MERCURY IN AUSTRALIA

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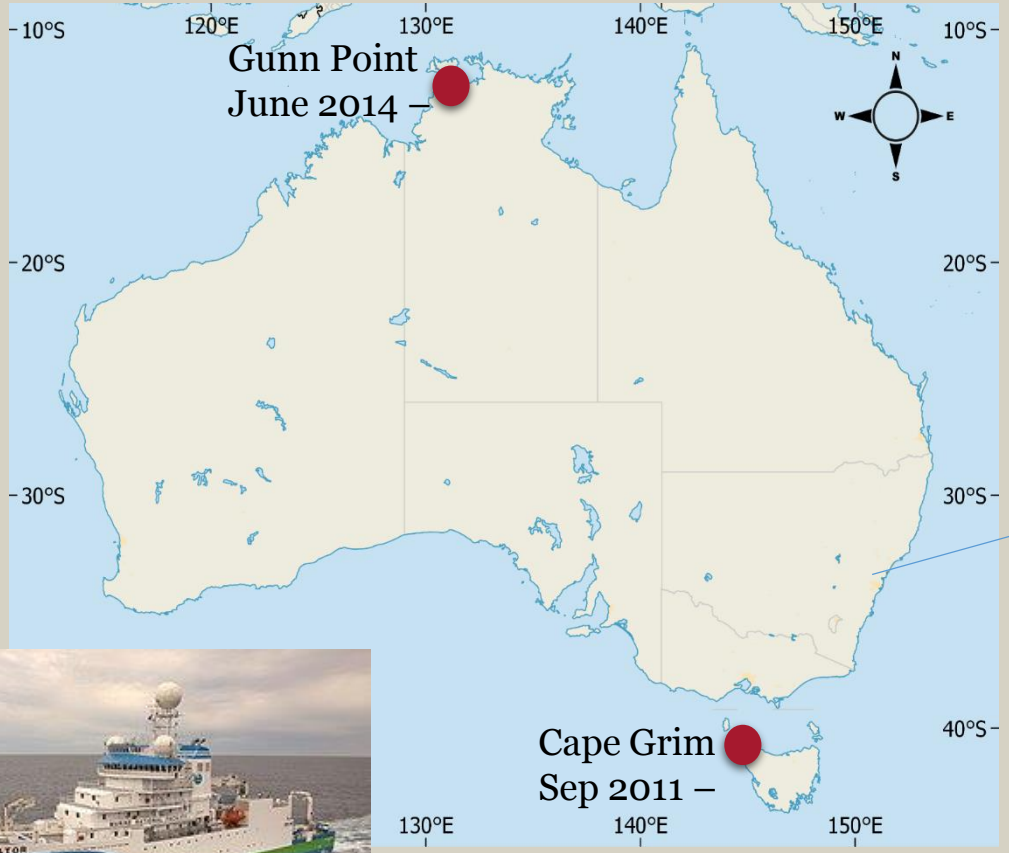
MACQUARIE University

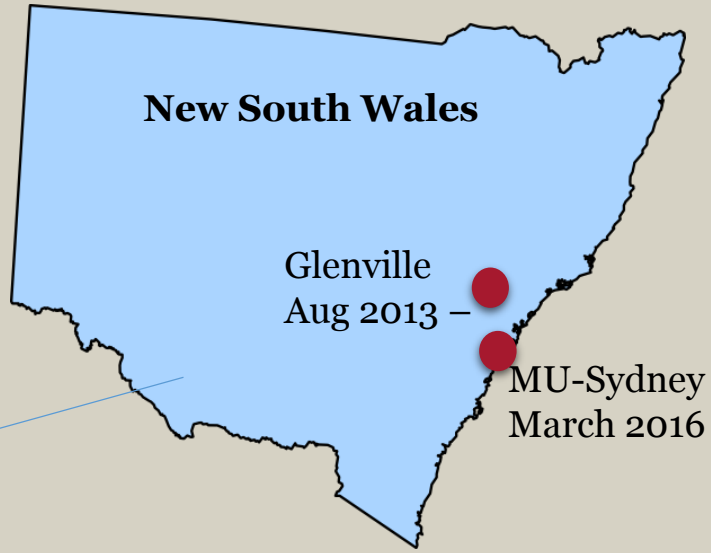
Mercury in Australia- background for group at MU

- *First Australian Power Station Measurements of mercury species*
- *Australian inventory from all sources- informing response to Minamata Convention*
- *First gas phase concentrations of mercury in Australia - Almost no SH data, providing constraints and tests of global mercury modelling and mercury atmospheric chemistry*
- *Invitation to join the Global Mercury Observing System (GMOS) led by EU*
- *First measurements of mercury in wet and dry deposition samples*
- *First mercury measured in fires in Australia; emission factors, and firefighter exposure*
- *Member UNEP Expert Group on Global Inventory (2010 Global Inventory, 2018 Assessment)*
- *Peter Nelson, Lead author (non ferrous smelting and roasting), UNEP Expert Group on Minamata Convention*
- *Long-term measurements and modelling in Sydney, Hunter Valley and Northern Australia - Included in Global Mercury Observing System*
- *Peter Nelson, Co-lead UN Environment Partnership on Mercury from Coal Combustion (with Dr Lesley Sloss, IEA Clean Coal Centre)*
  - *Currently negotiating large project with the Global Environment Facility (GEF) to demonstrate mercury control in industrial processes in developing countries*

Atmospheric Mercury

AUSTRALIAN LONG-TERM MONITORING SITES





RV Investigator

Seasonal Variation

GLENVILLE, NSW (32.4° S, 151.1° E)

