Convective- and turbulent **S**cale **E**valuation **T**oolkit, **CSET**

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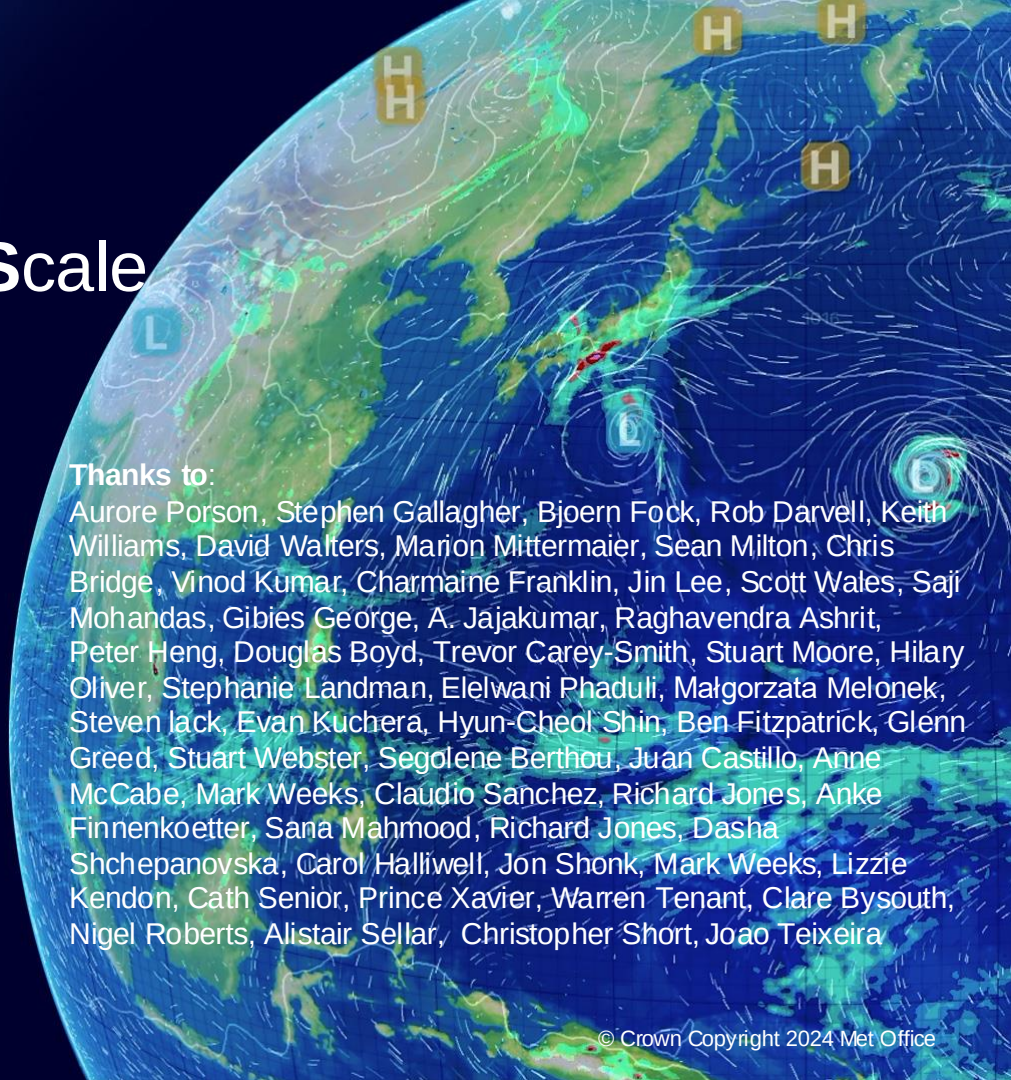
Huw Lewis & Mike Bush

