
SEVENTH FRAMEWORK PROGRAMME

# Characterisation of Metadata to Enable High-Quality Climate Applications

University of Reading

Science & Technology Facilities Council

Royal Netherlands Meteorological Institute
Ministry of Infrastructure and the Environment

CGI
Logica is now part of CGI.

TERRA SPATIUM SA

ASTRIUM
AN EADS COMPANY

Met Office

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

DWD

ECMWF

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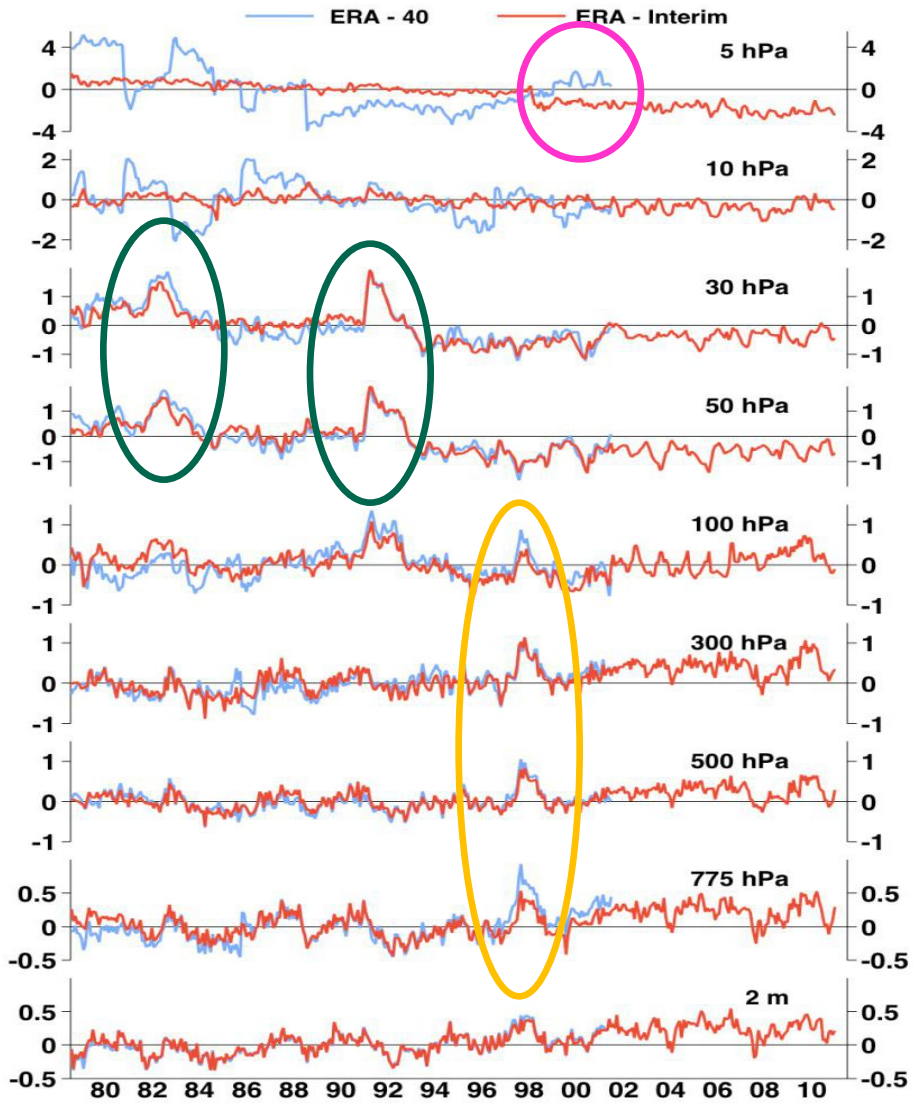
(on behalf of CHARMe consortium)
http://www.charme.org.uk