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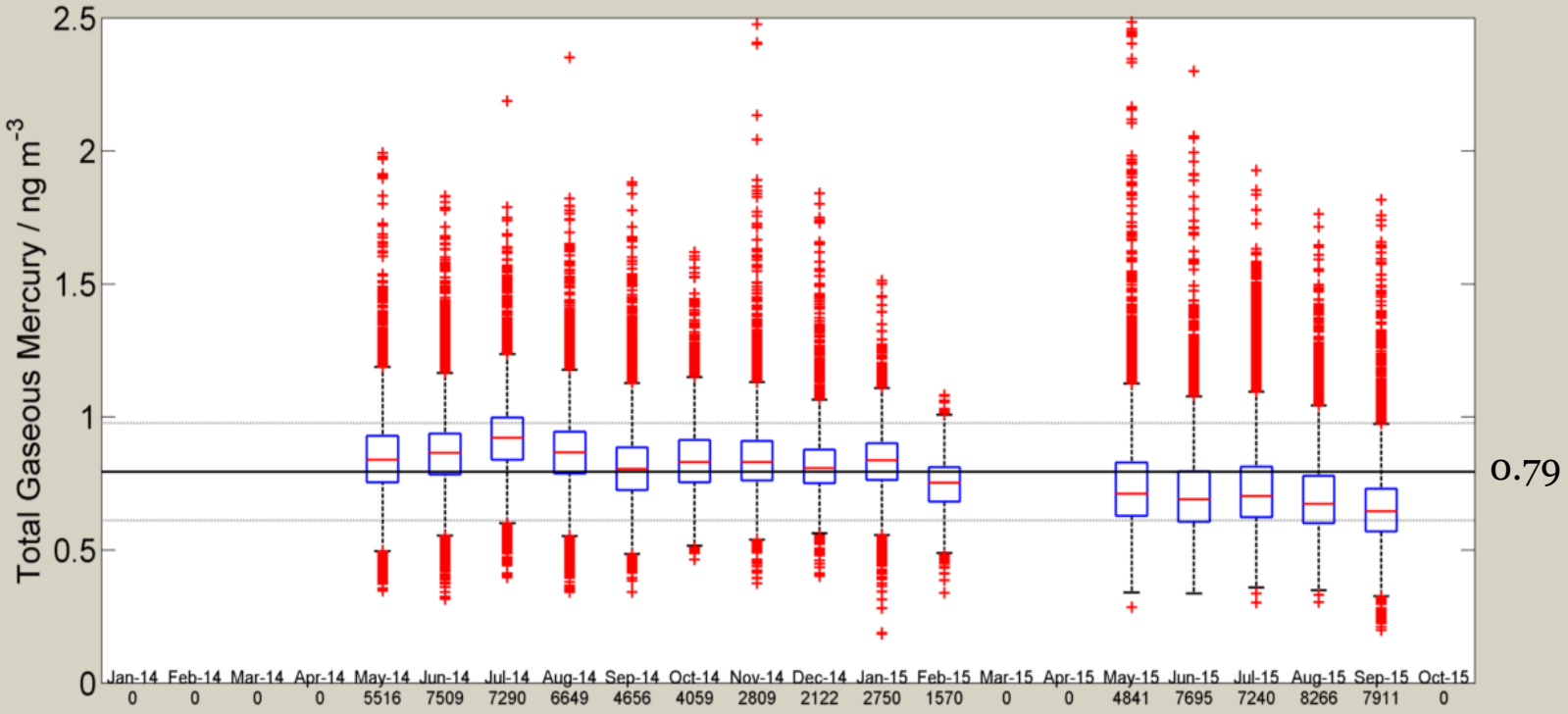
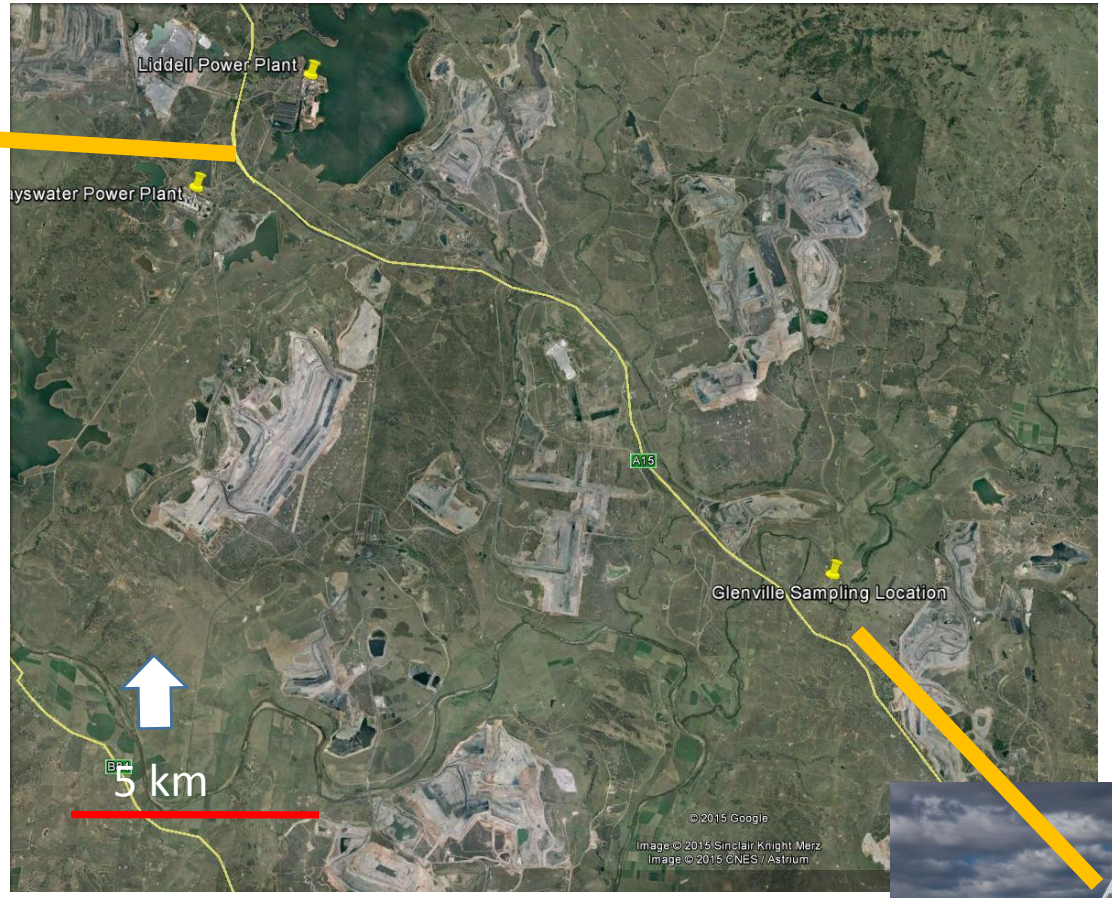
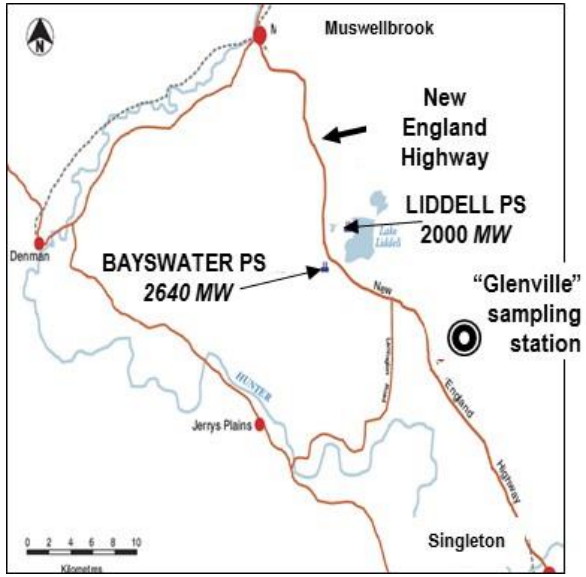


