A Data Visualisation Tool for Radionuclide Detection Events

Daniel Chester, Matthew Goodwin
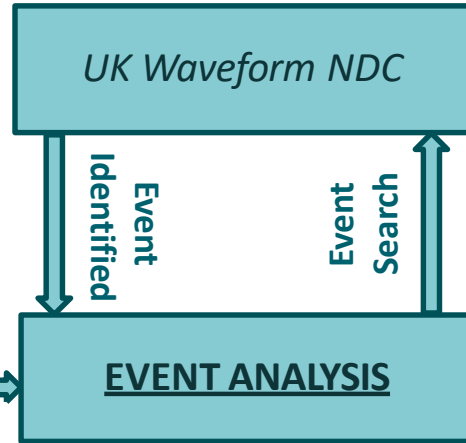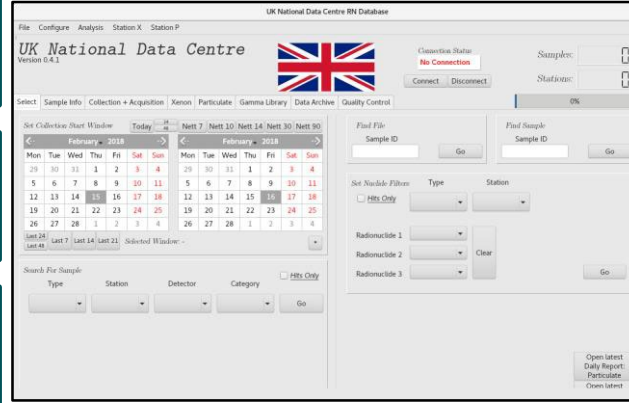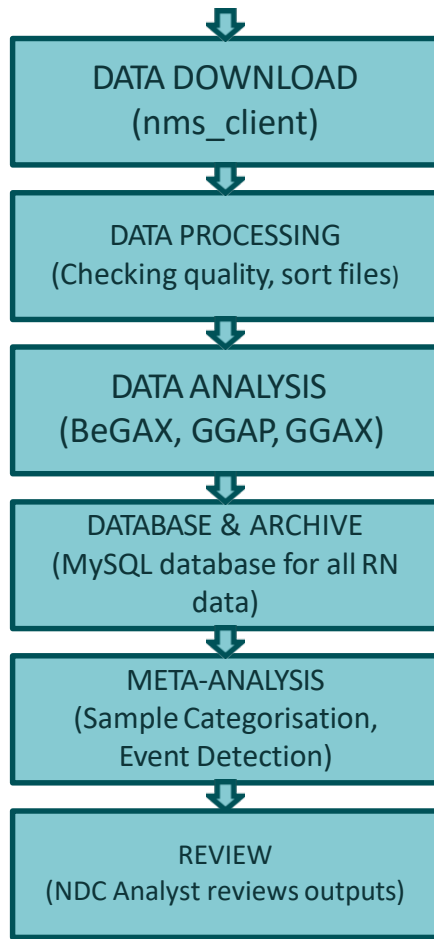
UK NDC, AWE Aldermaston, UK, RG7 4PR
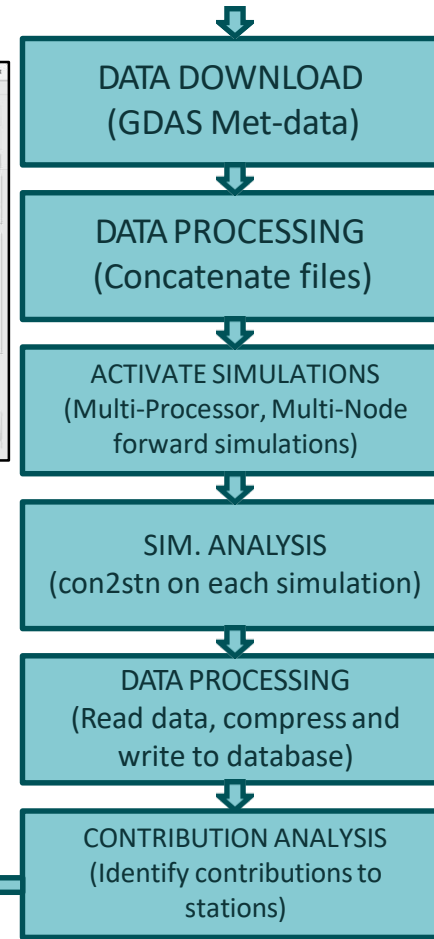
WOSMIP Remote 2, 27th May 2021

