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Climate Change Research Centre (CCRC)

Never Stand Still

Derived Optimal Linear Combination Evapotranspiration (DOLCE): a global gridded synthesis ET estimate

Sanaa Hobeichi, Gab Abramowitz, Jason Evans and **Anna Ukkola**

University of New South Wales and Australian National University

ARC CENTRE OF EXCELLENCE FOR CLIMATE SYSTEM SCIENCE

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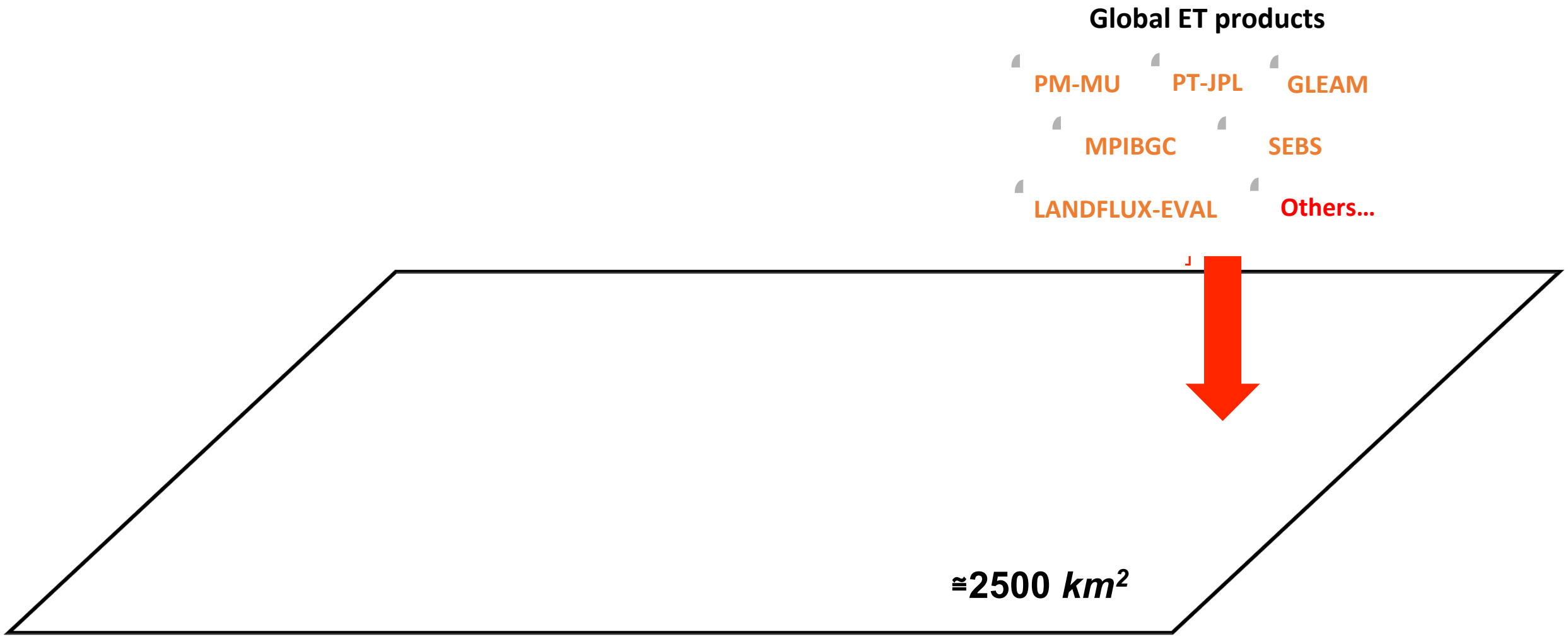
Evapotranspiration (ET)



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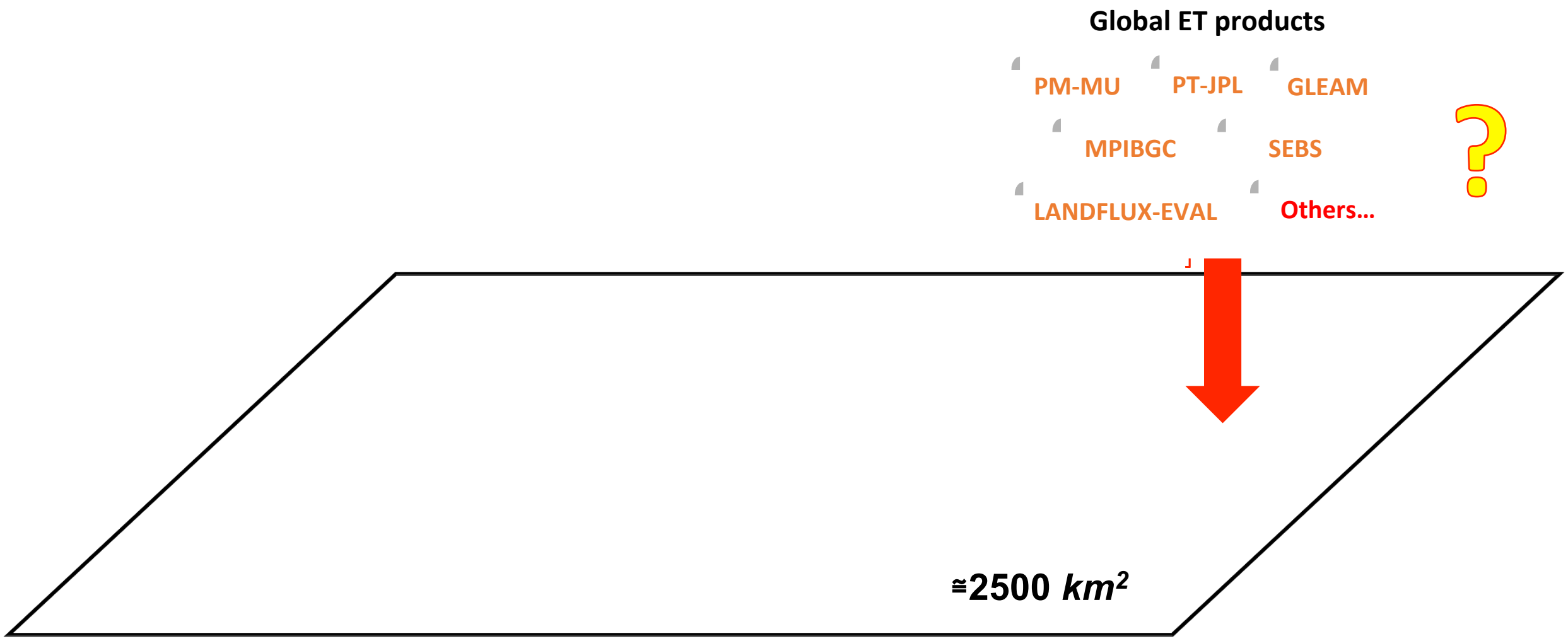

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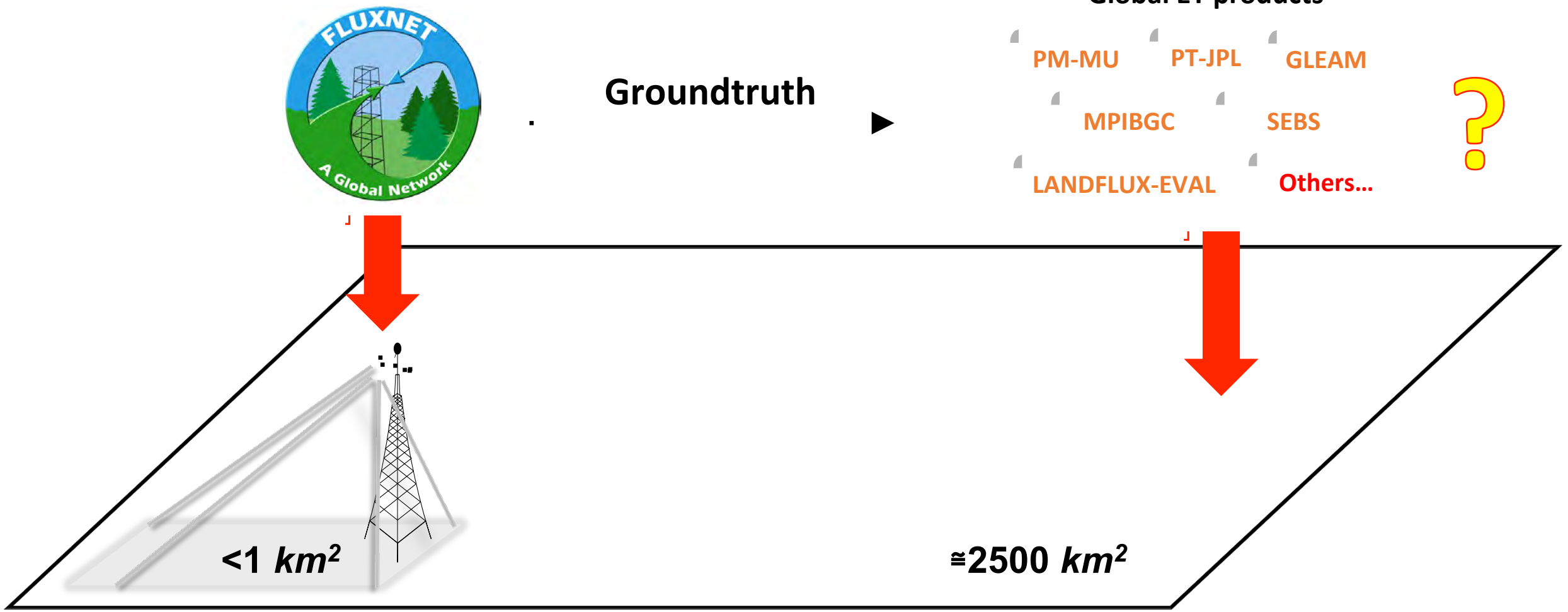

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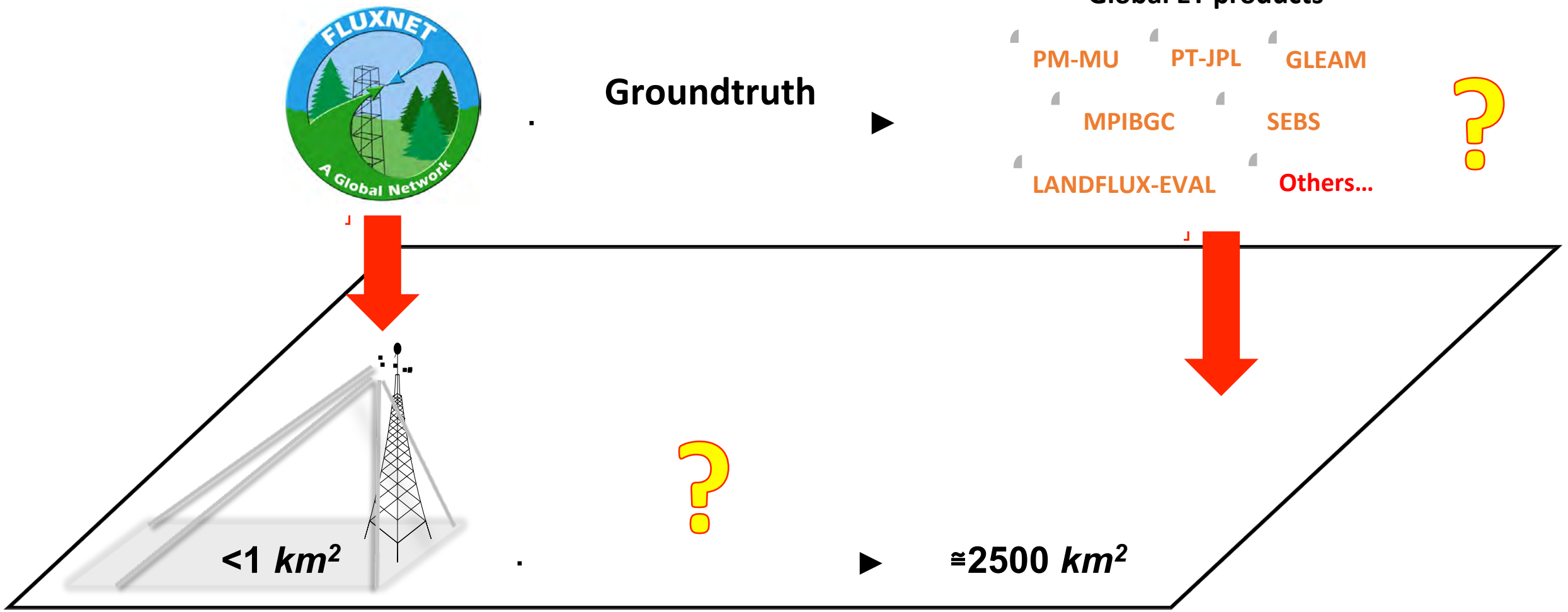
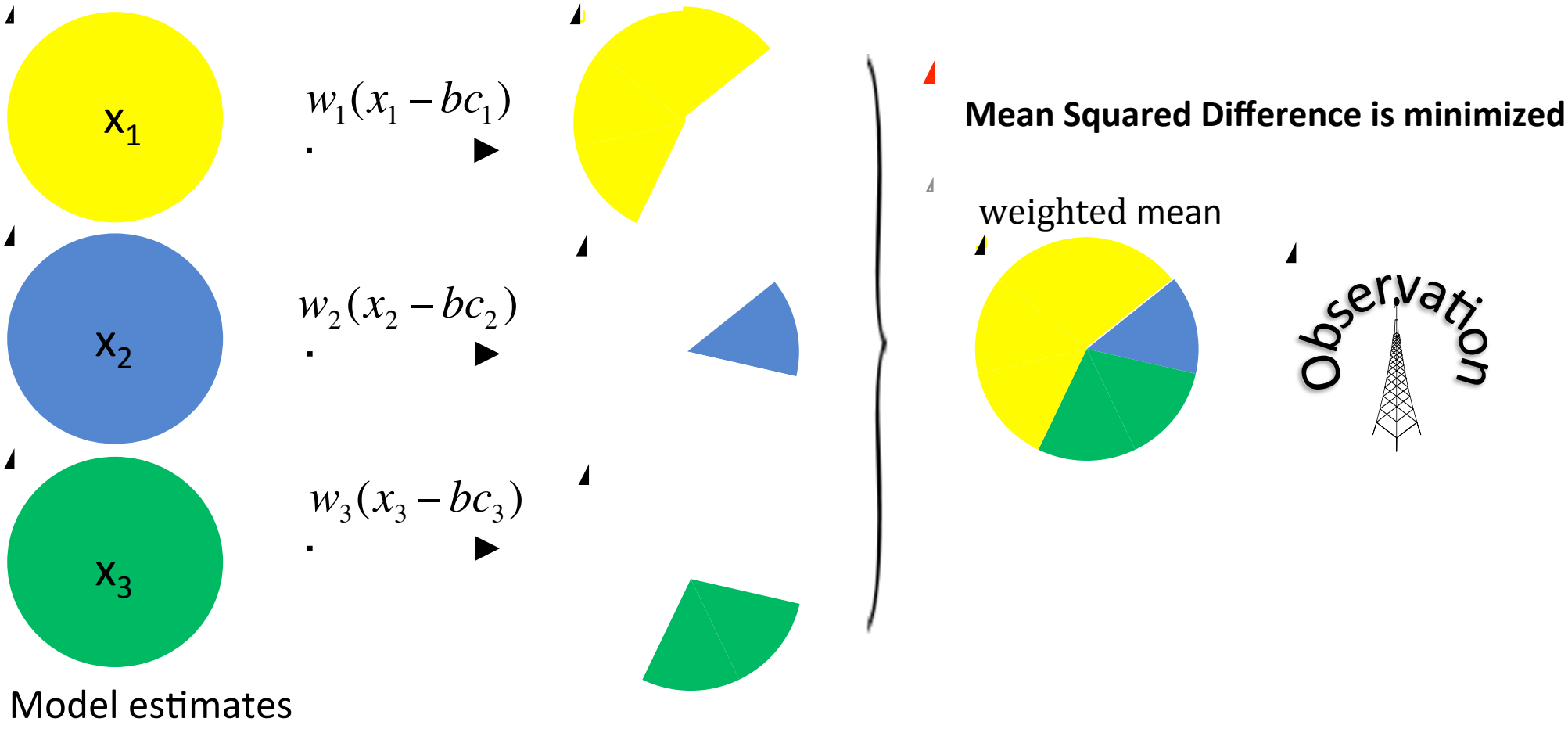


