Asian Dust and Daily Mortality in Japan: Preliminary Analysis

Chris Fook Sheng Ng

School of Tropical Medicine and Global Health, Nagasaki University, Nagasaki, Japan
London School of Hygiene and Tropical Medicine, London, UK

InDust Meeting, Barcelona, Jan 10, 2019

Background

- Current work is part of the project to study local and transboundary air pollution in ASIA.

  - Asian Dust in East Asia

  - Haze from fire smoke in Southeast Asia

- Japan data ready for analysis.

- Eventually, hope to extend to other countries/cities in the East Asian region

  - Through MCC Network (Antonio Gasparrini)

Data and Method

Location	47 capital cities (one in each prefecture)
Period	2011-2015
Outcome	Daily all cause mortality
Exposure	Suspended Particulate Matter (SPM, ~ PM_7 assuming inlet with a 50% efficiency cut off) Asian Dust indicator: visibility by Japan Meteorological Agency
Other variables	Temperature
Statistical analysis	Time Stratified Case Crossover (conditional Poisson) 2-stage analysis: city-specific & meta-analysis Distributed lag nonlinear model (DLNM)

Air quality monitoring stations

- Selected stations within city (red)
- 310 stations
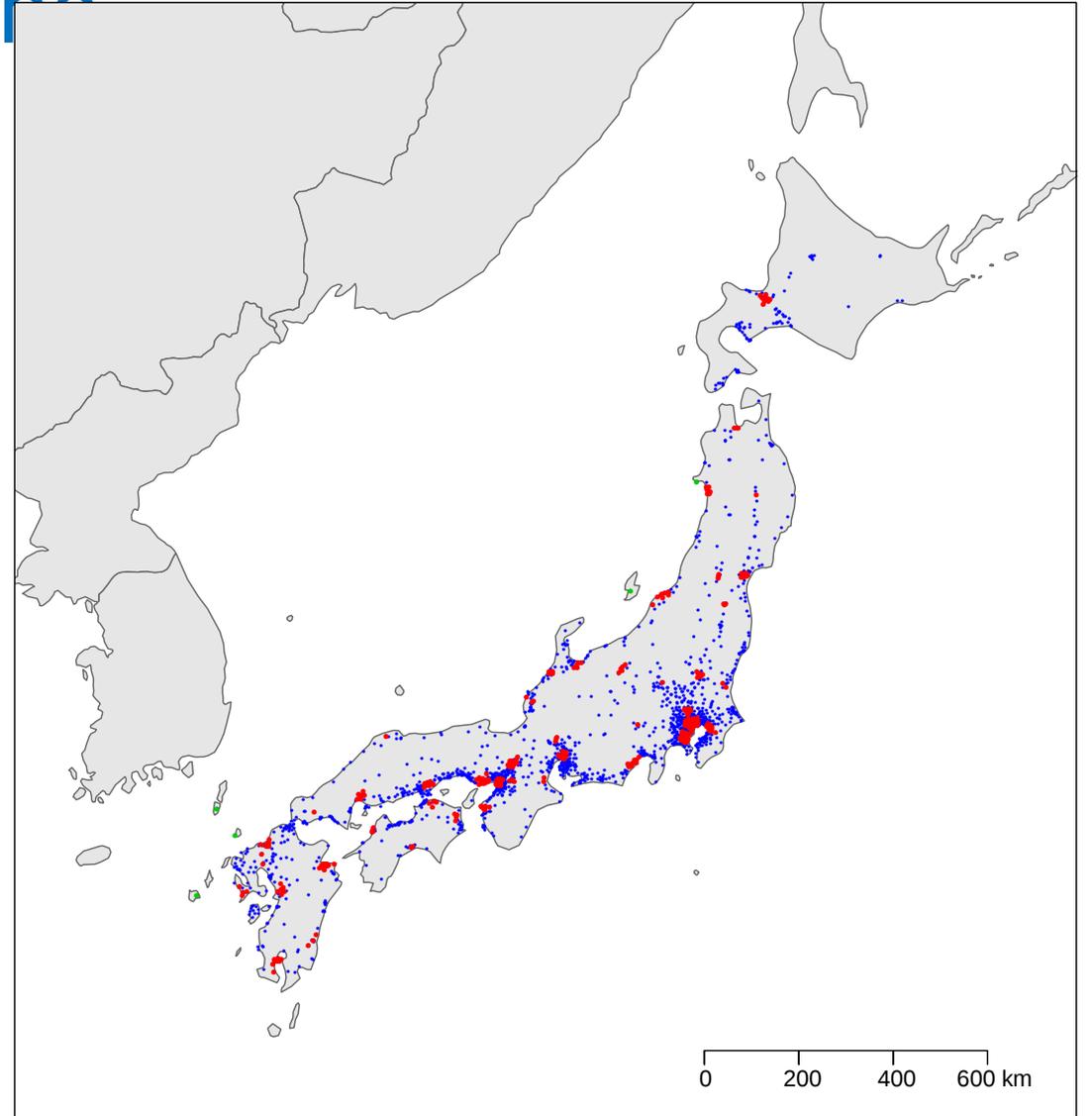
SPM level and Dust Events

