerbühler, K. 2017, ES&T, 51, 4482–4493

Global transfer of solid wastes (e.g. e-waste, plastics)



Global

Asia



Concentration ratios of with/without e-waste transfer

(Knut Breivik et al., ES&T)

Accra, Ghana

Guiyu, China

PCBs transfer by global fish trade

nature food

ARTICLES

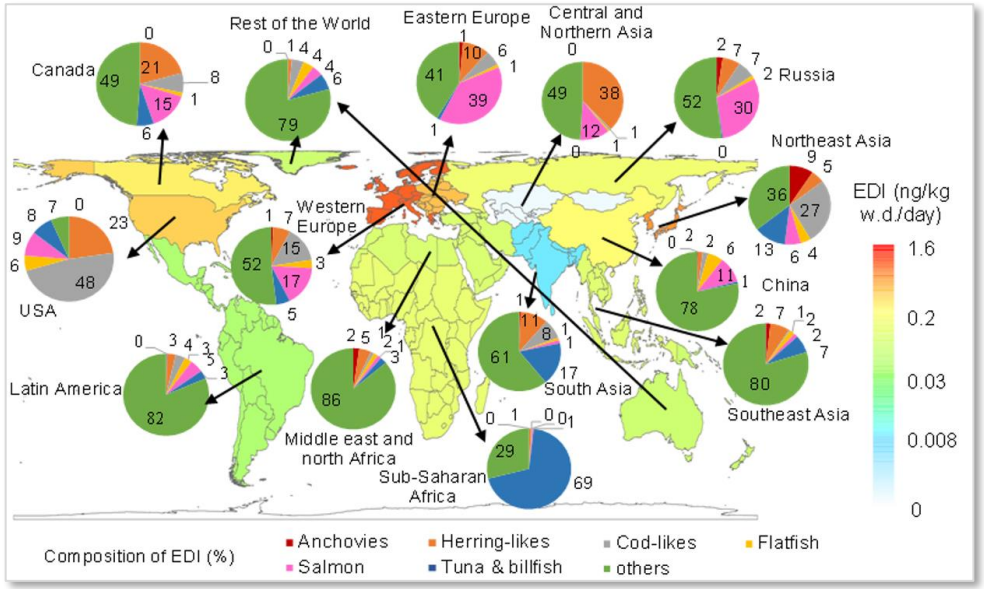
https://doi.org/10.1038/s43016-020-0066-1

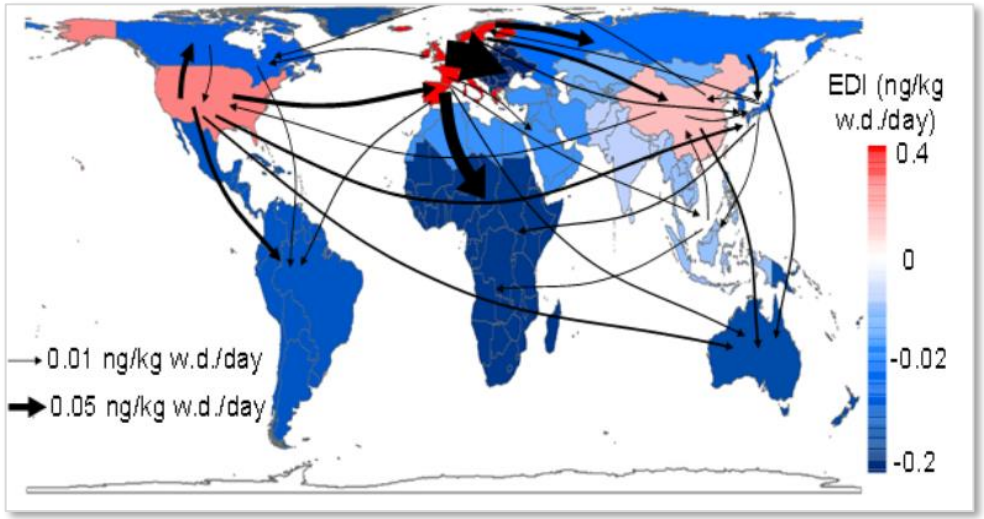
Check for updates

Human exposure to polychlorinated biphenyls embodied in global fish trade

Tao Huang[1], Zaili Ling[1], Jianmin Ma[1,2]✉, Robie W. Macdonald[3,4], Hong Gao[1], Shu Tao[2], Chongguo Tian[5], Shijie Song[1], Wanyanhan Jiang[1], Lulu Chen[1], Kaijie Chen[2], Zhiyong Xie[6], Yuan Zhao[2], Liuyuan Zhao[1], Chen Gu[1] and Xiaoxuan Mao[1]

International food trade poses food safety risks through the collateral transport of contaminants that are harmful to human health. Persistent organic pollutants, such as the polychlorinated biphenyl (PCB) congener PCB-153, are consumed via fish intake traded globally, but the estimated daily intake and risk to human health are poorly understood. Using a food trade pathway model, a global-scale atmospheric persistent organic pollutant transport model and UN Global Comtrade data, high PCB exposure was identified in Western Europe. Marine fish exported from Europe to Sub-Saharan African countries account for 84% of PCB-153 consumer exposure. In contrast, European fish consumers face reduced exposure to PCB-153 by consuming marine fish imported from countries where PCB-153 concentrations are low. People consuming aquaculture-farmed salmon fed with marine ingredients from PCB-153-contaminated seawaters face a higher PCB exposure. Our findings demonstrate that global fish trade can exacerbate PCB-153 exposure in regions where environmental PCB-153 levels are low. This approach demonstrates how the exposure to harmful food contaminants distributed through global food trade can be predicted and quantified.