Aim

- **Utilise currently available ET products and FLUXNET observations**
  - **Build a more observationally constrained gridded ET product**
  - **Compute its spatio-temporal uncertainty by combining products**

Weighting approach



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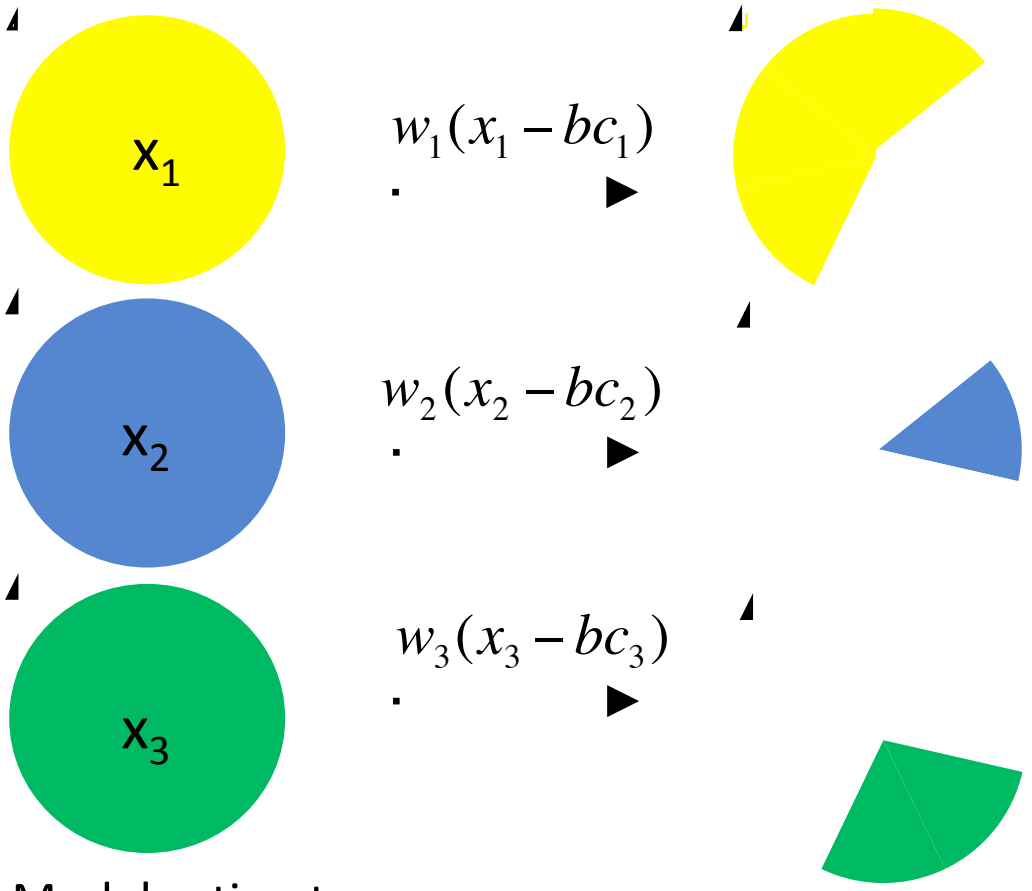
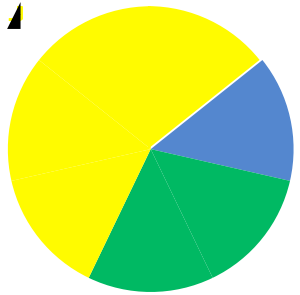


Model estimates

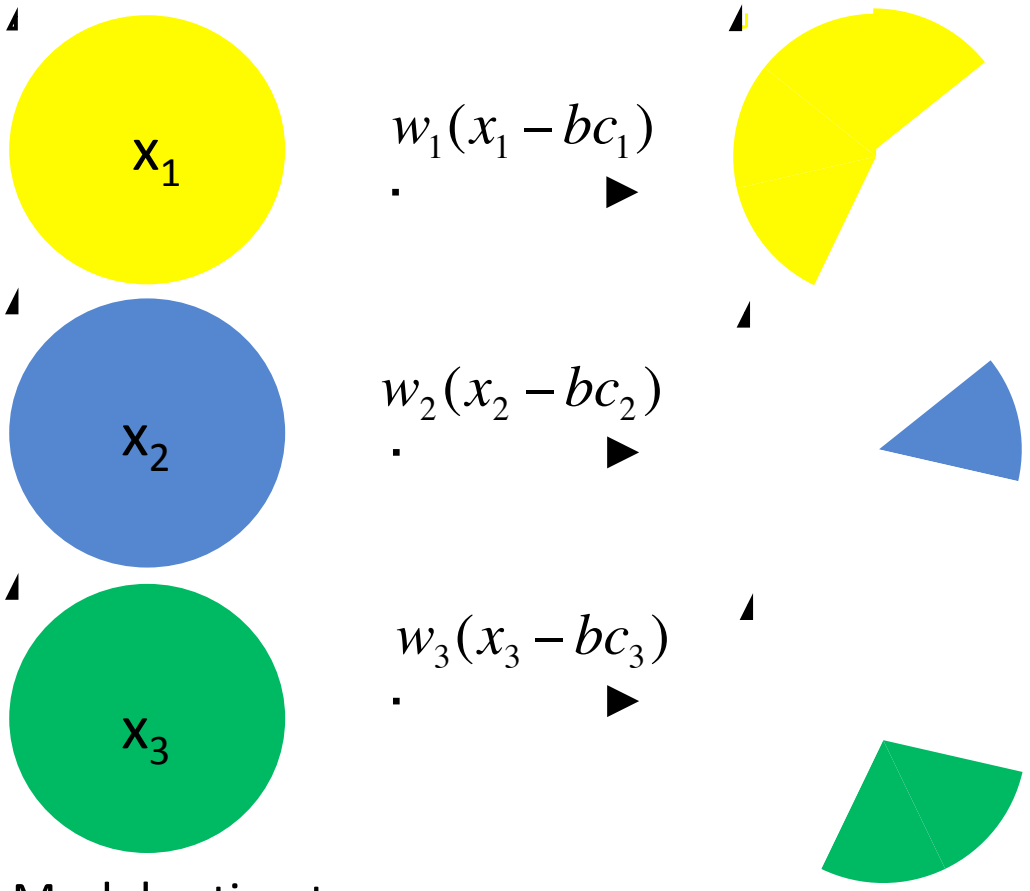
Mean Squared Difference is minimized

weighted mean



$$w_1(x_1 - bc_1) + w_2(x_2 - bc_2) + w_3(x_3 - bc_3)$$

Weighting approach



Model estimates

performance differences & error covariance

Mean Squared Difference is minimized

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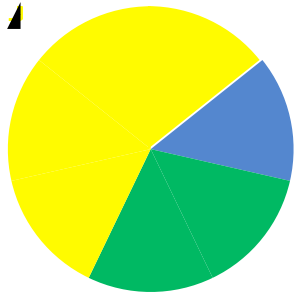

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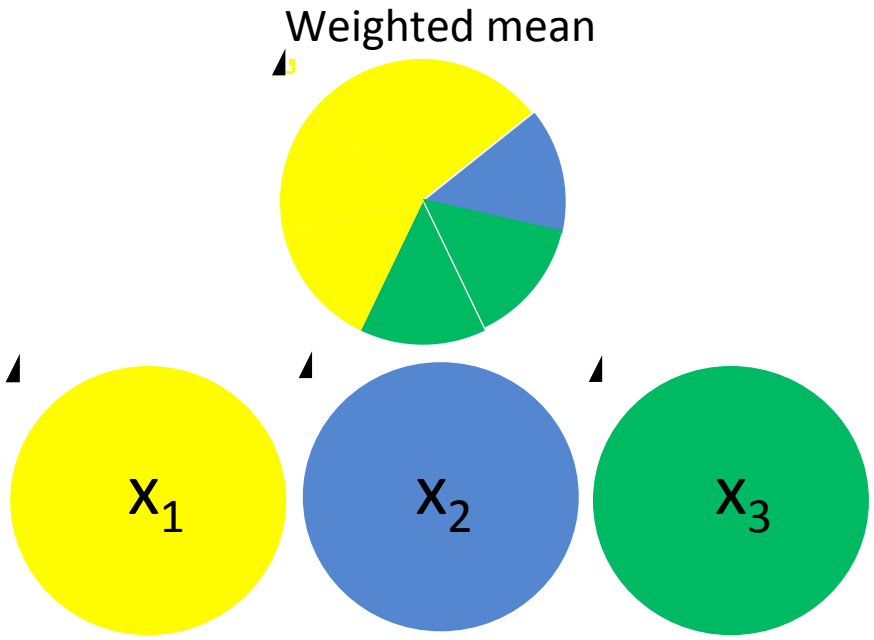
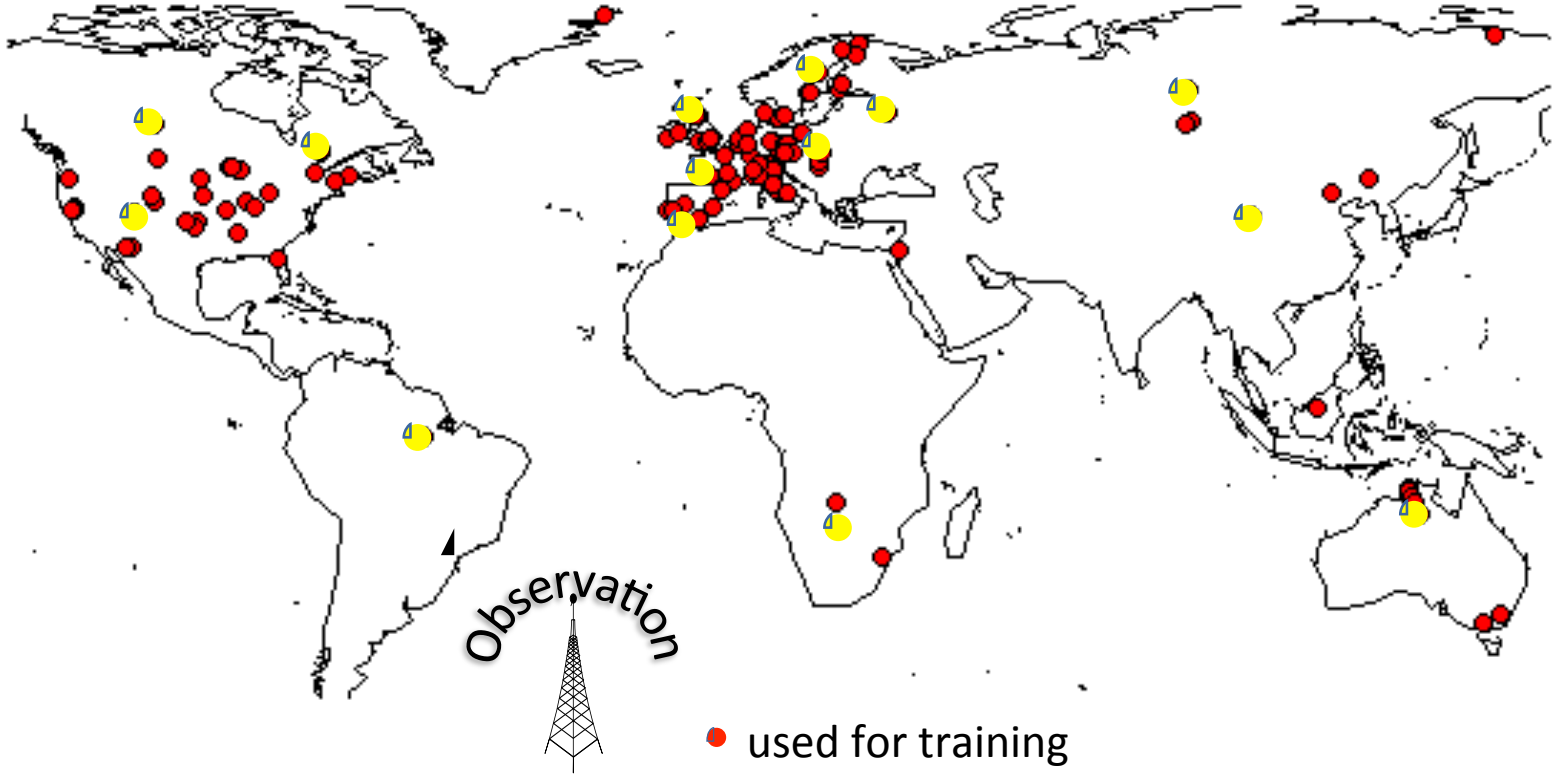
Weighting in-sample





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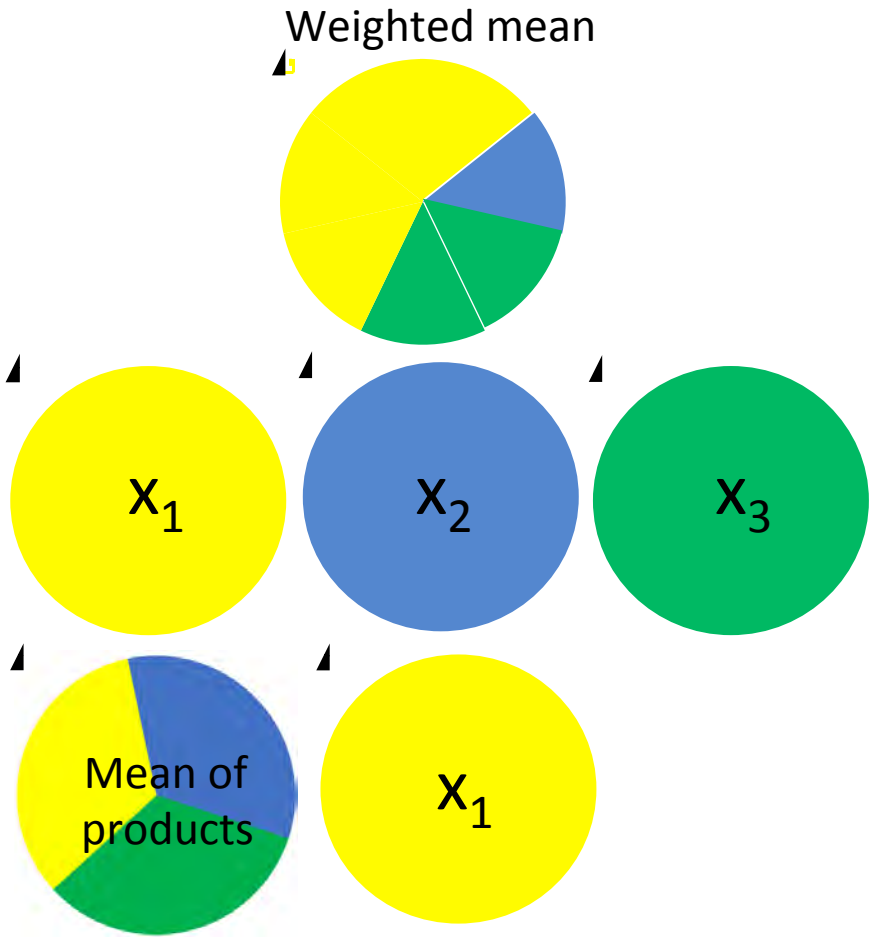