# Motivation



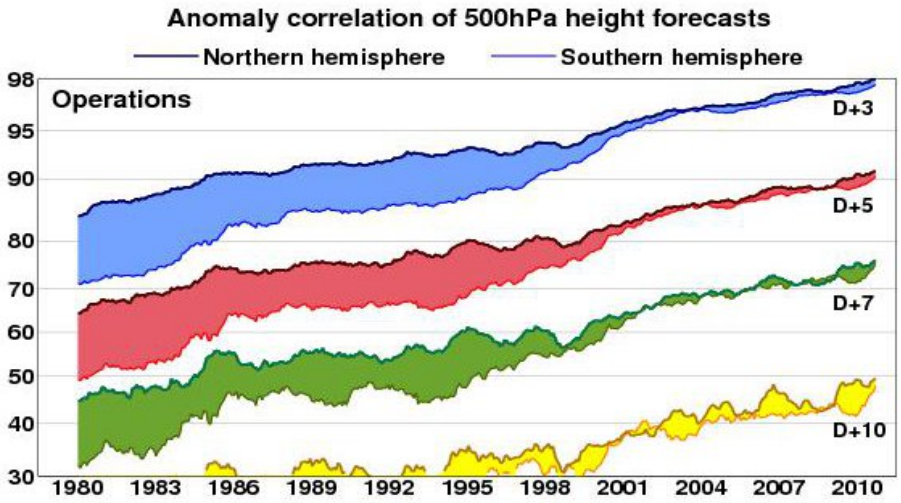

- Global temperature changes at different levels in ERA-Interim
- Are the signals real climate parameter changes or can be attributed to observing system/data/operational changes?
- ERA-40 (blue) shows many additional bumps and changes due to changing satellite instruments - this is one of the improvements was achieved in ERA-Interim

- **1982-03-29 Volcanic eruption El Chichón, southern Mexico**
- **1991-06-15 Volcanic eruption Pinatubo, Philippines**
- **1998 El Nino**
- **Changes in satellite instruments**

# Motivation

Atmospheric model id

| Date | ECMWF model Cycle | GRIB Generating process identification number |
|---|---|---|
| 25-Jun-13 | IFS Cycle 38r2 | 143 |
| 19-Jun-12 | IFS Cycle 38r1 | 142 |
| 15-Nov-11 | IFS Cycle 37r3 | 141 |
| 18-May-11 | IFS Cycle 37r2 | 140 |
| 09-Nov-10 | IFS Cycle 36r4 | 139 |
| 22-Jun-10 | IFS Cycle 36r2 | 137 |
| 26-Jan-10 | IFS Cycle 36r1 | 136 |
| 13-Oct-09 | IFS Cycle 35r3 | 135 |
| 08-Sep-09 | IFS Cycle 35r3 | 135 |
| 10-Mar-09 | IFS Cycle 35r2 | 134 |
| 30-Sep-08 | IFS Cycle 35r1/33r2 | 133 |
| 03-Jun-08 | IFS Cycle 33r1 | 132 |
| 11-Mar-08 | IFS Cycle 32r3 | 131 |
| 06-Nov-07 | IFS Cycle 32r3 | 130 |
| 05-Jun-07 | IFS Cycle 32r2 | 129 |
| 12-Sep-06 | IFS Cycle 31r1 | 128 |
| 01-Feb-06 | IFS Cycle 30r1 | 127 |
| 28-Jun-05 | IFS Cycle 29r2 | 126 |
| 05-Apr-05 | IFS Cycle 29r1 | 125 |
| 28-Sep-04 | IFS Cycle 28r3 | 124 |
| 29-Jun-04 | IFS Cycle 28r2 | 123 |
| 09-Mar-04 | IFS Cycle 28r1 | 122 |
| 07-Oct-03 | IFS Cycle 26r3 | 121* |
| 29-Apr-03 | IFS Cycle 26r1 | 203 |
| 04-Mar-03 | IFS Cycle 25r5 | 202 |




- Plot shows how the ECMWF forecast prediction system improved over the years
- Many of the changes can be attributed to IFS upgrades

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# CHARMe

- "CHARacterization of Metadata to enable high quality climate applications and services"
- EU FP7, Jan 2013 – Dec 2014
- Aims to answer a question:

How can climate data users decide if a dataset is "fit for purpose"?