- Sapporo[1], Tokyo[13], Fukuoka[40], Nagasaki[42]

- Red bar = dust event
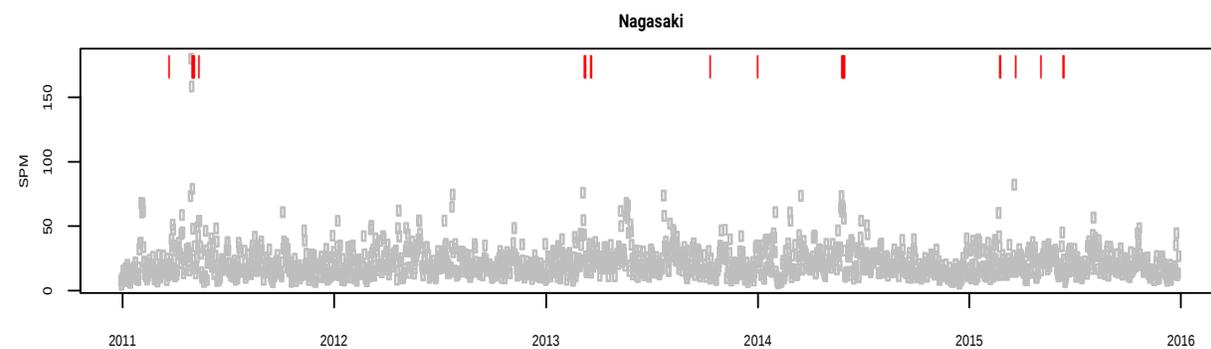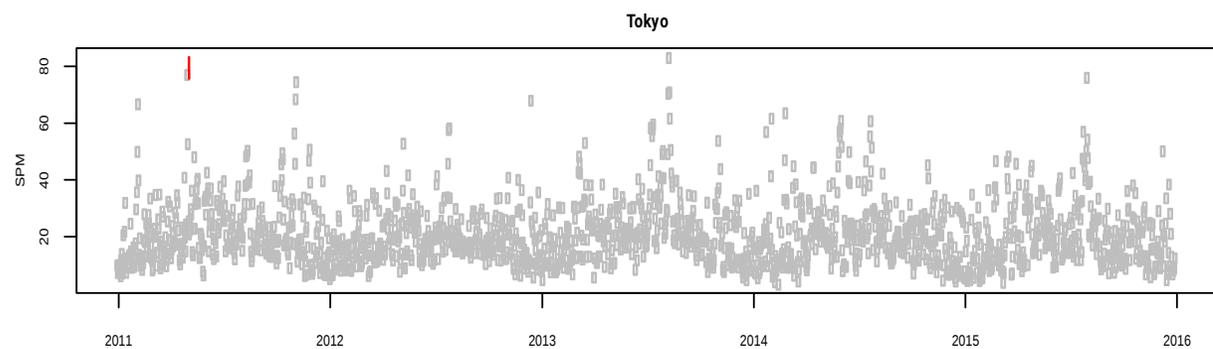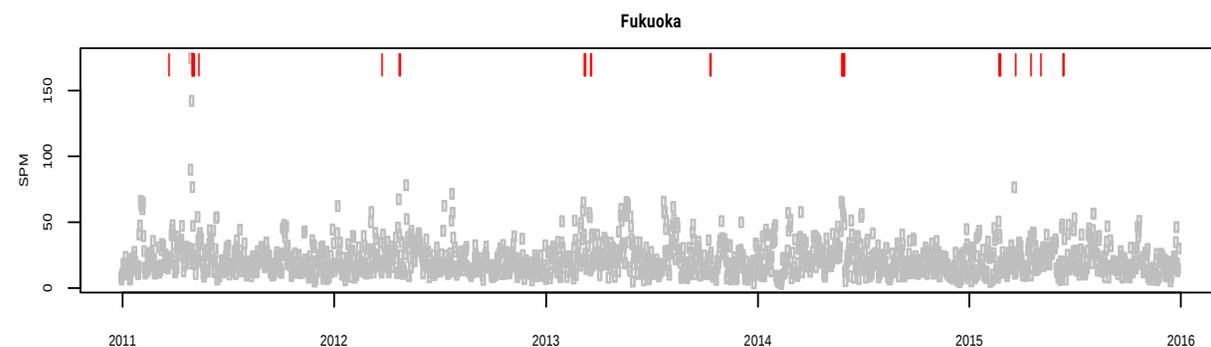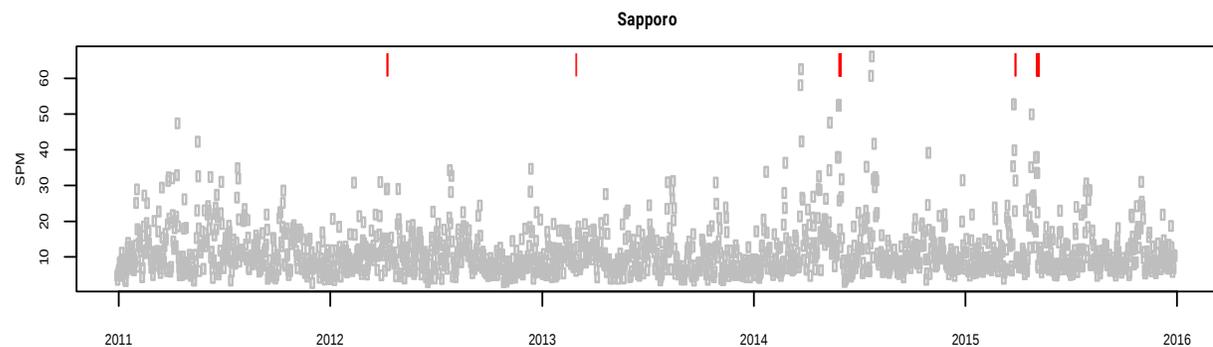
Exposure response function

