

UNDERSTANDING THE ENVIRONMENTAL IMPACTS OF LARGE FISSURE ERUPTIONS: 2014-2015 HOLUHRAUN ERUPTION (ICELAND)

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Scan  for our paper (EPSL 2017, 472)

1. Icelandic large fissure eruptions

Huge emissions of gas and aerosol can cause severe environmental pollution

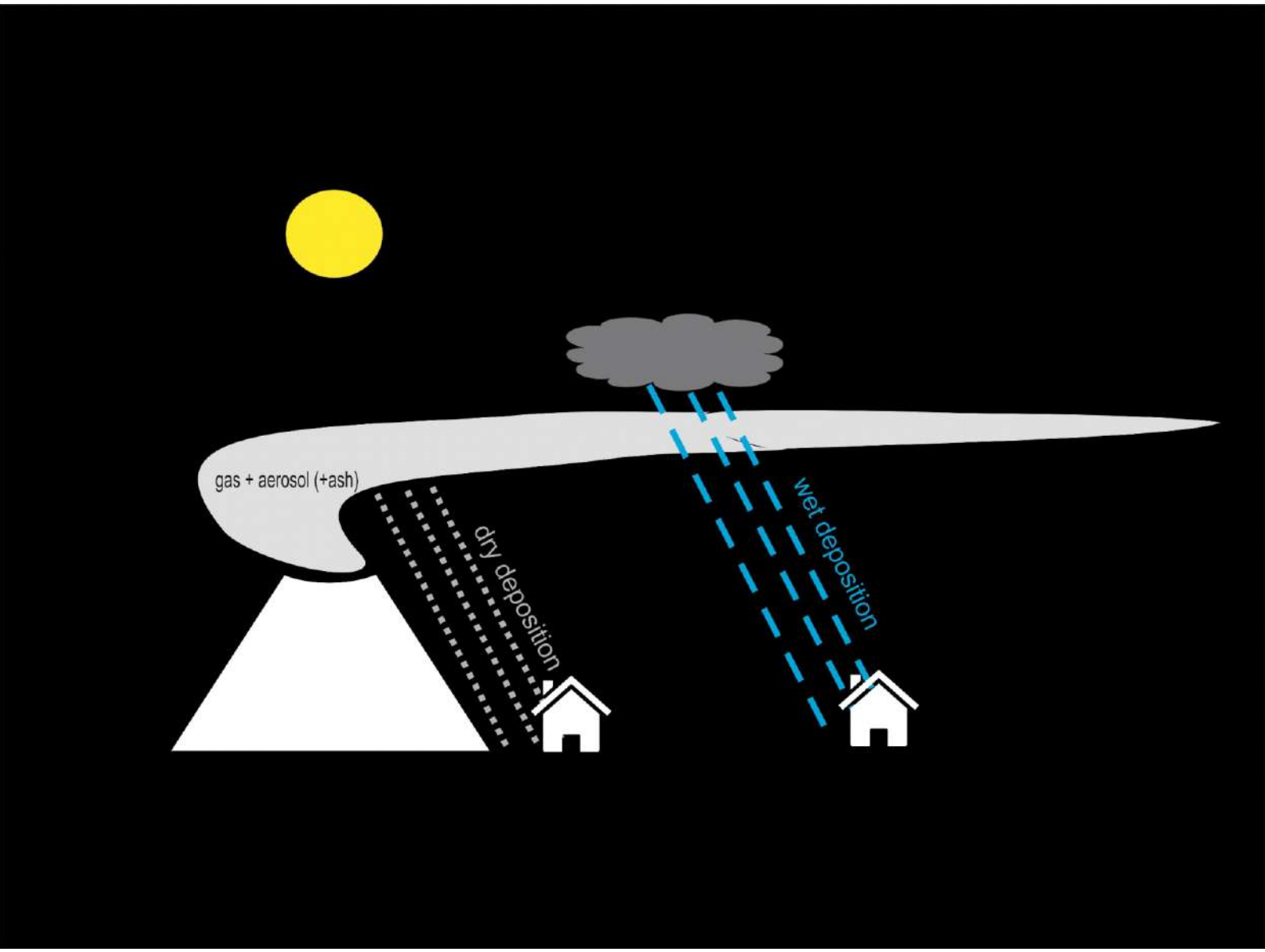
~25% of Iceland population died during the last flood basalt eruption in the 18th century