Rachel North, Stephen Gallagher, Phil Gill, Zubair

Maalick + wider CSET team



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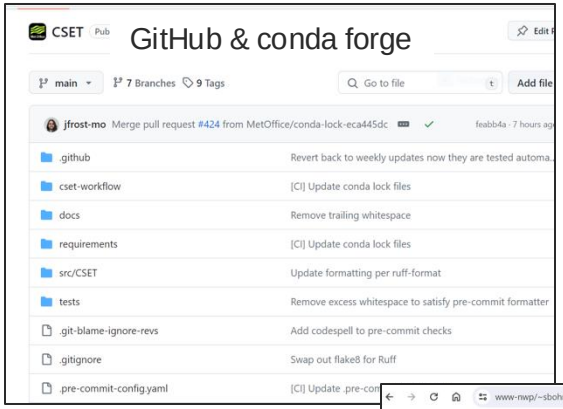
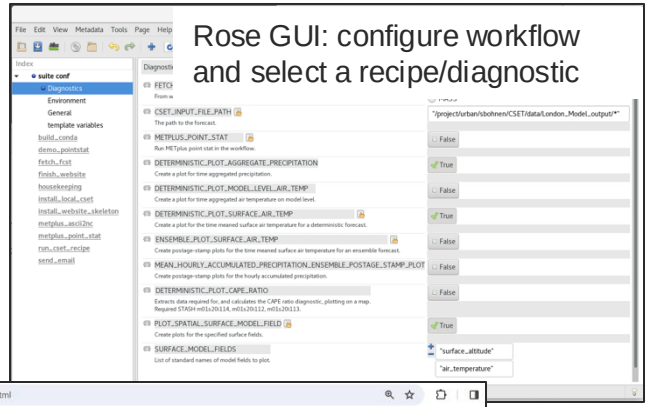
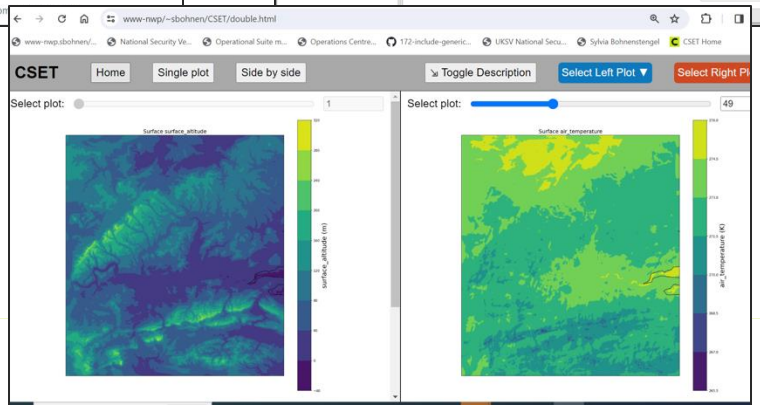
What is CSET?

Community tool for process-oriented evaluation supporting RAL development



GitHub & conda forge


Rose GUI: configure workflow and select a recipe/diagnostic



Website with

- Diagnostics visualisation
- Ensembles
- download data
- information about diagnostic

Library

- Operators
- Recipes
- METplus wrappers (linking to operational verification tools)
- metadata

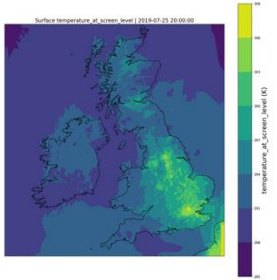
to (pre-)process analysis of data and generate diagnostics and plots

Workflow (flow.cylc cylc8) orchestrates

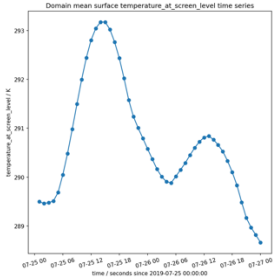
- build conda environment
- install CSET
- fetch data
- run and link of multiple recipes
- run METplus wrappers
- webpage
- cleans
- housekeeping

Current diagnostics (UM & LFRic)