First−stage and pooled estimates

RR (y-axis) vs SPM (x-axis)

Legend:
— Pooled (with 95%CI)
- - First−stage city−specific
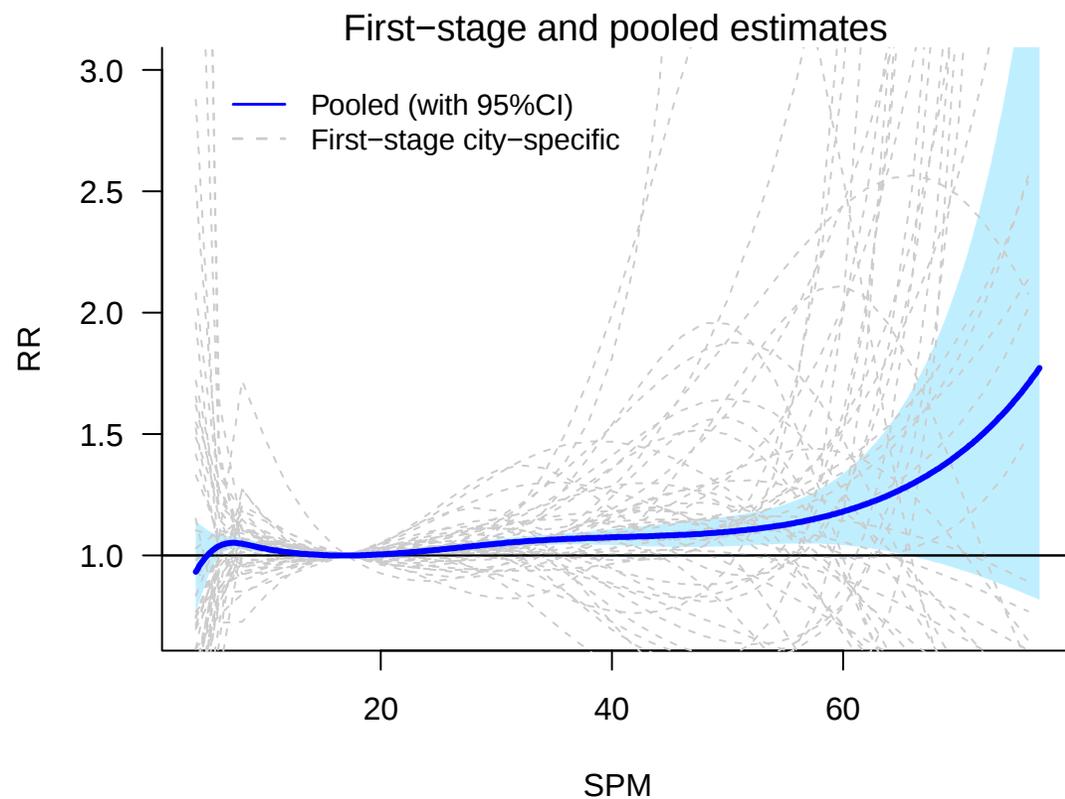
- Model: all ~ crossbasis.spm + temp_01 + temp_2_13