“Glenville” site location

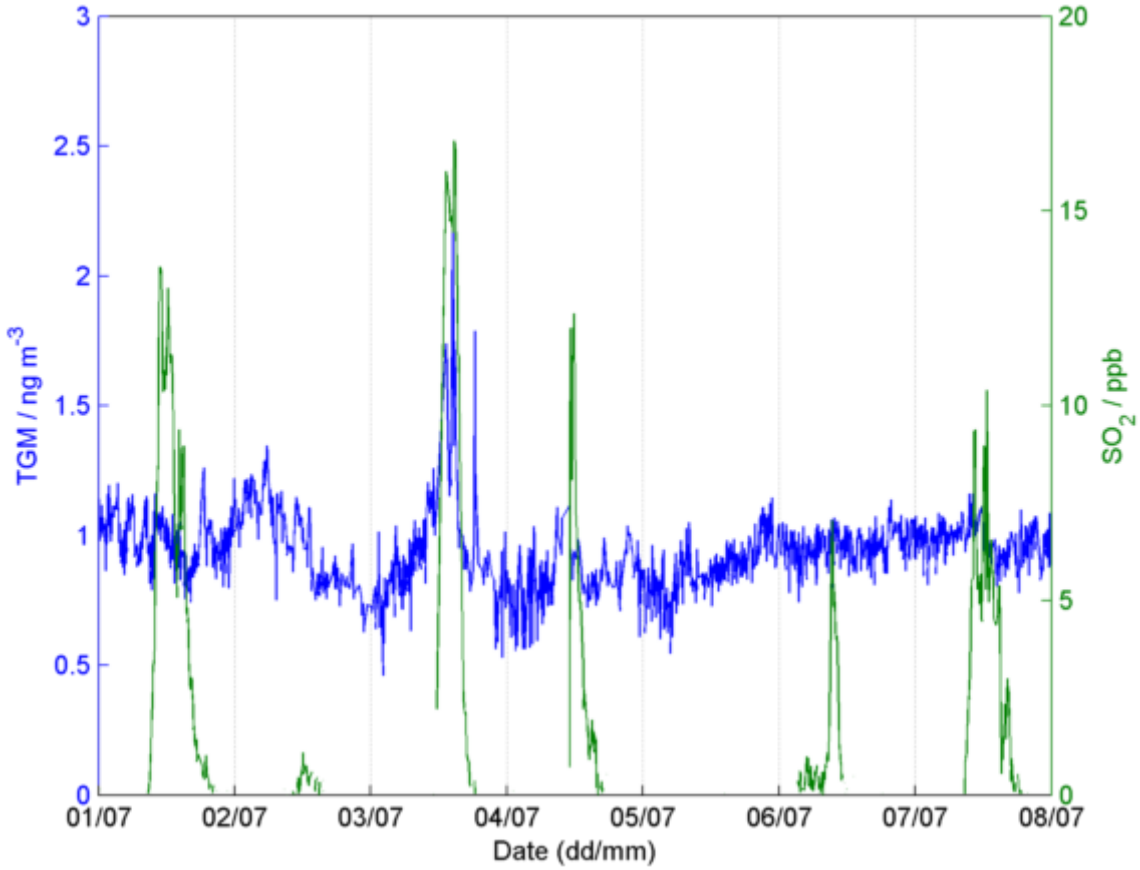


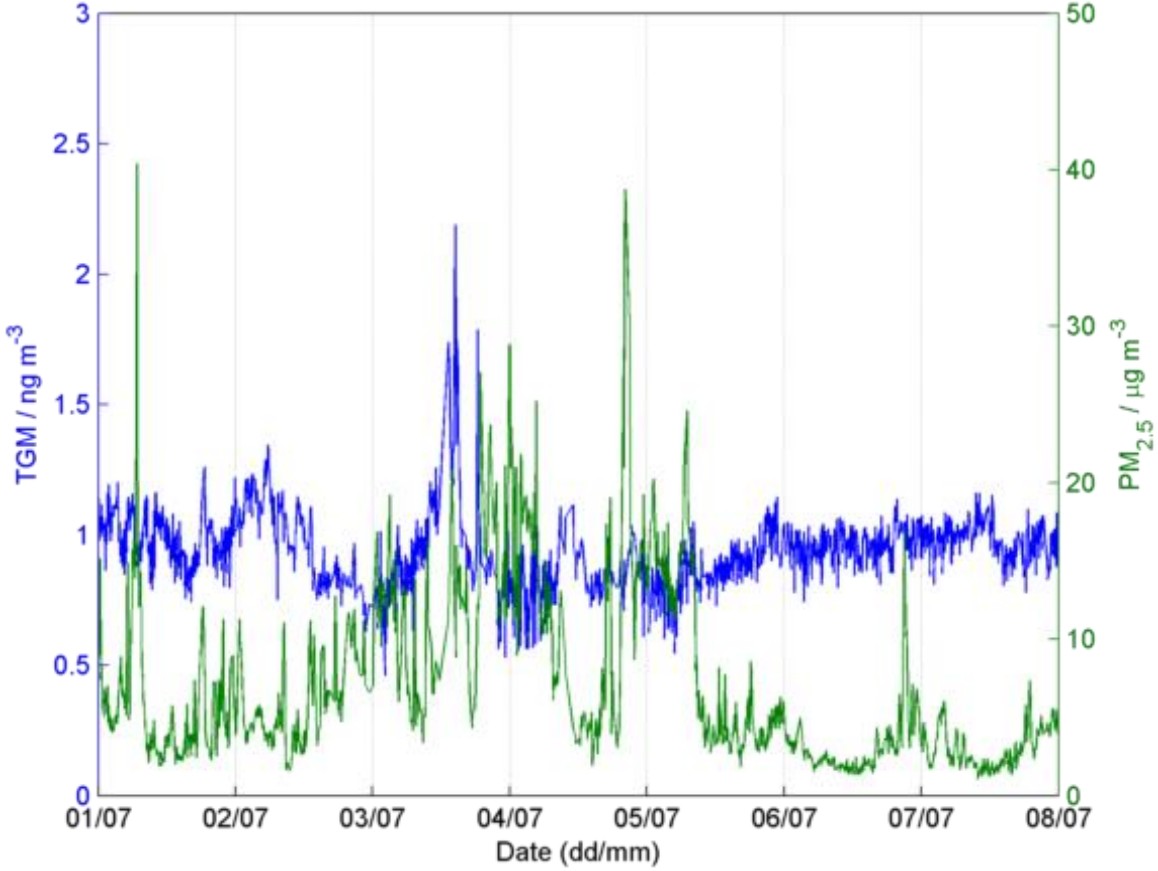


Equipment:

- Tekran 2537 + 1170 (GOM) module
- SO_2 –Thermo-Scientific
- PM – OSIRIS –Turnkey Instruments
- WS/WD

Mercury concentration during plume strike events





Changes in TGM, SO_2 and $PM_{2.5}$ concentrations (5 min averaging period) at “Glenville” in the period 1-8 July, 2014

