Atmospheric mercury observations in China

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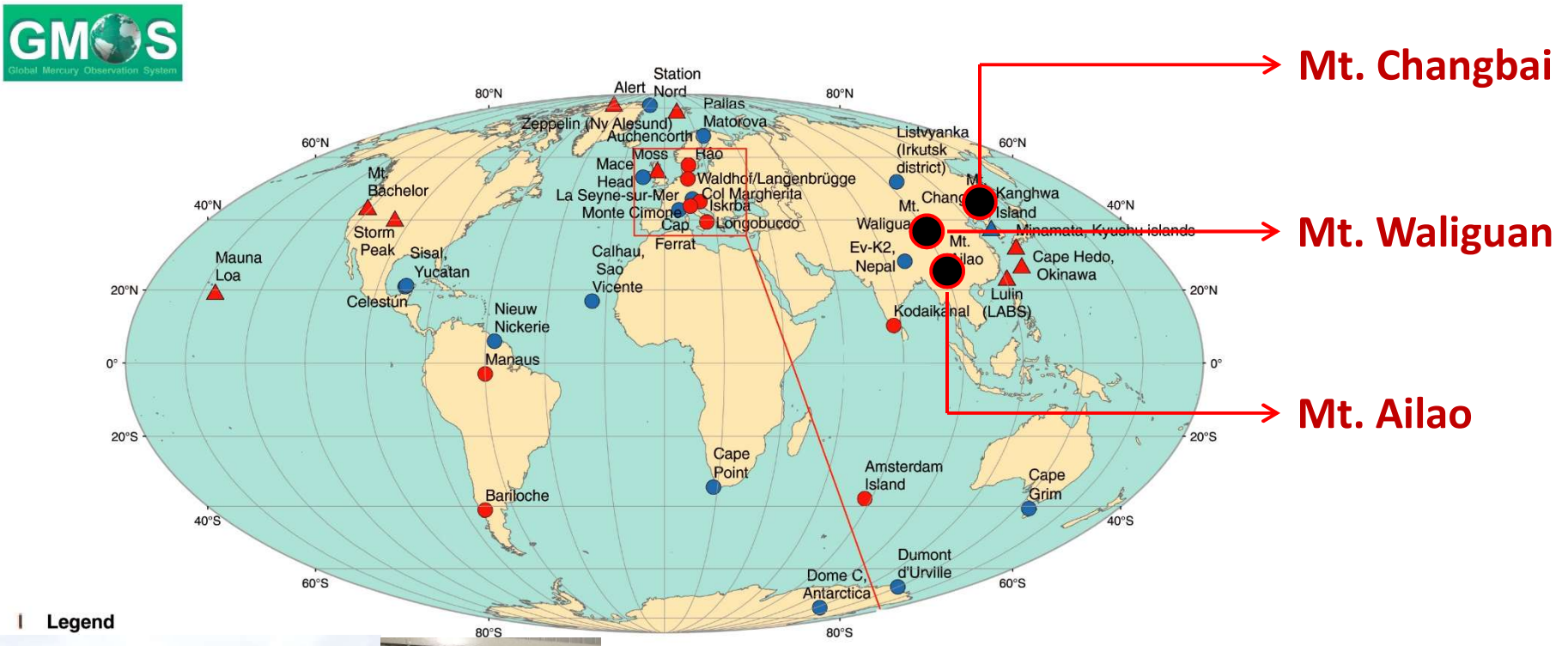
Outline

1. **Observational network and stations in China**
2. Concentrations: Patterns and factors
3. Regional transport patterns
4. Long-term observations of TGM