The CHARMe project will provide additional information about climate data to help the user to decide on the quality and suitability of a climate dataset.

Significant Event Viewer tool will help a user to study possible causes of variability, shifts and drifts apparent in the climate product.

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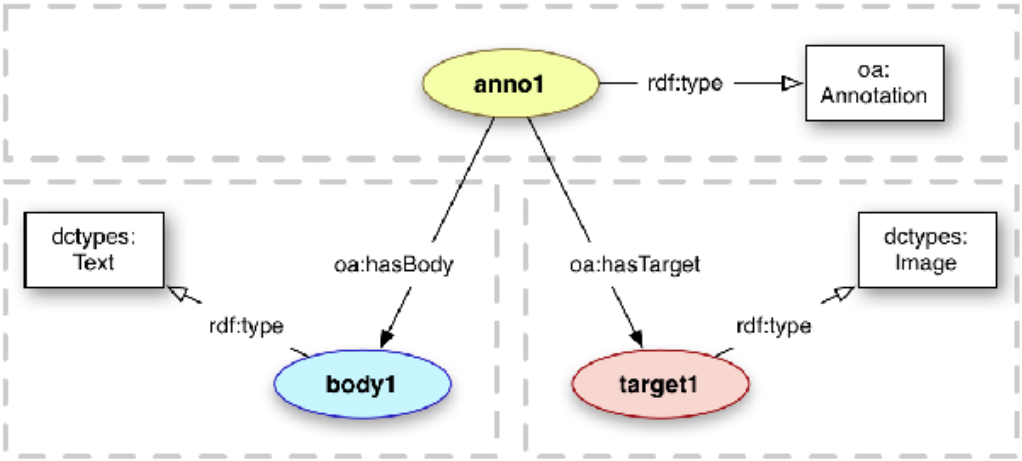
# Commentary Metadata

- Post fact annotations: citations, ad-hoc and peer review comments and notes, 'grey' literature references
- Results of assessments: validation campaigns, comparisons with models or other observations, reanalysis, quantitative error assessments
- Significant events: volcanic eruptions, El-Niño index, satellite or instrument failure, operational changes to satellite orbit calculations
- Properties of data distribution: data policy and licensing, timeliness (is the data delivered in real time?), reliability
- Supplementary dataset quality information: validity period, updates, quality flags
- Any other post-fact information or information defined by sources other than the Data Provider.

# Data Model

## Open Annotation data model




- An *annotation* links a target (the subject of the annotation) with a body (any resource which is associated with the target).
- *Target* – typically refers to a dataset that we wish to say something about or link to some other document via a *Body.*
- *Target* and *Body* have no defined type → the body of one annotation can be the target of another → enables to build a chain of linked annotations.
- CHARMe C-metadata is predominantly associated with the OA concept of a Body.

# Significant Events

- SE – are external events that can affect the dataset
- SE are not annotations
- Can be either a body (with the dataset being a target) or a target (with the description of SE as a body and a user comment about SE as annotation)
- SE are linked to datasets only by times when they happen

Current categories

- Climate events: hurricanes, volcanic eruptions, El-Niño index
- Software events: software cycle updates
- Operational events: satellite or instrument failure, operational changes to satellite orbit calculations
- Data/Observing system events: how the data was obtained