Daily Variation

GLENVILLE, NSW

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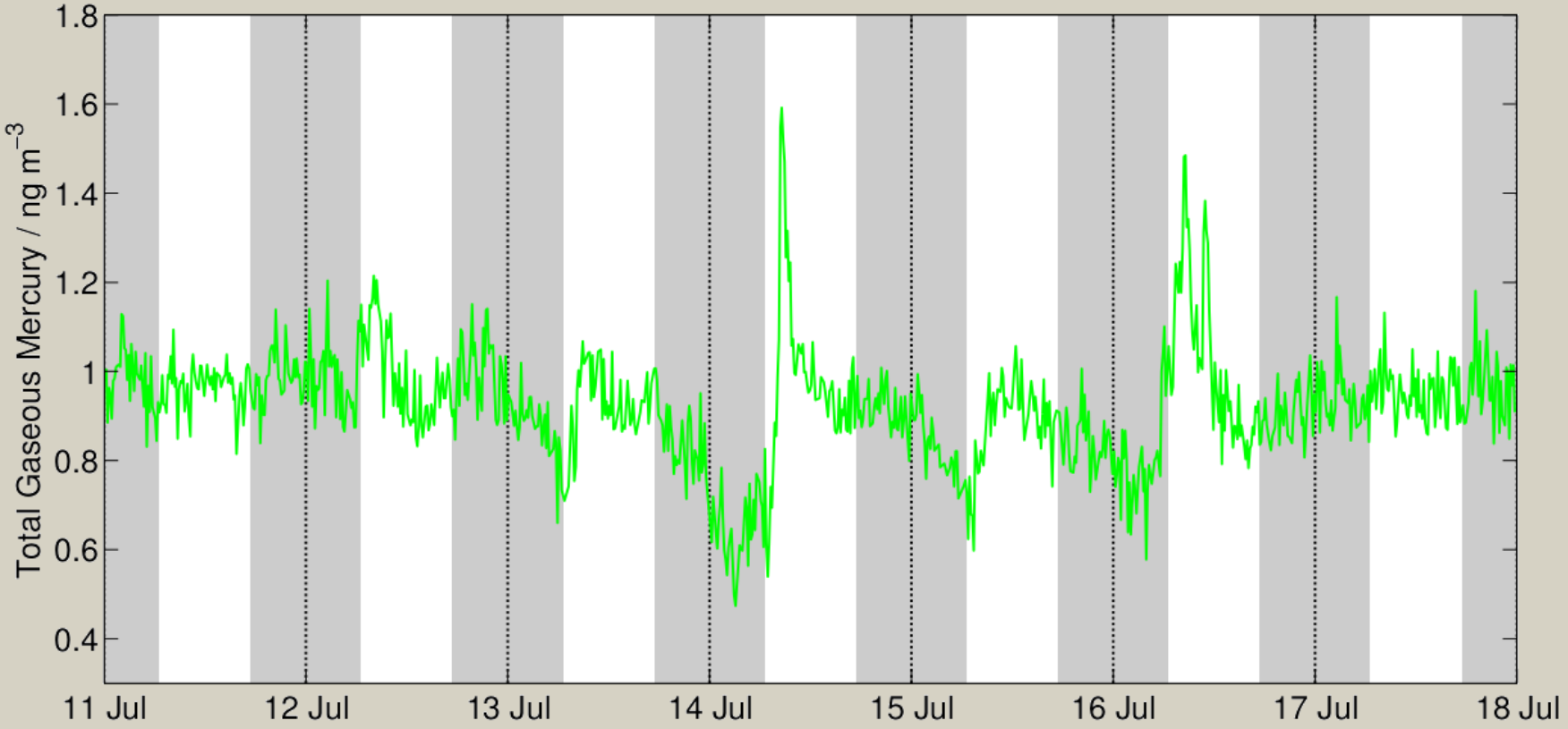

Seasonal Variation

MACQUARIE UNIVERSITY WEATHER STATION, MARSFIELD, NSW

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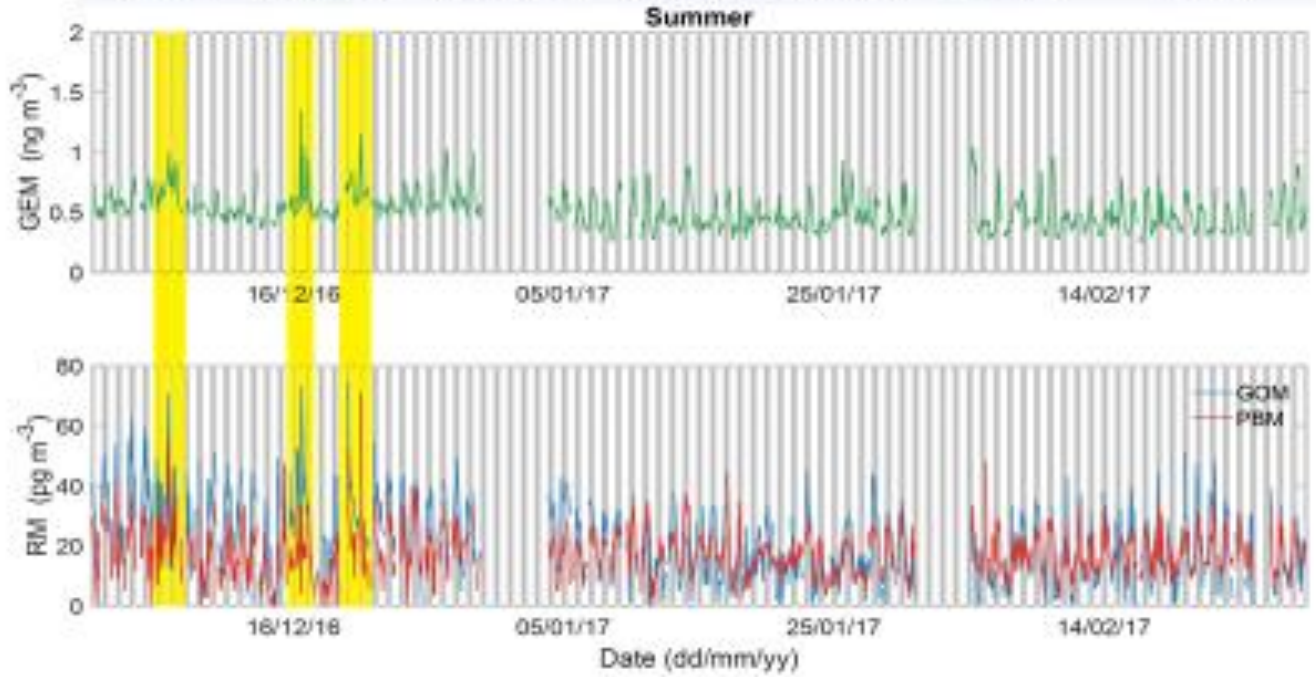
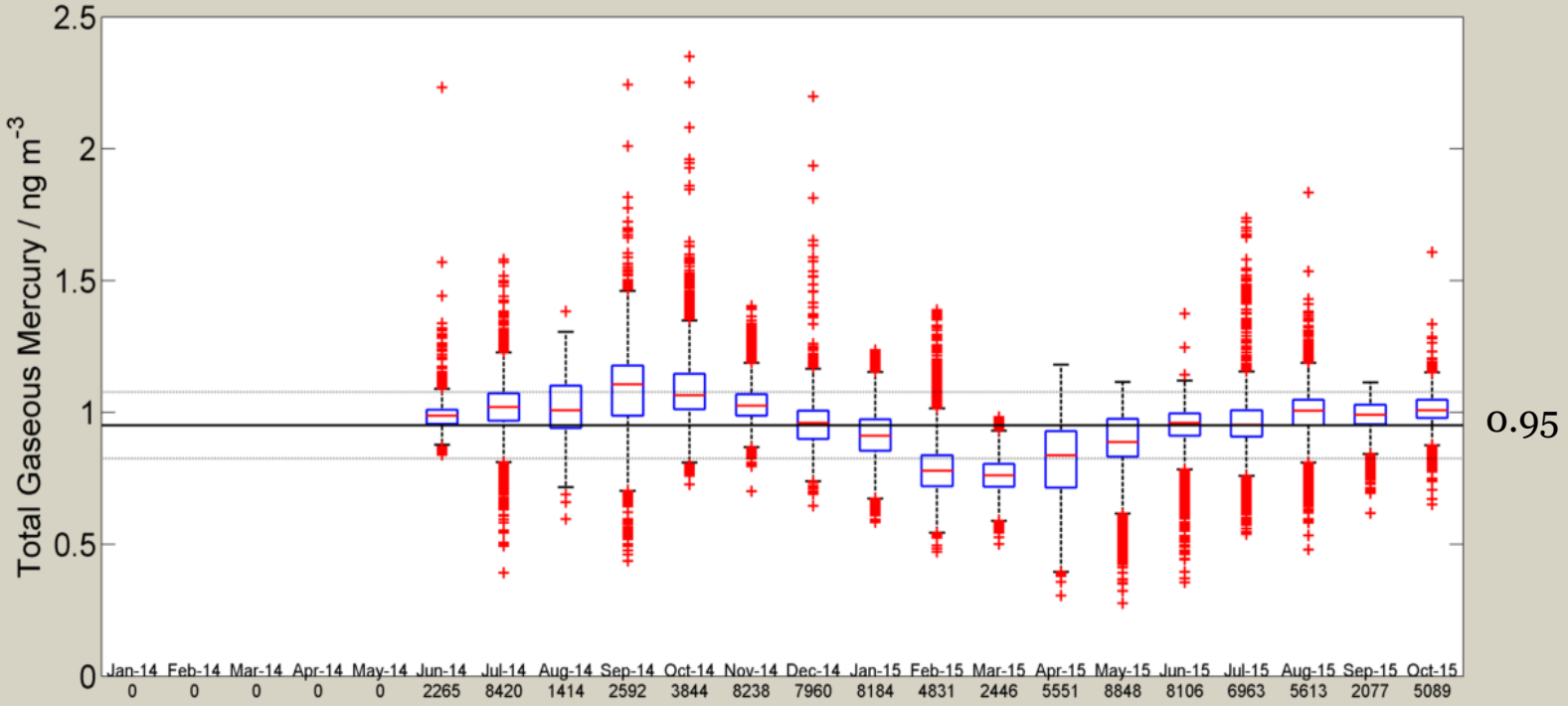
	MEAN			RANGE		
	GEM (ng m^{-3})	GOM (pg m^{-3})	PBM (pg m^{-3})	GEM (ng m^{-3})	GOM (pg m^{-3})	PBM (pg m^{-3})
ALL DATA	0.60 ± 0.14	18.21 ± 10.56	13.67 ± 7.32	0.25 - 1.53	0 - 74.64	0 - 61.43
SUMMER	0.52 ± 0.14	21.55 ± 12.98	15.57 ± 8.23	0.25 - 1.35	0 - 74.64	0 - 59.72
AUTUMN	0.61 ± 0.12	17.22 ± 7.95	12.33 ± 5.55	0.26 - 1.08	0 - 46.36	0 - 32.11
WINTER	0.66 ± 0.10	15.94 ± 9.35	13.11 ± 7.54	0.41 - 1.53	0 - 55.44	0 - 61.43