- Exposure: B-spline with df=3, knots at 9 and 32 (about 10th and 90th percentiles)

- Lag: 0 to 13, natural cubic spline, 2 knots in log scale

- Range: 0.1st to 99.9th percentile (4 to 77 μg/m^3)

- Per 1 μg/m^3 increase

Lag response function at specific exposure

At SPM = $17 \mu g/m^3$ (Median)

At SPM = $77 \mu g/m^3$
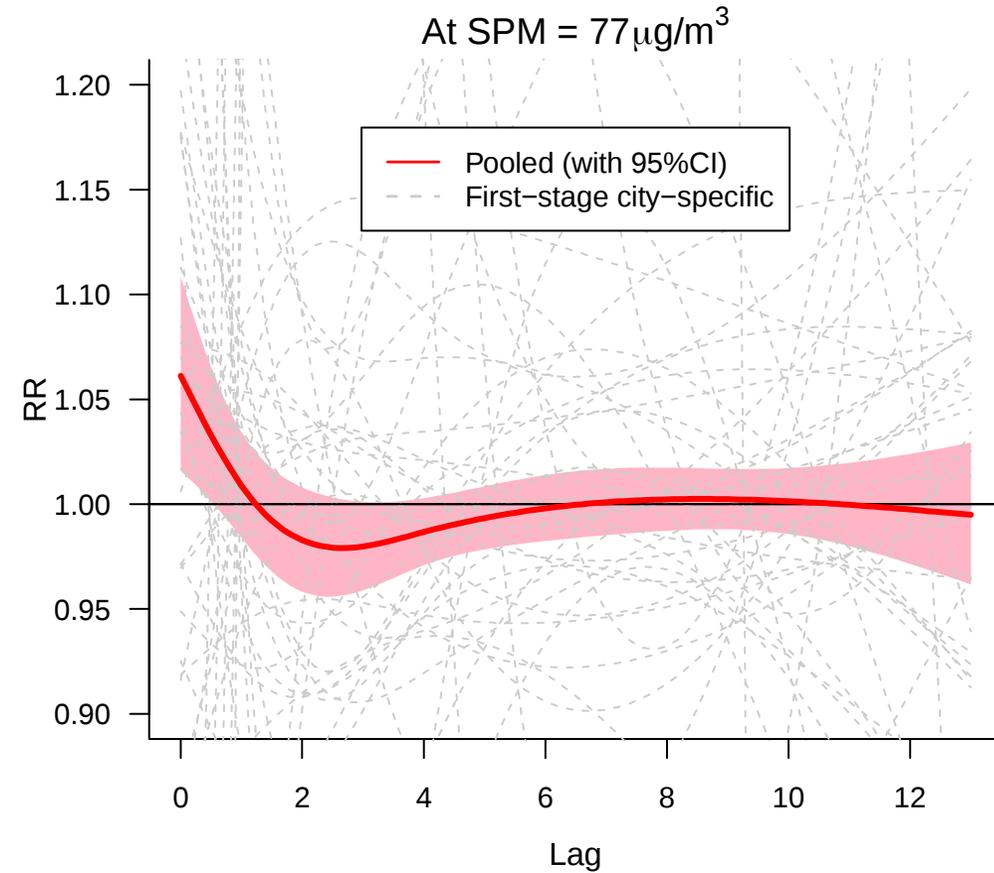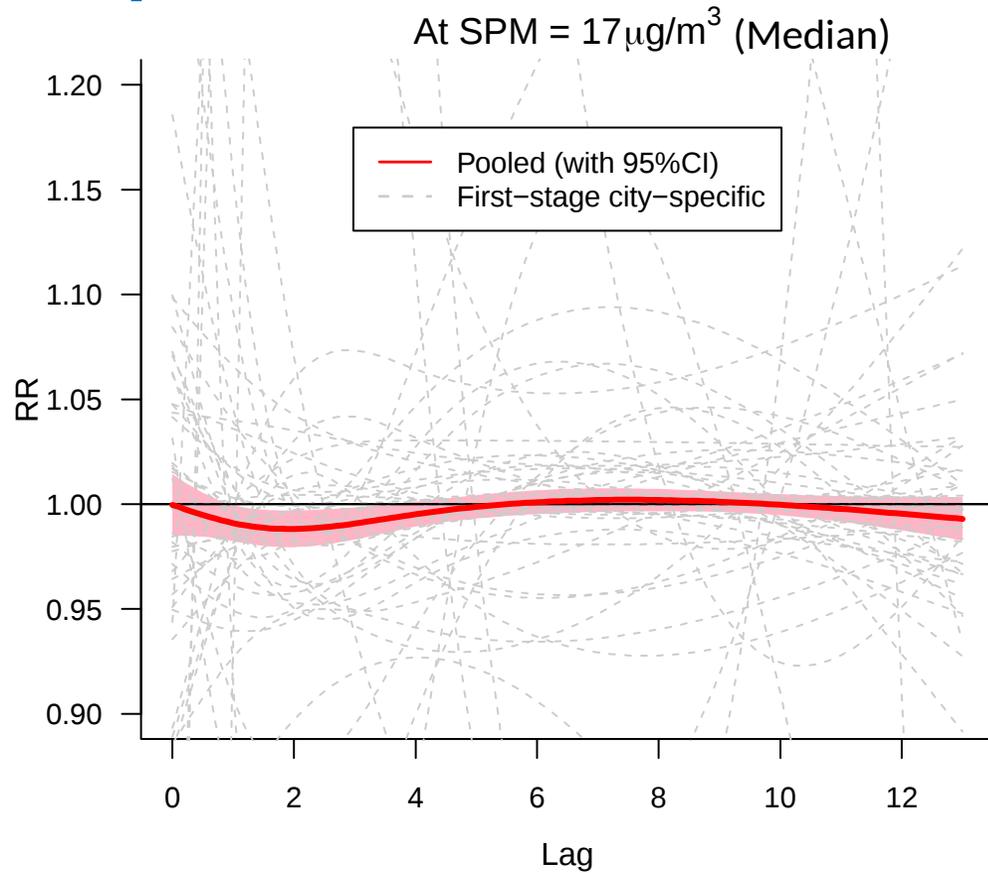
Asian dust indicator