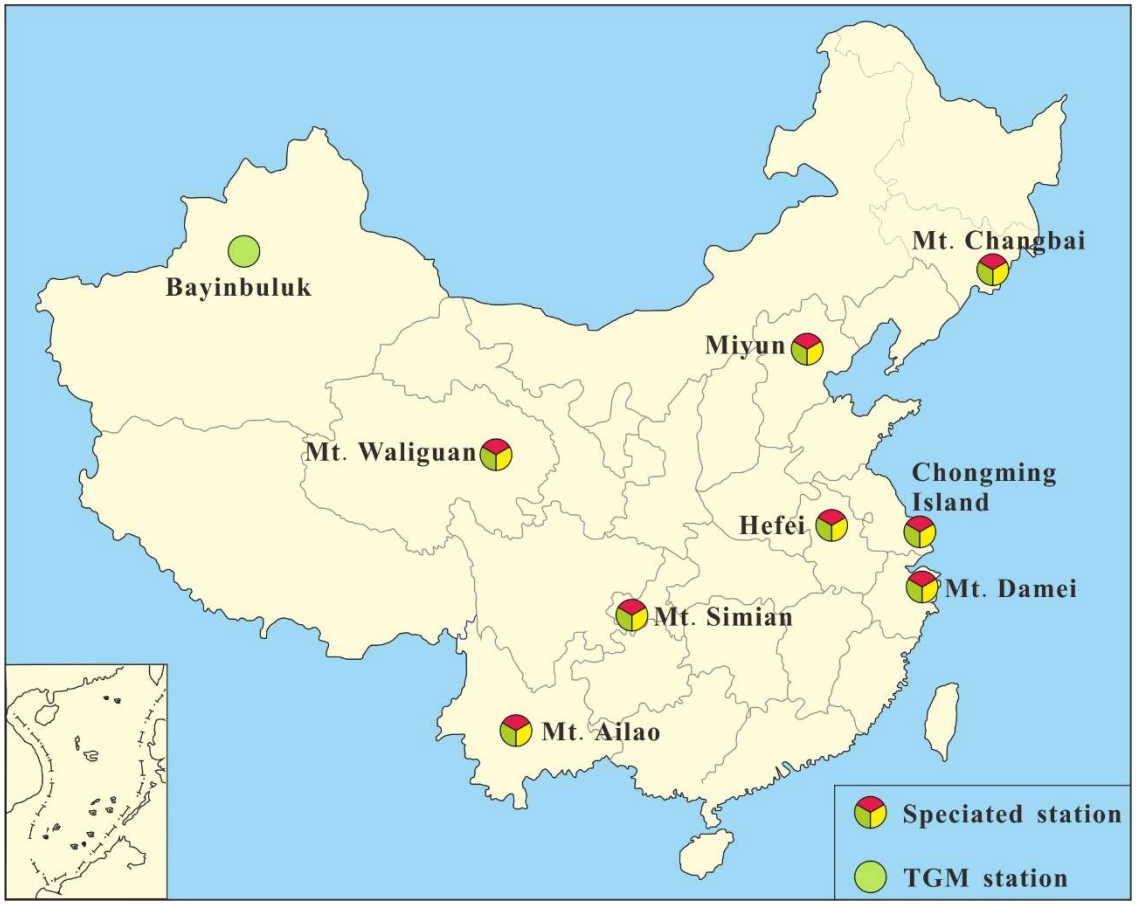
Chinese stations in the GMOS network



- **Time: 2011-2015**
- **Observation:**
  GEM, PBM, GOM
  wet deposition
- **Method:**

Tekran Speciation system, automatic wet-only sampler

973 program network



1. Tsinghua University
Miyun and Chongming Island

2. University of Science and Technology of China
Hefei

3. Southwest University
Mt. Simian

4. GYIG, CAS
Mt. Changbai
Mt. Damei
Mt. Waliguan
Mt. Ailao
Bayinbuluk

- **Time: mainly during 2014 and 2017**
- **A total of 9 stations**
- **Observations: TGM, speciated atmospheric Hg (8 stations), wet deposition**
- **Method: Tekran Speciation system, automatic wet-only sampler**

Stations monitored by our group

A total of 11 stations, and 5 of them are active

TGM or speciated atmospheric Hg, wet deposition flux

All the previous monitoring station in China

- 35 GEM stations
- 22 PBM stations
- 20 GOM stations
- 20 wet deposition stations
- Method: mostly by Tekran instrument, and some using Lumex instrument

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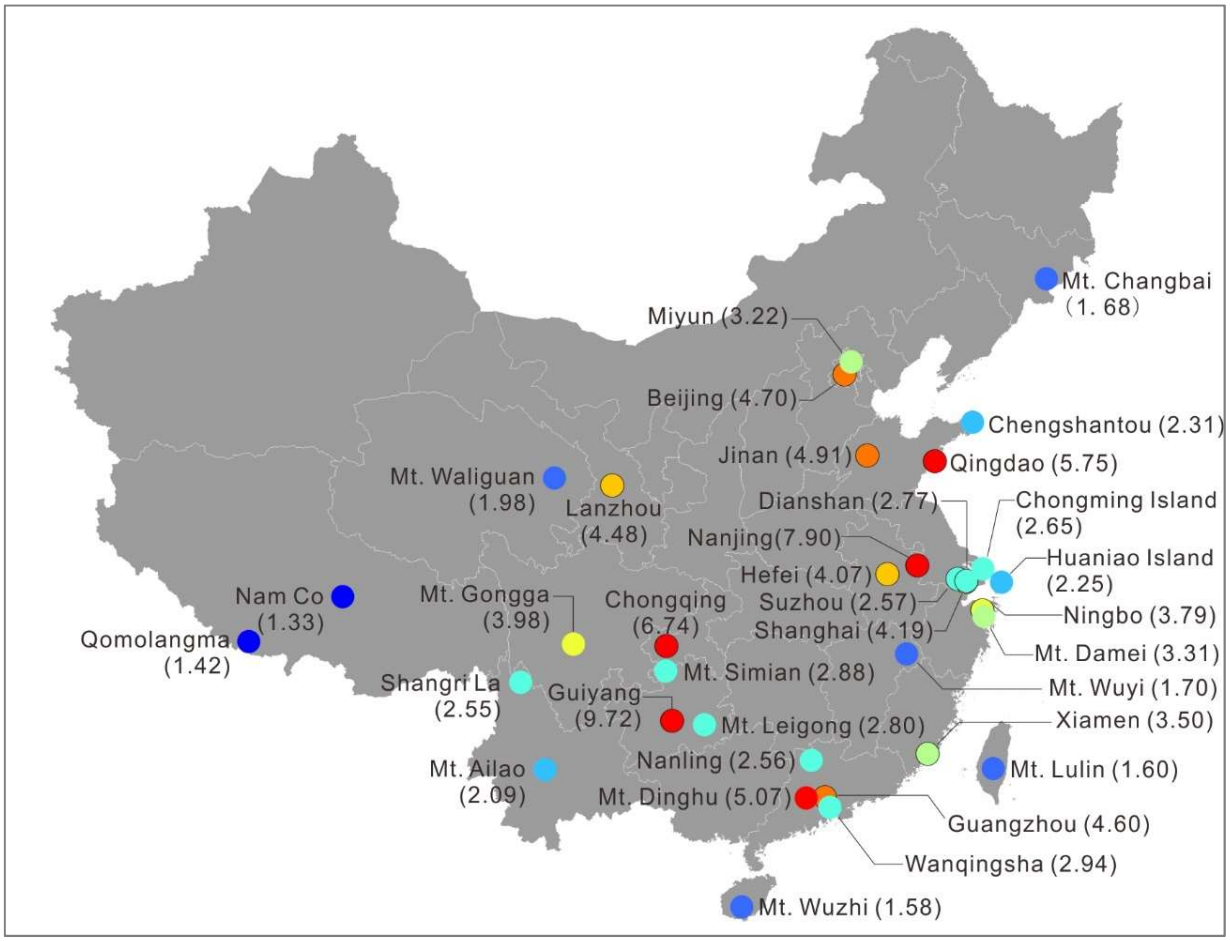
GEM concentrations