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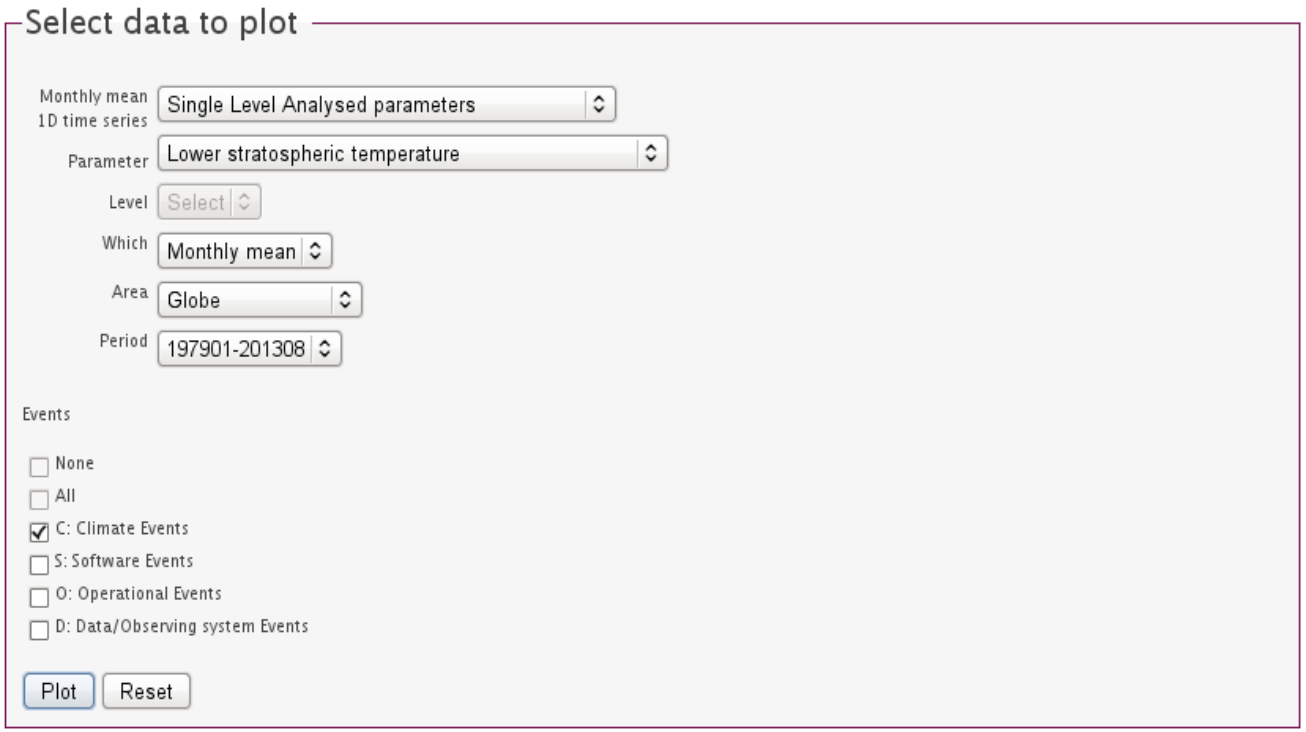
# Significant Events Viewer Tool

- Developed at ECMWF
- Will help to assess uncertainties in climate products to determine whether the climate signals represented by the product are real.
- Will allow the user to visualise relevant information about the data product (source, limitations, error estimates, etc.), search for alternative climate products, and study possible causes of variability, shifts and drifts apparent in the climate product.
- Technologies: database of significant events, Django, jquery, python (in the future will look into using Magics+ for plotting)

# Significant Events Viewer Tool

- Interactive
- Plots ERA-CLIM data
- Pre-generated plots are used in the early development stages
- Will be replaced by  real data plots generated at run time