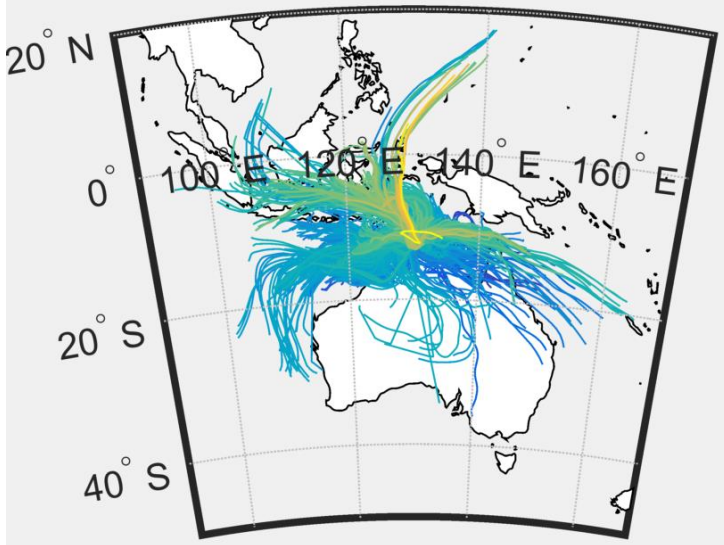


Gunn Point: Tropical savanna grass

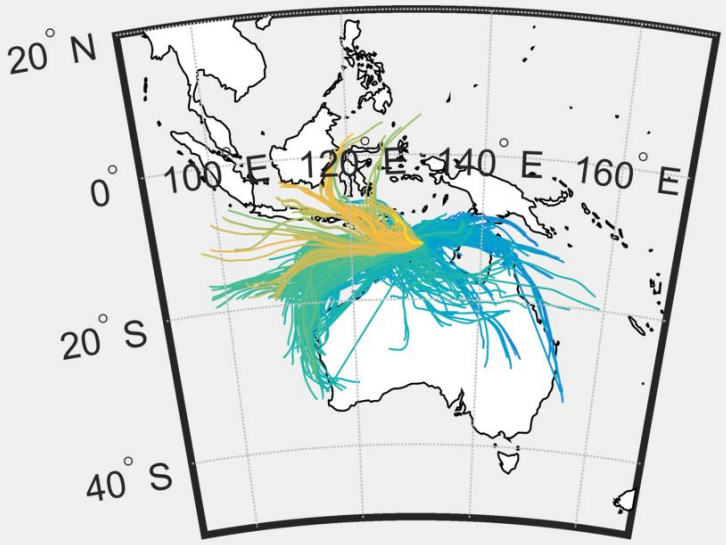
Seasonal Variation

GUNN POINT, Northern Territory (12.2° S, 131.0° E)