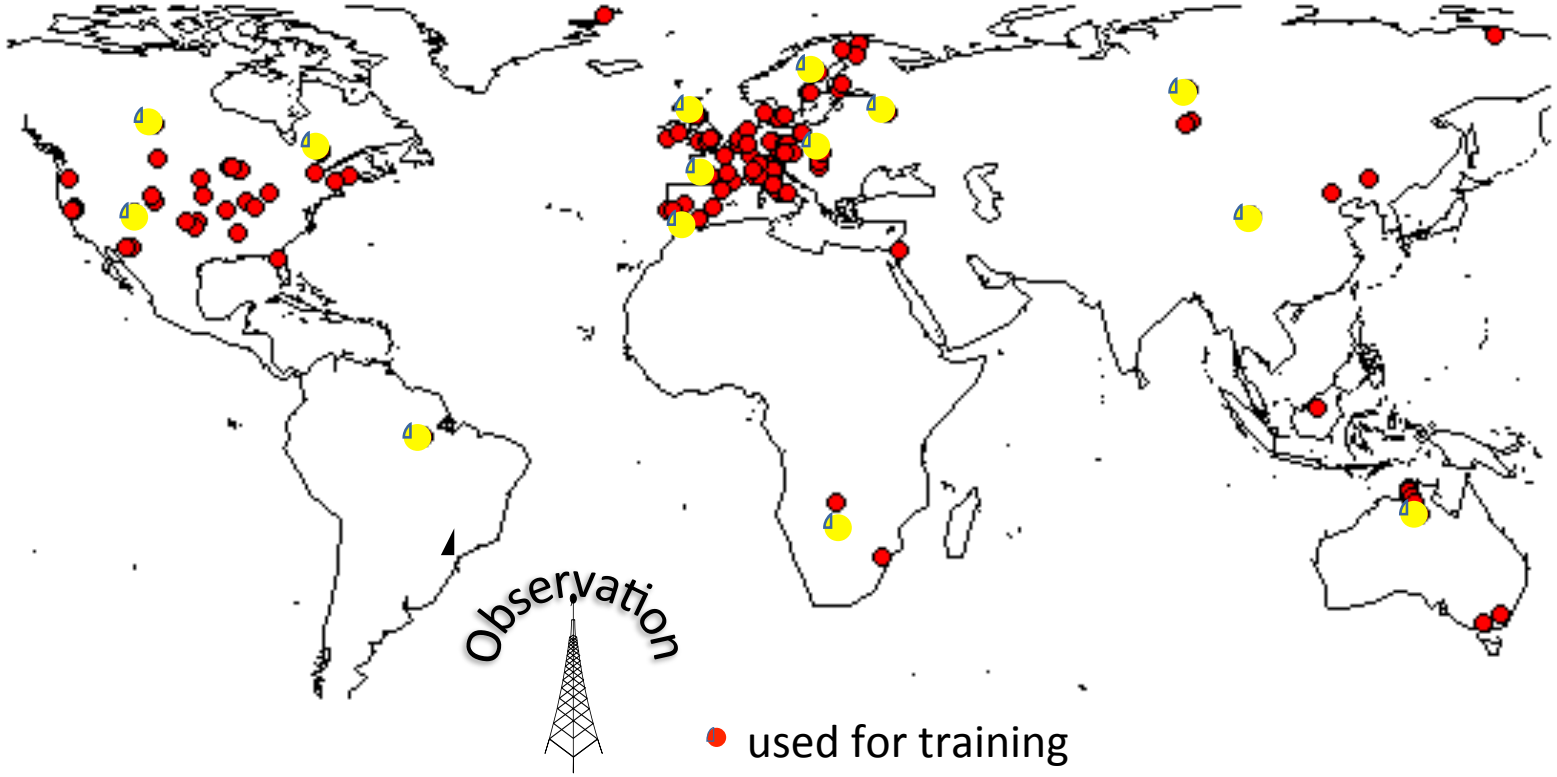

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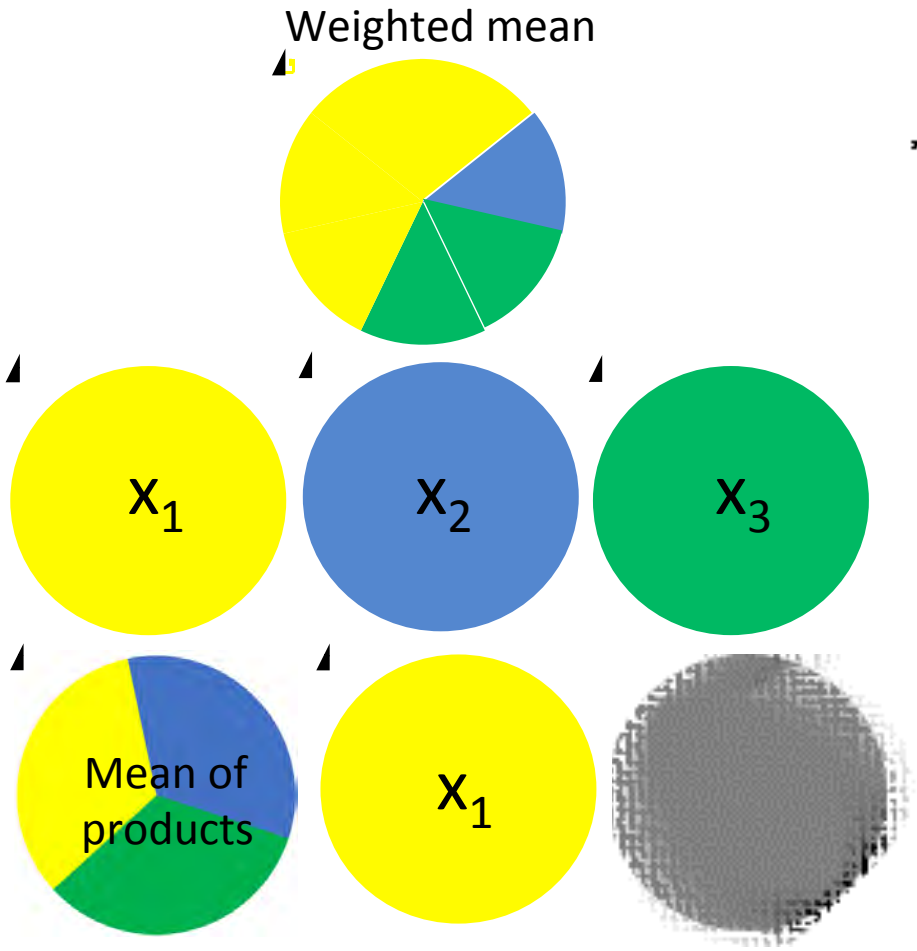
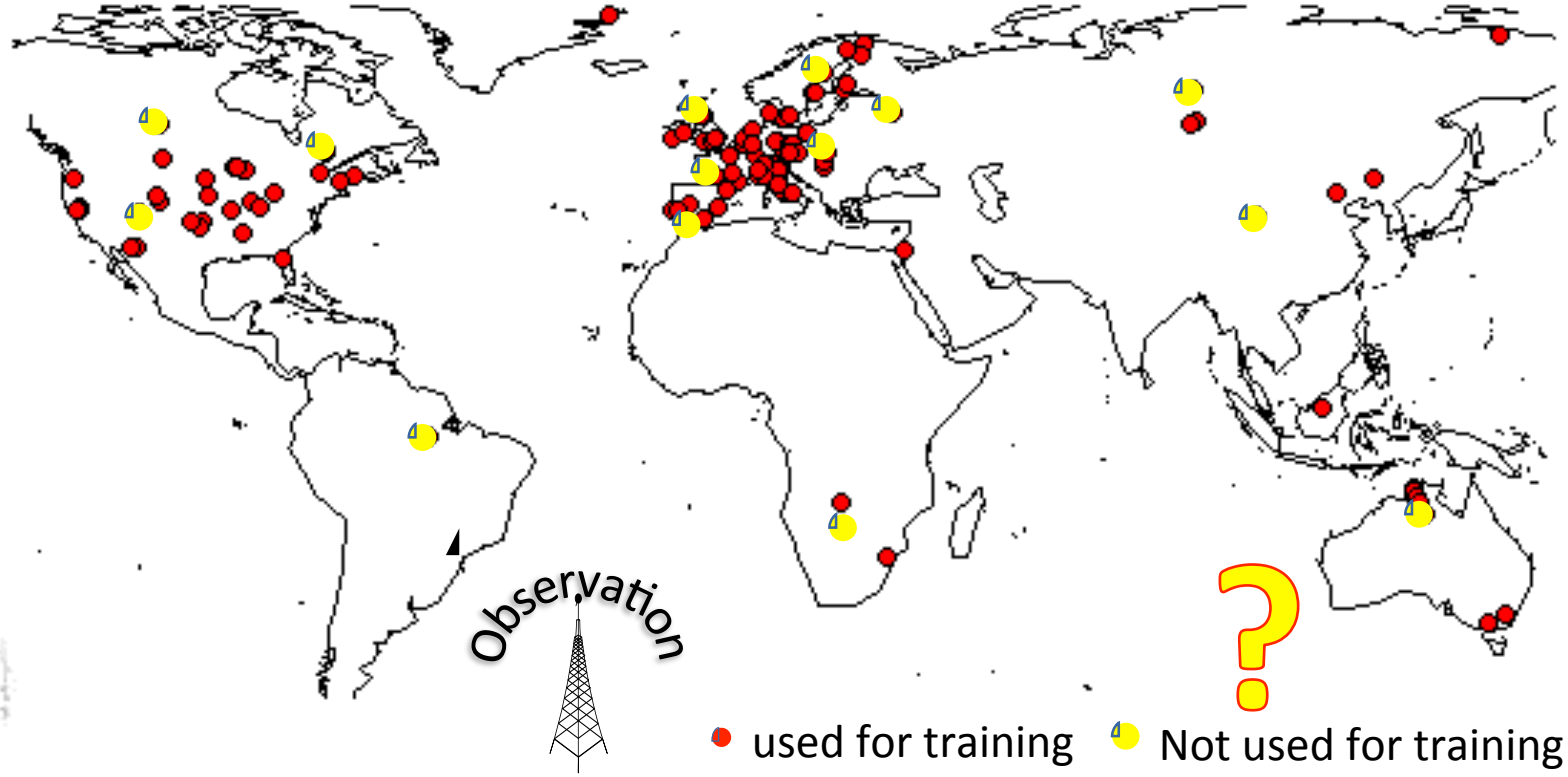
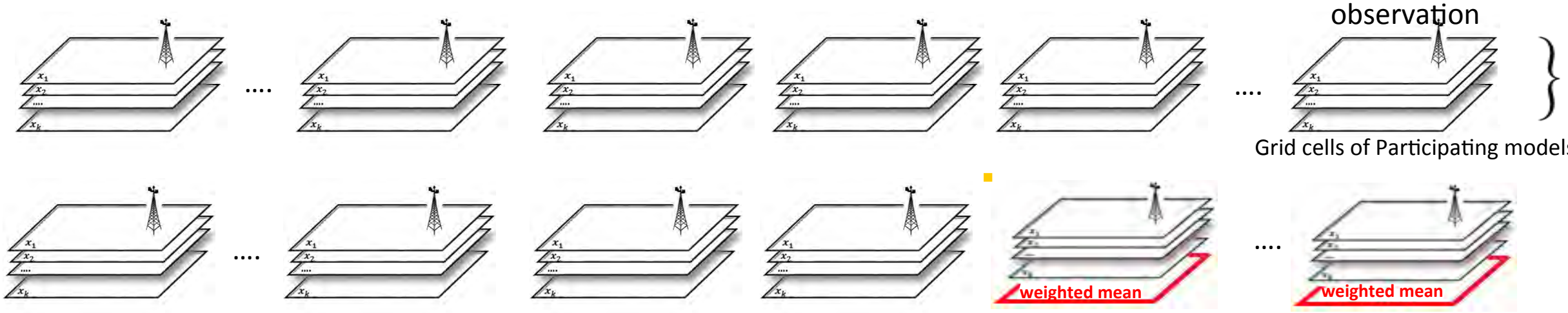




Out-of-sample test



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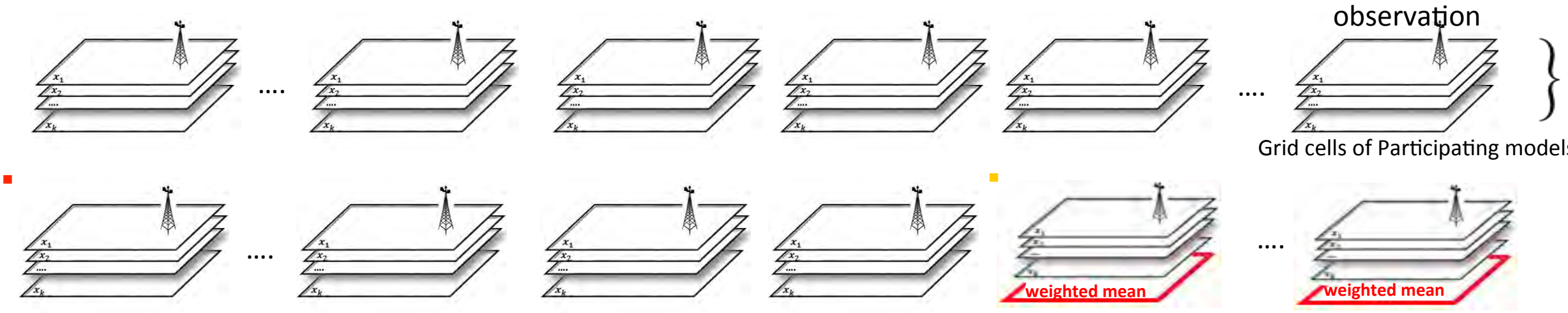
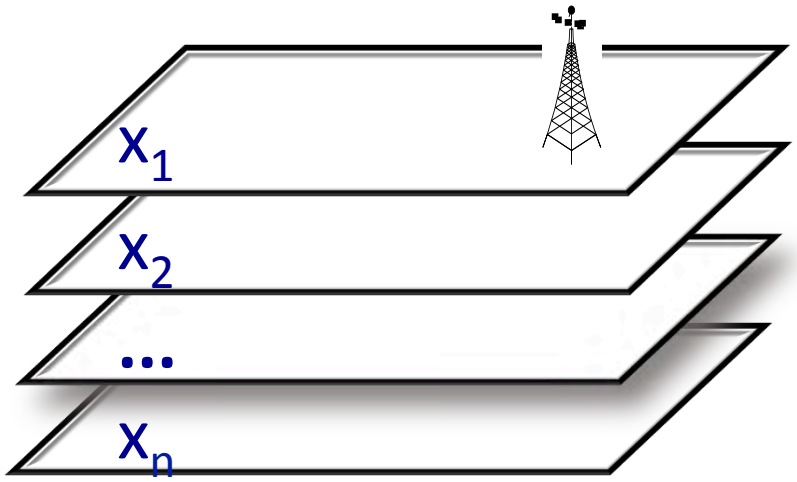