- Africa: low PCB environmental concentrations, but high PCBs in human breast milk. Seafoods from W Europe (84%)?
- China, 61% burden from domestic fishes, 39% from imported fish, 20% from W Europe

Huang Tao et al., 2020, Nature Food

A CAS BELT & ROAD INITIATIVE

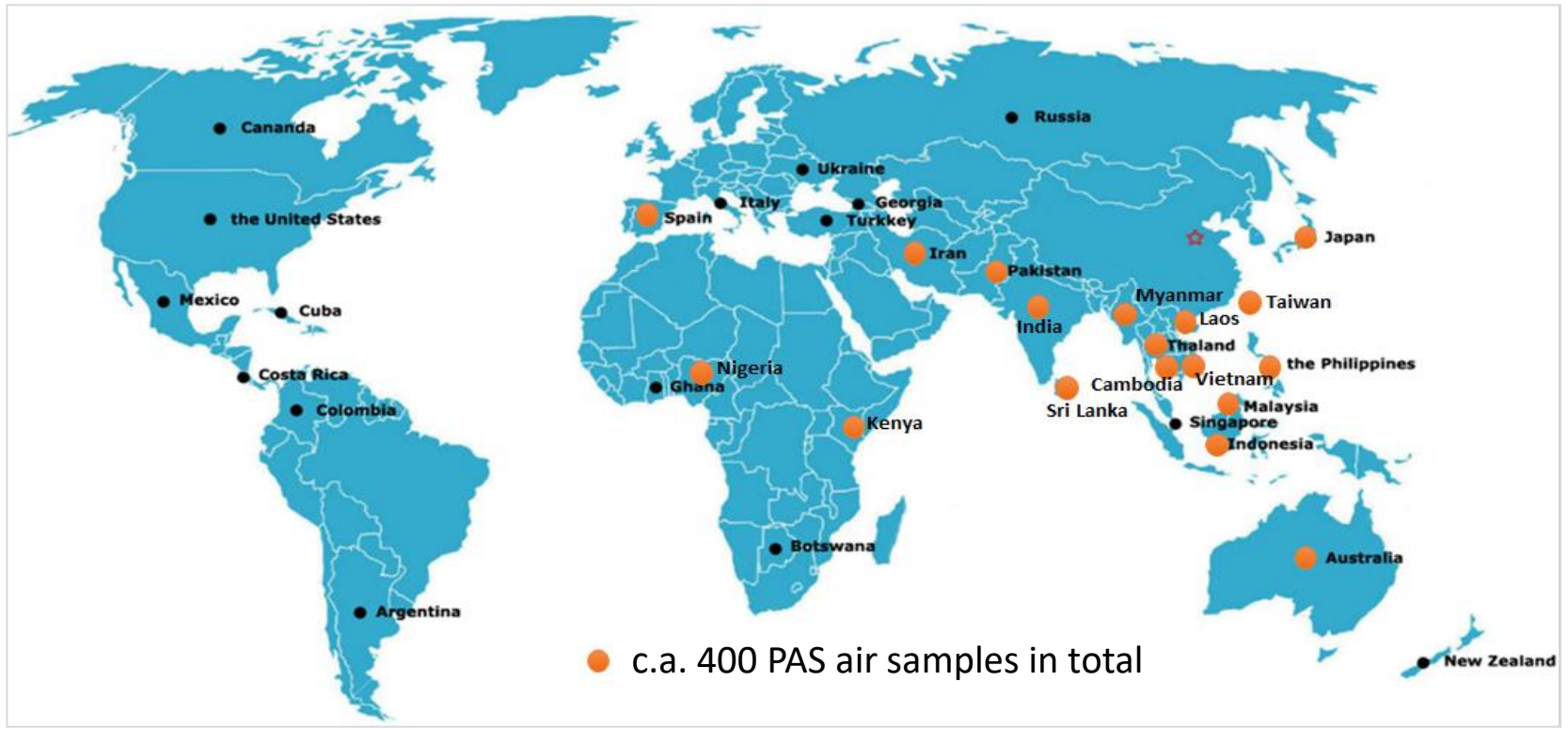
Southern Contaminants Programme
南方污染观测与研究计划