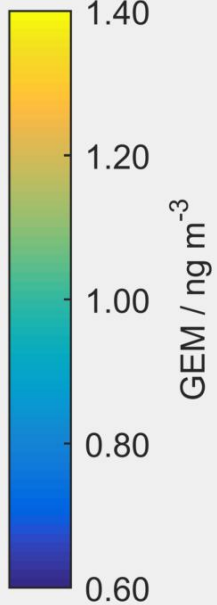


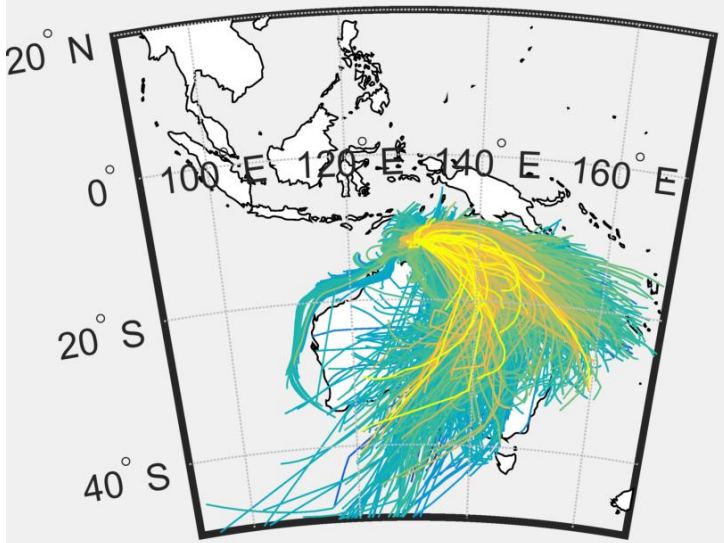


Wet Season 2014/15

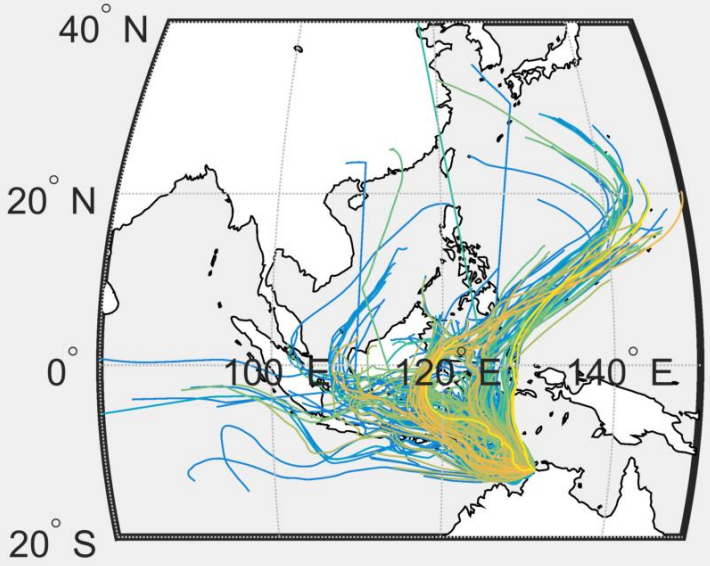


Wet Season 2015/16

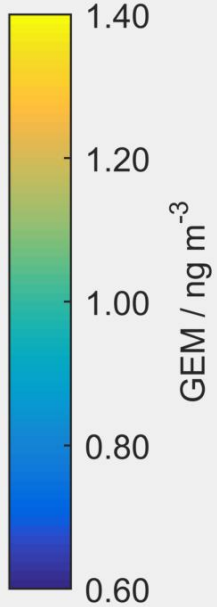




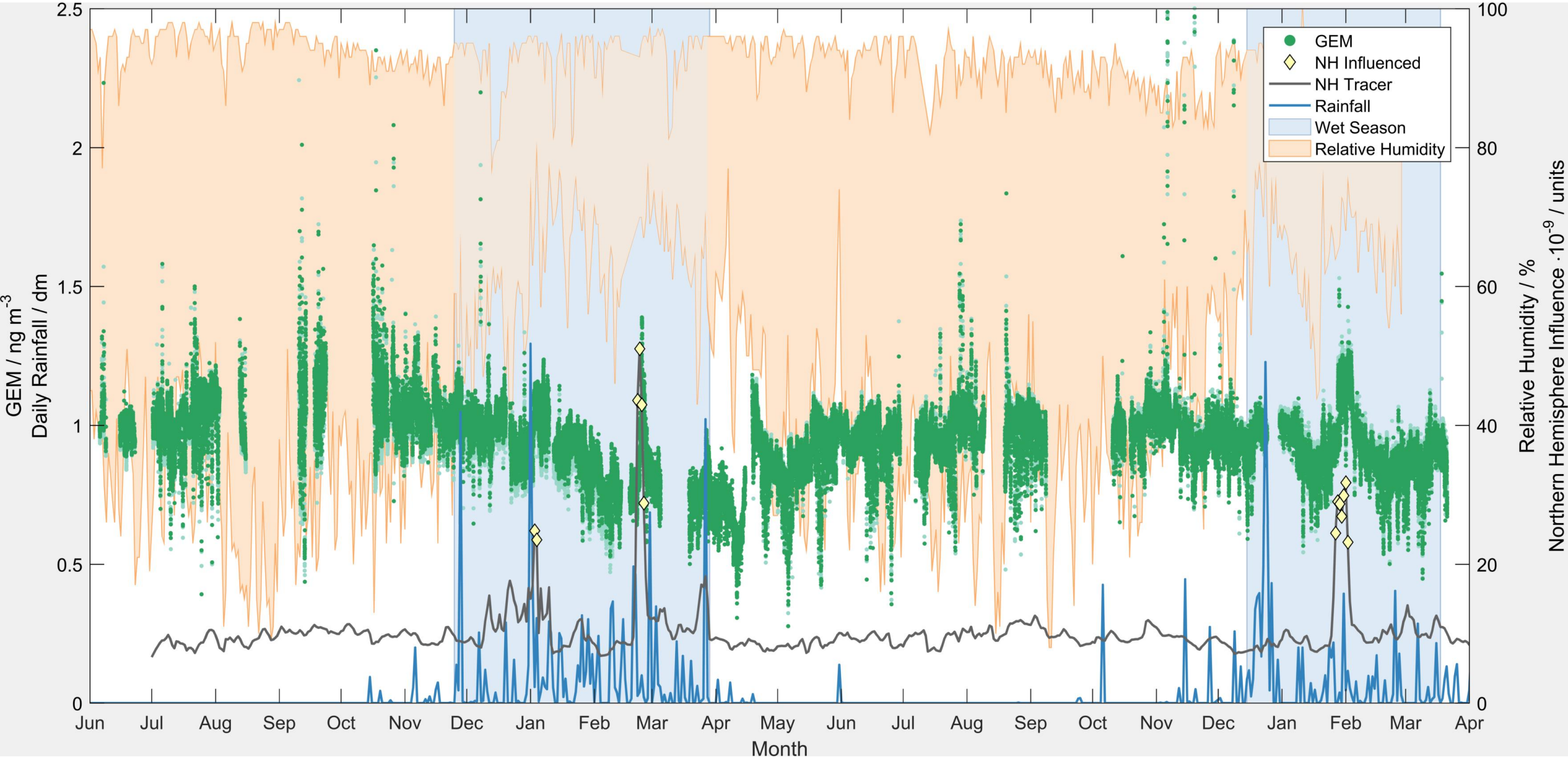
Dry Seasons 2014-2016



NH-Influenced (Wet Seasons)