Holuhraun 2014-2015:

- *The first ‘real-time’ large fissure eruption in Iceland
- *6 months duration
- *1.6 km³ of lava & 11 Mt of SO₂



Episode of severe air pollution from Holuhraun 100km downwind



Volcanic plumes impact the environment



Holuhraun large fissure eruption

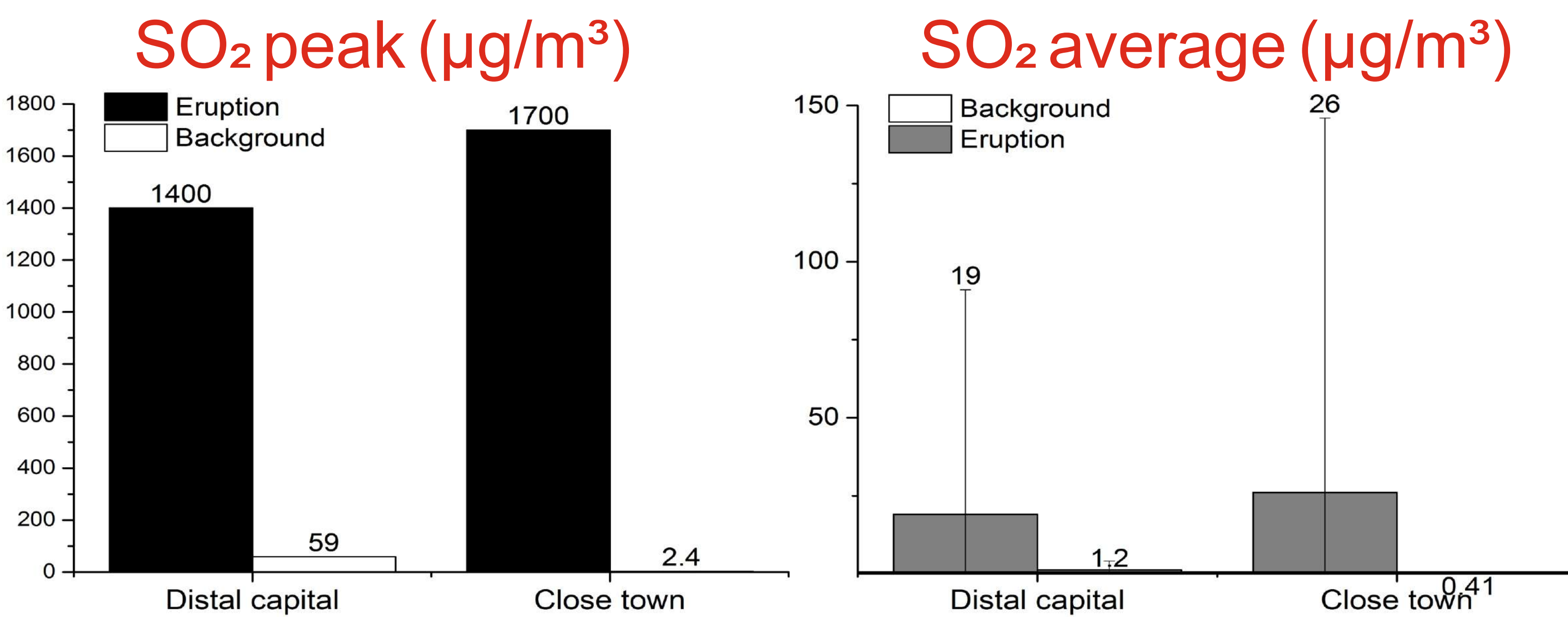
2. Data set



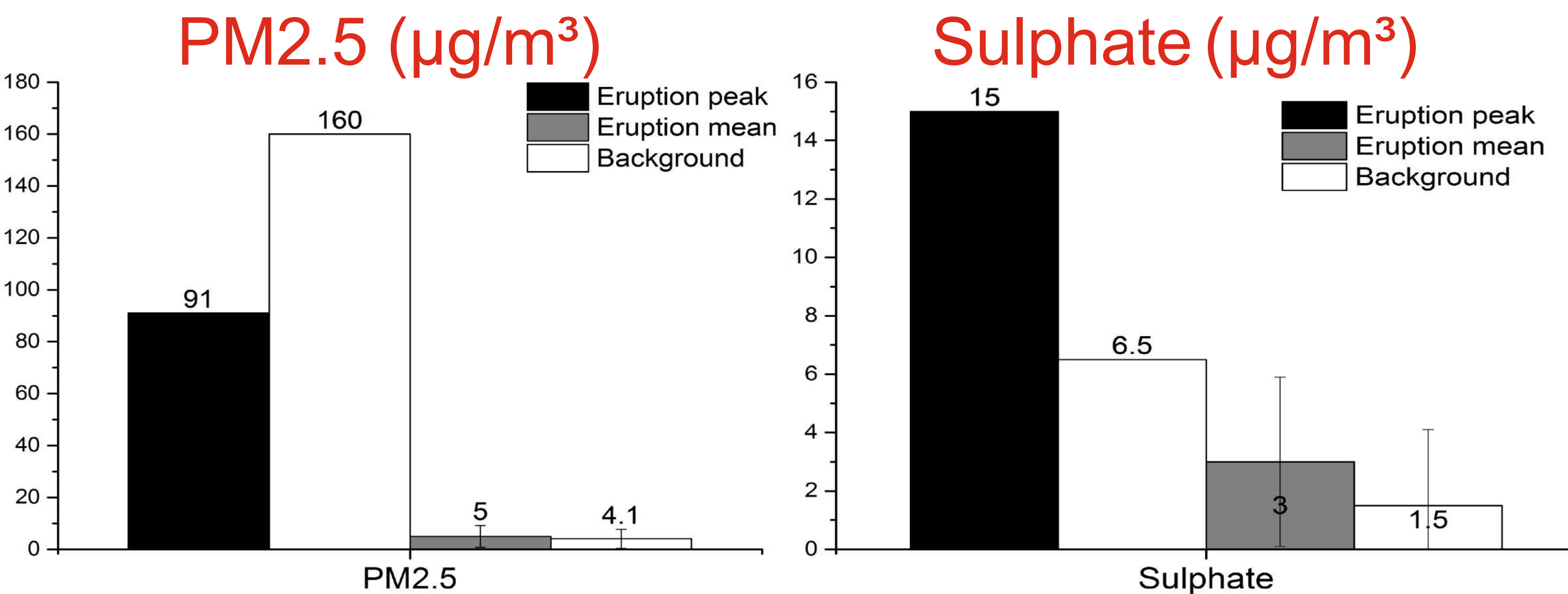
- Close town** (100 km downwind). Population 300.
 - *Continuous SO₂ monitoring
 - *Aerosol sizing (OPC)
 - *Direct sampling gas & aerosol
- Eruption site** - Very remote.
 - *Automated SO₂ monitoring
 - *Aerosol sizing (OPC)
 - *Direct sampling gas & aerosol

- Distal capital** (250 km downwind). Population 120,000.
 - *Continuous SO₂ and PM monitoring
 - *Aerosol sizing (OPC)
 - * Daily sampling of aerosol

3. Impact on AQ in populated areas



AQ limits for SO₂ exceeded multiple times. **Close town**: 88 hours / 10 days. **Distal capital**: 34 hours / 10 days.