WORKSHOP ON ENVIRONMENTAL MONITORING ALONG THE 21ST CENTURY MARITIME SILK ROAD

26-27 May 2018
Guangzhou Institute of Geochemistry
Chinese Academy of Sciences

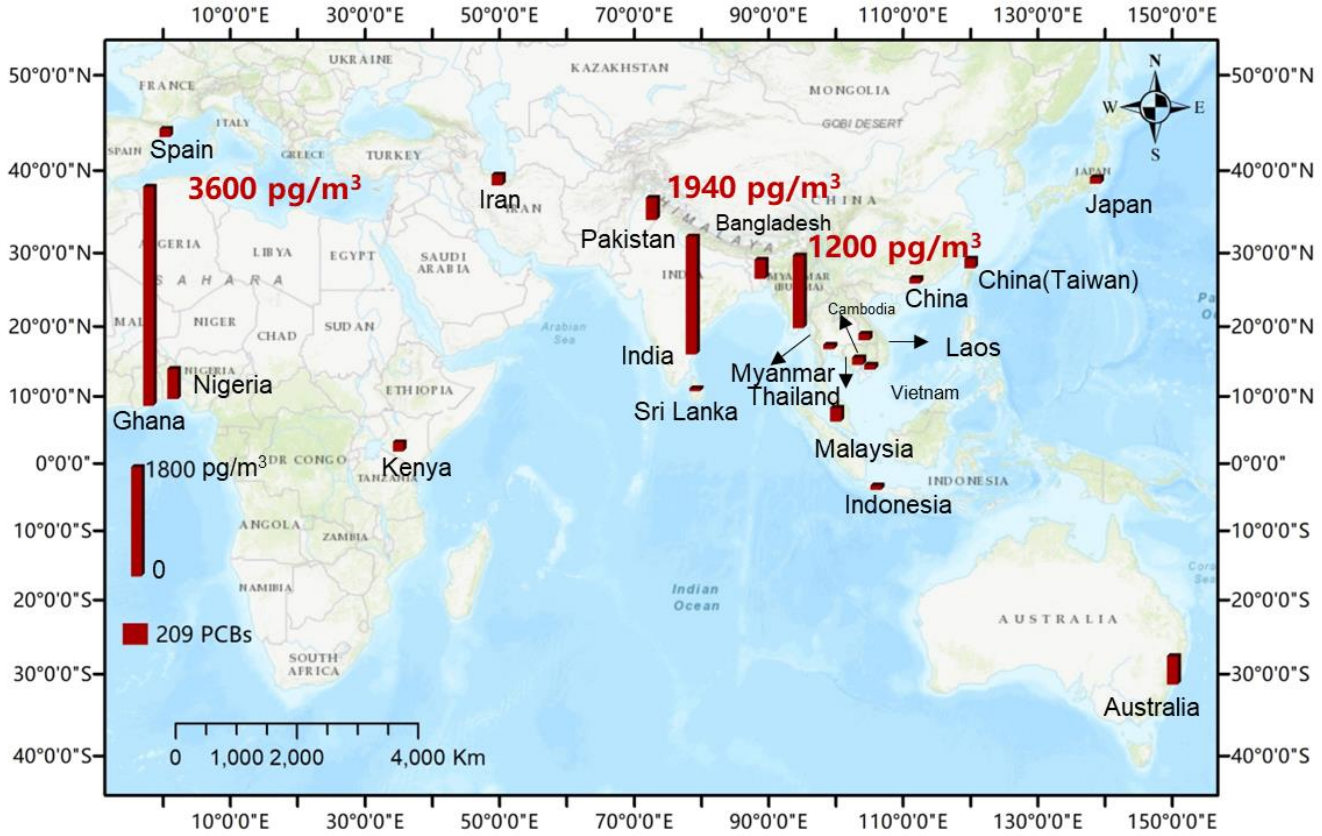
“The 21st Maritime Silk Road ” PUS-PAS network:

covering *19* countries/regions、*45* cities



Passive air sampling

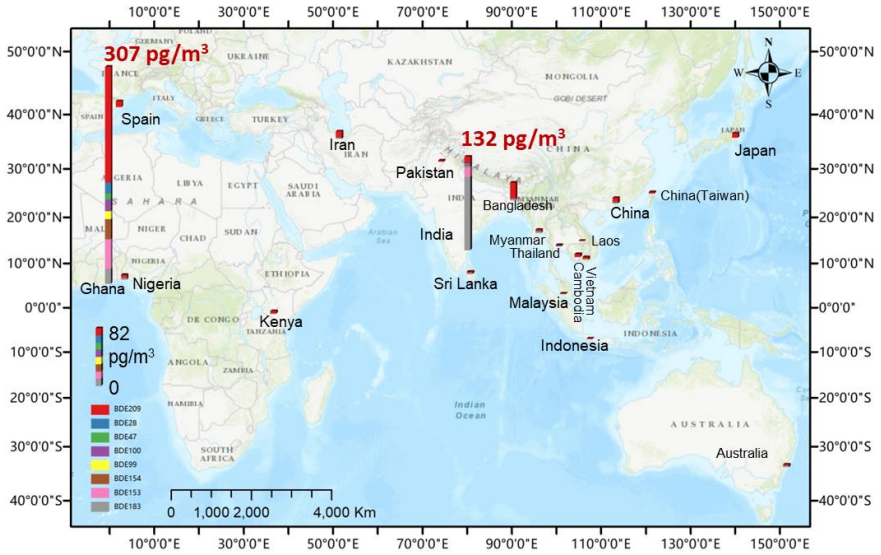
PCBs (209 congeners) in the atmosphere of 20 developing countries