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RN PIPELINE

DATA DOWNLOAD
(nms_client)

DATA PROCESSING
(Checking quality, sort files)

DATA ANALYSIS
(BeGAX, GGAP, GGAX)

DATABASE & ARCHIVE
(MySQL database for all RN data)

META-ANALYSIS
(Sample Categorisation, Event Detection)

REVIEW
(NDC Analyst reviews outputs)

ATM PIPELINE

DATA DOWNLOAD
(GDAS Met-data)

DATA PROCESSING
(Concatenate files)

ACTIVATE SIMULATIONS
(Multi-Processor, Multi-Node forward simulations)

SIM. ANALYSIS
(con2stn on each simulation)

DATA PROCESSING
(Read data, compress and write to database)

CONTRIBUTION ANALYSIS
(Identify contributions to stations)

UK Waveform NDC

Event Identified

Event Search

EVENT ANALYSIS

A Consideration of Radioxenon Detections Around the Korean Peninsula, Goodwin et al., Pure and Applied Geophysics, 2020

Fig 1. NDC analysis pipelines

REVIEW
(NDC Analyst reviews outputs)

EVENT ANALYSIS

CONTRIBUTION ANALYSIS
(Identify contributions to stations)

1. Xenon Plume Analysis
2. RN Detection Event Analysis
3. HYSPLIT Trajectory Model Simulations
4. HYSPLIT Backward ATM Simulations
5. SRS Fields
6. Bayesian Source Determination (FREAR)

UK National Data Centre - AWE

File   Edit   View   Help

Ad-Hoc   Events   Plumes

Mapping   Search Results

Directory: /ServerNDC/EVENT_dev/Adhoc_Archive   Browse

Station:

Date/Time: 2010-01-01 00:00:00   to   2021-01-01 00:00:00

Configure interactive map: Clear Checks

☑ Contributing ATM Sims   ☑ Xenon History
☑ Check Nuclear Tests   ☑ All Stations
☑ Xenon Detections   ☑ All Database Emitters
☑ Xenon Ratios   ☑ Extra Power Plants
☑ Particulate Detections   ☑ Research Reactors
☐ Trajectory Plot   ☐ Backward Simulation