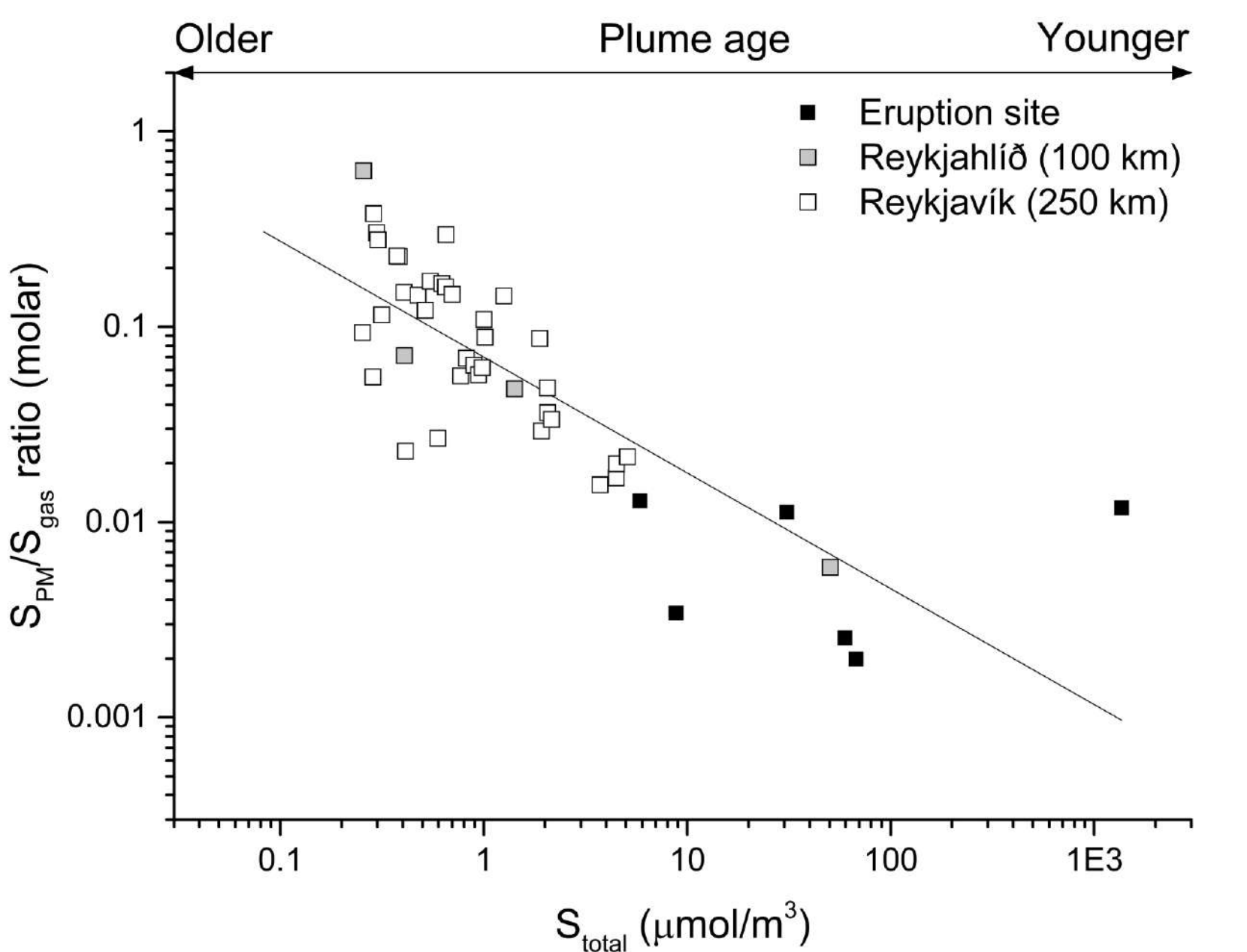
PM_{2.5} concentration not significantly impacted by eruption

But the PM_{2.5} composition is now dominated by sulphuric acid!

