Metview 5.0 and Beyond, to its Pythonic Future

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What is Metview?

• Workstation software for researchers and operational analysts
  – Runs on UNIX, from laptops to supercomputers (now includes Mac OS X)
• Retrieve/manipulate/visualise/examine meteorological data
• Drag & drop user interface / powerful scripting language

Built on core ECMWF technologies: MARS, ecCodes, Magics, ODB, Emoslib
(future: MIR)

• Handles GRIB, BUFR, NetCDF, ODB, Geopoints, CSV, ASCII
• Can access MARS, either locally or through the Web API
• Open Source under Apache Licence 2.0
• Metview is a co-operation project with INPE (Brazil)
Using Metview

- Icon-based user interface
  - interactive investigation of data
  - icons represent data, settings and processes
  - icons can be chained together – output from one is input to another

- Powerful Macro scripting language
  - more serious computations
  - batch or interactive usage
Visualisation
Visualisation - Overlay
Interactive Data Inspection
Metview and ensemble data

- Many ways to process and visualise ENS data

Stamp, RMSE plumes, CDF and spaghetti plots
Metview and ensemble data

• Ensemble mean:

\[
data = \text{retrieve} (...) \\
en_{-}\text{mean} = \text{mean}(\text{data})
\]
Metview and ensemble data

- Ensemble spread:

\[
data = \text{retrieve} (...) \\
\text{ens\_spread} = \text{stdev}(data)
\]
Metview and ensemble data

- Ensemble probability:

```python
data = retrieve (...) 
ens_prob = mean(data>22) * 100
```
Metview 5

- Expected in the coming months
- First major version number update since 2010
- We plan to update the major version number more often
  - Users should not be worried by it!
- Metview 4 to 5 transition should involve no work for the majority of users
Metview 5 – new features

• Layer Management
  – Possible to make changes to the plot “inline” in the plot window
  – Can drop visual definition icons onto a particular data layer
  – Can drop icons at different ‘levels’ of the plot hierarchy, e.g. to apply contouring to all maps in a stamp plot
Metview 5 – new features

• Colour gradients
  – More sophisticated colour gradient definition
  – Can use a single Contouring icon where multiple icons were needed in the past
  – Takes advantage of new developments in Magics
Metview 5 – new features

• Improved support for transparency
  – Can now have transparent colours and gradients in the interactive plot window

Simulated satellite (b&w) plus probability of total precipitation > 5mm (semi-transparent colours)
Metview 5 – new features

• FLEXPART
  – particle dispersion model

• Metview can
  – prepare input data
  – run FLEXPART
  – process and visualise the output
Metview 5 – Changes and Removals

• Remove all Motif code (pre-2015 user interface gone)

• Change (improve) netCDF handling in Macro
  – E.g. handle time variables properly, automatically apply scaling factors, understand missing values, etc.

• Harmonise the output drivers (e.g. font sizes and line widths in PDF, PNG, SVG, PostScript and on-screen)
  – Actually coming with Magics 3.0
25 years of Metview so far

- Serving users of ECMWF data since...
  - 1990  Announced at EGOWS (Oslo)
  - 1991  First prototype (INPE)
  - 1993  Metview 1.0
  - 1998  Metview 2.0
  - 2000  Metview 3.0
  - 2010  Metview 4.0
  - 2017  Metview 5.0

- Used daily by many analysts and researchers
  - also by commercial users of our data

- Some large developments, e.g. the Diagnostics Toolbox, OpenIFS workshops, are based on top of Metview

- ecCharts is based on Metview’s architecture and takes it onto the web
Metview’s Trajectory (Beyond Metview 5)

• Continue to develop Metview, providing a high-level interface to ECMWF packages
  – In-house software gives us full control for scalability and research

• Bring Metview forward and allow more interoperability with other packages

• Therefore…
Metview + Python (1)

- Project to design and prototype a Python interface to Metview
- Should provide an environment where ECMWF libraries can work seamlessly together, and with the Python eco-system in general
- Better unify the Python-based interfaces at ECMWF where we currently have different solutions (e.g. verification)
- Bring in the expertise of an external company to help with this design phase
  - Greater knowledge of the wider Python community
  - Helps us during another very busy year

```python
import metview
```
Metview + Python (2)

• Requirements to be based on existing Metview functionality, plus input from users (and non-users)

• Should be able to interact with the Copernicus Climate Data Store Toolbox (in development)

• Use existing solutions where possible (e.g. for multi-dimensional data arrays, data models)

• Ensure the new framework can smoothly interact with existing high-level packages
Metview Availability

• The Metview Virtual Machine
  – Comes with Metview and other ECMWF software pre-installed
  – Contains the latest Metview training course material

• Available on ecgate (just type ‘metview’)

• Alternatively:
  – Install from binaries
  – Build from source
  – Build from bundle

• Thanks to the Ubuntu community for incorporating Metview into its default distribution
For more information…

• Email us:
  – metview@ecmwf.int

• Visit our web pages:
  – http://software.ecmwf.int/metview

• Download (Metview source, binaries, virtual machine)

• Documentation and tutorials available

• Metview articles in ECMWF newsletters

• Coming soon – e-Learning material

• See us at the exhibition this afternoon!

Questions?