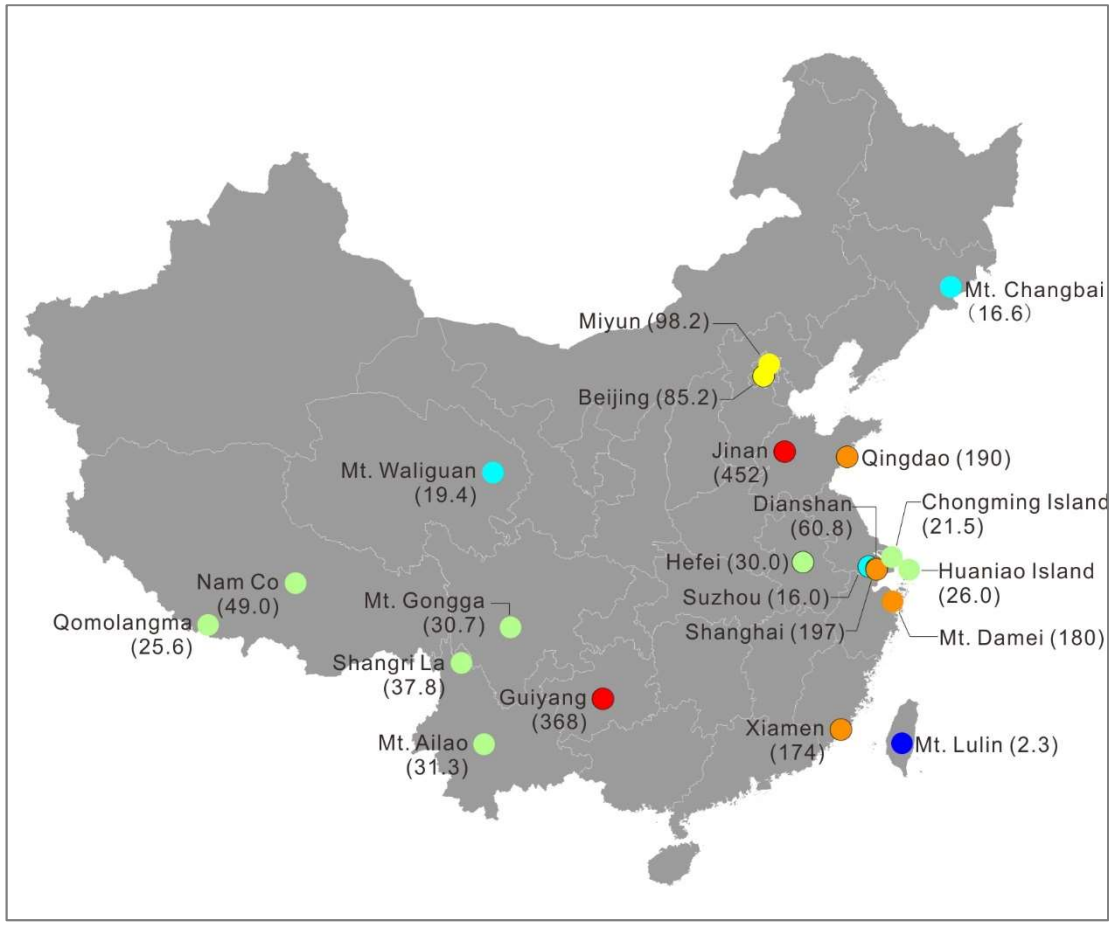


- Lower values in Tibetan Plateau, Northeast China, Hainan and Taiwan Island
- Urban mean: 5.0 ng m^{-3}
- Rural mean: 2.5 ng m^{-3}

Both urban and rural observations are much higher than the background values in the Northern Hemisphere

Sheu et al., 2010; Fu et al., 2015; Fu et al., 2016; Gao et al., 2016; Hong et al., 2016; Li, 2016; Liu et al., 2016a; Liu et al., 2016b; Zhang et al., 2016a; Duan et al., 2017; Liu et al., 2017; Chen et al., 2018; Fu et al., 2018; Yin et al., 2018; Lin et al., 2019; Liu et al., 2019a; Liu et al., 2019c; Nguyen and Sheu, 2019; Qin et al., 2019; Zhang et al., 2019; Lu et al., 2020; Nie et al., 2020; Yin et al., 2020