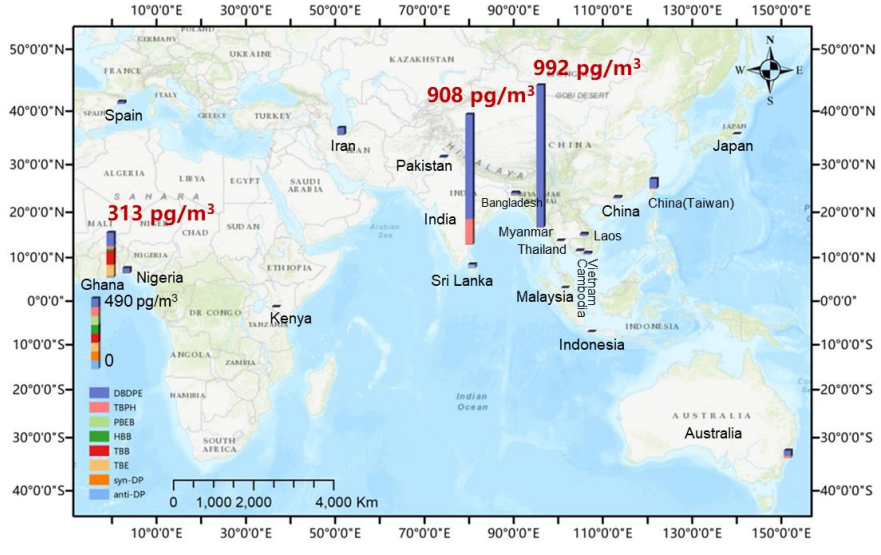
No.	Country/city	Average concs
1	Guangzhou	83
2	Vietnam	84
3	Spain	134
4	Keneya	154
5	Sri Lanka	36
6	Iran	168
7	Laos	110
8	Cambodia	126
9	Bangladesh	305
10	Austrailia	463
11	Pakistan	360
12	Japan	103
13	Taiwan	160
14	Indonesia	67
15	Malaysia	220
16	Indian	1940
17	Ghana	3600
18	Nigeria	496
19	Myanmar	1200
20	Thailand	67

SKLAET, unpublished data

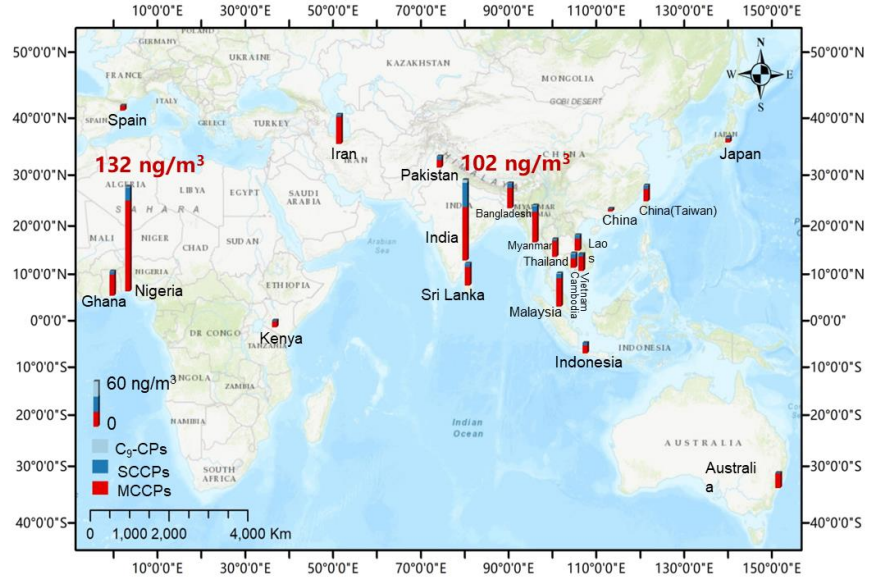
PBDEs (8 congeners)



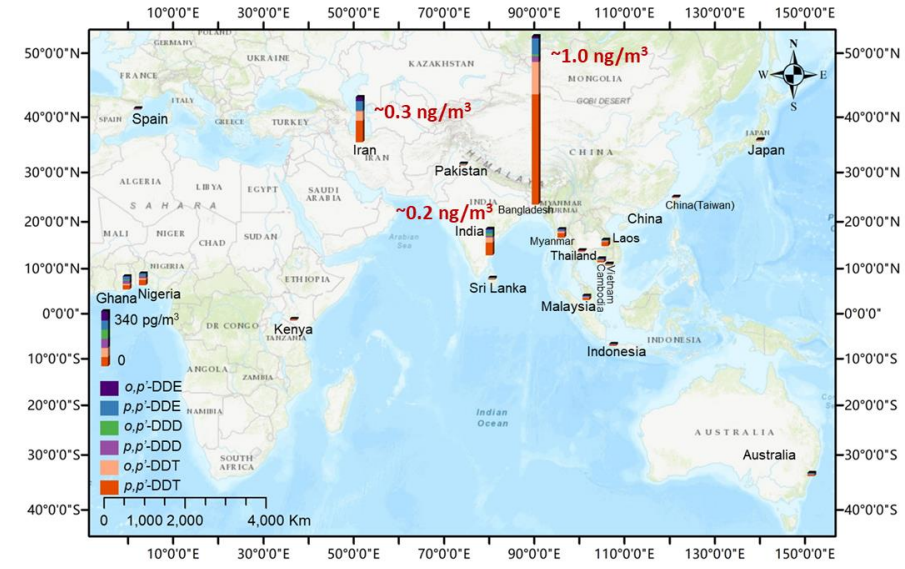
NBFRs (8 species)