- Model:

  all ~ factor(adlag01) + spm_01 + temp_01 + temp_2_13
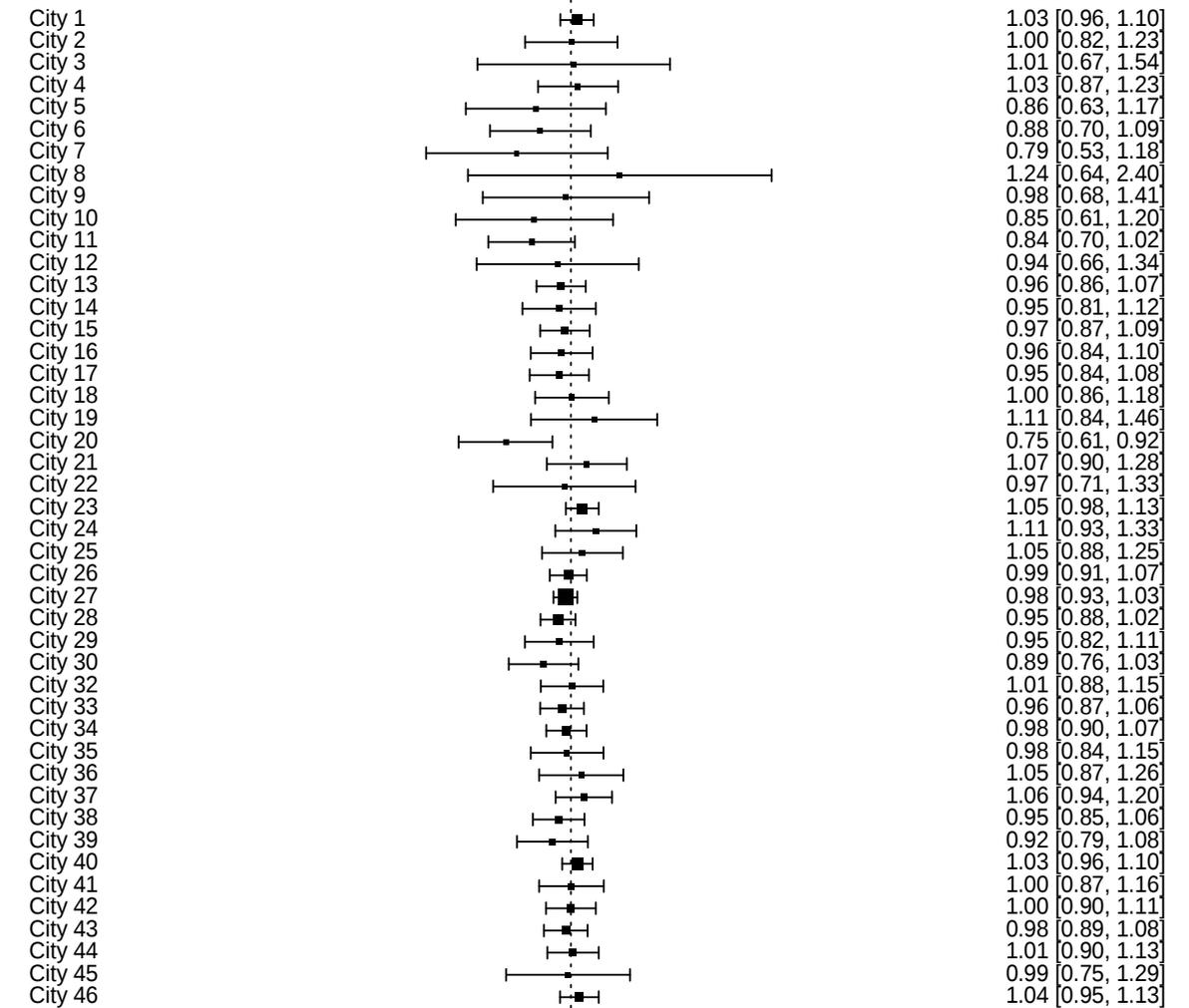
  - adlag01: same day & lag 1 of dust indicator