4. Conversion of SO₂ to sulphate

Young plume has ~1% of sulphur in the aerosol phase

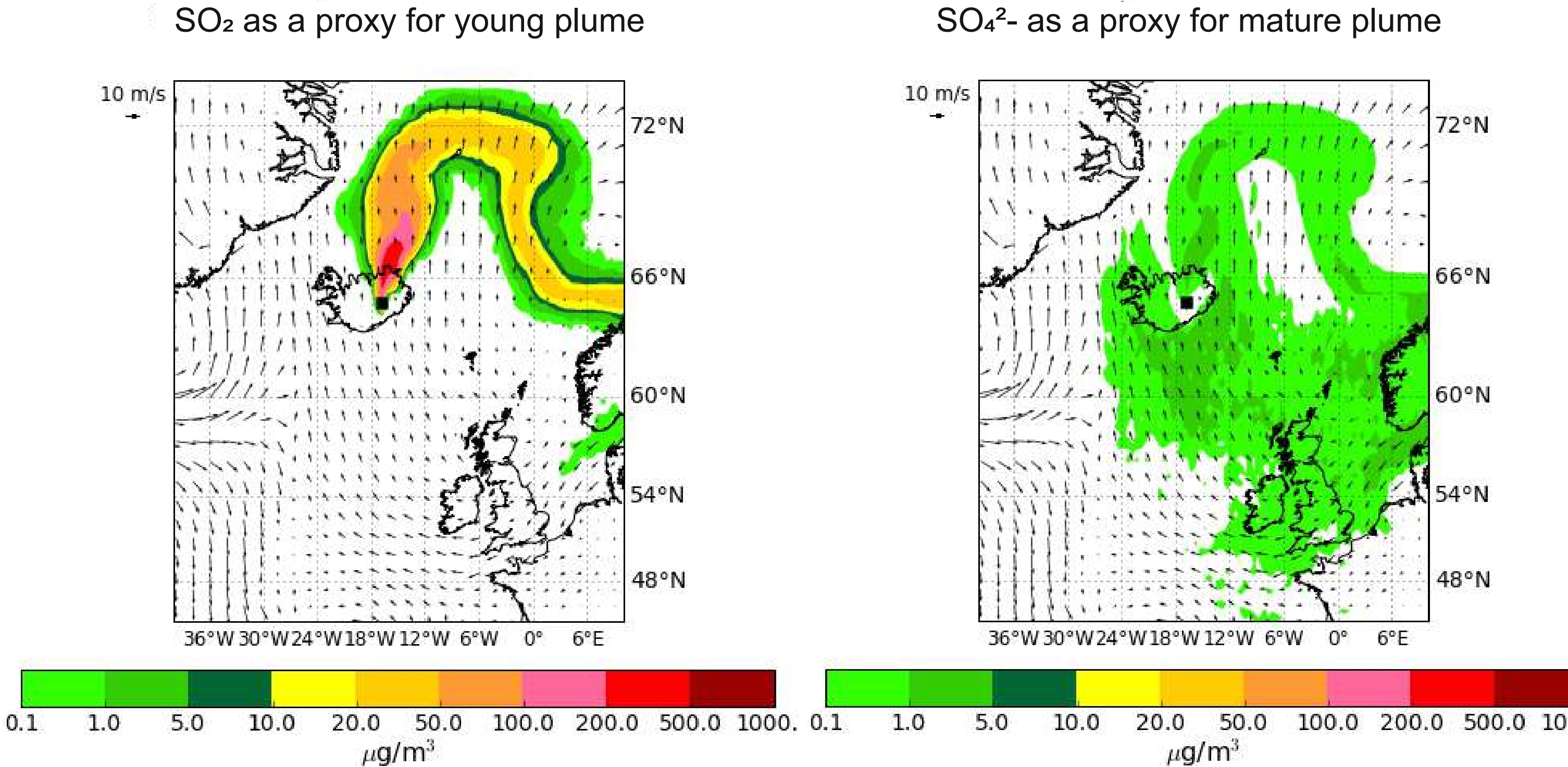
The older the plume, the higher the aerosol/gas sulphur ratio