SCCP and MCCP

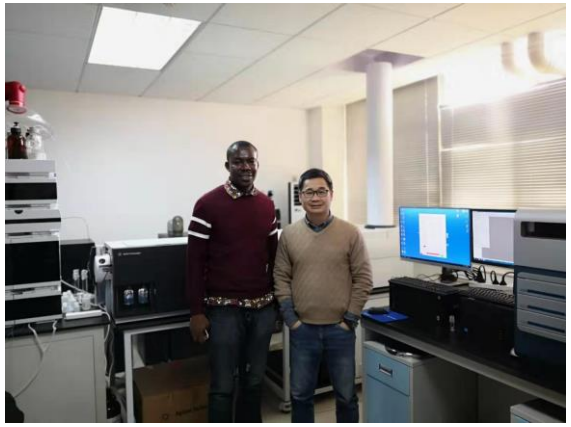


DDTs (6 isomers)



SKLAET, unpublished data

Tailored study: CPs in the air of Ghana



Science of the Total Environment 954 (2024) 176252

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Impact of anthropogenic activities on atmospheric chlorinated paraffins in Ghana using polyurethane foam disk - passive air sampler

William Ekow Arko [a,b,c], Shizhen Zhao [b,*], Jianchu Ma [b,d], Lele Tian [b,d], Kwadwo Ansong Asante [c,*], Daniel Kwaku Amoah [c], Shihua Qi [a], Gan Zhang [b]

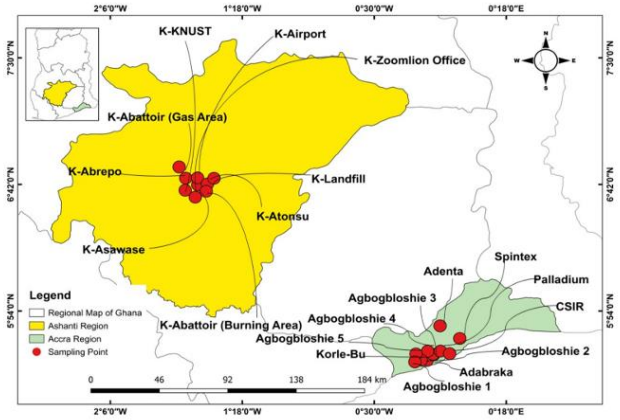


Fig. 1. Map of Ghana showing the sampling locations in the southern and middle belts.

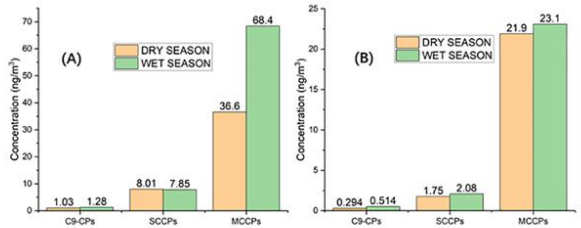


Fig. 2. Seasonal variation of mean CP levels in (A) Accra and (B) Kumasi of Ghana.