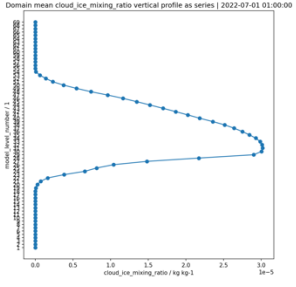
Spatial plots



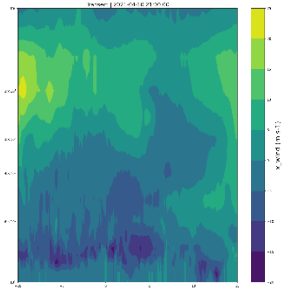
Timeseries domain mean



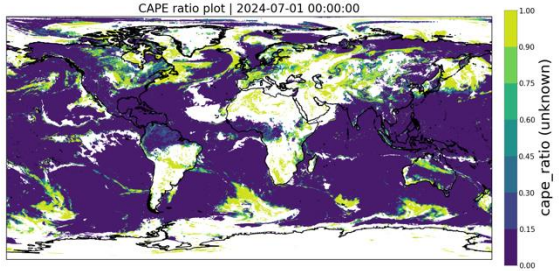
Profiles: mean or at selected points



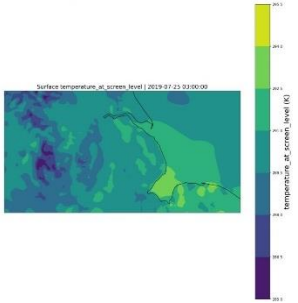
Transects



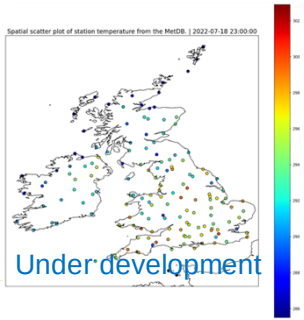
Elevated convection



Subset area

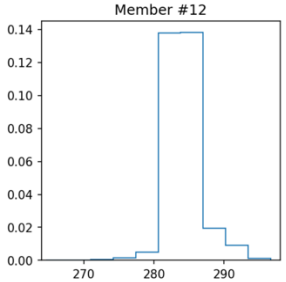


Observations overlay

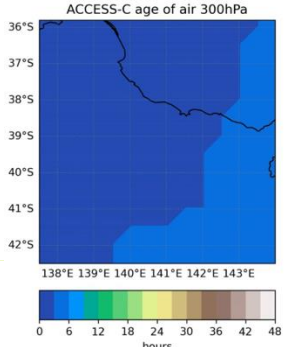


Under development

PDF



Age of air



Focus so far workflow infrastructure and progressing physical process-based diagnostics

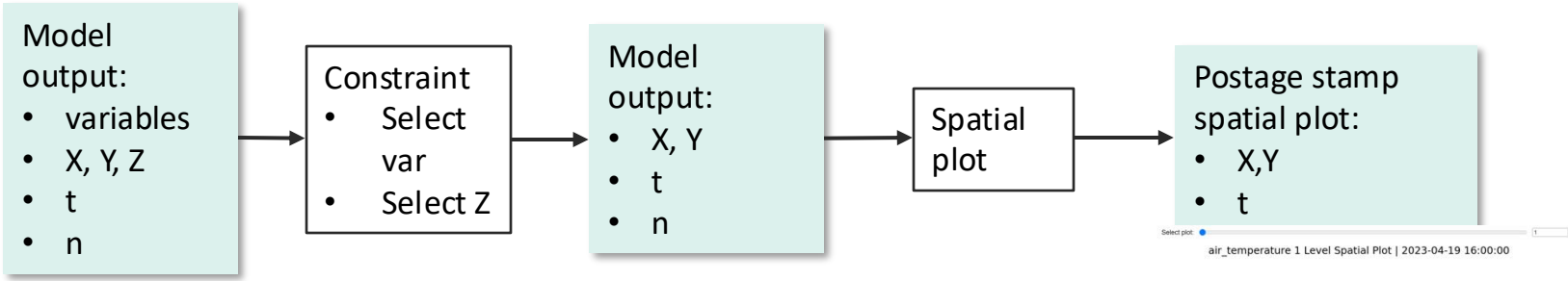
Met Office

CSET concept and definitions

CSET **Operator**	The smallest CSET unit. E.g., read data, write data, filter data, stratify data Act on cubes
CSET **Recipe**	Consists of a combination of CSET Operators that gives i.e. temperature bias. This can be written and plotted or processed further. Defined with YAML. Act on files. Can produce a diagnostic.
METplus **Wrapper**	The smallest METplus unit. Aligned with operational verification. Act on files.
Diagnostic	Stepping through a series of CSET Recipes and/or METplus Wrappers resulting in a data file that is plotted. Each diagnostic is a single final output.