SPM during dust events

- Model:

all ~ factor(adlag01) +
factor(adlag01):spm_01 + temp_01 +
temp_2_13

- adlag01: same day & lag 1 of dust indicator
- Per 10 μg/m^3 increase
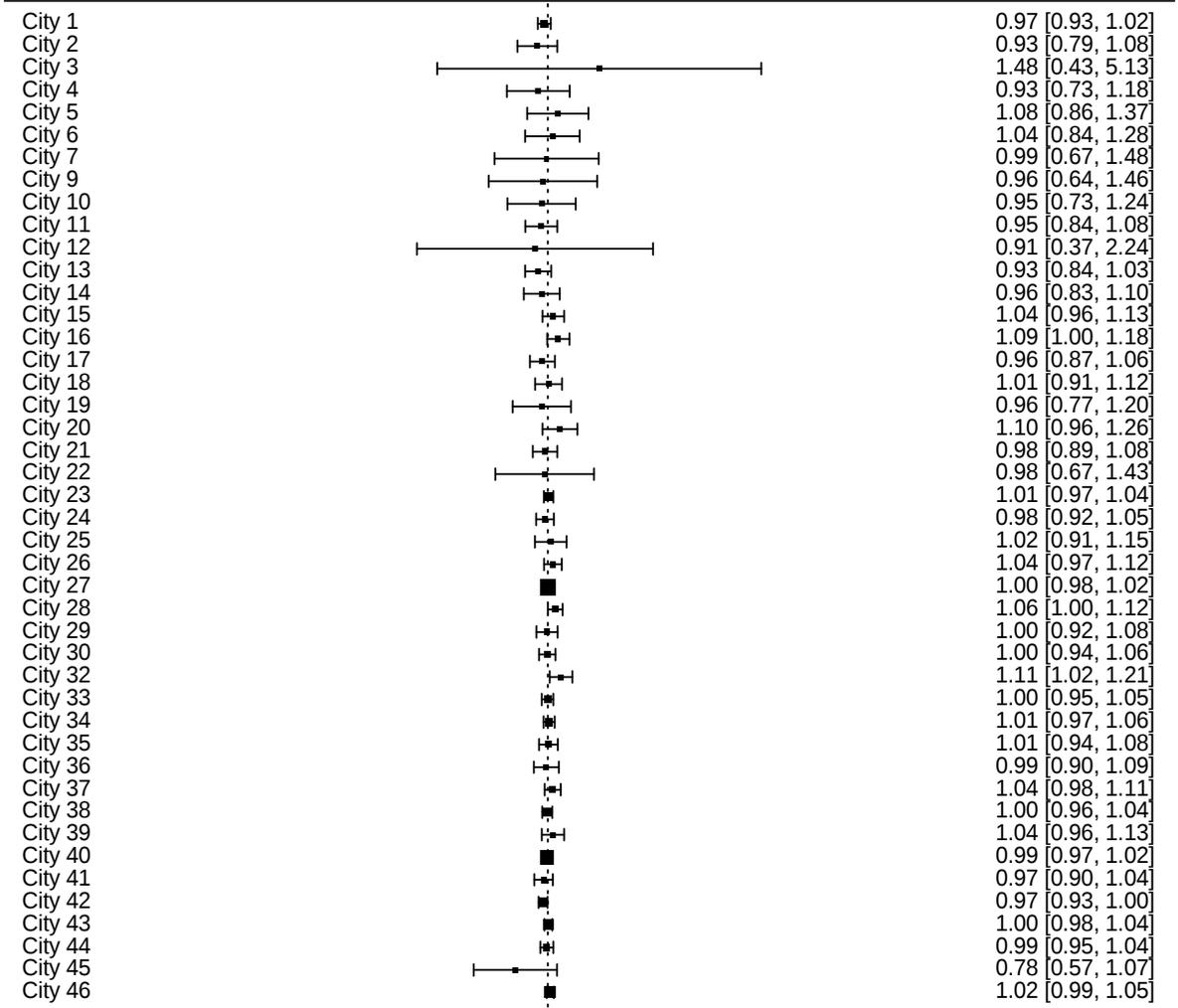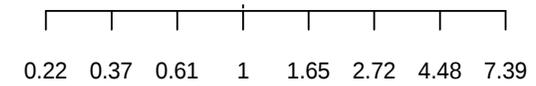
Discussions