PBM concentrations

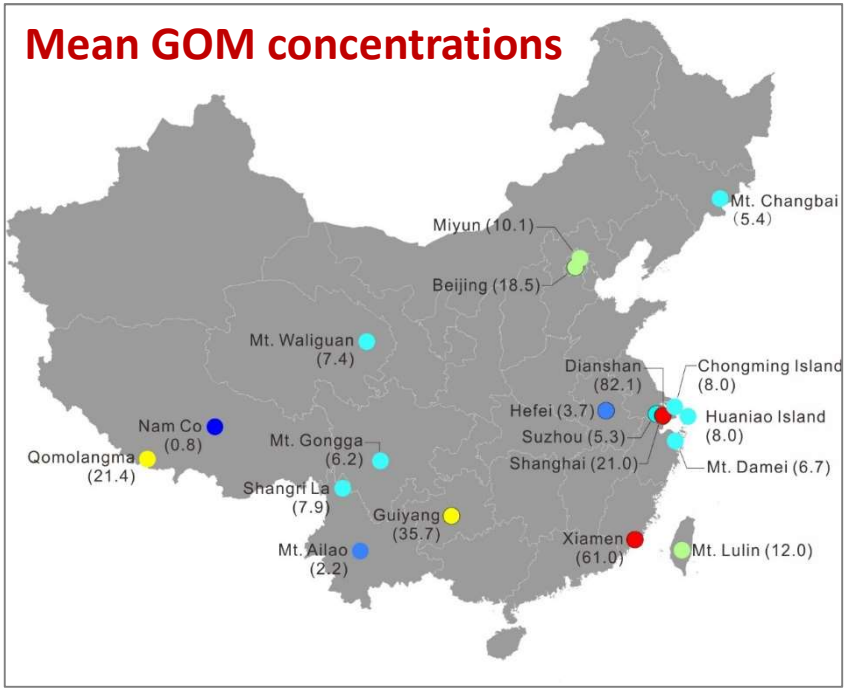


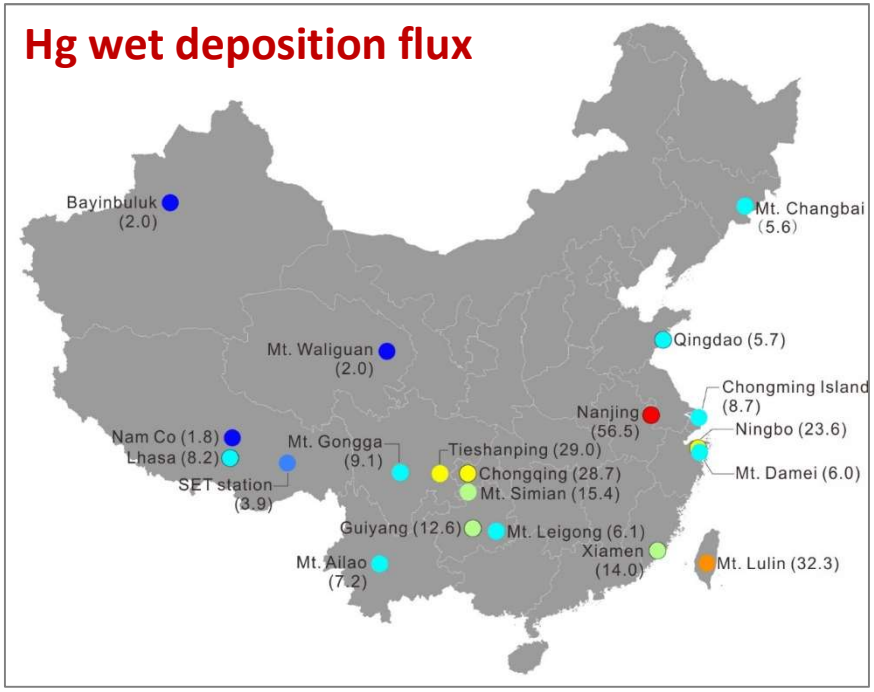
- Urban sites have much higher PBM levels
- Urban mean: 175 pg m^{-3}
- Rural mean: 45 pg m^{-3}

PBM levels in China are approximately one order of magnitude higher than the means in Europe and North America

Sheu et al., 2010; Fu et al., 2015; Fu et al., 2016; Gao et al., 2016; Hong et al., 2016; Li, 2016; Liu et al., 2016a; Liu et al., 2016b; Zhang et al., 2016a; Duan et al., 2017; Liu et al., 2017; Chen et al., 2018; Fu et al., 2018; Yin et al., 2018; Lin et al., 2019; Liu et al., 2019a; Liu et al., 2019c; Nguyen and Sheu, 2019; Qin et al., 2019; Zhang et al., 2019; Lu et al., 2020; Nie et al., 2020; Yin et al., 2020