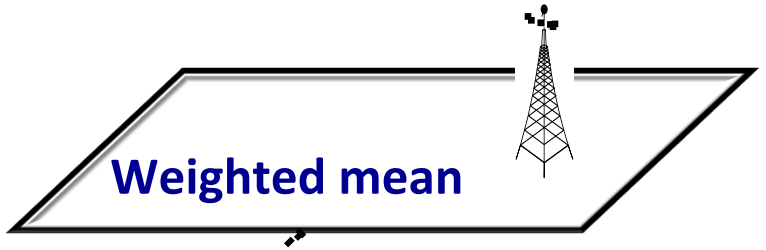
Metrics of Performance

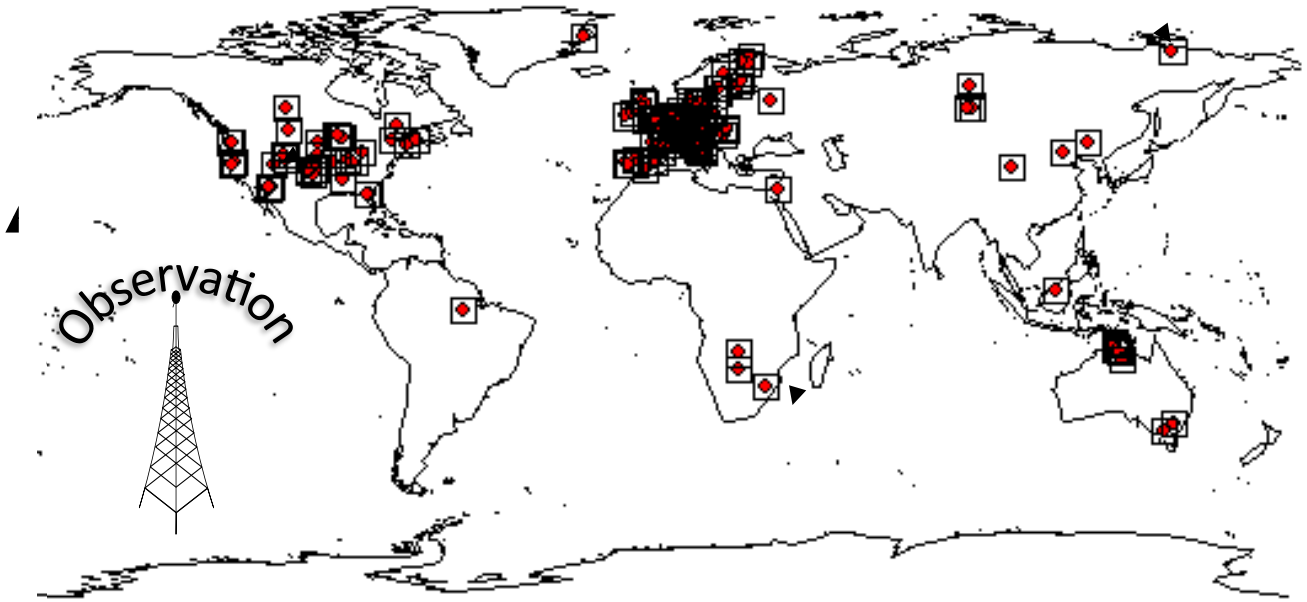
- Mean Square Error
- Relative Standard Deviation
- Correlation
- Mean bias

Uncertainty of the weighted product



Participating ensemble





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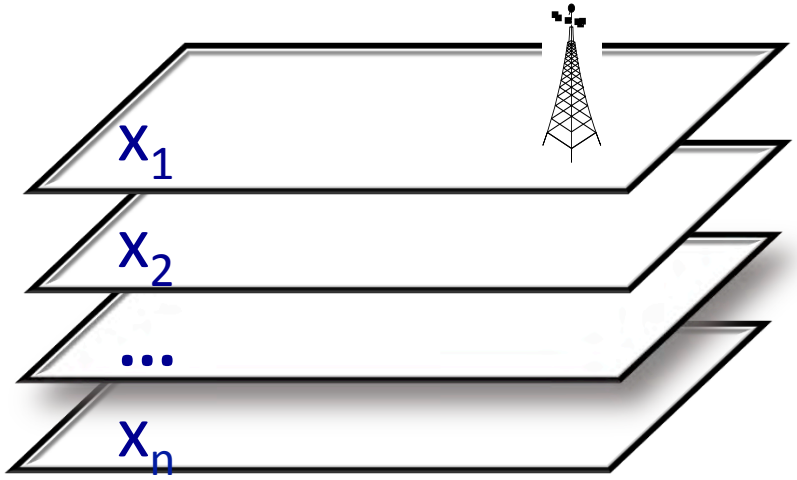

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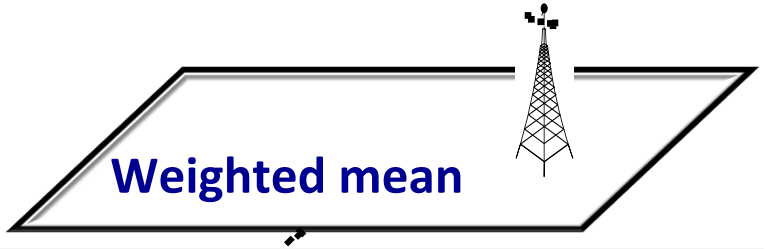
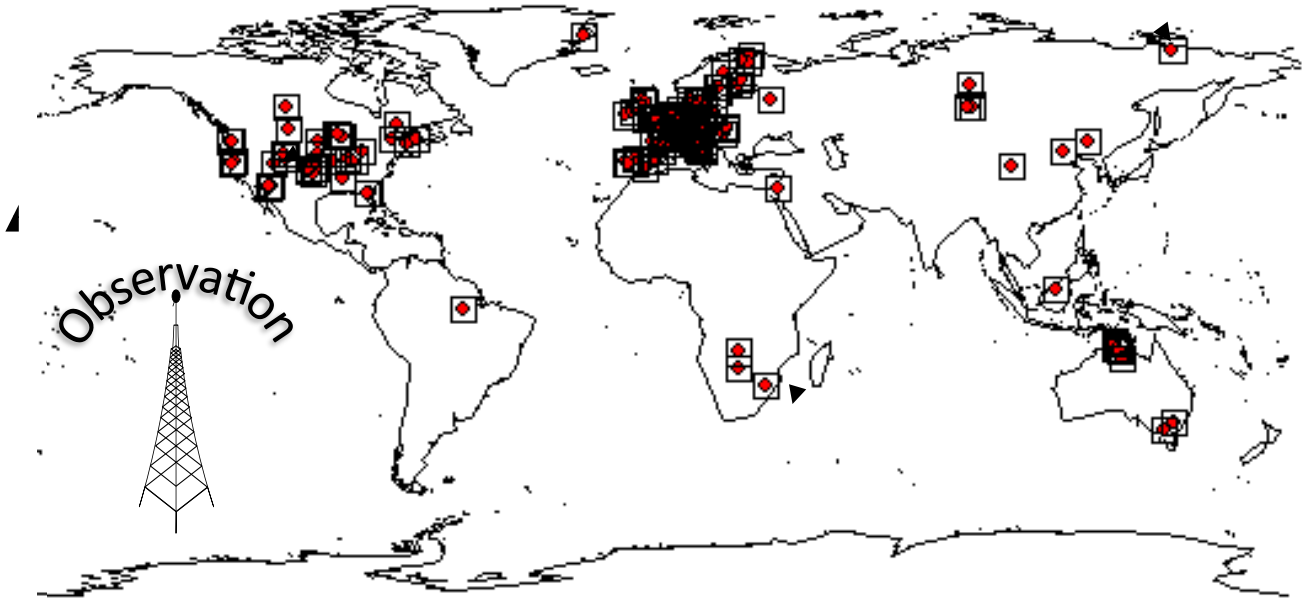


Error Variance
(Weighted mean, observation)



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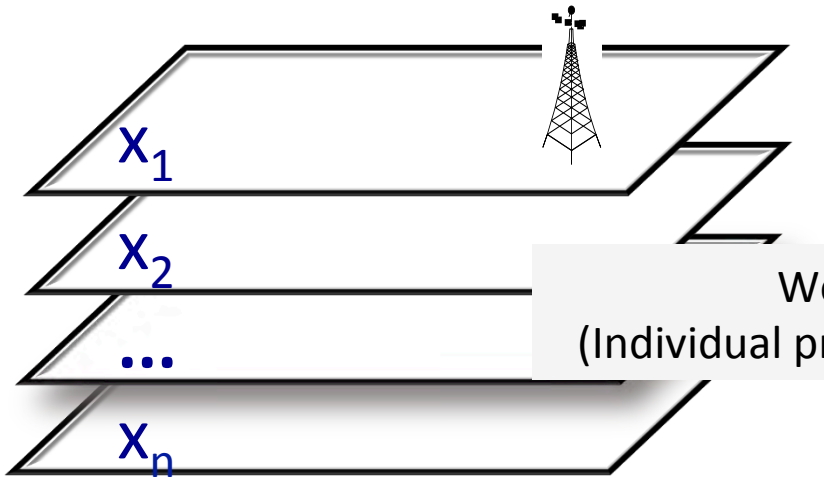
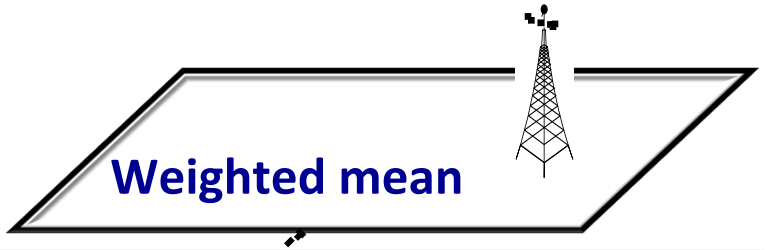


Participating ensemble

Weighted Variance
(Individual products, mean of products)

≠



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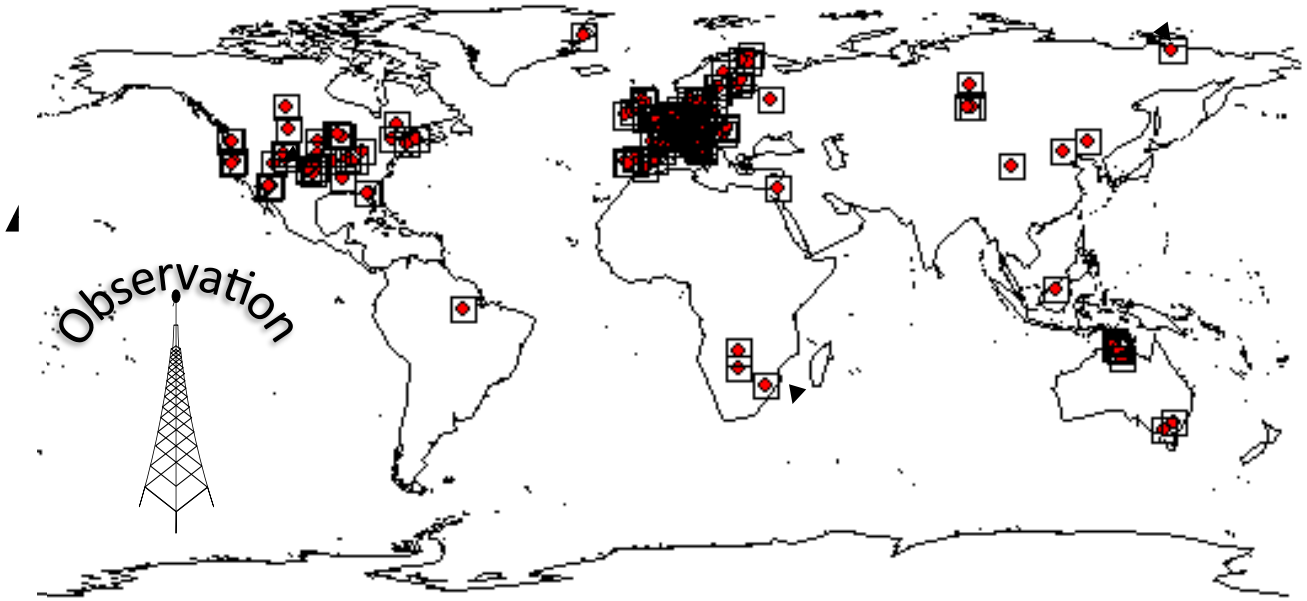
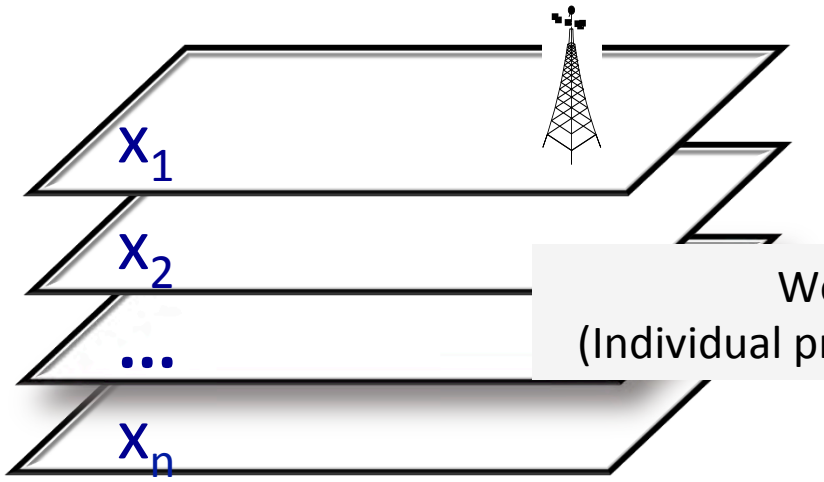


Uncertainty of the weighted product



Transformed ensemble

Weighted Variance
(Individual products, mean of products)

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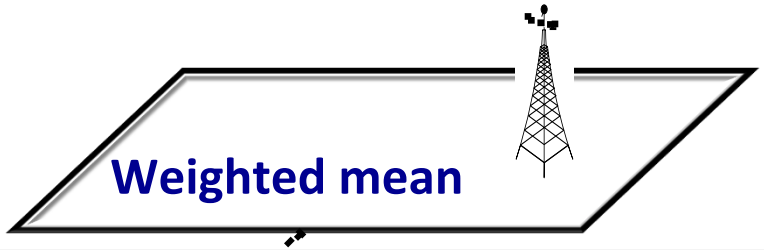

Error Variance
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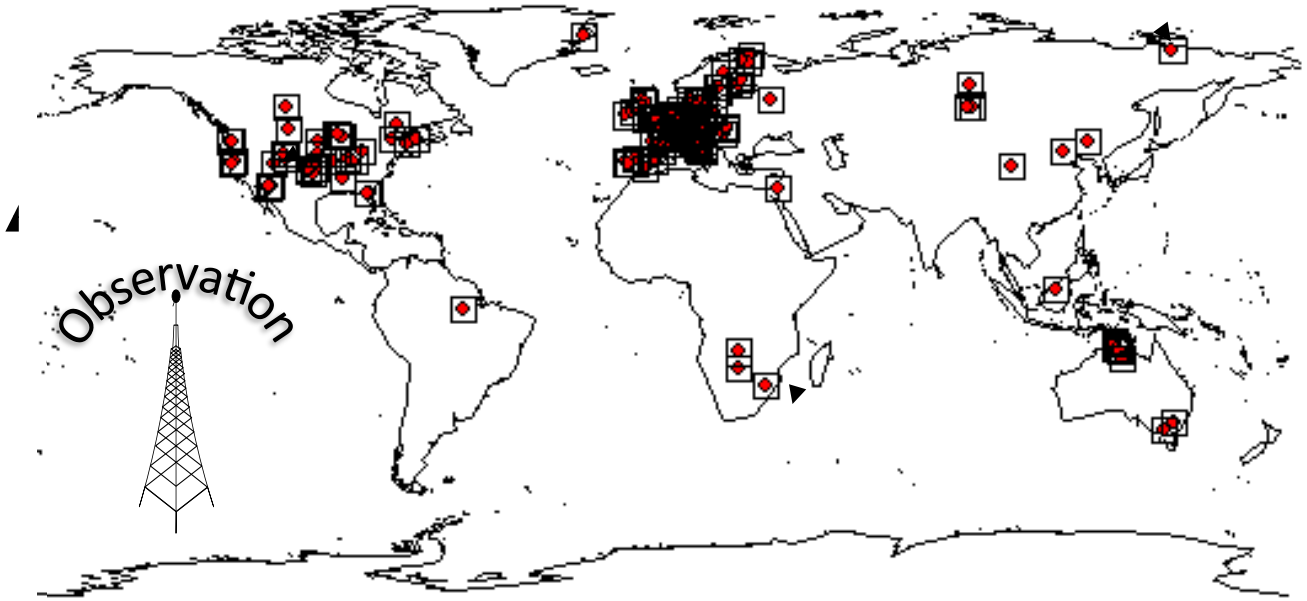
Uncertainty estimates
At the grid scale