Recipe

flexibly chain operators to plot **spatial postage stamp** diagnostic

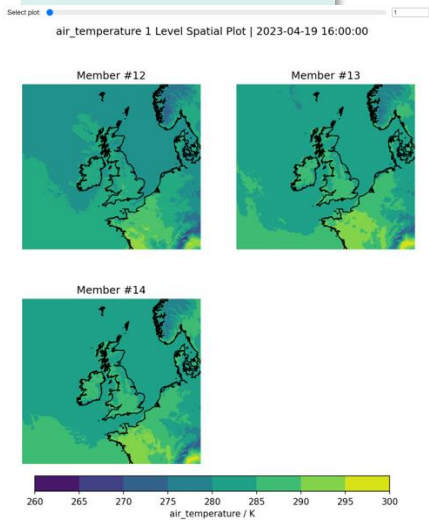


Data

Operator

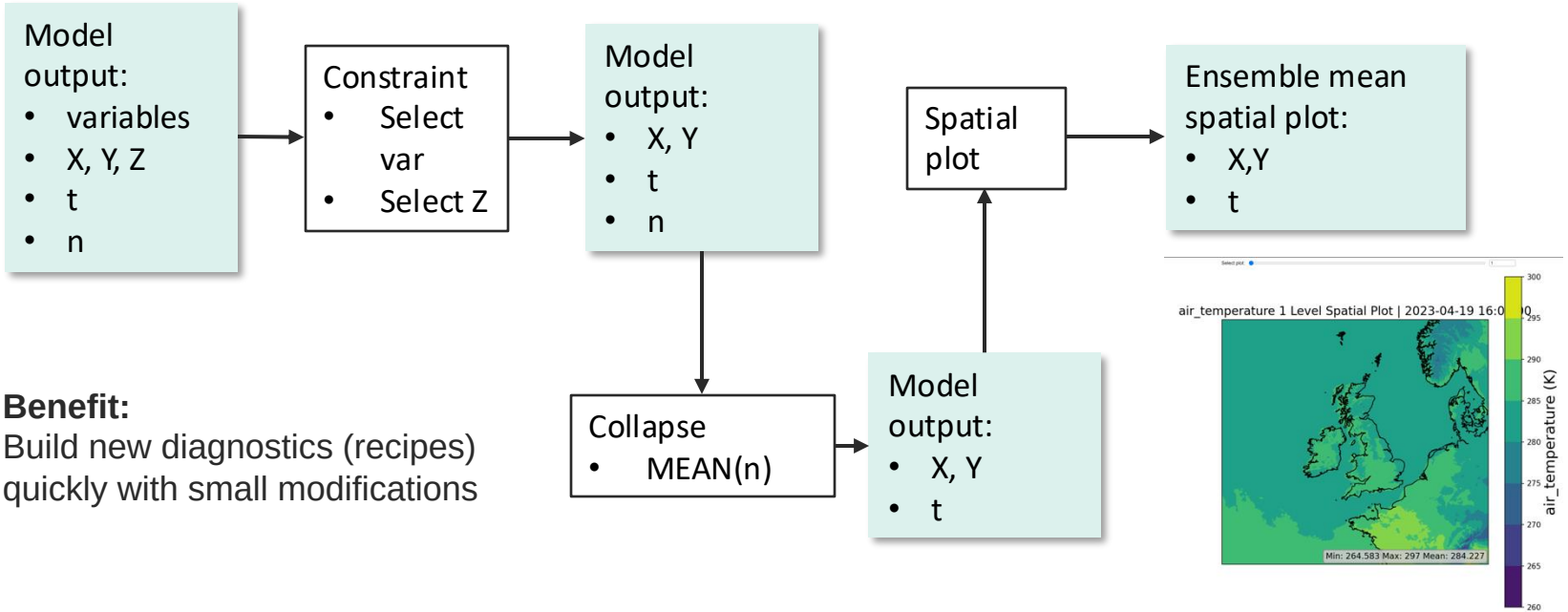
Ensemble case:

- n=3 ensemble member dimension (realisation coordinate)
- t time (sequence coordinate)
- Operators act on cubes



Recipe

Insert additional collapse operator into recipe to plot **ensemble mean** spatial plot



Benefit:
Build new diagnostics (recipes) quickly with small modifications

See James Frost's talk next for the corresponding code change in the recipe

Met Office

What are the benefits of using CSET?