William Arko et al., 2024, STOTEN

Tailored study: POPs in the air of Lagos, Nigeria

Atmospheric Pollution Research 12 (2021) 101162

Contents lists available at ScienceDirect

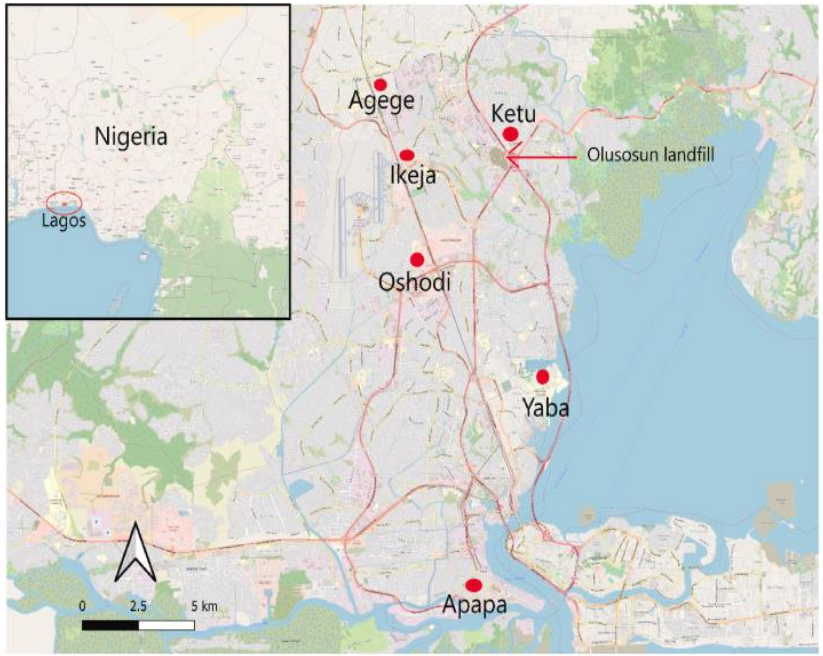
Atmospheric Pollution Research

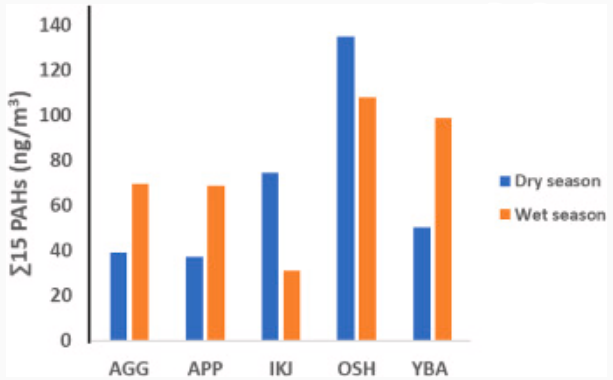
journal homepage: www.elsevier.com/locate/apr

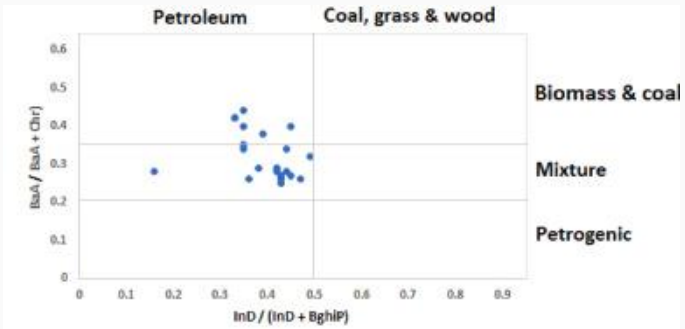
Concentrations, profiles and exposure risks of polycyclic aromatic hydrocarbons (PAHs) in passive air samples from Lagos, Nigeria

Rose Alani [a,*], Shizhen Zhao [b], Xin Liu [b], Olumide Akinrinade [a], Foluso Agunbiade [a], Olusegun Ayejuyo [a], Gan Zhang [b]

[a] Department of Chemistry, Faculty of Science, University of Lagos, Akoka, Nigeria
[b] Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou, China







Alani et al., 2021, Atmospheric Research

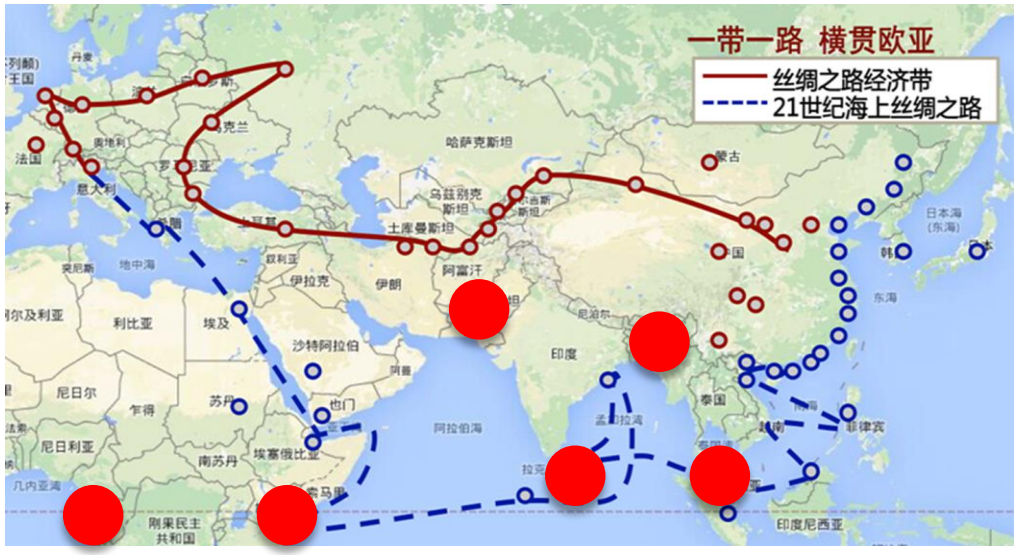
ANSO Program：MORATOXA （2021-）

ANSO: Alliance of International Science Organizations. The Chinese "Belt and Road Initiative for the promotion of shared development and achievement of the UN SDGs.

