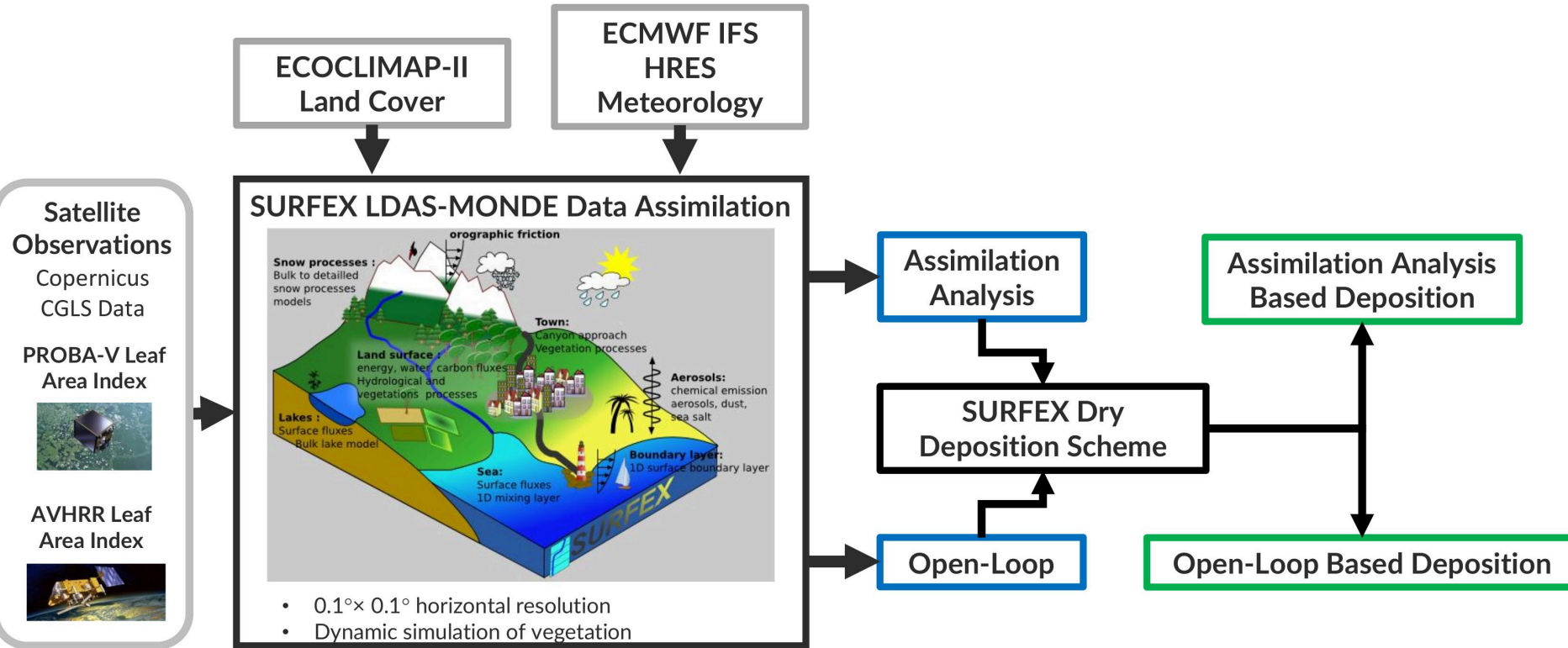


SEEDS - Sentinel EO-based Emission and Deposition Service



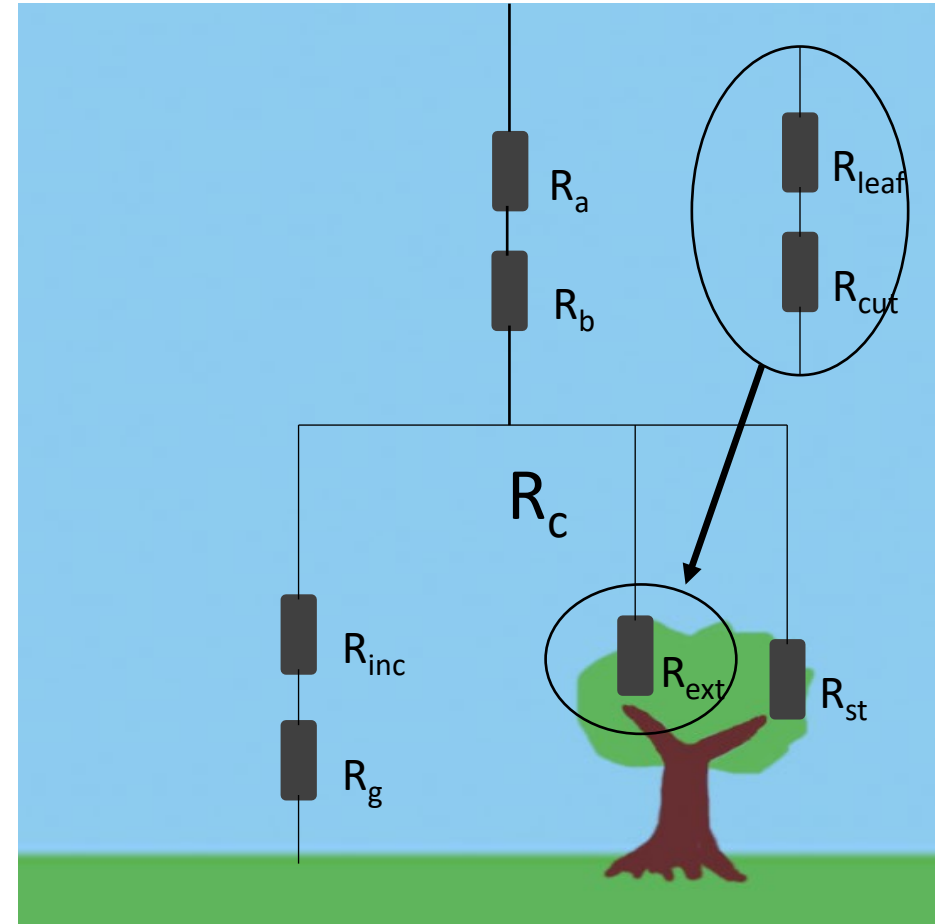
- Develop a dry-deposition add-on service to CAMS that combines:
 - Suitable satellite observations
 - State of the art land surface modelling
 - Recent advancements in dry deposition modelling
 - Land surface-data assimilation.
- Aim to deliver new dry deposition products and services that complement the existing CAMS data product portfolio and expand uses into new market areas.
- We develop a pathway towards operationalisation of the tools and data products.

- Coupling of the dry deposition scheme with an advanced land surface model including dynamic and realistic plant phenology
- Dry deposition scheme within SURFEX will be coupled with the SURFEX LDAS-MONDE data assimilation analyses key land surface variables;
- Estimation of the dry deposition fluxes and diagnostics at the land cover patch type scale in SURFEX including water bodies
- Simulations run with high resolution meteorological forcing from ECMWF.
- Improved estimation of the land surface classification within the CAMS European regional domain;
- Provision of dry deposition products for users in downstream applications.