GOM levels and Hg wet deposition flux

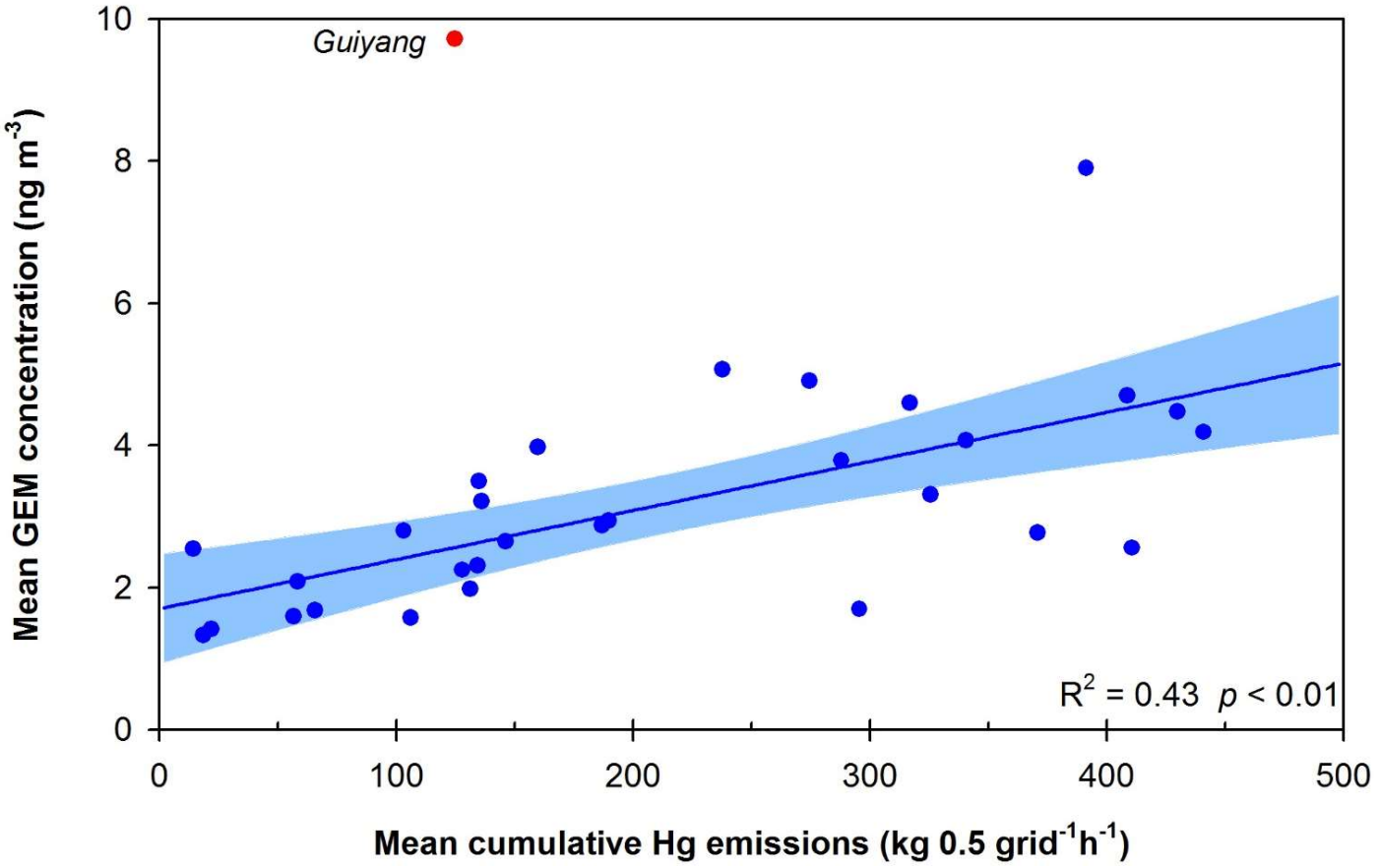




- Mean GOM in urban is 32 pg m^{-3}, which is 4 times higher than rural sites (8)
- Wet deposition flux in urban is 21.3 µg m^{-2} yr^{-1}, and is two times higher than rural sites (9.9)

GOM levels and Hg wet deposition fluxes at rural sites are similar to Europe and North America