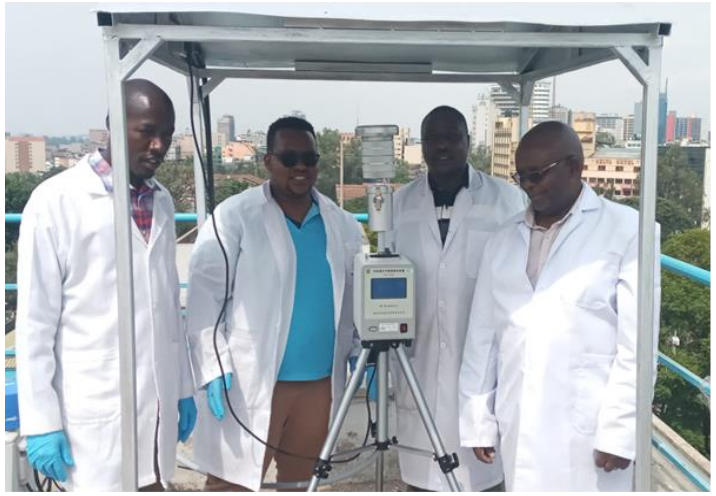
- **Monitoring and Risk Assessment of Toxic Chemicals in the Air （MORATOXA）**
- Focusing on air toxics， promoting the nontoxic environment concept and clean air action
- Research collaboration, knowledge transfer, young talent, for Green B&RI

Active air sampling!

- Collaborators from： along the 21st Maritime Silk Road (MSR)
- Current key partners：
  - COMSATS University Islamabad, Pakistan
  - Peradeniya University, Sri Lanka
  - Dhaka University, Bangladesh
  - University of Malaya, Malaysia
  - CSIR, Ghana
  - University of Nairobi, Kenya