Development is supported by our three pillars

Technical

- Built on modern software
  - Python 3
  - Cylc 8
  - GitHub
  - Builds on Iris and METplus
- Easy to use and contribute
  - Clear documentation incl tutorials
  - Reproduceable
  - Portable
  - Open access
- QA and best practice
  - Automation for testing and docs
  - Scientific peer review

Science

- Align parametrisation, diagnostics development and evaluation research linked to Regional Atmosphere Land (RAL) suites
- Process based understanding, evaluation, and verification
- Flexible evaluation code
- Aligned with operational verification to support PS and RAL3-LFRic testing
- Ensembles and LFRic supported by default

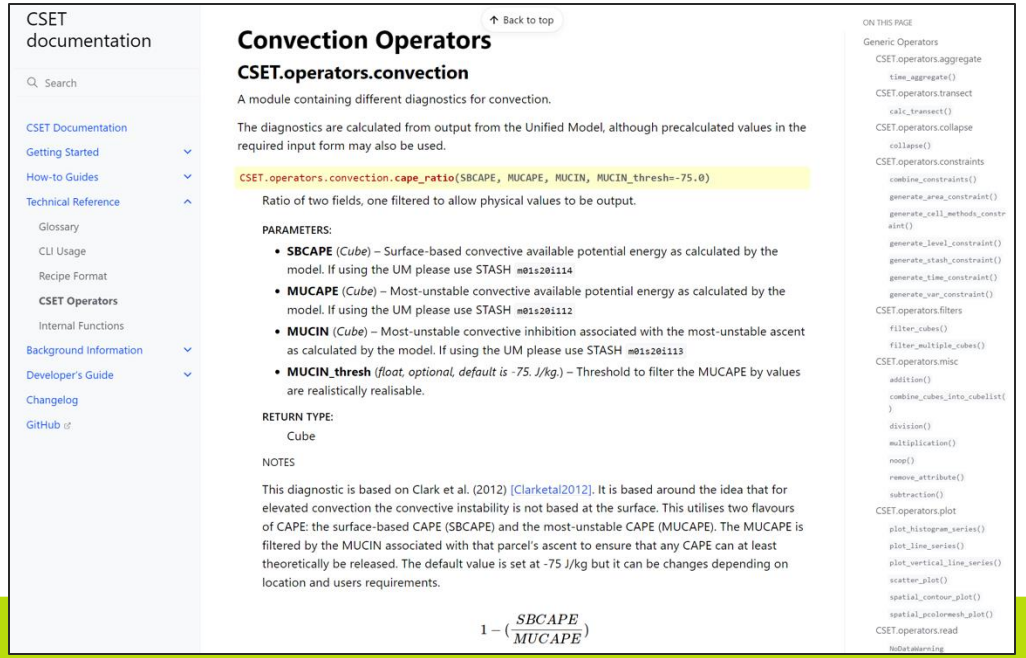
Community

- Centralised and documented resource
- Common working practices
- Legacy for diagnostics and observations
- Community development

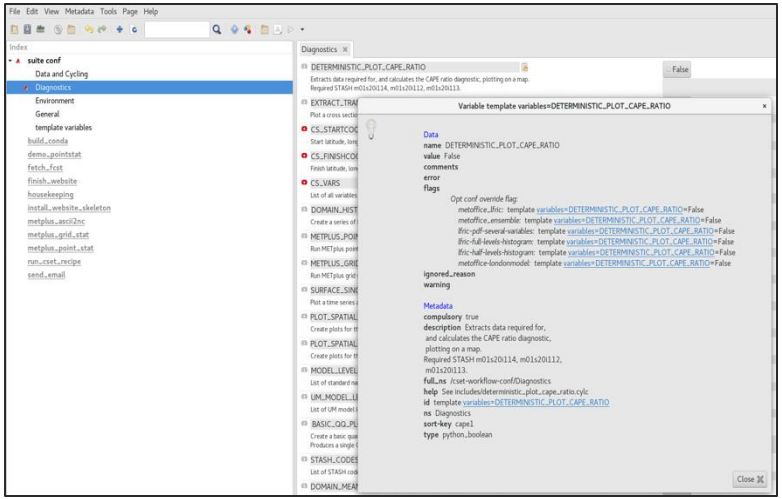
Find out more: https://metoffice.github.io/CSET