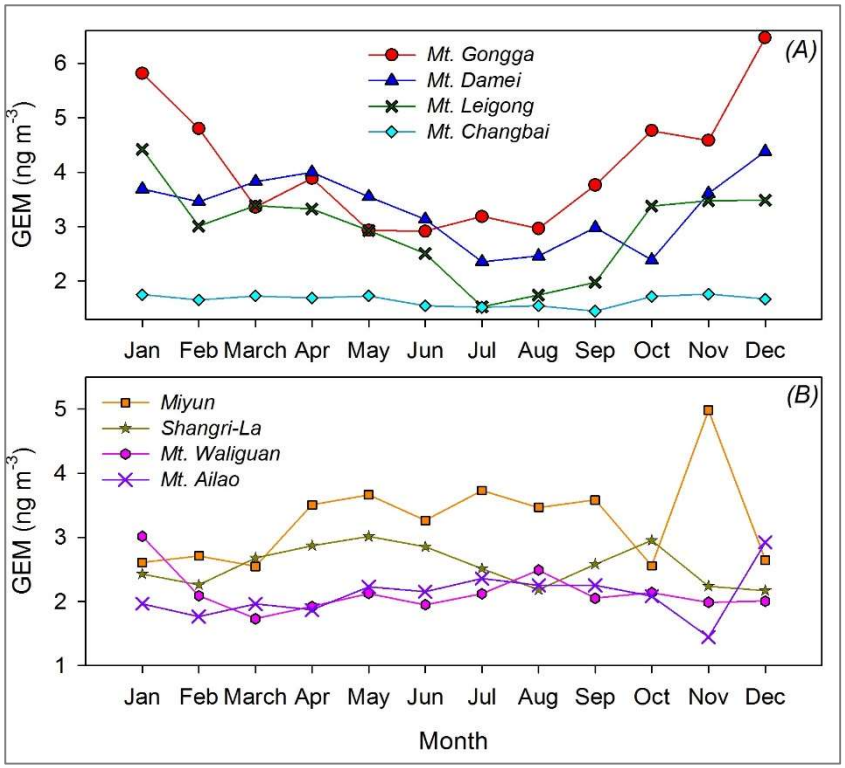
GEM *versus* anthropogenic emissions

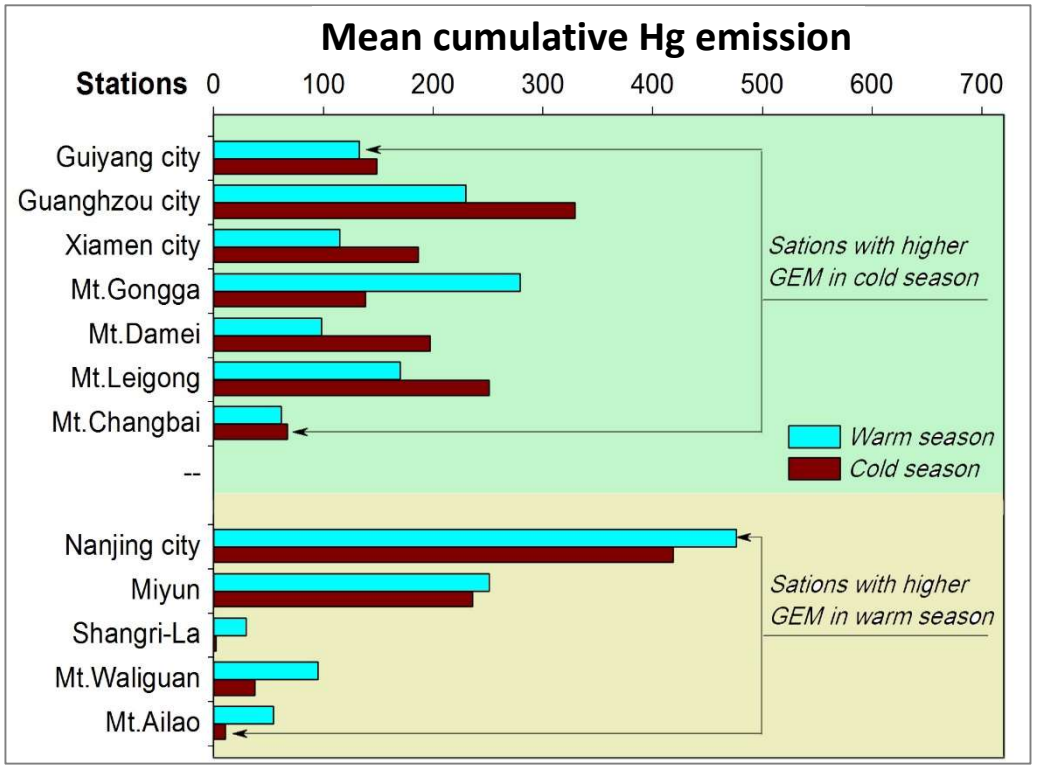


Spatial variations in GEM concentrations in China were mainly controlled by local and regional anthropogenic emissions

Feng et al., 2020, manuscript under preparation

Seasonal variation and controls





Seasonal variations in GEM coincide well with the seasonal variations in the transport of anthropogenic emissions at most sites

Fu et al., 2015

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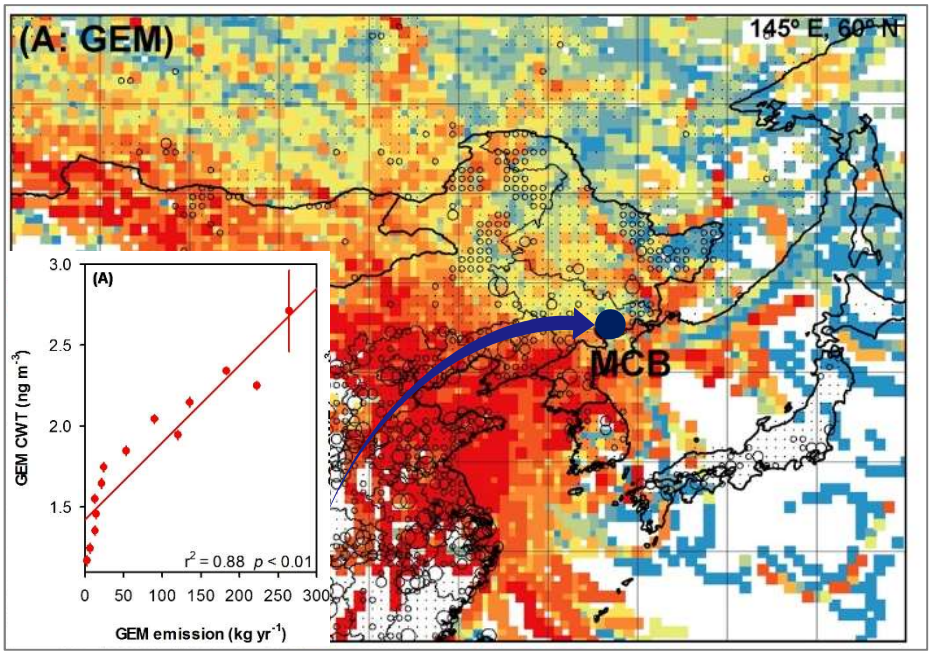
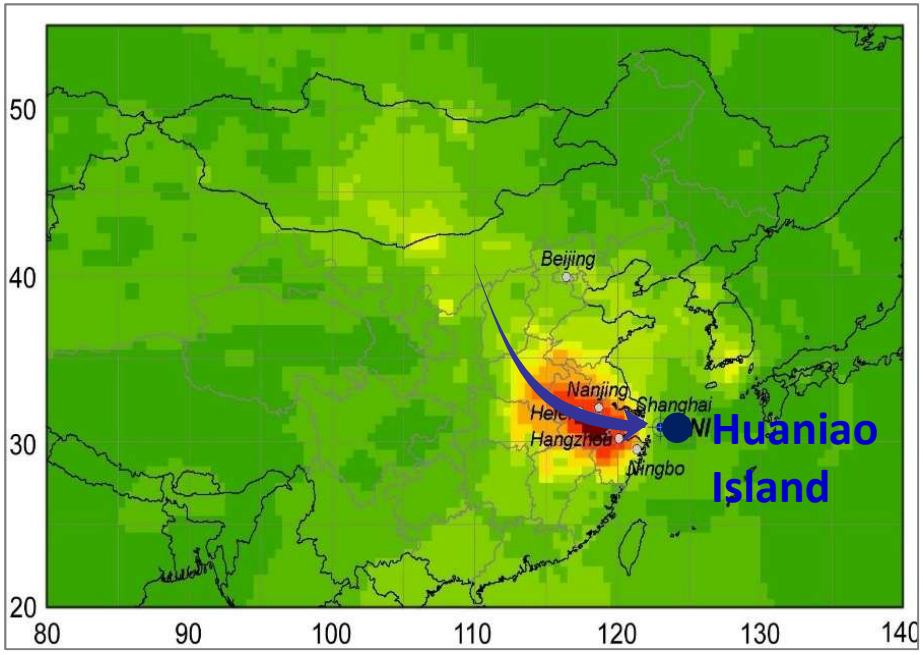
Outflow of Hg from eastern China