- No health effects observed (but this is a quick analysis)
  - Previous 5 cities study (South Korea [Seoul] and Japan [Nagasaki, Matsue, Osaka and Tokyo] using LIDAR continuous measurements reported adverse health effect *(Kashima et al. 2016 Atmospheric Environ)*

- Visibility-based dust indicator might be limited?

- Other type of dust measurements?
  - 40th percentile moving average of rural stations to estimate dust-related SPM/PM2.5? Region applicable? Interference of sea salt?
  - LIDAR information, possible to use?
  - Calibrate reanalysis data for in-model decomposition?
  - Other data?
  - PM2.5 available but shorter time period
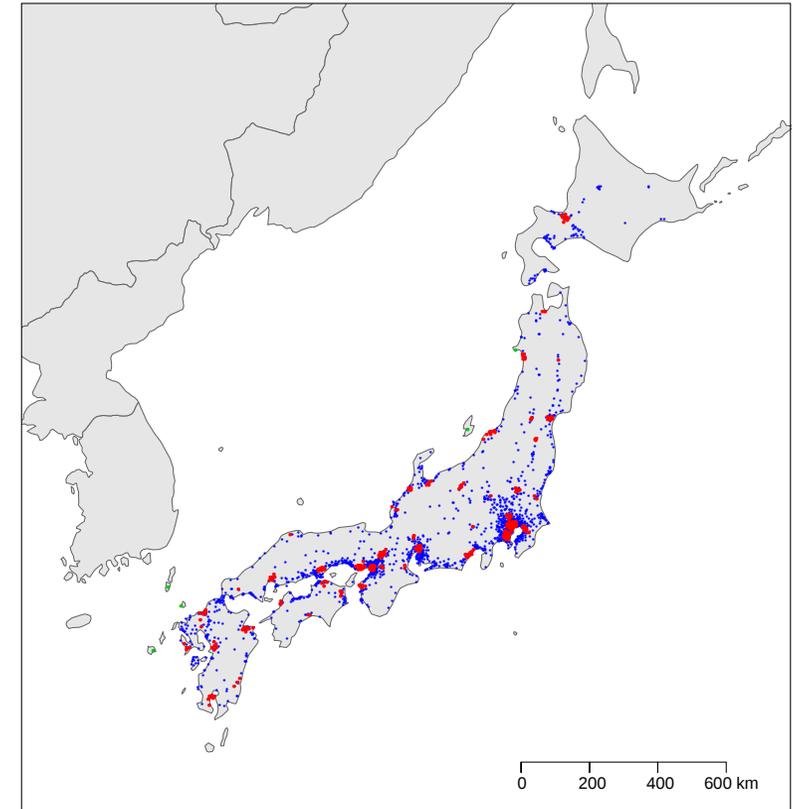
Potentially Useful Data

- Rural air quality monitors (west Japan, green dots on previous map)

- LIDAR data (light detection and ranging)
  - From the Asian dust and aerosol lidar observation network (National Institute for Environmental Studies, Japan)
  - Extinction coefficients for mineral dust

- JRAero reanalysis data
  - assimilation of AOD from MODIS into MASINGAR mk-2, a global aerosol model by Meteorological Research Institute, Japan *(Yumimoto et al. 2017 Geosci Model Dev)*
  - Reconstructed measures of $PM_{2.5}$, PM_{10}, dust, black carbon (BC), organic carbon (OC), and sulfate
  - No emission information from industrial and urban areas ⬚ might represent spatio-temporal distribution of transboundary pollution in the selected region