Datasets

- **Combine 6 global ET products:**
  - MPIBGC
    - empirical approach
  - MOD16
    - Physical approach, PM formula
  - PML
    - Physical approach, PM formula
  - GLEAM v2A
  - GLEAM v2B
  - GLEAM v3A
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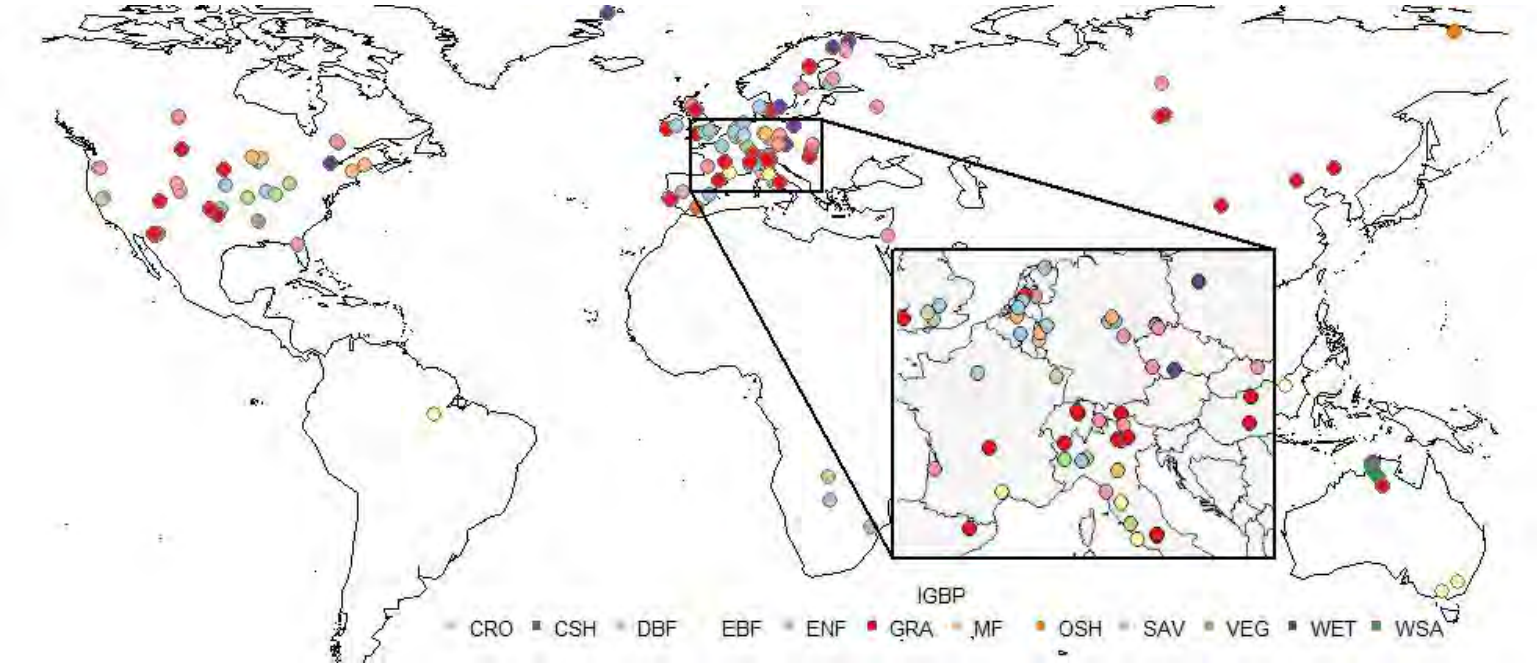
- **159 FLUXNET sites from LaThuile2007 and FLUXNET2015**



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- **Four additional global ET products for evaluation:**
  - CSIRO-global
  - LandFlux-EVAL-ALL
  - LandFlux-EVAL-DIAG
  - PT–JPL

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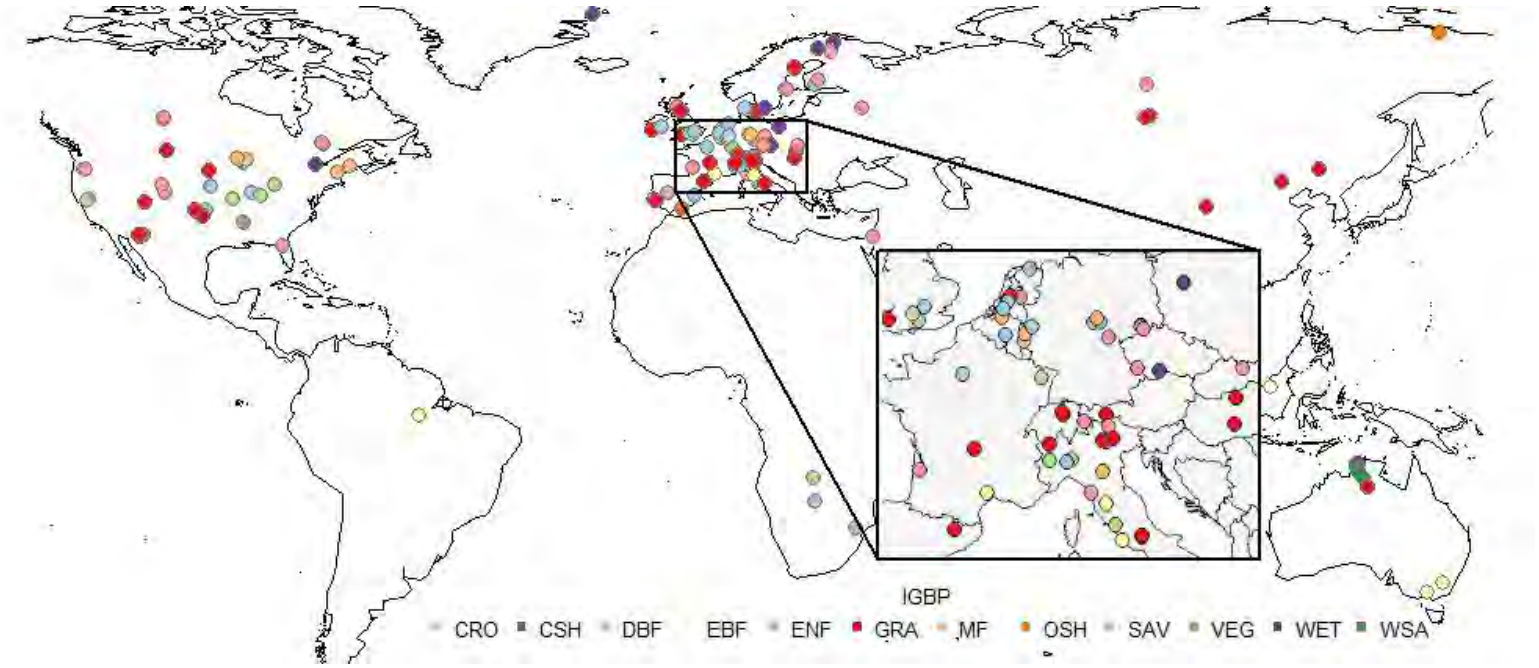
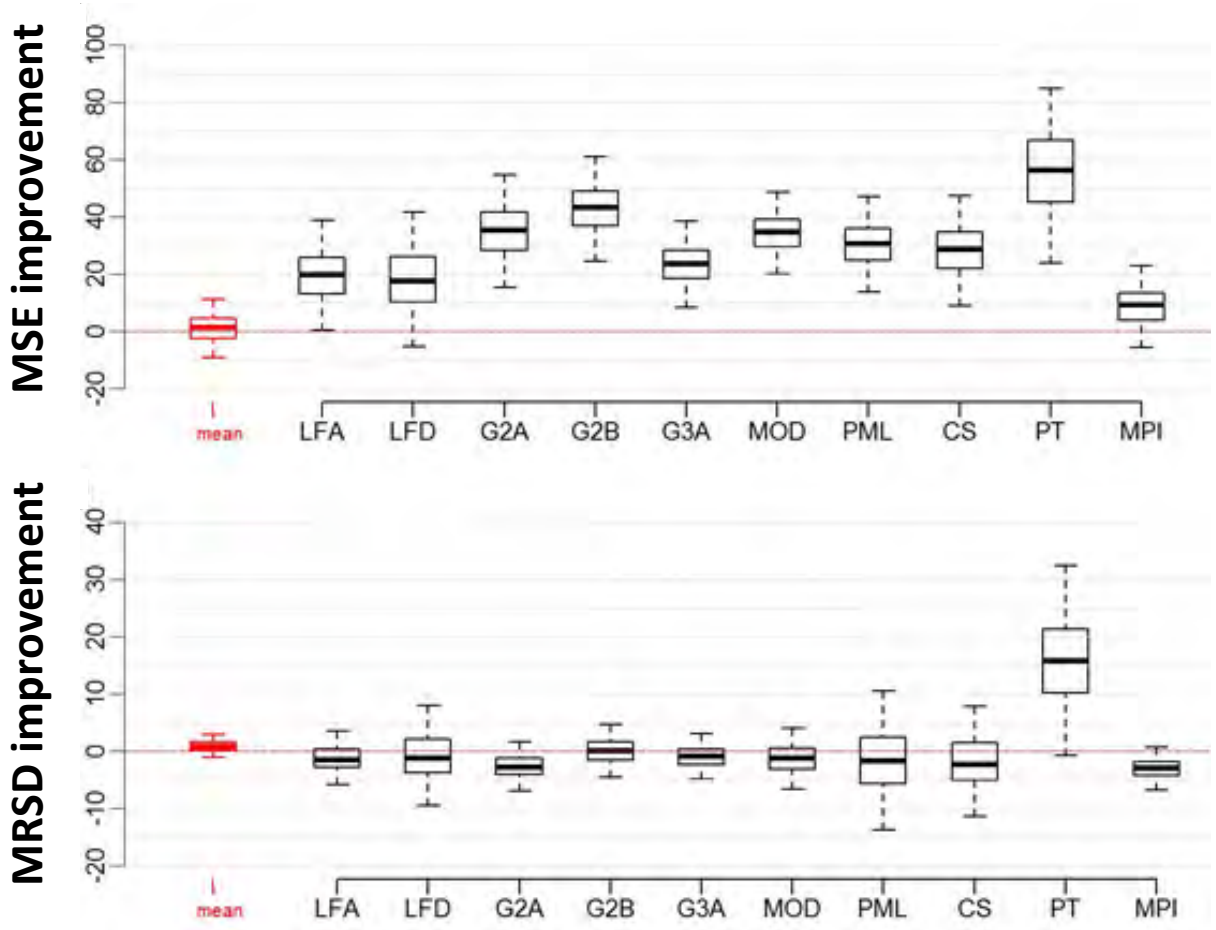
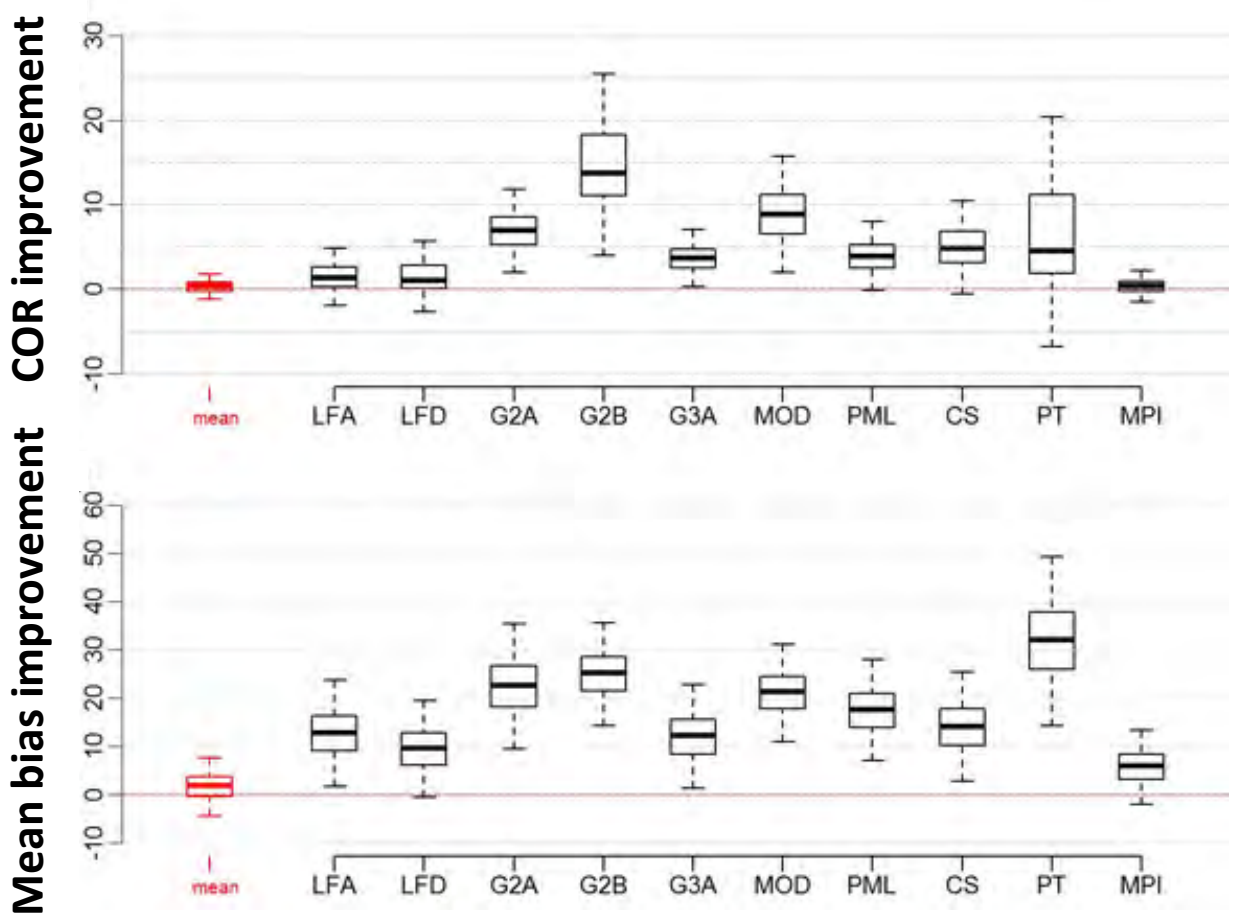