Potential source regions of Mt. Changbai



Potential source regions of Huaniao Island

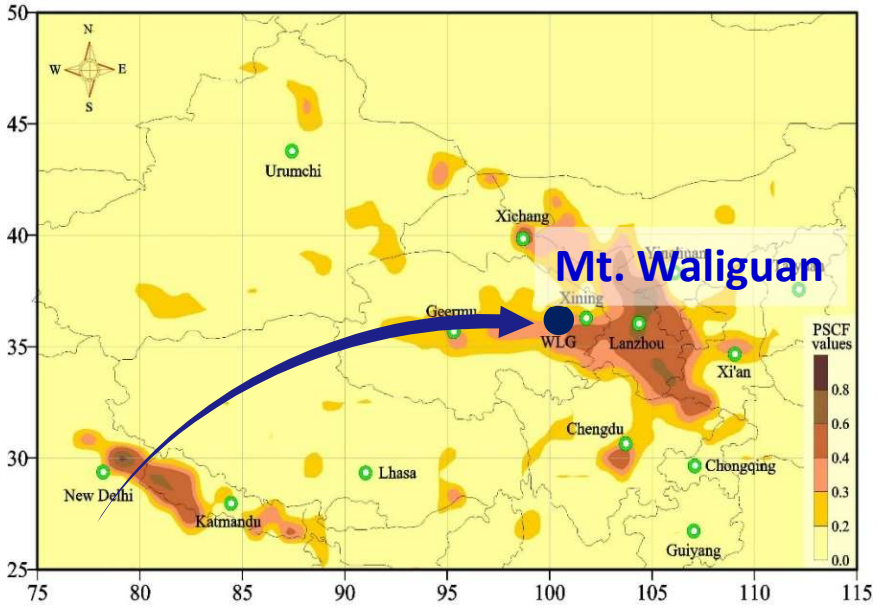


- **At. Mt. Changbai in northeastern China, Concentration-weighted trajectory (CWT) analysis suggested the major source regions of GEM were mainly located in northern and eastern China, and gridded CWT values were positive correlated with gridded anthropogenic GEM emissions**
- **At Huaniao Island in East China Sea, the major source regions were mainly located in eastern China.**

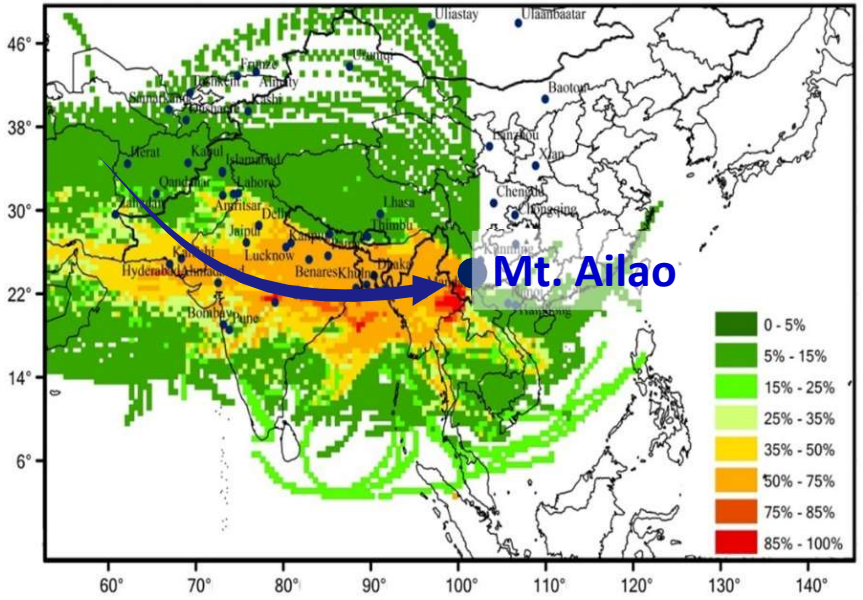
Fu et al., 2018; Liu et al., 2019

Outflow of Hg from South Asia to West China

Potential source regions of Mt. Waliguan



Potential source regions of Mt. Ailao



- At Mt. Waliguan in northern Tibetan Plateau, long-range transport of TGM from South Asia, in addition to industrial areas in northwestern China, was also and important source of TGM
- emissions from South Asia was the dominant source of TGM at Mt. Ailao in cold season