Trajectory Plot File: Traj. Data
Backward Sim File: Sim. Data

Create New

Internet Connection Detected

○ stamenterrain
☑ All Xenon Stations
☑ All Particulate Stations
☑ Non-IMS Stations
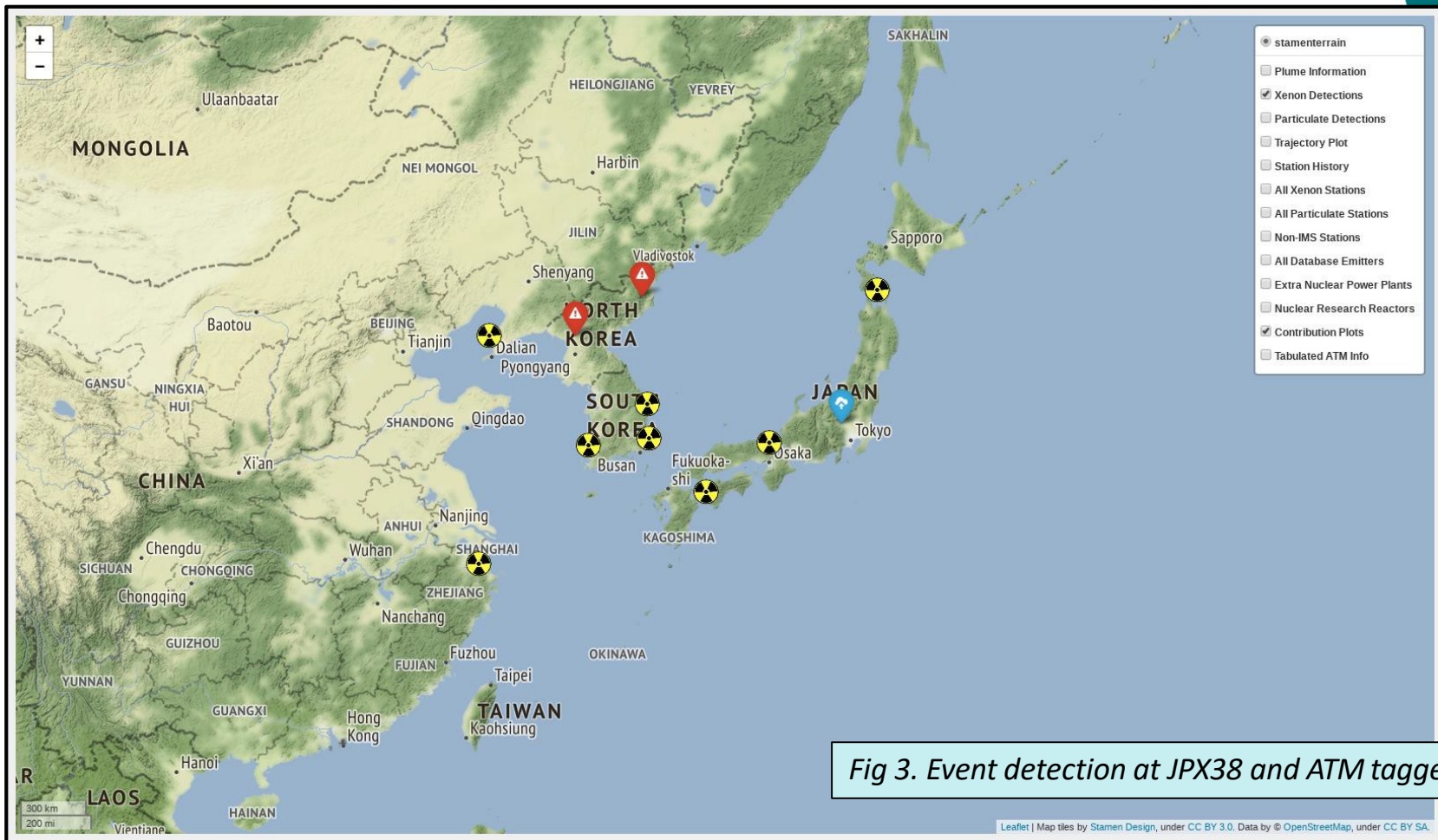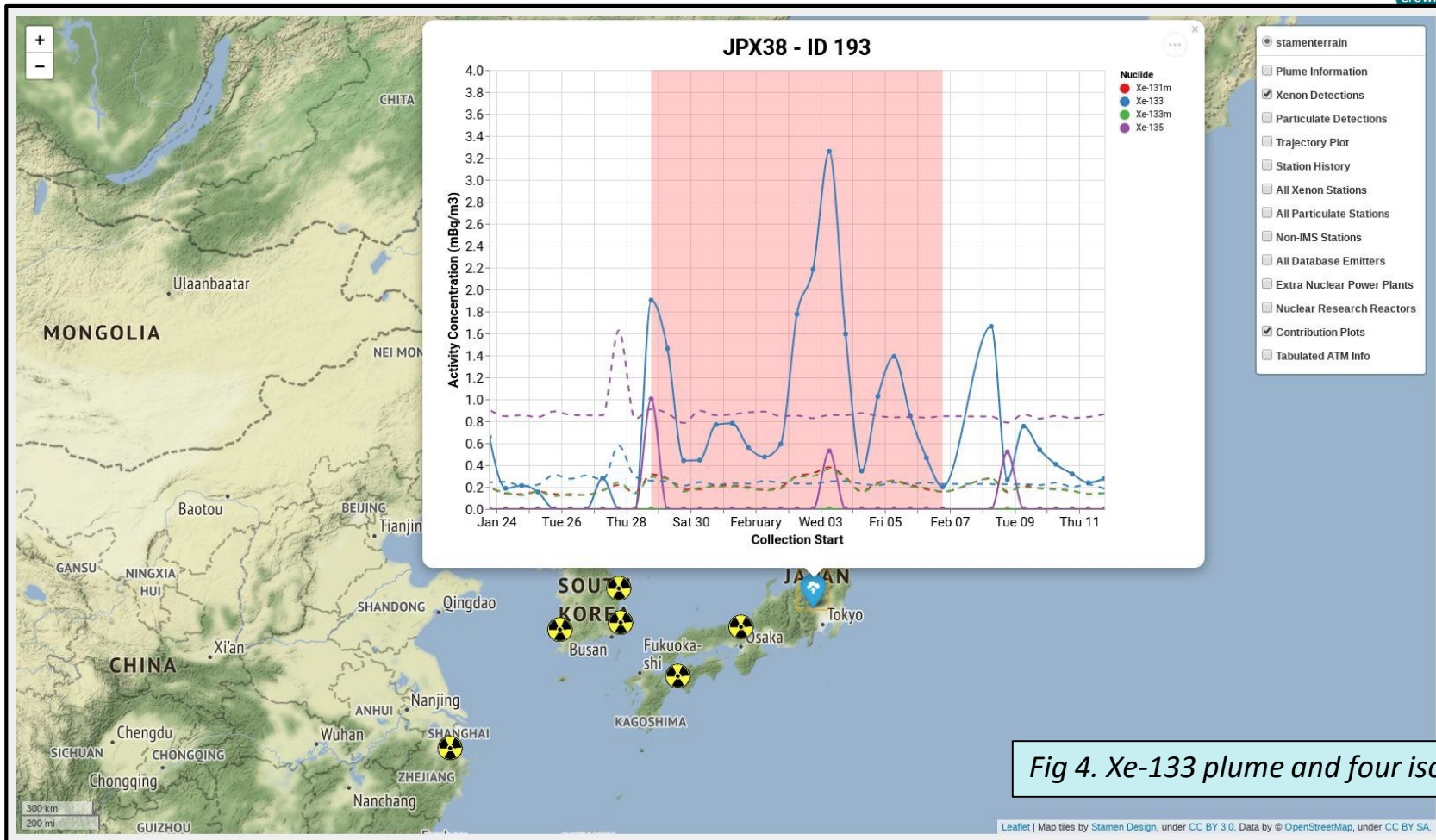☑ All Database Emitters