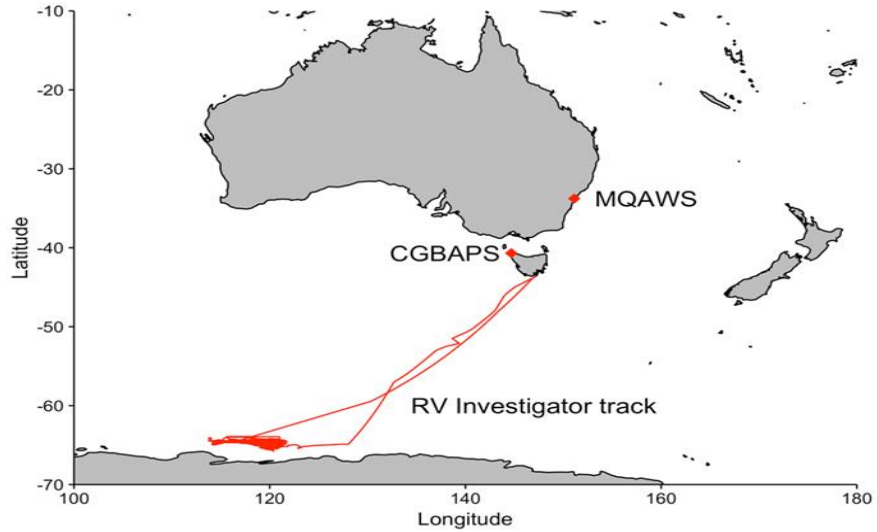


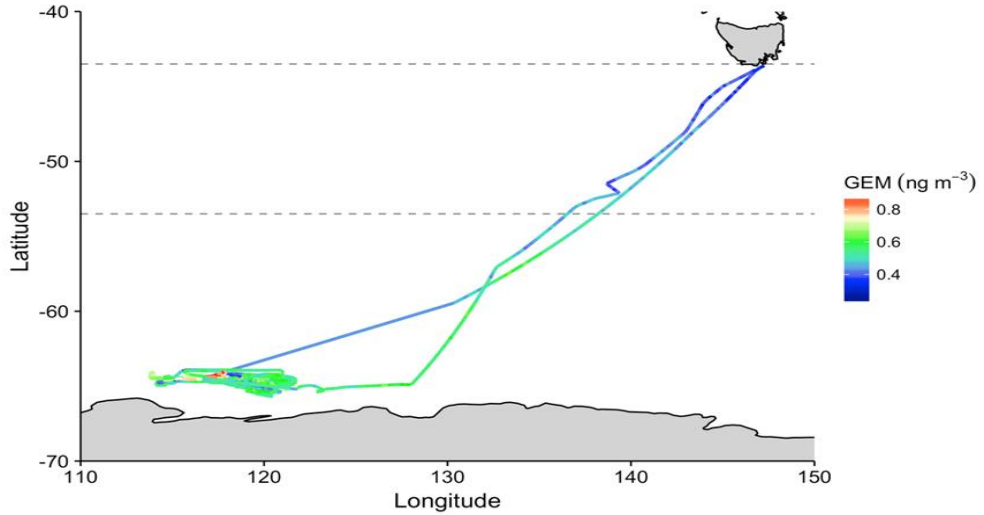
GUNN POINT, NORTHERN AUSTRALIA



GUNN POINT, NORTHERN AUSTRALIA

Voyage: RV Investigator





Challenges

AMBIENT MERCURY LONG TERM MONITORING

MACQUARIE University

- **Tyranny of distance**;

  - lack of co-location of research staff with mercury sampling sites has meant that sites can often only be visited on a monthly (Glenville) or quarterly (Gunn Pt) basis.

  - breakdown of either instruments or communication to instruments results in considerable cost and inconvenience, due to travel distances.

  - has led to development of the Macquarie University (MU) Weather Station site in close proximity to the University which can be more regularly serviced and maintained.

Potential

AMBIENT MERCURY LONG TERM MONITORING

MACQUARIE University

- **Wet sampling**
  - with establishment of the MU Weather Station site and its location near to the University campus potential exists for some wet sampling to be commenced.

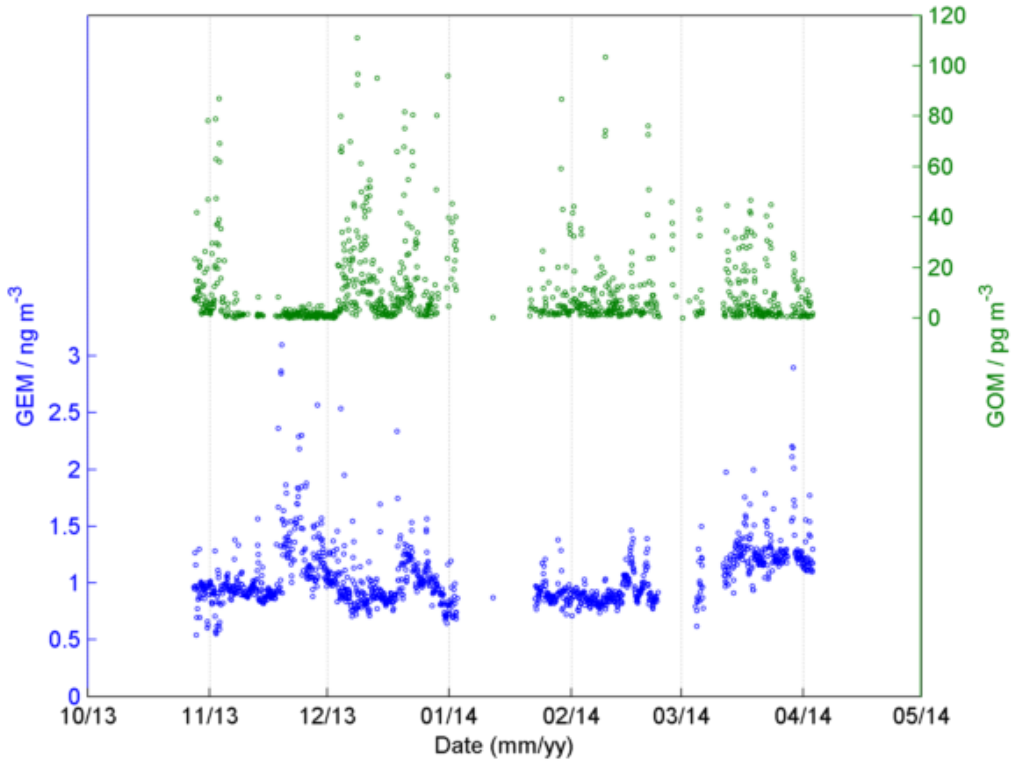
- **Lack of ongoing longer term funding**;
  - funding has always been intermittent which has meant that as a team it has been a struggle to maintain sites over the long term

In Summary

MACQUARIE University

- Australia's emissions relatively low and dominated by industrial sources particularly non-ferrous sector
- Natural and re-emitted sources dominate over anthropogenic sources; fires significant particularly in northern Australia
- Atmospheric mercury measured at several sites since 2011
- Power Stations not the source of above background mercury at a site near two large coal fired power stations
- Both Glenville and Gunn Point show intermittent periods of TGM *depletion*
  - Generally only under calm, stable, nocturnal conditions
  - Large spikes at Glenville may be due to fumigation into overlying weak mixed layer, or advection from nearby sources