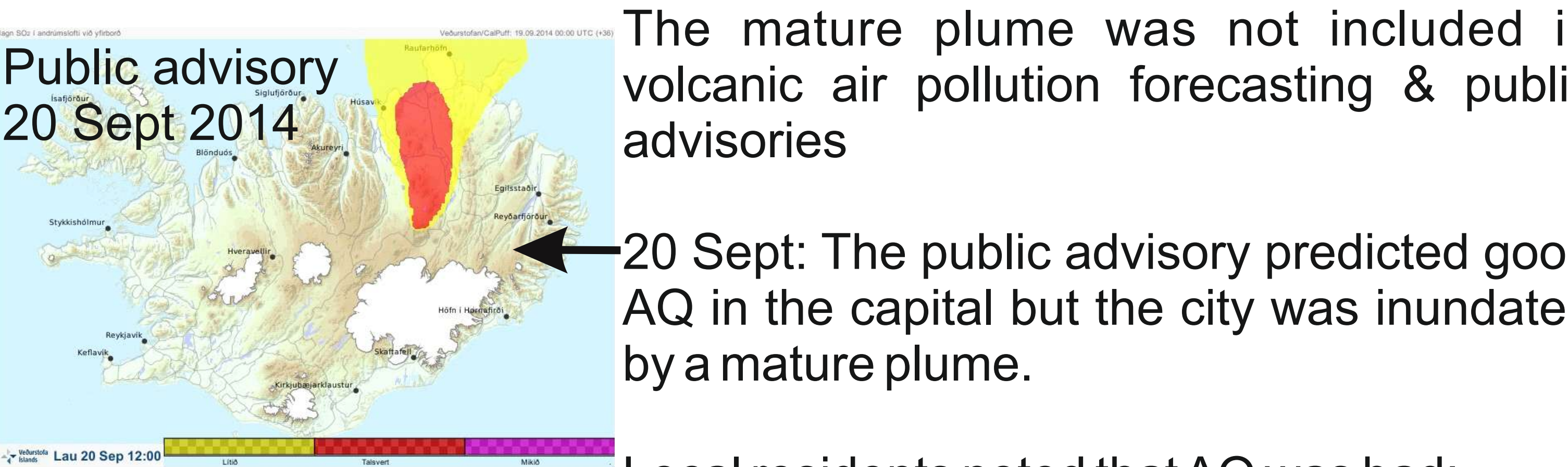
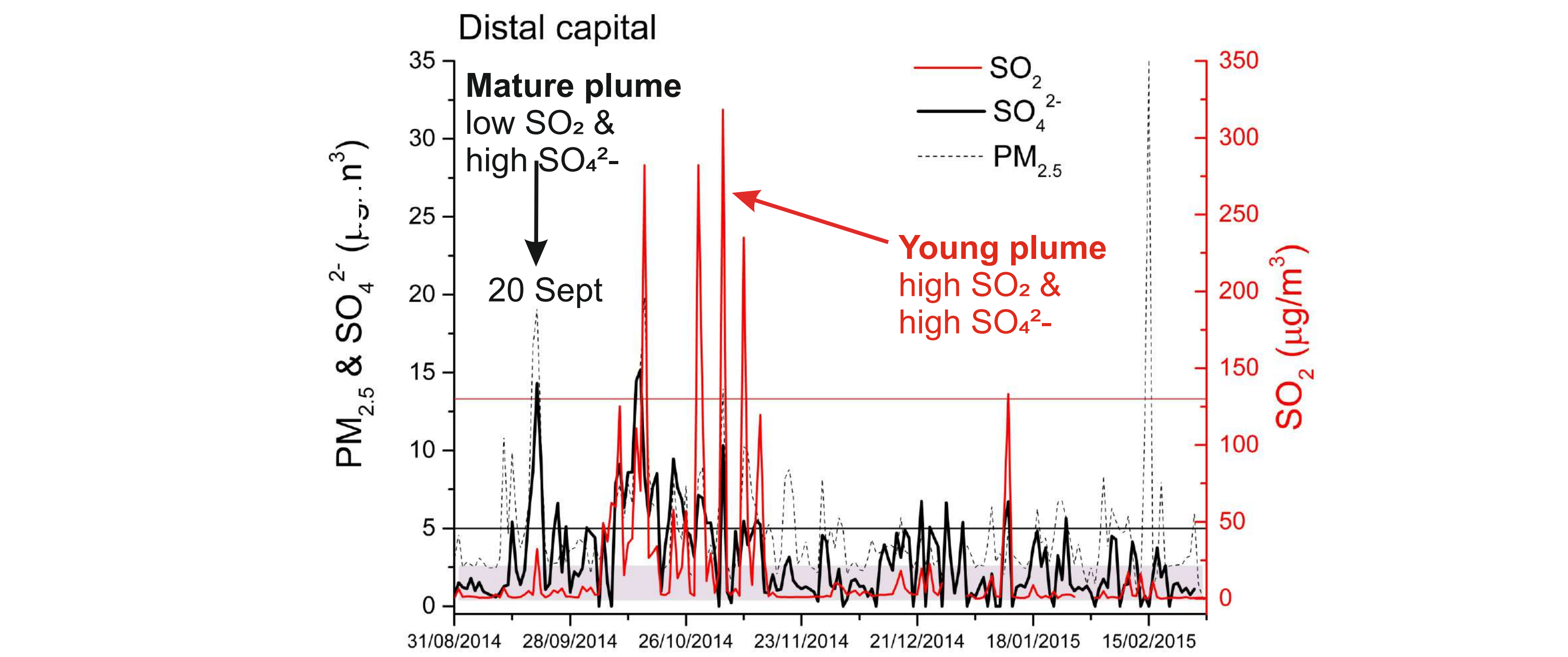
5. The ‘plumerang’ effect

A young plume leaves Iceland...

... then ‘boomerangs’ back after a trip to Europe



Both young plume and the mature plume caused deterioration of AQ. The mature plume was not detected by real-time AQ monitoring



The mature plume was not included in volcanic air pollution forecasting & public advisories

7. Conclusions and next steps

Both young and mature plumes can have environmental impacts and should be included in operational forecasting

Ongoing study on assessing public health effects of both types of plume (to be submitted end of 2017)