Fig 2. Event analysis pipelines and CARVE graphical user interface

CARVE – Contributions Analysis of Radionuclides from Virtual Emitters

- Custom software tool produced by UK NDC for the analysis of radionuclide detection events on the International Monitoring System.

- Fuses the outputs of several automated data streams into a single source, allowing for rapid data interrogation by analysts.

- Assigns simulated atmospheric transport modelling contributions from known radionuclide emitters to the collection period of interest to assess station sensitivity.

- Data is visualised on interactive virtual maps. Package is completed with a graphical user interface from which users can customise algorithm parameters and view relevant database fields.

Fig 3. Event detection at JPX38 and ATM tagged emitters

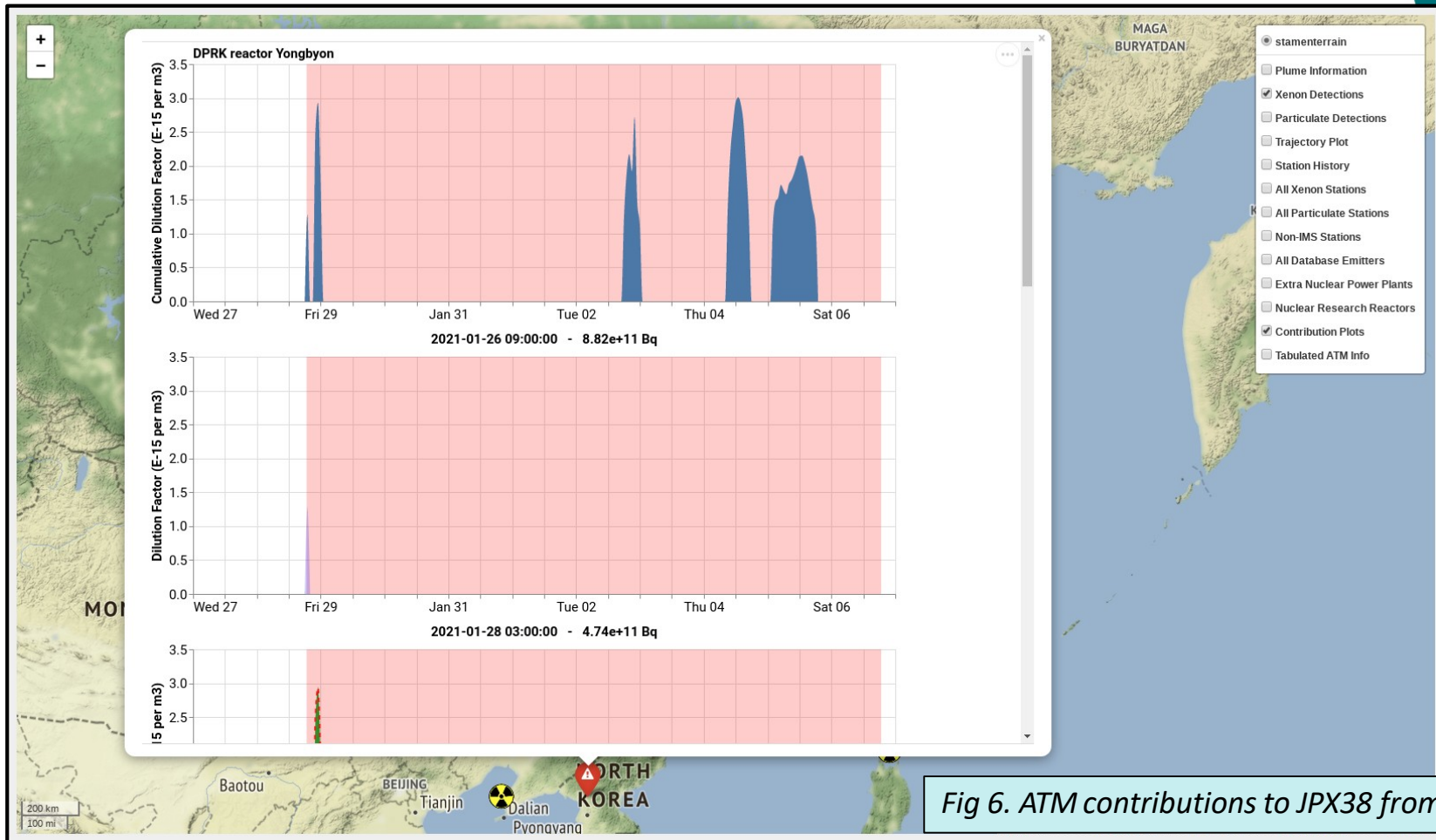*Fig 4. Xe-133 plume and four isotope plot*