Example: Extensive documentation pulled from code

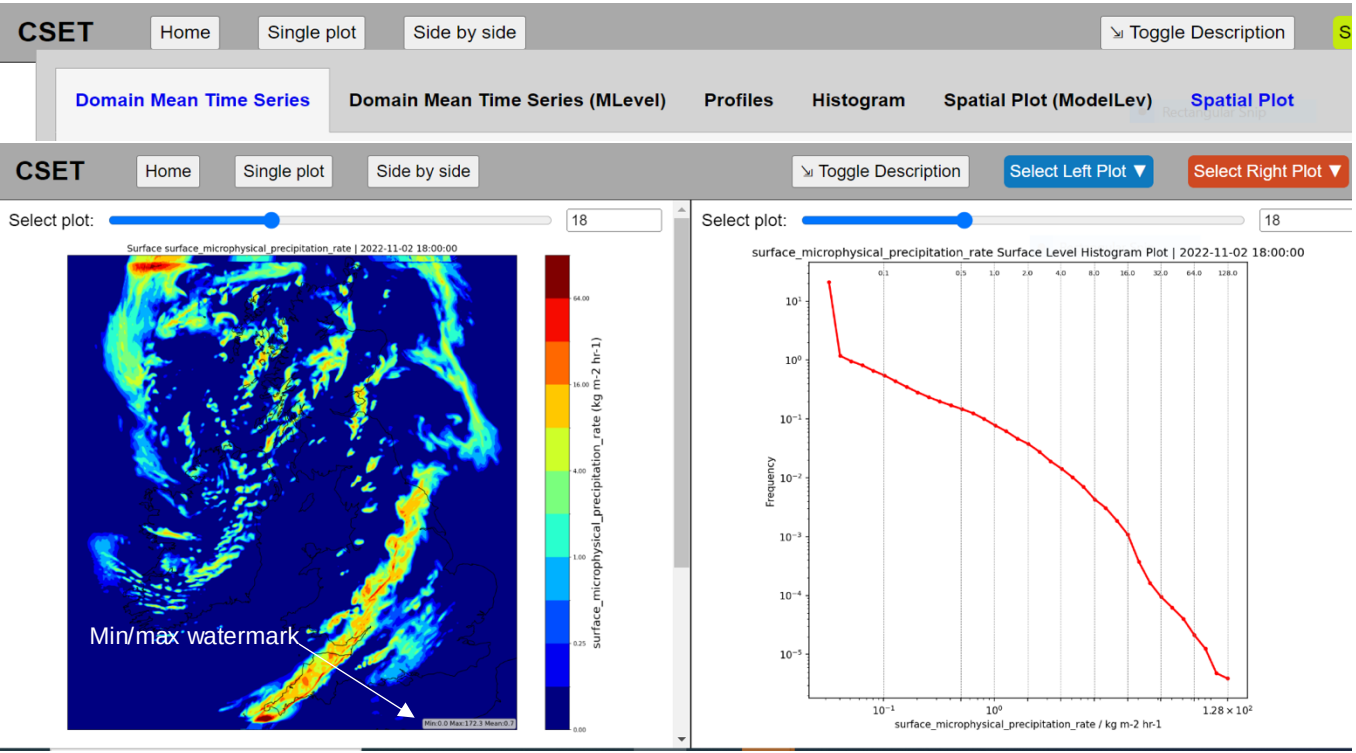
GitHub documentation



Rose GUI documentation

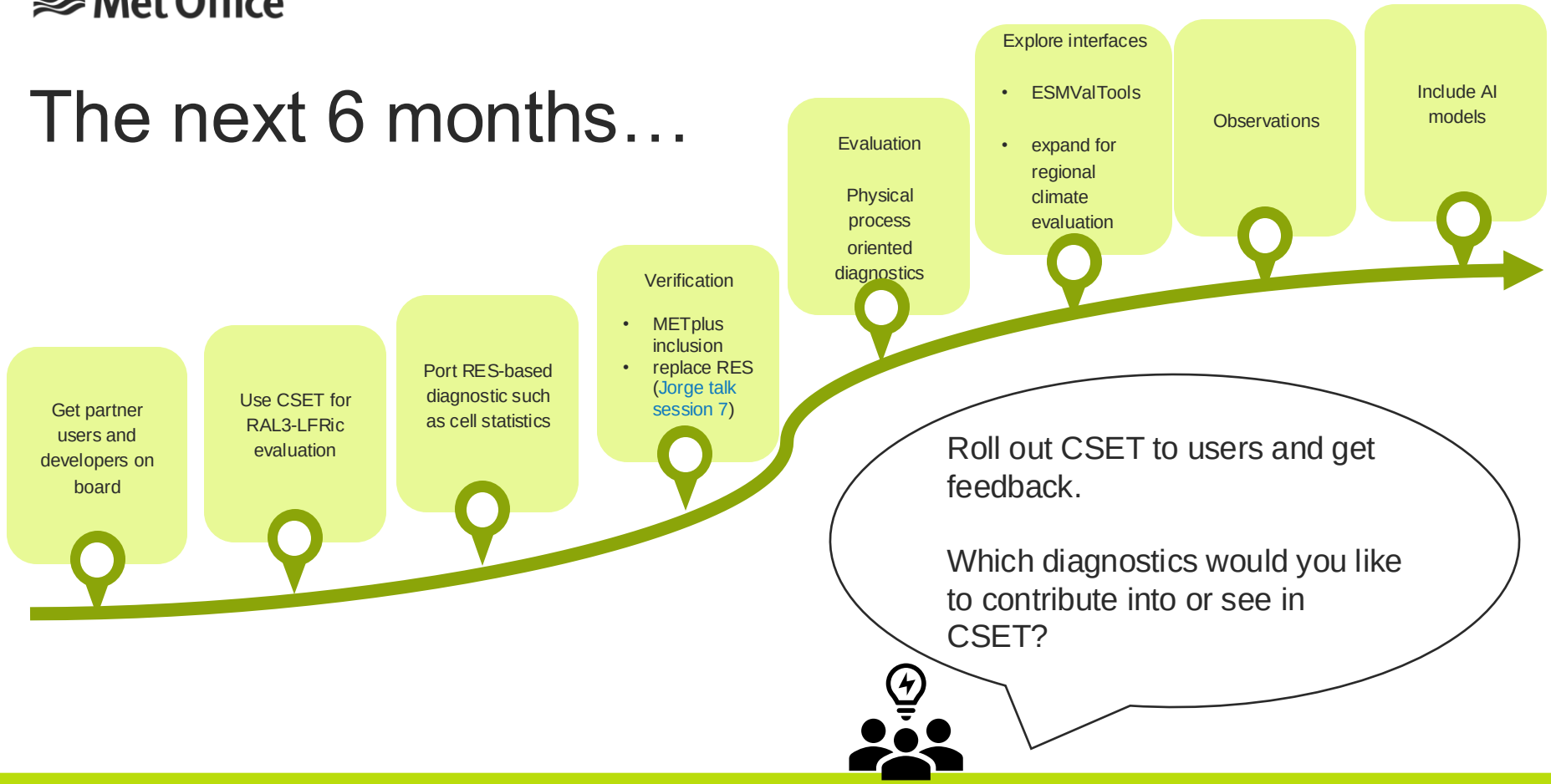


CSET supports RAL3-LFRic evaluation



- Multi-case study capability
- Trial capability
- Data time cycling
- Use CSET for RAL3-LFRic assessment (~35 RAL3-LFRic cases have run with CSET)

The next 6 months…



We welcome new developers and users!

Links to further information:

- CSET SharePoint page
- Software requirements specification
- Potential diagnostics list (working document)
- Architecture design
- Evaluation strategy

Documentation

- Main documentation: metoffice.github.io/CSET

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The code

- https://anaconda.org/conda-forge/cset
- CSET code and workflow

Get engaged

- Open issue on CSET GitHub
- Talk to us
- CSET surgeries coming
- CSET tutorial on Friday