Results: Out-of-sample test





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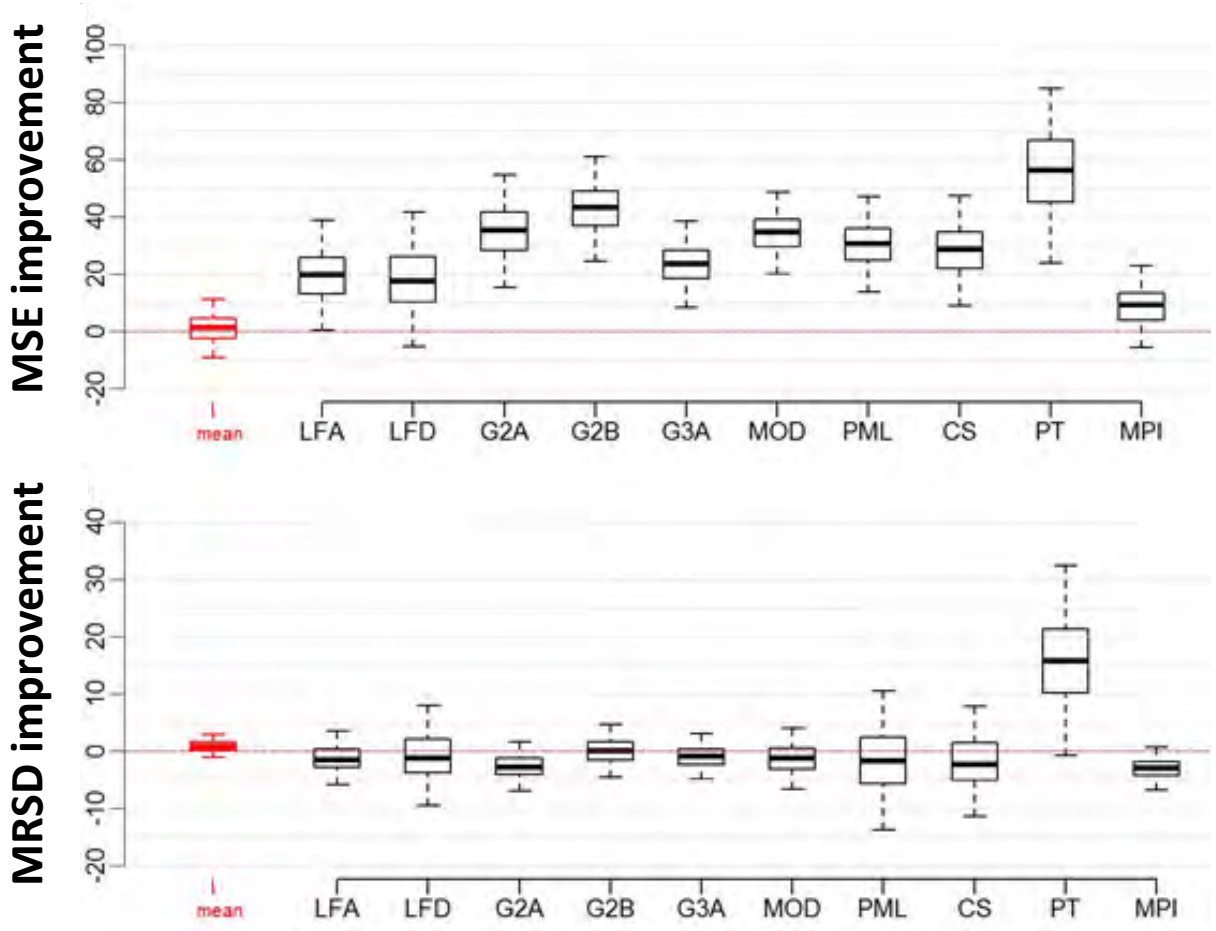

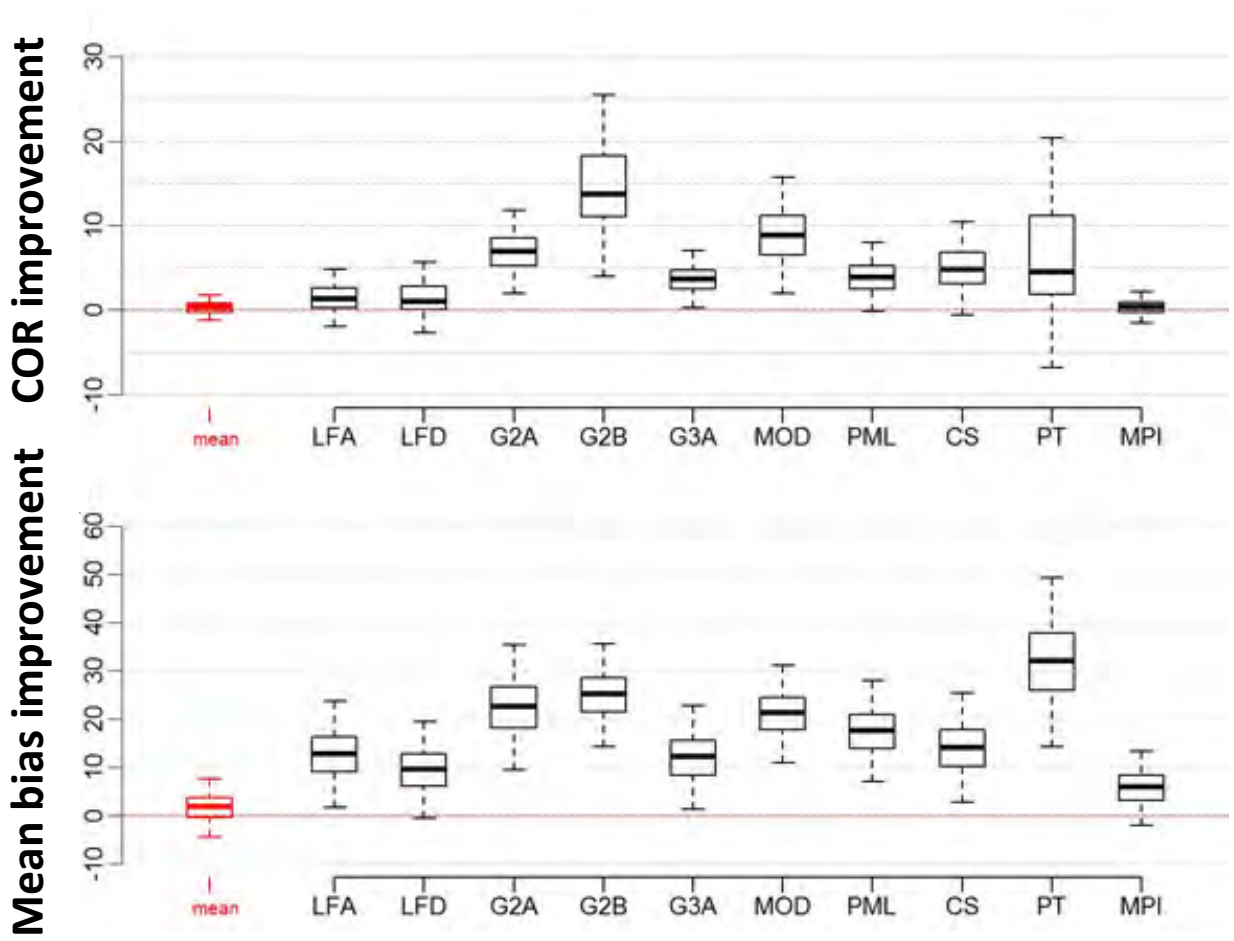

- **The weighted product is likely to be a more reliable gridded ET estimate**

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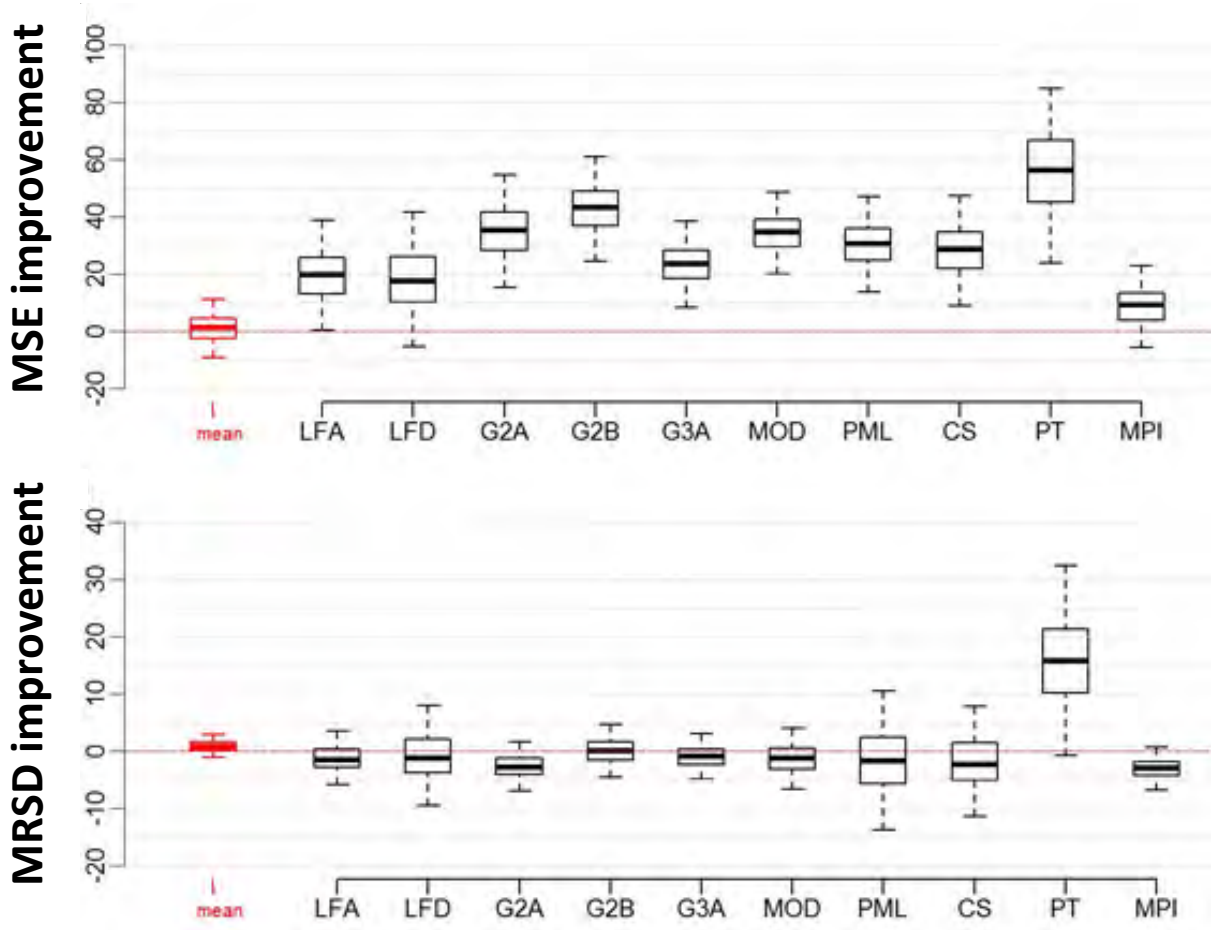
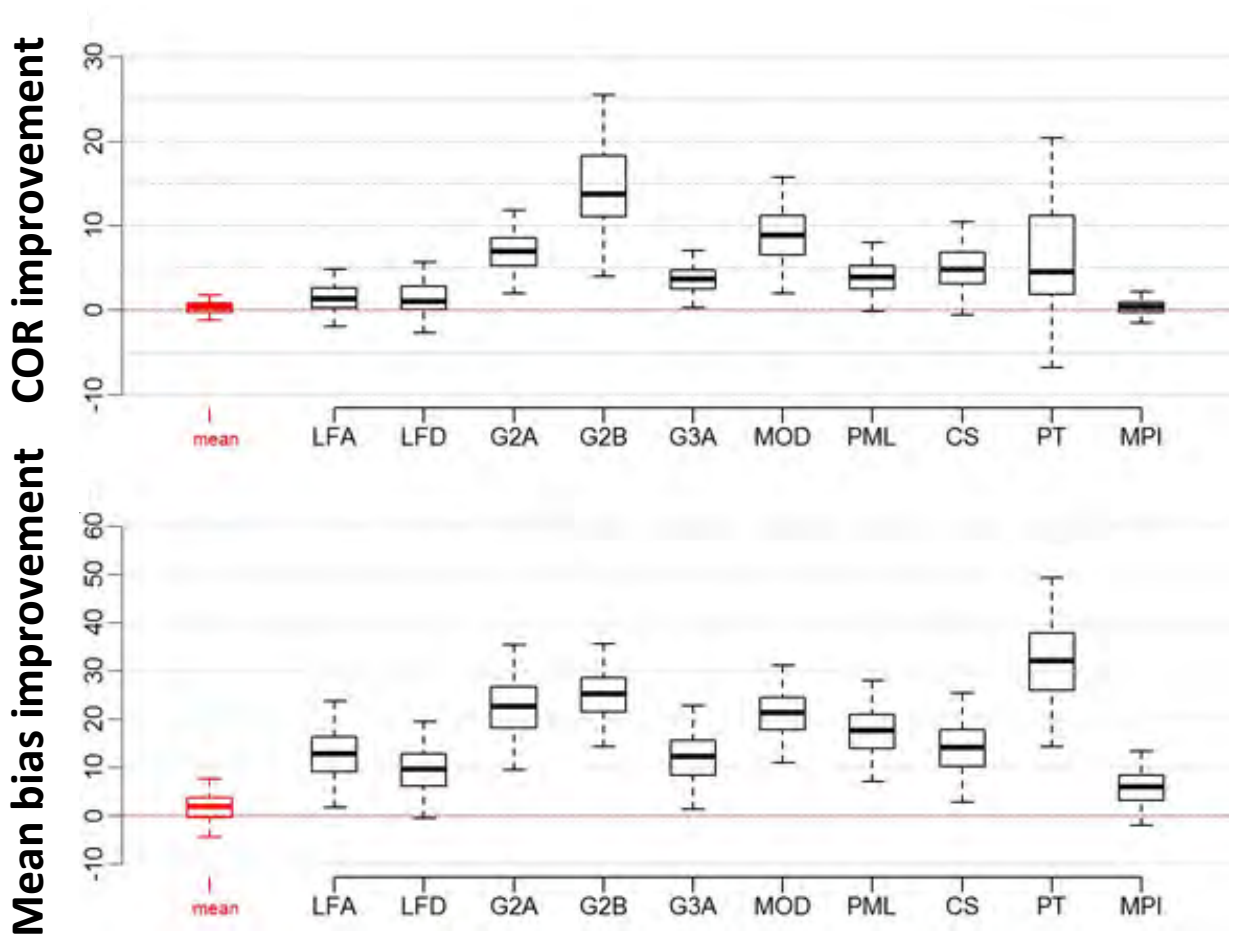
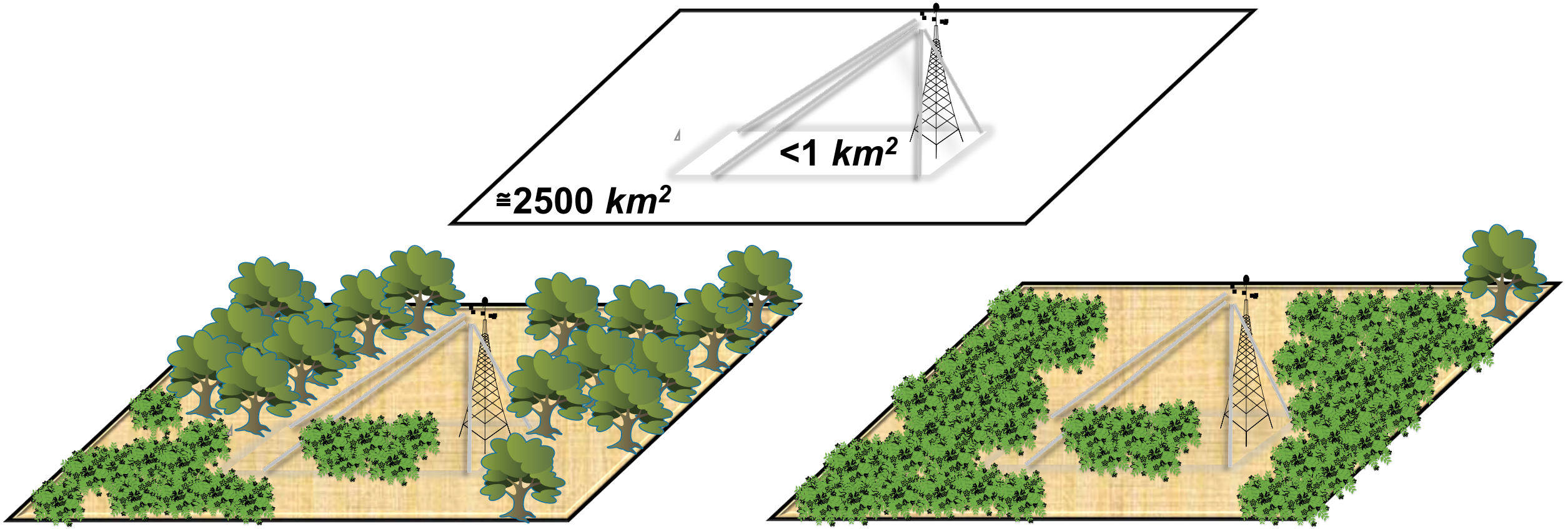