Fig 5. Particulate filter measurements

Fig 6. ATM contributions to JPX38 from Yongbyon
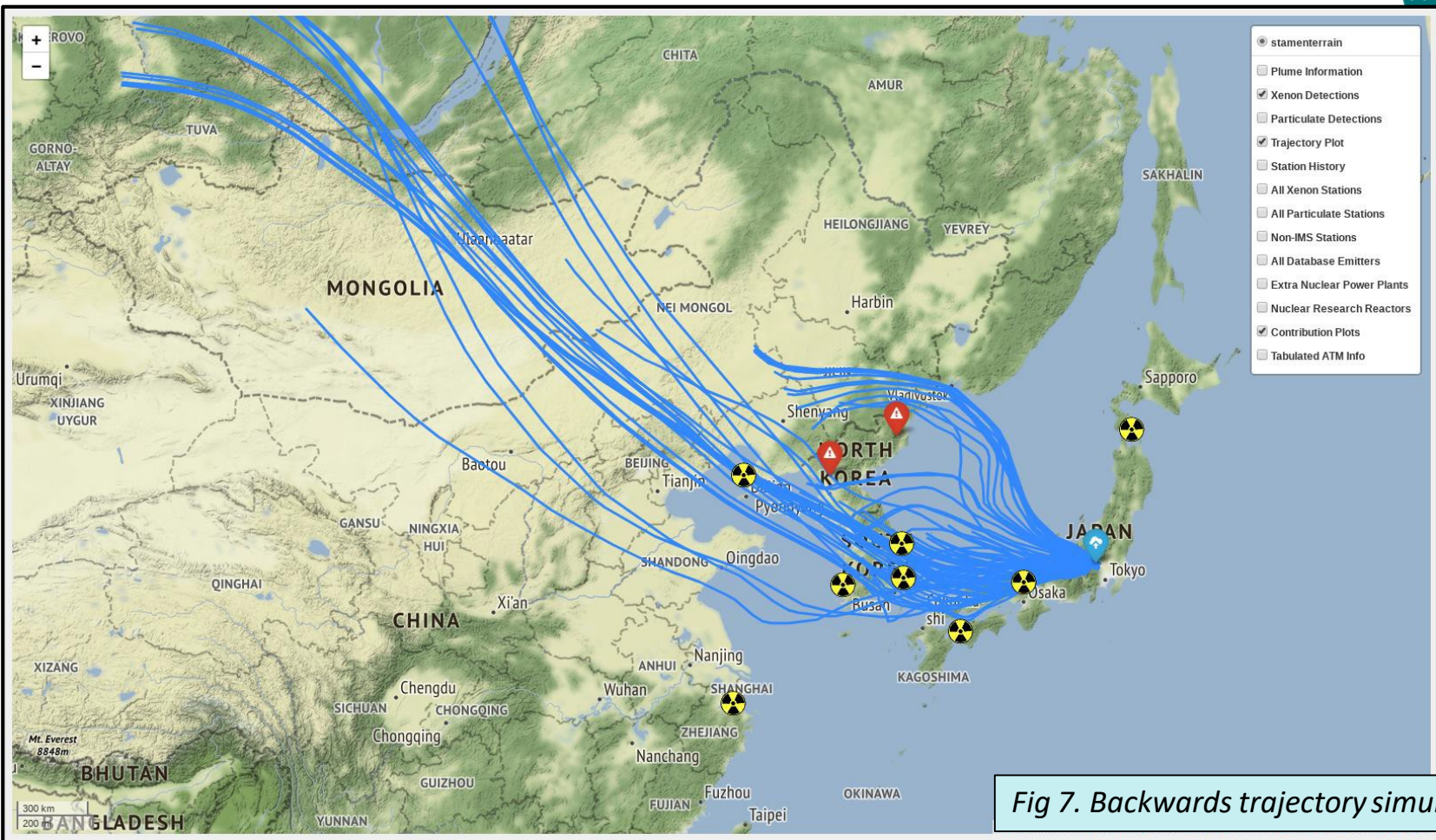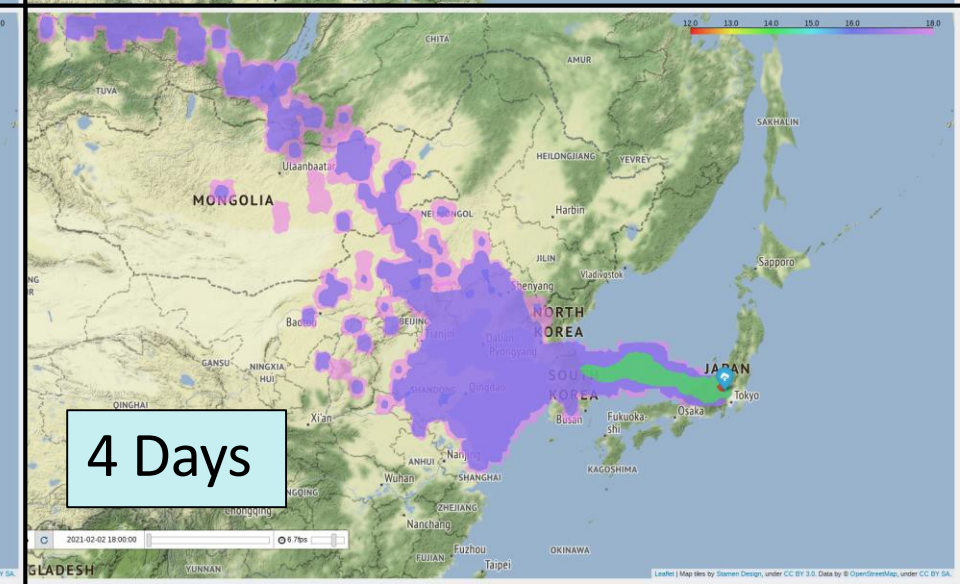
Fig 7. Backwards trajectory simulations