Fu et al., 2012; Zhang et al., 2016

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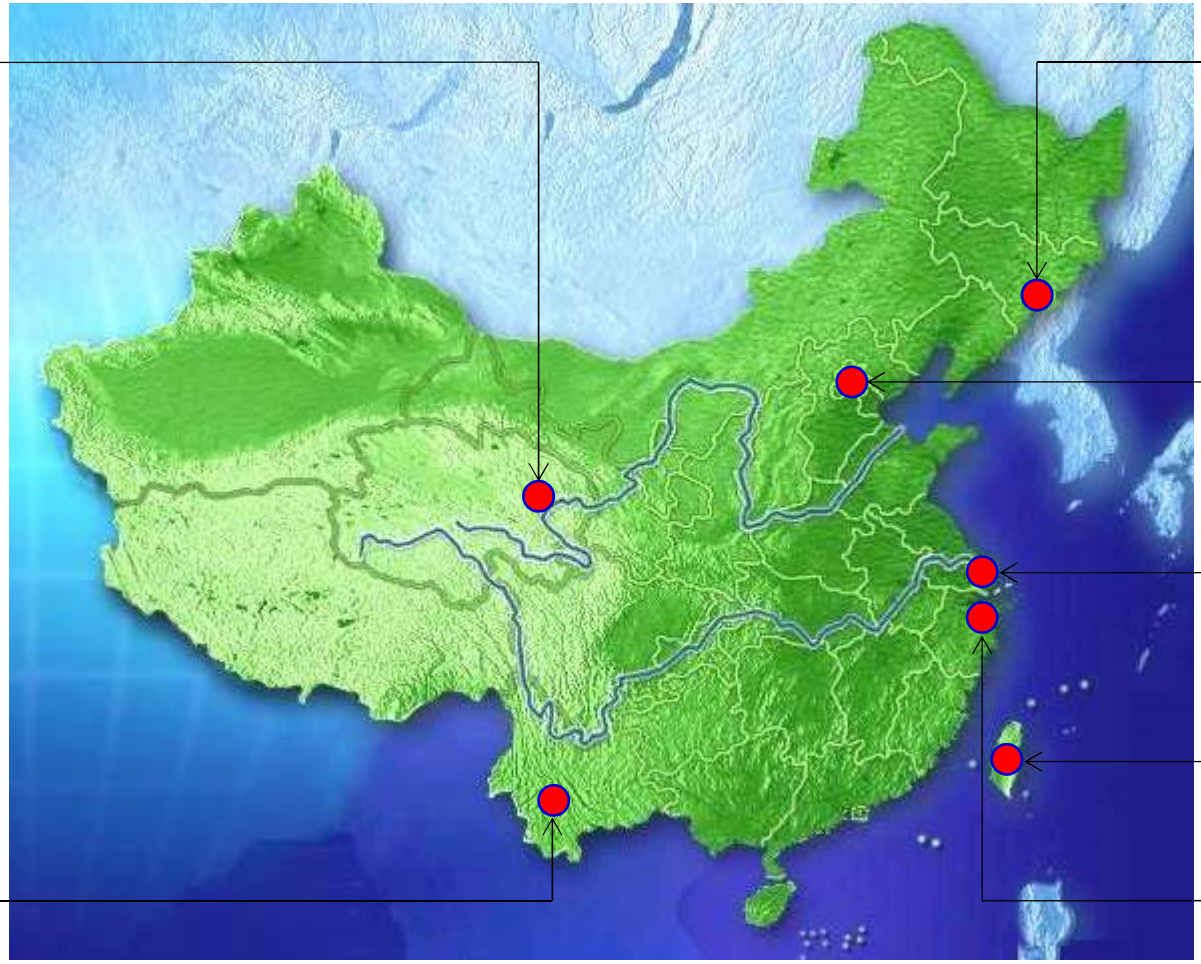
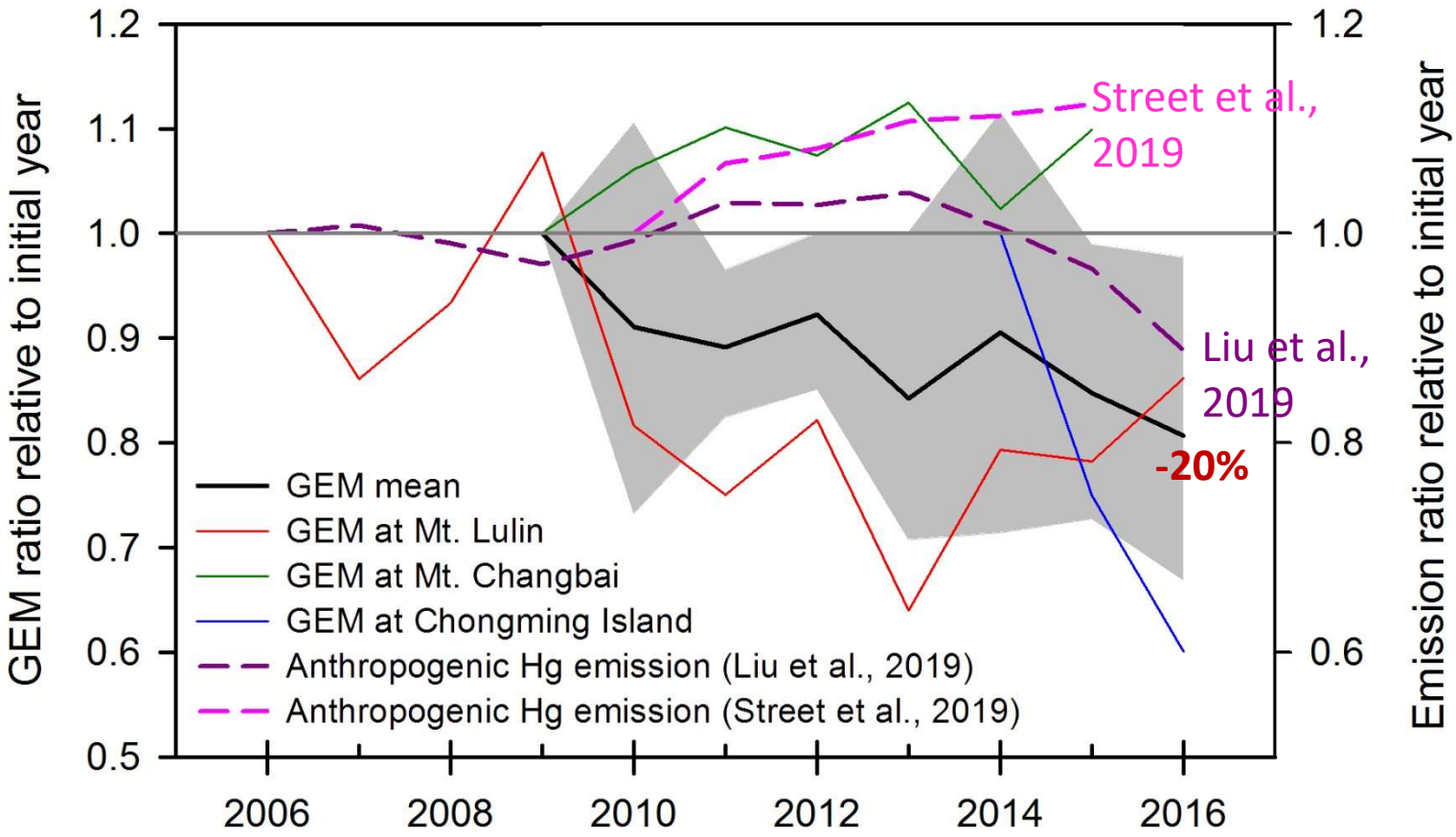
Long-term monitoring stations in China



Trend in GEM concentrations



Fu et al., 2015; Tang et al., 2018, Nguyen et al., 2019

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