- **The weighted product is likely to be a more reliable gridded ET estimate**
- **There is enough information in the flux towers to successfully weigh the gridded products**

Results

- The ensemble of flux towers provide information about the grid cells that contain them



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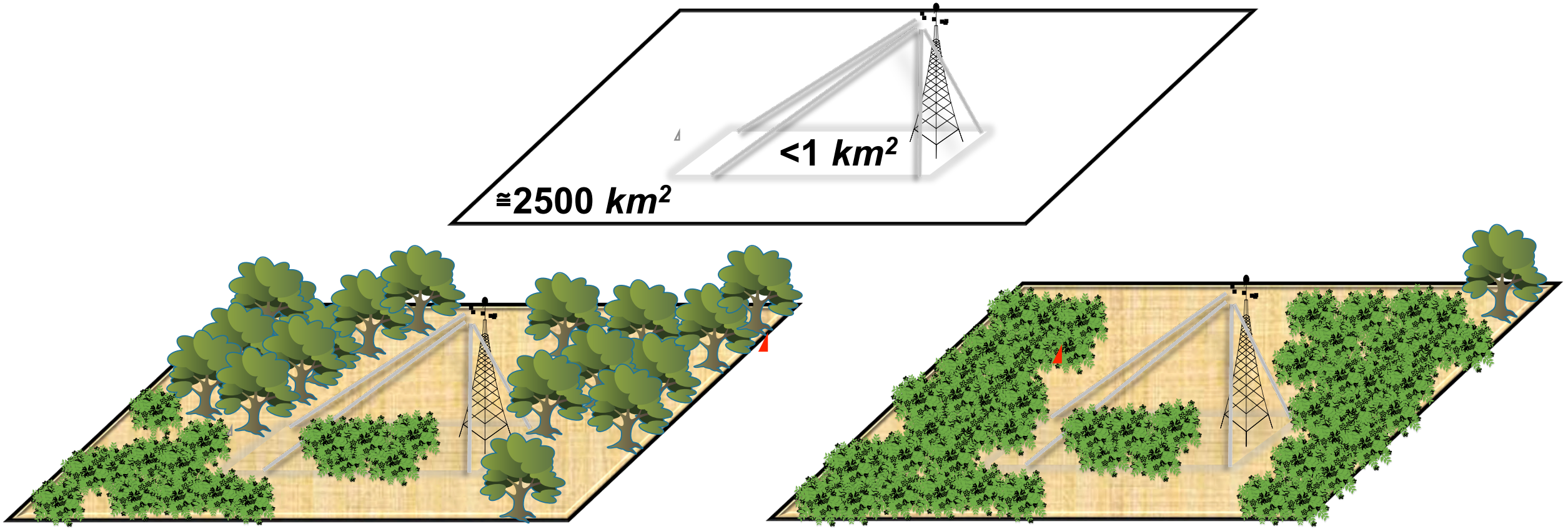


DOLCE

Derived

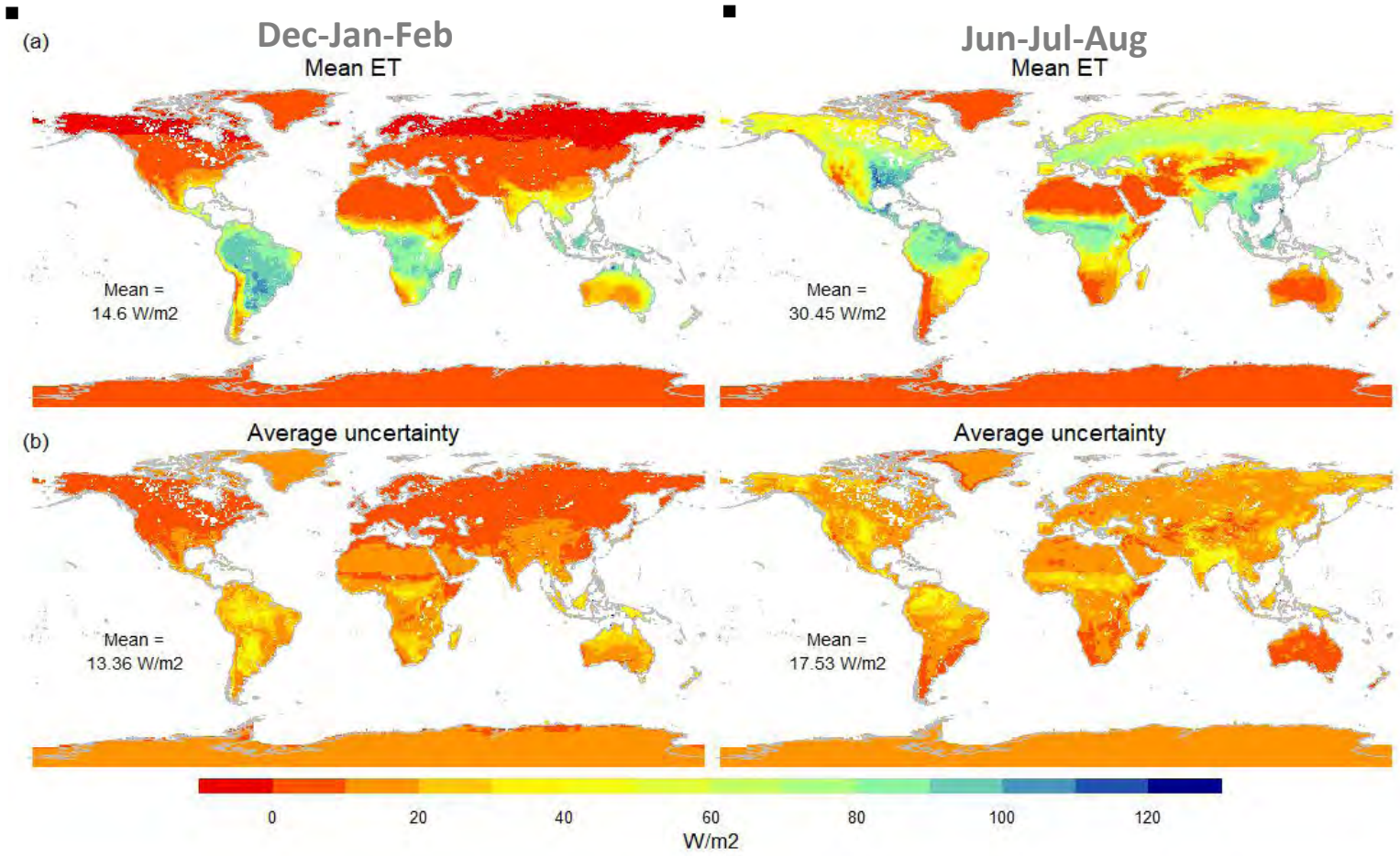
Optimal

Linear

Combination

Evapotranspiration

Global evapotranspiration dataset and its associated uncertainty



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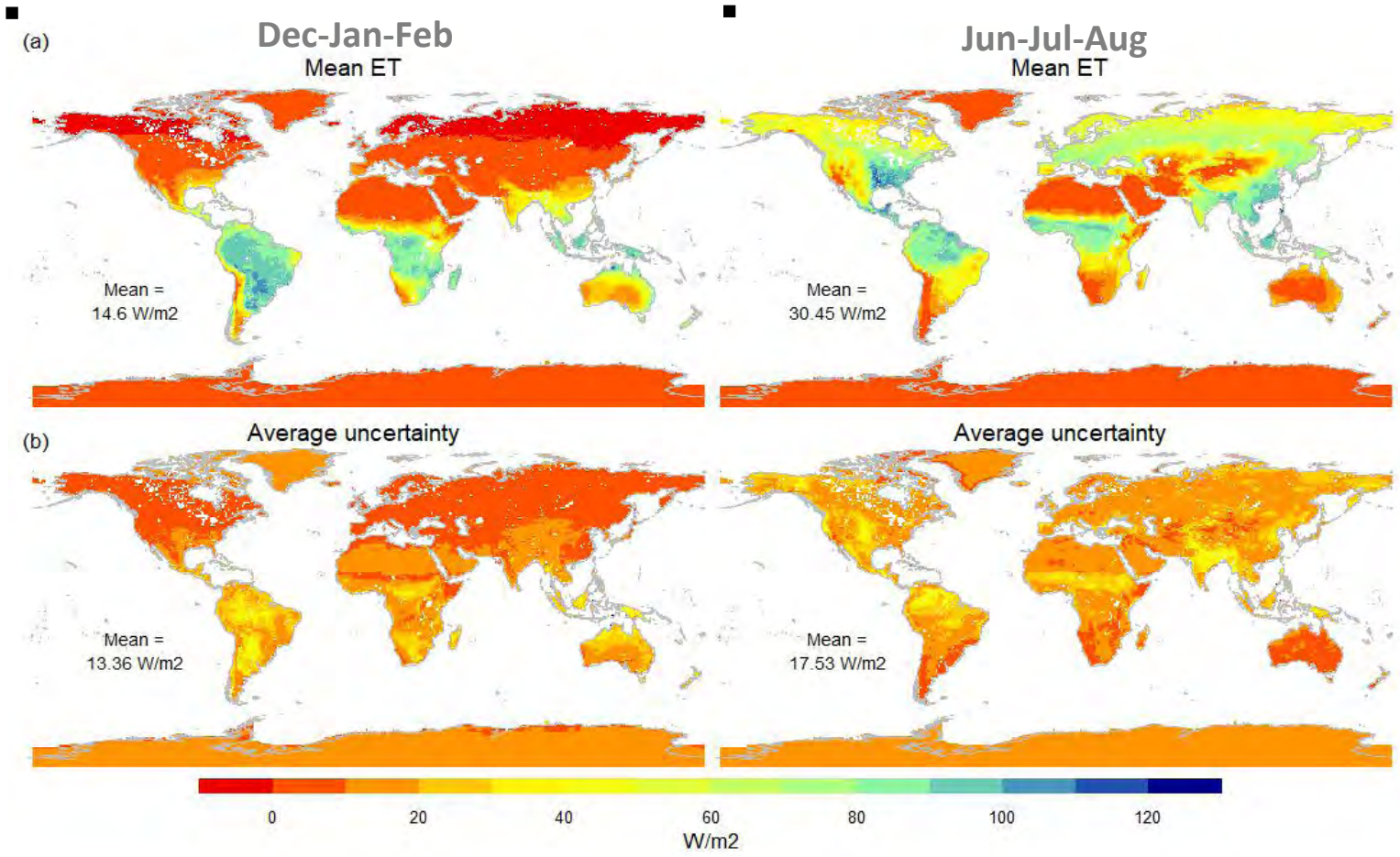
Global evapotranspiration dataset and its associated uncertainty

0.5° spatial resolution and monthly temporal resolution for 2000–2009



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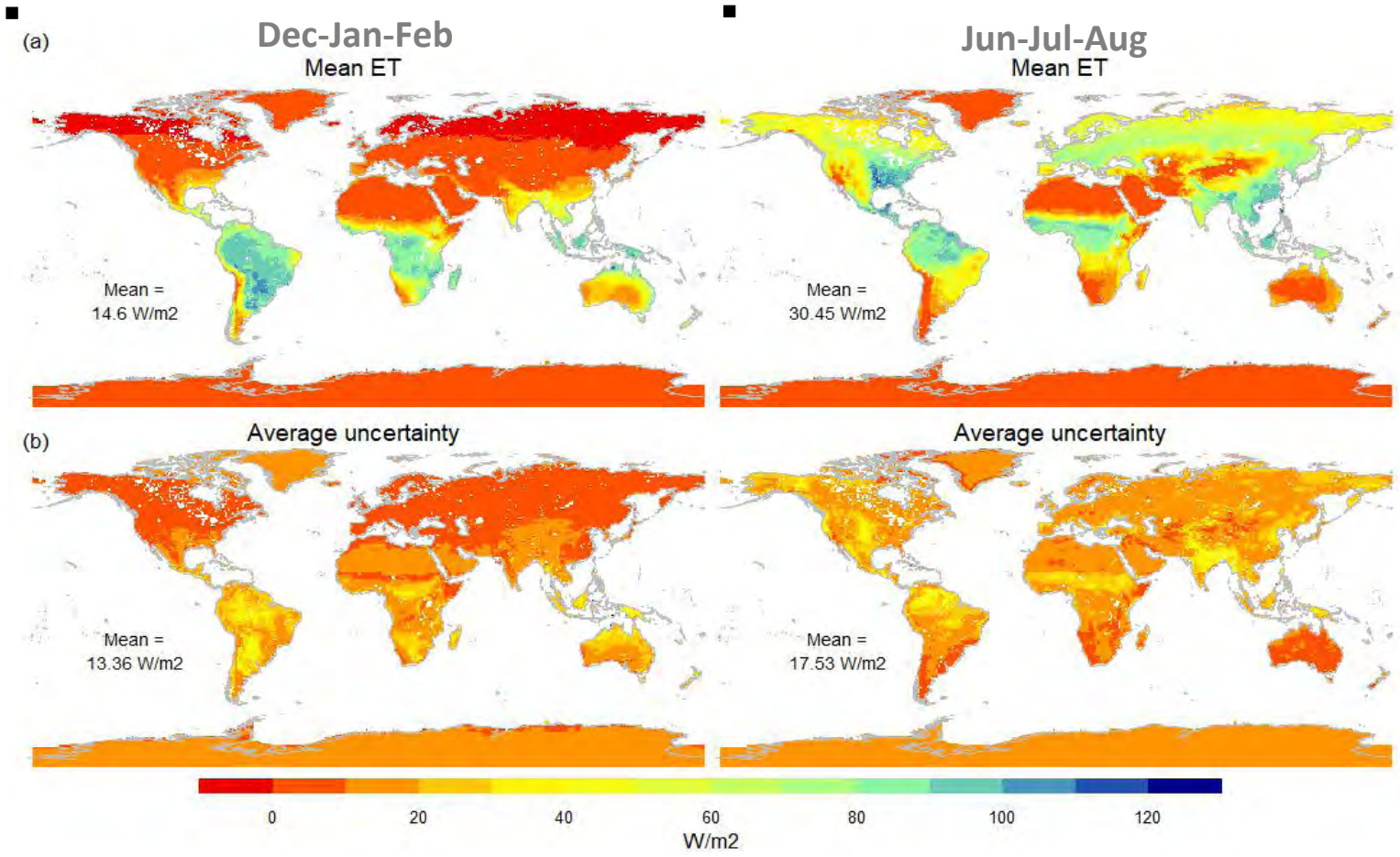
NCI ≡ NCI DATA CATALOGUE



Reference:
Hobeichi, S., Abramowitz, G., Evans, J., and Ukkola, A.: Derived Optimal Linear Combination Evapotranspiration (DOLCE): a global gridded synthesis ET estimate, *Hydrol. Earth Syst. Sci.*, 2018