Fig 8. Backwards dispersion simulation

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1 Day

2 Days

3 Days

4 Days
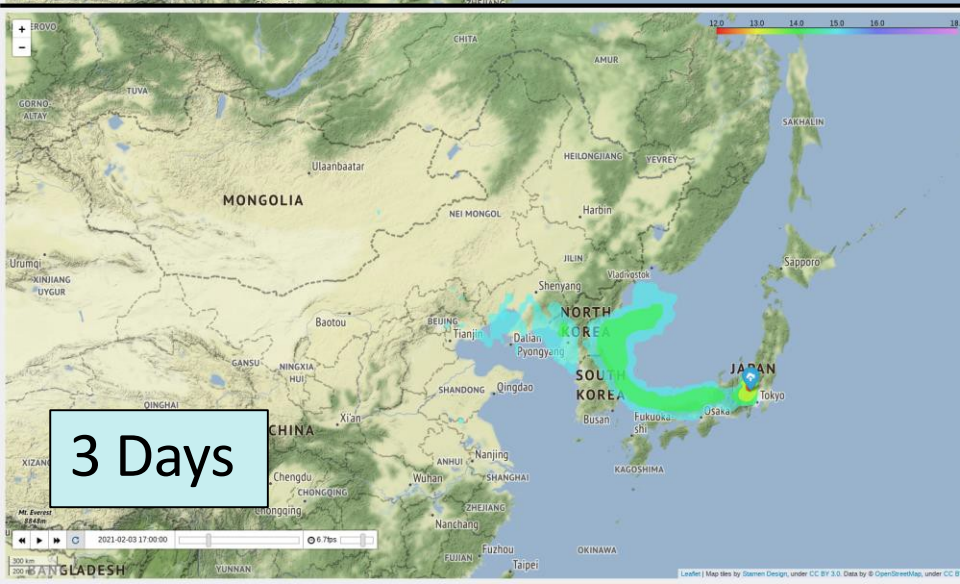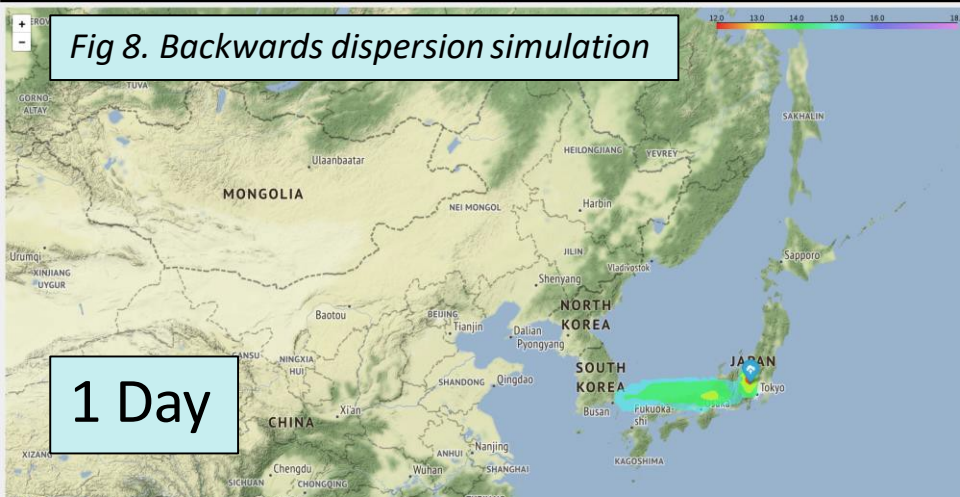
CARVE

- Filters down terabytes of meteorological data, gigabytes of radionuclide data and megabytes of HYSPLIT results for analysts to review.

- All this information is contained within a small, easily manageable .html file, which can be interacted with from within the CARVE graphical user interface or from an internet browser.

- These files are produced automatically upon the identification of new radioxenon plumes or high-category detection events.

- CARVE files for many years of historical IMS data have been produced and archived within the UK NDC, should the need arise to interrogate the data.

Summary

- The UK NDC operates and maintains a series of custom automated pipelines for the analysis of radionuclide data relevant to the verification of the Comprehensive Nuclear-Test Ban Treaty.

- CARVE is a data visualisation tool for the analysis of radionuclide detection events on the International Monitoring System. It presents relevant data in a single place, to allow analysts to make informed decisions.

Thank you.
Any Questions?