ANSO sampling campaign for emerging pollutants in the air



Kenya-Nairobi

China-Guangzhou

Bangladesh-Dhaka

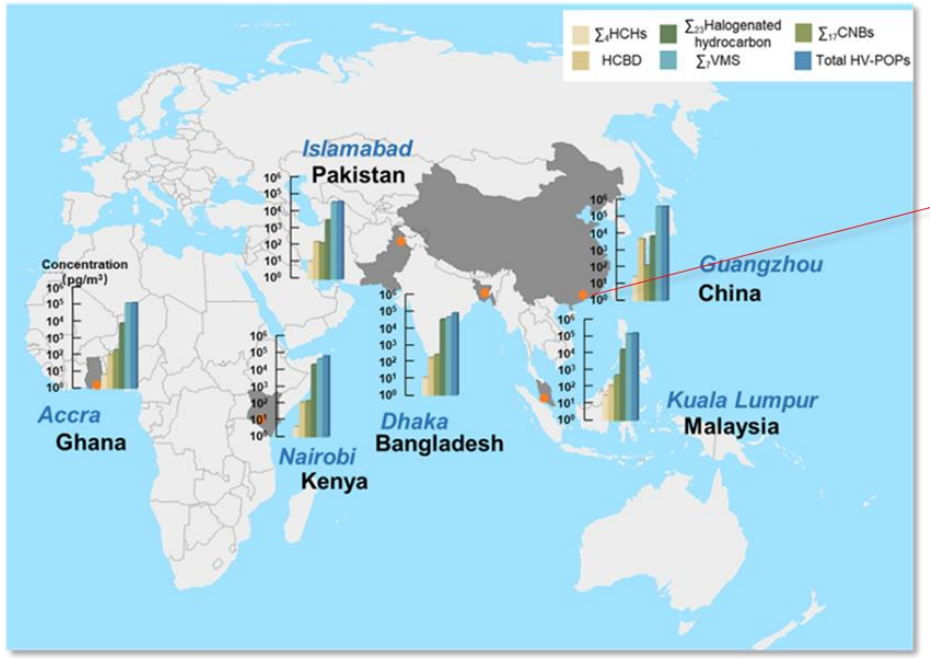
Ghana-Accra

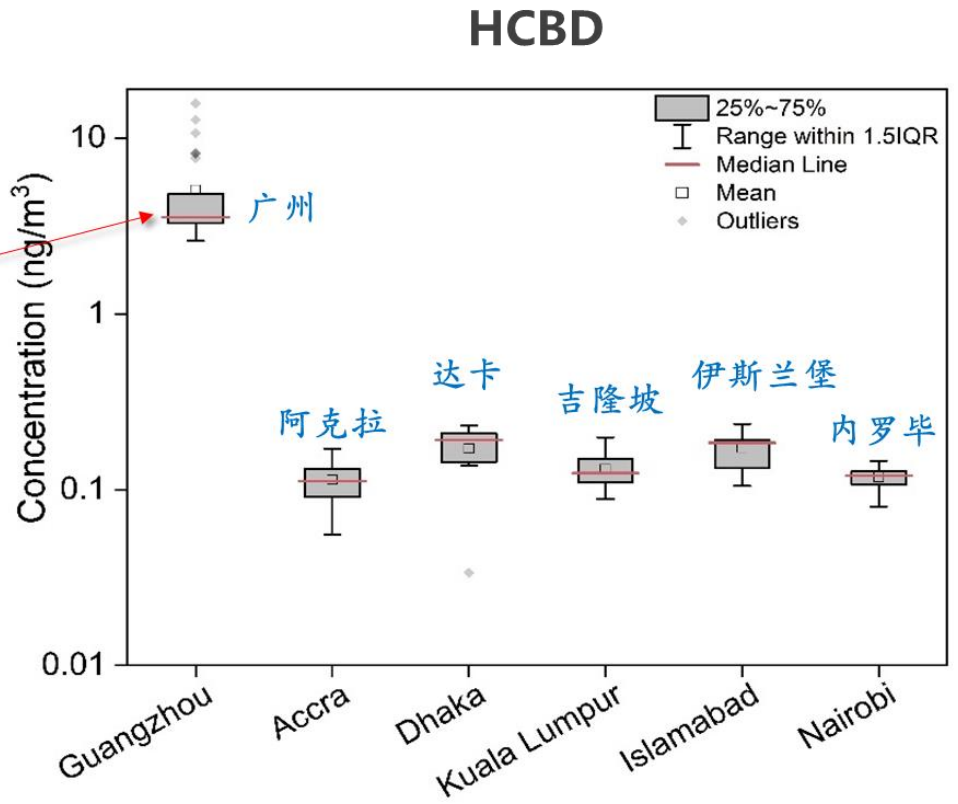
Air sampler portable

DHL delivery

Sampling cartridge

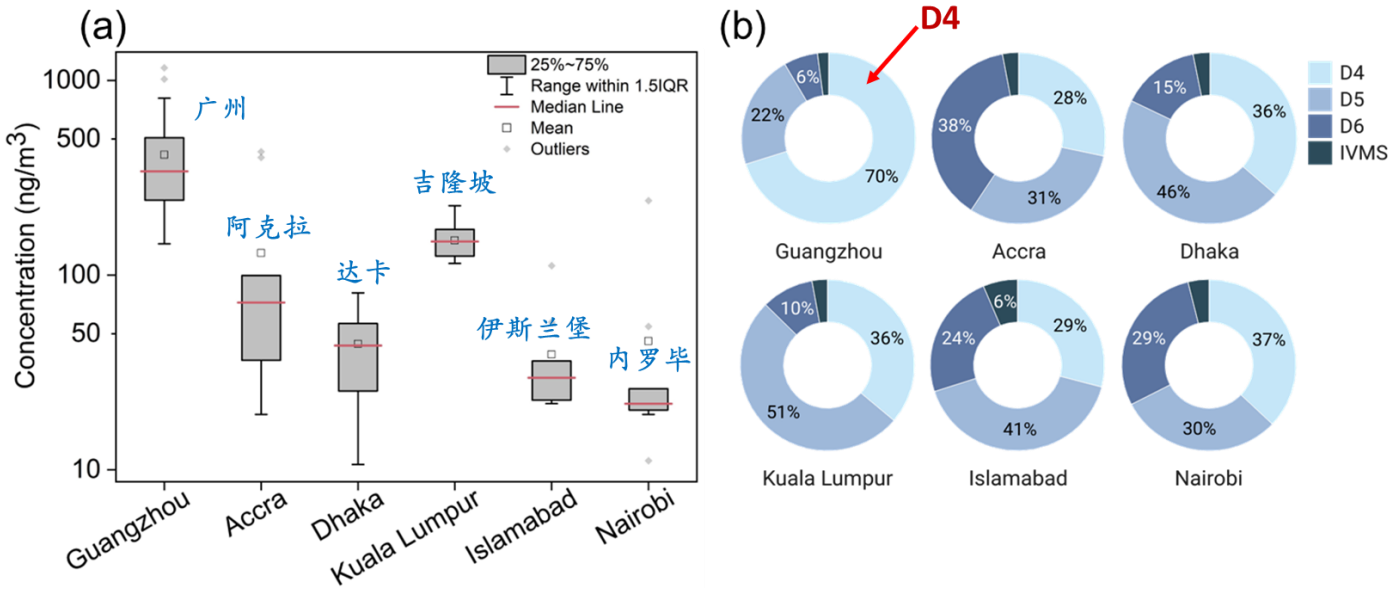
Hexachlorobutadiene（HCBD）: petrochemical industry





Xiao Yuwei, Zho Shizhen, Zhang Gan et al.， under review

Volatile methylated siloxanes (VMSs): cosmetic chemical industry



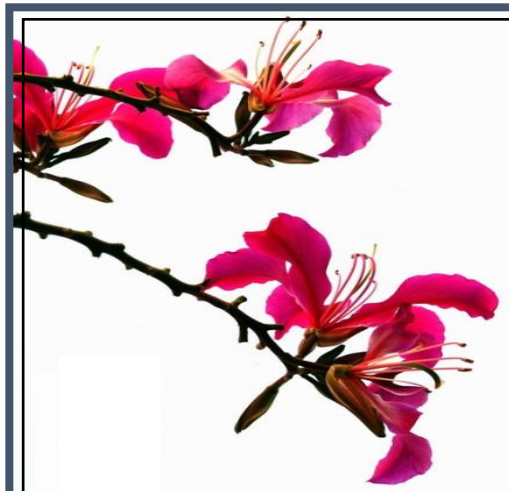
Guangzhou International Beauty Expo

- **D4 mostly in industries, while D5, D6 in cosmetics products**
- **China： annual production of siloxanes>6 million MT(2022)， world top 1**
- **Guangzhou： 1868 cosmetics producers**

Xiao Yuwei, Zho Shizhen, Zhang Gan et al.， under review

ANSO training courses/open shortly:
Monitoring and risk assessment of persistent toxic substances in the environment

Next: expecting September 2025



中国科学院
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For collaboration interest, please contact:

zhanggan@gig.ac.cn