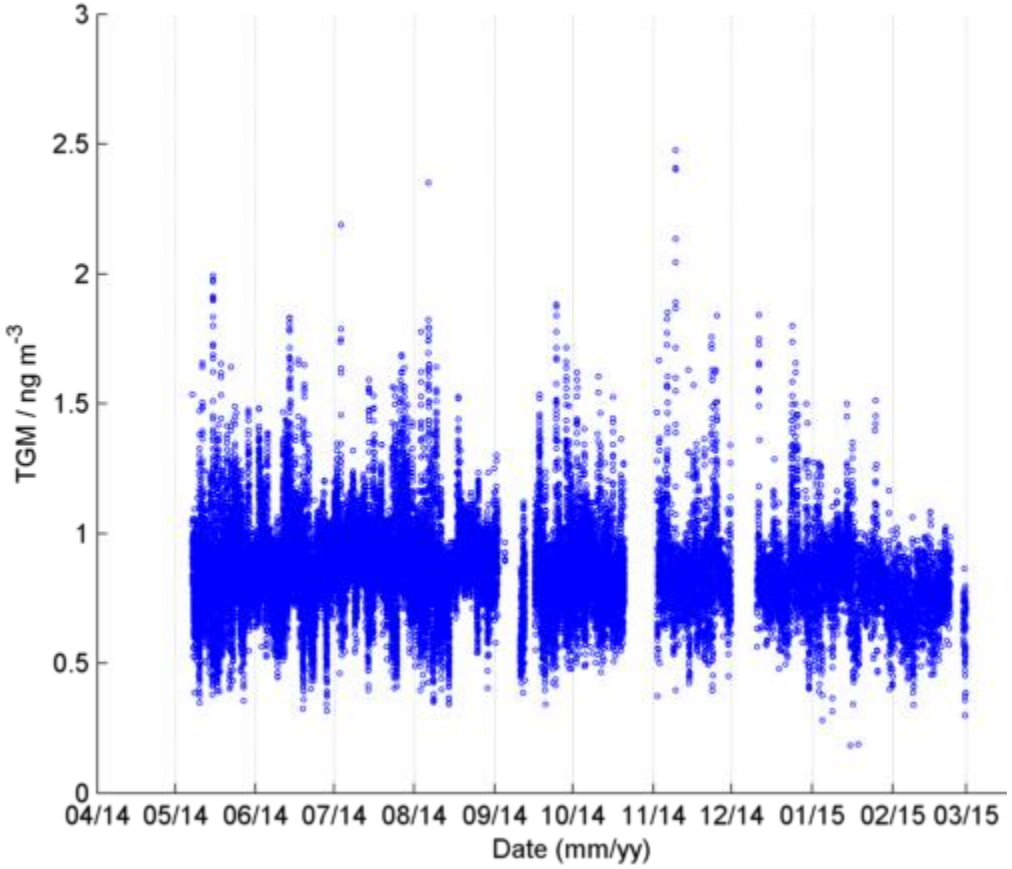
Outcomes-long term



Speciated mercury concentrations (hourly averages) at “Glenville” sampling site, November 2013-April 2014 (n=1393)

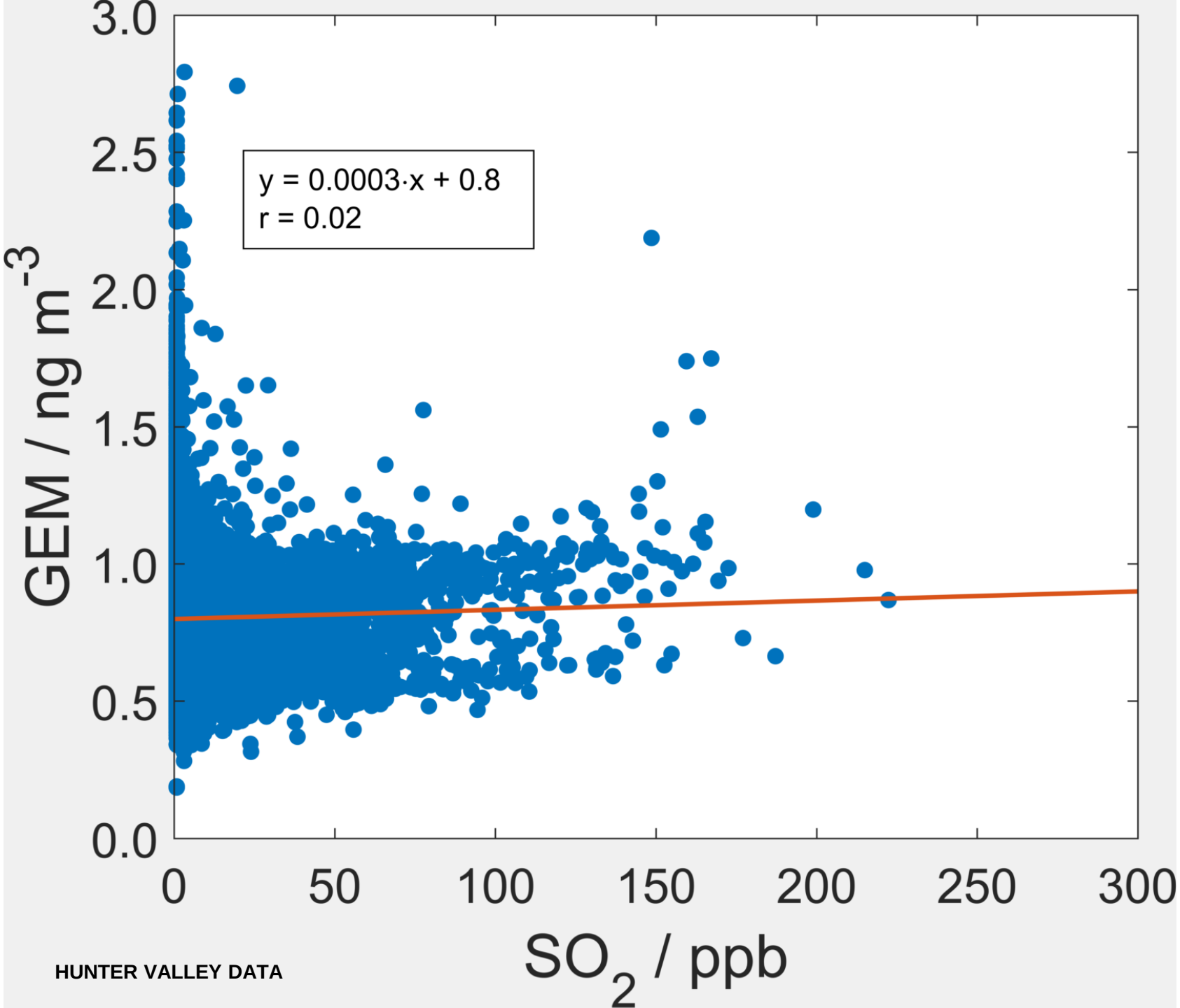
Species	Mean	Median	Range
GEM	1.05 (ng/m^3)	0.97 (ng/m^3)	0.54-3.10 (ng/m^3)
GOM	11.28 (pg/m^3)	4.31 (pg/m^3)	0 -164.21 (pg/m^3)

Outcomes-long term



Total gaseous mercury concentrations (five min collection period) at “Glenville” sampling site, April 2014 – April 2014 (n=45005)

Species	Mean	Median	Range
TGM	0.86 (ng/m^3)	0.85 (ng/m^3)	0.19-2.48 (ng/m^3)



HUNTER VALLEY DATA

In Summary

AMBIENT MERCURY AND POWER STATIONS

MACQUARIE University

- Ambient mercury concentrations in the Upper Hunter are low by world standards;
- Many times lower than no observable adverse effect levels (NOAELs);
- Likely health effects of ambient mercury at the site are negligible;
- Power stations appear to have little impact on the concentrations measured at the site;
- Further work is needed to explain high and low concentration periods.

- National Pollutant Inventory gives emission estimates for SO_2 and Hg
- Using these estimates and the peak SO_2 concentrations observed suggest that power station mercury would only increase atmospheric mercury by ~0.07-0.15 ng/m^3


QUESTIONS?

MQ: Urban, Sydney NSW