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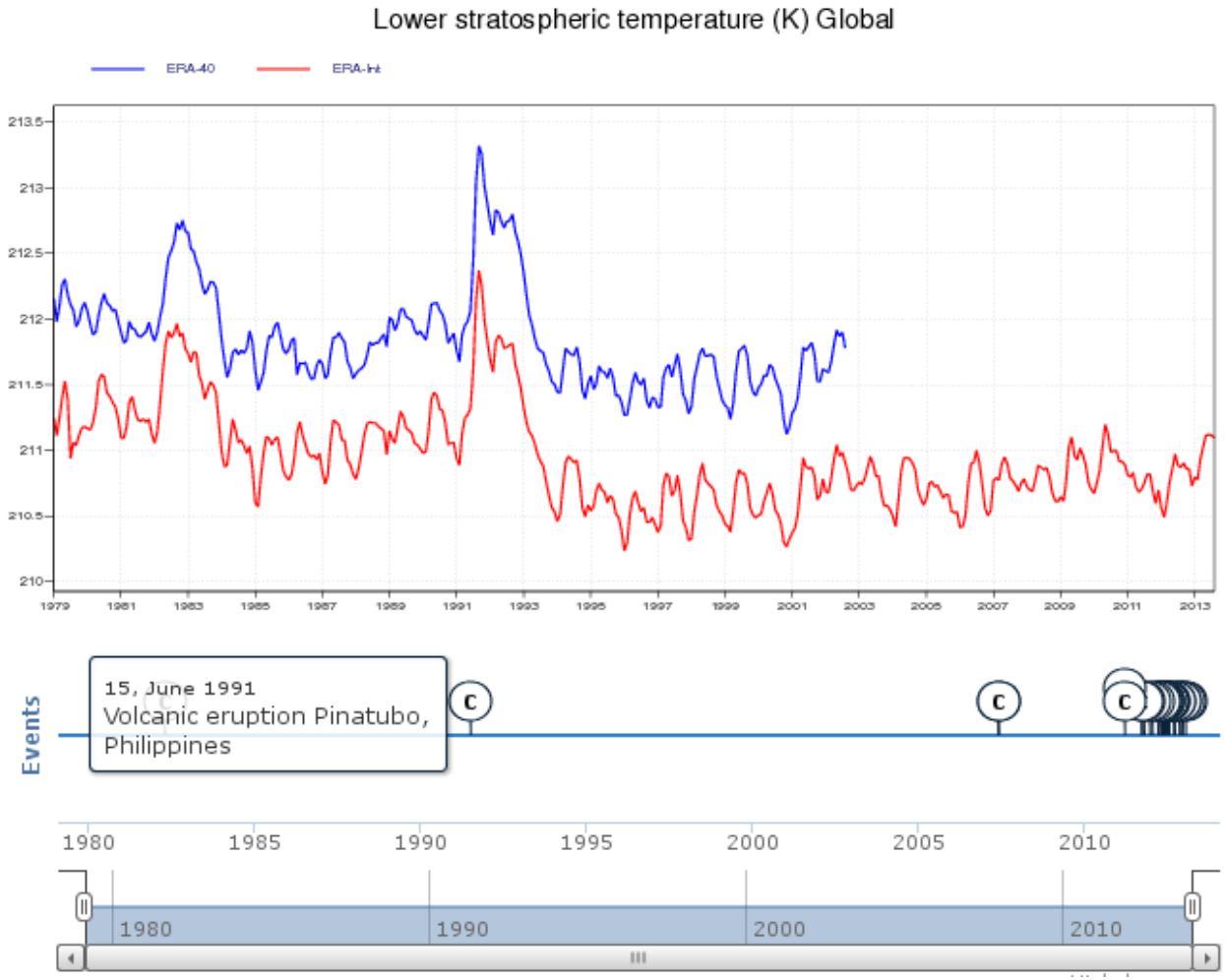
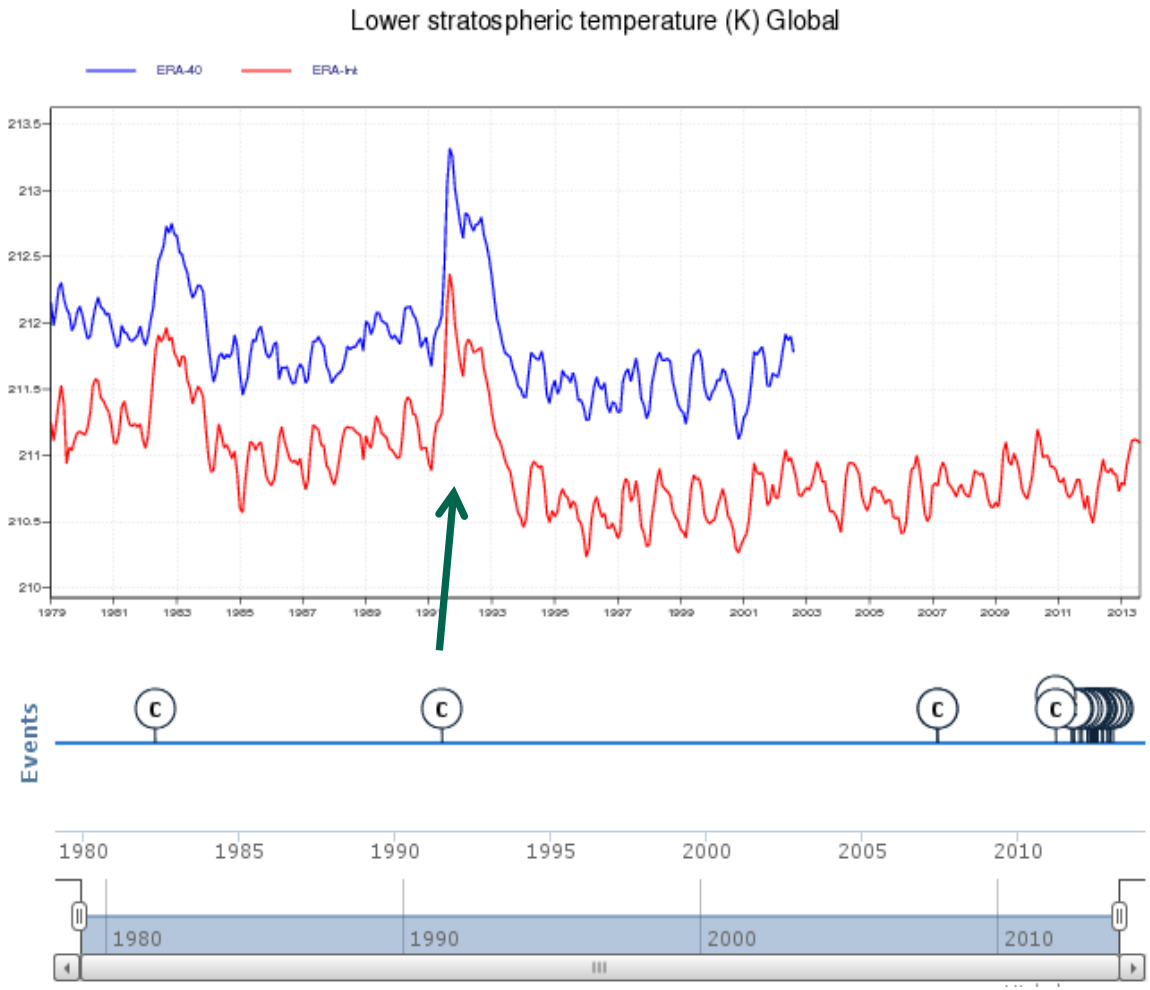