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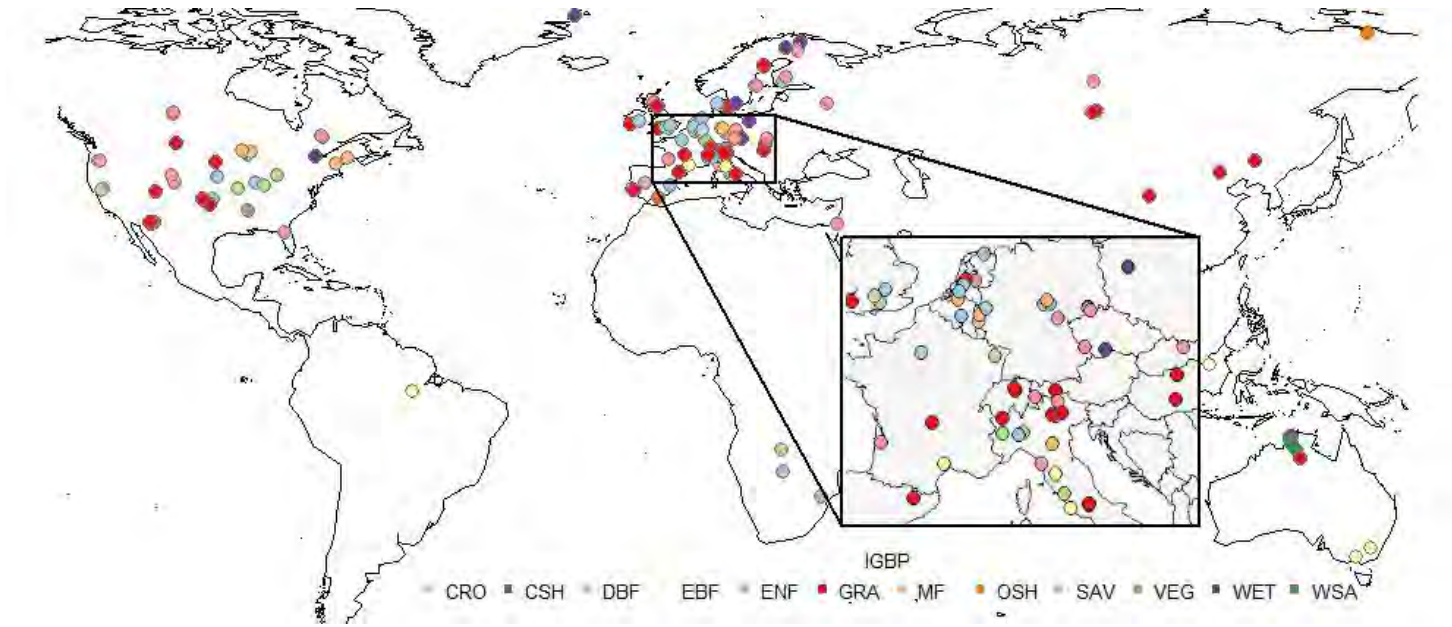

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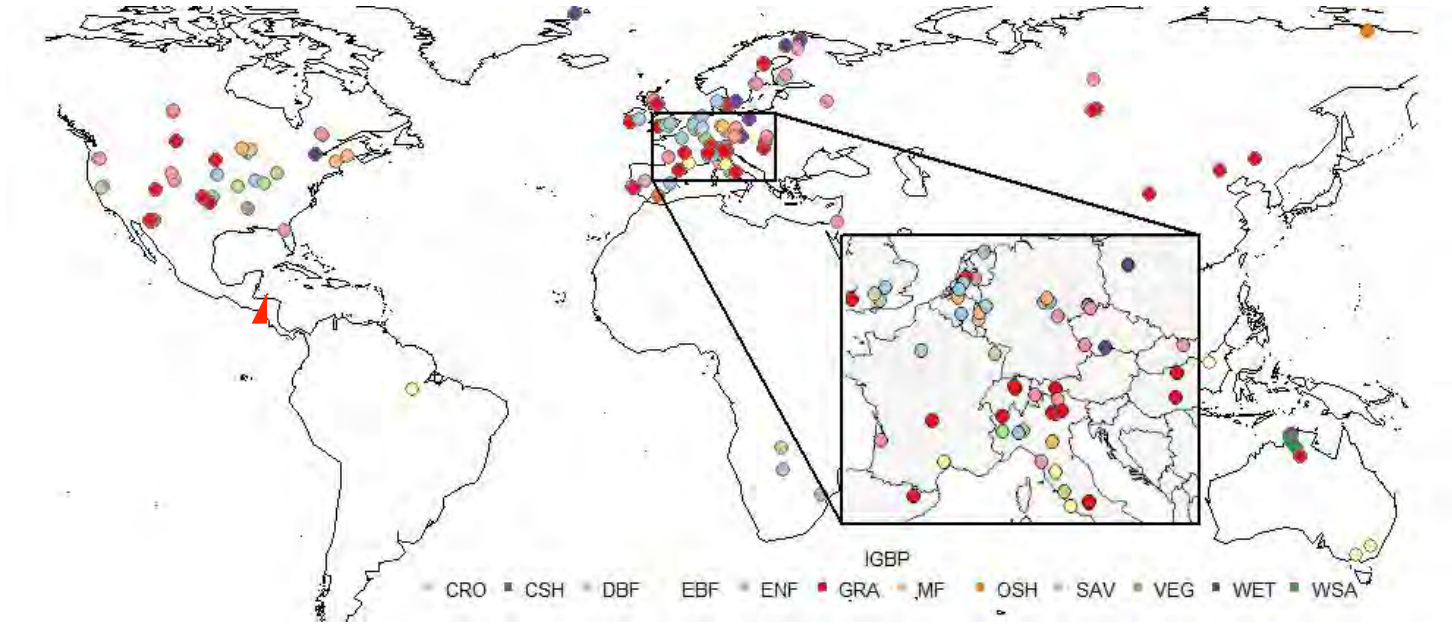

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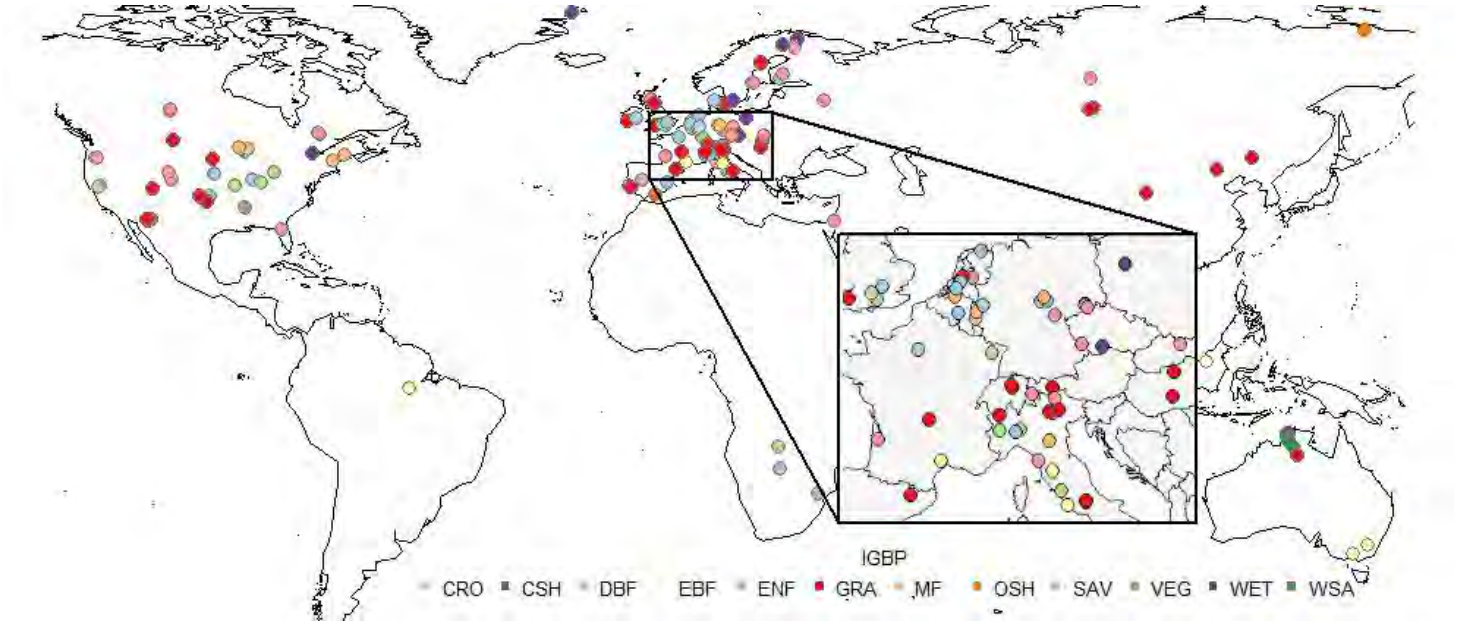

- A common imperfection in all the weighted products will lead to the same imperfection in the derived product.

Summary

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- The weighting approach accounts for both the performance differences and error covariance between the participating ET products.
- The ensemble of flux towers as a whole provides information about the grid cells that contain them

Future Work

- New versions of DOLCE:
  - Incorporate more products
  - Extend the time period

- Use the same weighting method to develop monthly global gridded estimates of complete water and energy budgets.

Thanks for your time and attention

Hobeichi et al.

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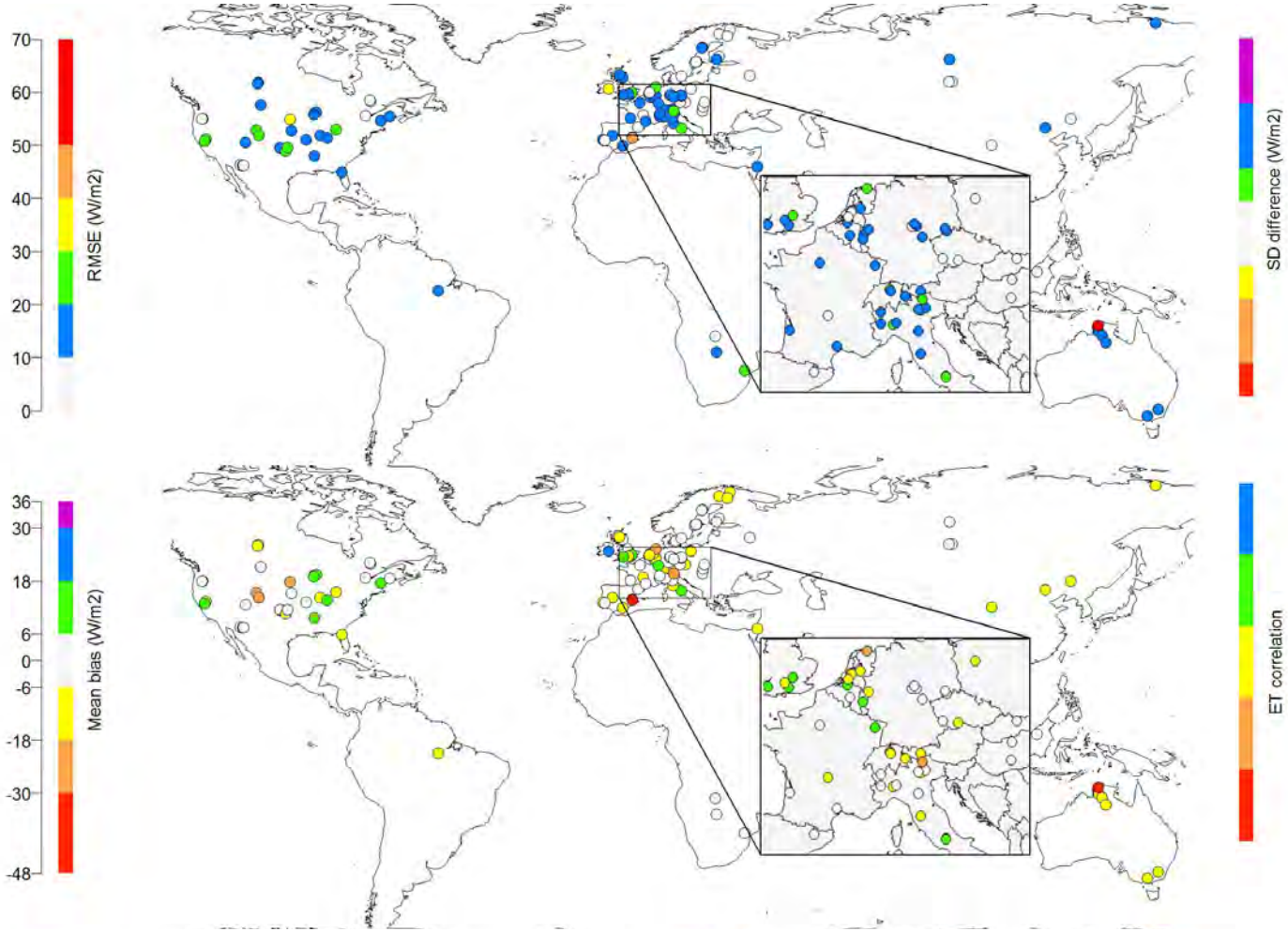
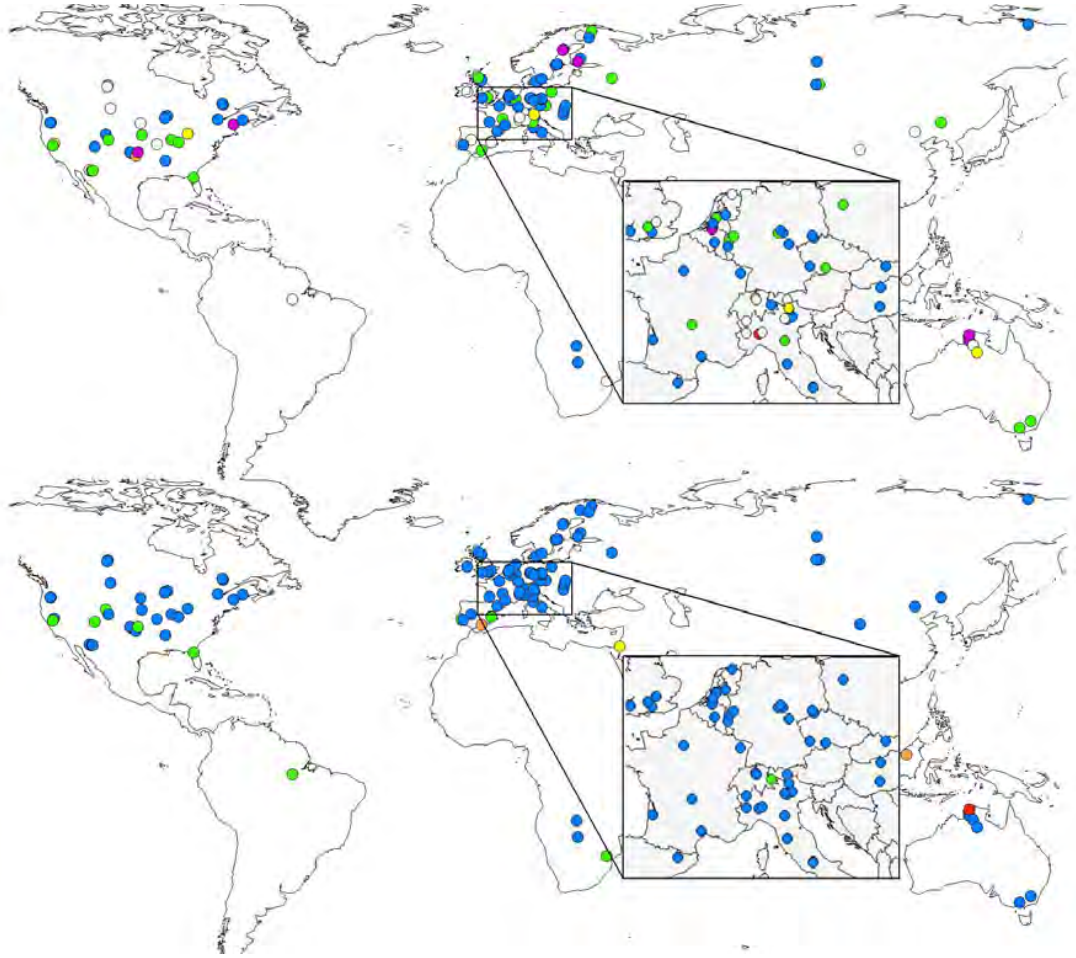
Hydrol. Earth Syst. Sci., 2018

DOLCE- on-site metrics





Global Coverage