JRAero Reanalysis Data

Daily Averaged PM2.5 [ug/m3]: 23Feb2015

The Japanese Reanalysis for Aerosol (JRAero) v1.0 MRI/KU_RIAM
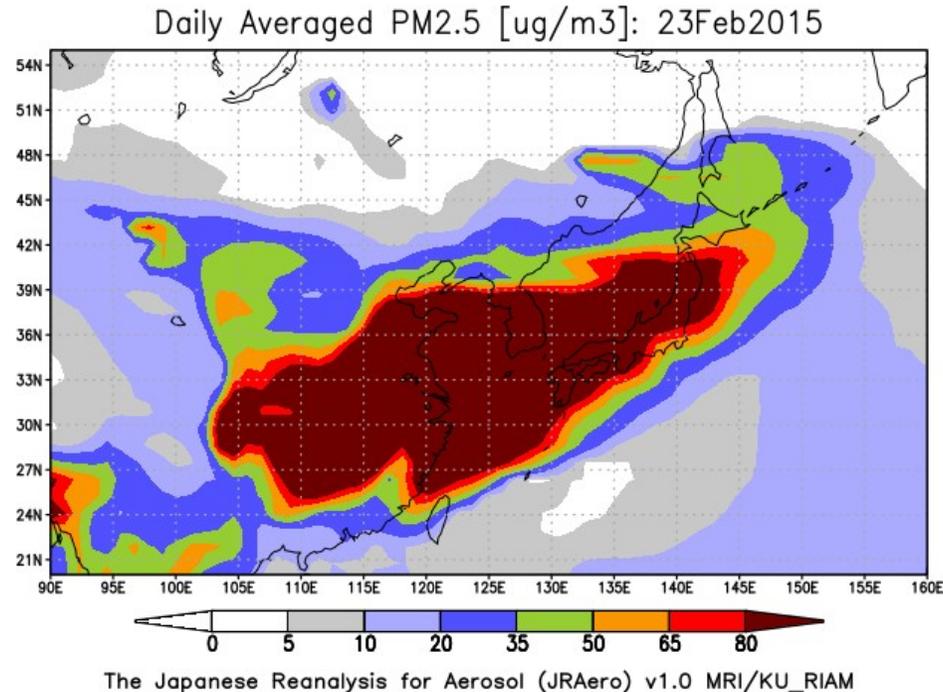
Figure 2. PM$_{2.5}$ by JRAero in the East Asian region on 23 February 2015, during a major Asian dust event shown in the picture on the right.

Source:
JRAero PM$_{2.5}$ data: https://www.riam.kyushu-u.ac.jp/taikai/JRAero/index.html
Asian Dust in South Korea: https://edition.cnn.com/videos/world/2015/02/23/lok-hancocks-south-korea-yellow-dust.cnn

Reanalysis and Observed PM$_{2.5}$

Reanalysis

Observed PM$_{2.5}$
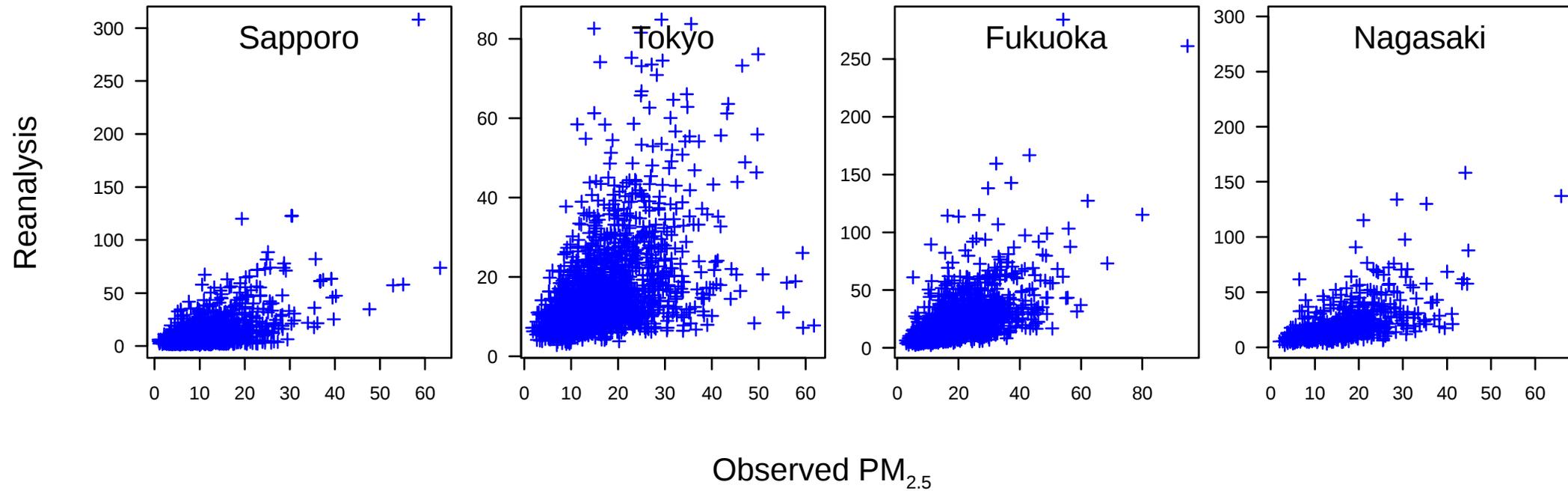
Thank You

Chris Fook Sheng Ng

chrisng@nagasaki-u.ac.jp