# Significant Events Viewer Tool




**Event information:**

1991-06-15
Volcanic eruption Pinatubo, Philippines

Is an active stratovolcano. The 1991 eruption was the second largest terrestrial eruption of the 20th century. It ejected 10,000,000,000 tonnes of magma and 20,000,000 tonnes of SO2 to the surface environment. It injected large amounts of particulate into the stratosphere. Over the following months, the aerosols formed a global layer of sulfuric acid haze. Global temperatures dropped by about 0.5 °C (0.9 °F), and ozone depletion temporarily increased substantially.
More information

# Significant Event Viewer Tool: Next Steps

- The timeline plot can cope only with ~ 1’000 events
- Need to introduce thinning or filtering
    1. Show events according to their priority value: zoom out – events with higher priority, zoom in – include events with lower priority to show more details.
    2. Averages: display weekly, monthly, yearly averages depending on a zoom level.

- Introduce plotting real data at run-time
- Populate a significant event database with data

# Summary

- CHARMe will provide a framework for the users to discover, understand and exploit climate data they need through commentary metadata and tools.
- The user will be able to add commentary metadata to the CHARMe repositories.
- Commentary metadata is modelled on the Open Annotation data model.
- Significant Event Viewer tool will help users to understand if the climate signals represented by the product are real.
- In development - there is still significant work needs to be done.

Thank you