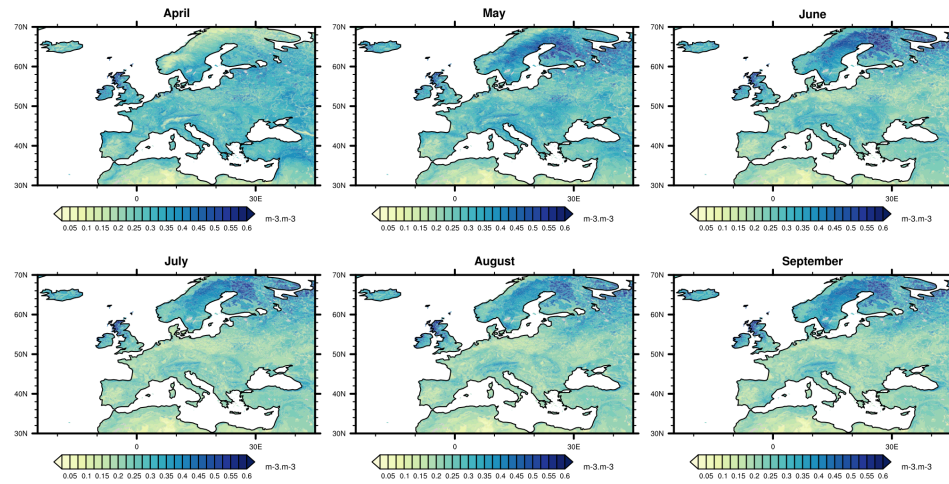
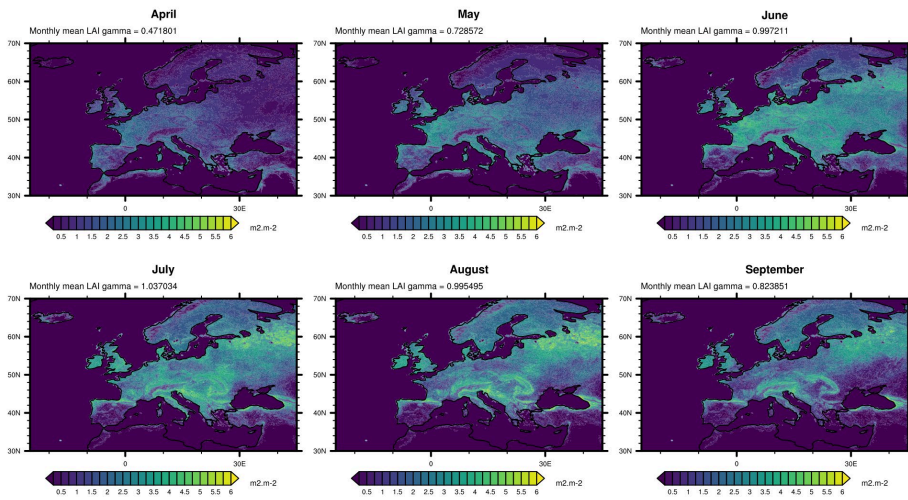
- A new dry deposition scheme was developed and implemented within SURFEX.
- The dry deposition scheme was based on the scheme used in EMEP.
- Notable differences relative to existing scheme include:
 - Different treatment of reactive gases over fresh and salt water,
 - modified treatment of nitric acid,
 - reduced deposition of ozone over sandy soils and desert
- Dry deposition schemes describe the deposition of gases using a resistance analogy model.
- Surface deposition fluxes, F , of gas concentrations, C , are calculated via $F = C \times V_d$

$$V_d = \frac{1}{R_a + R_b + R_c}$$



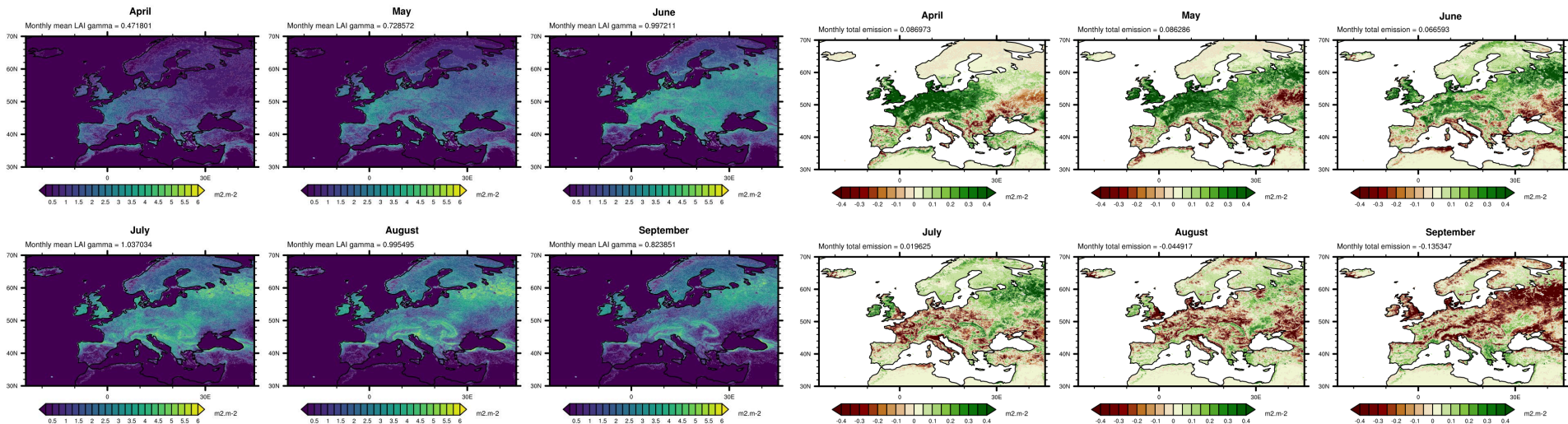
LAI 2019 – Assimilation Analysis

Root Zone Soil Moisture 2019 – Assimilation Analysis



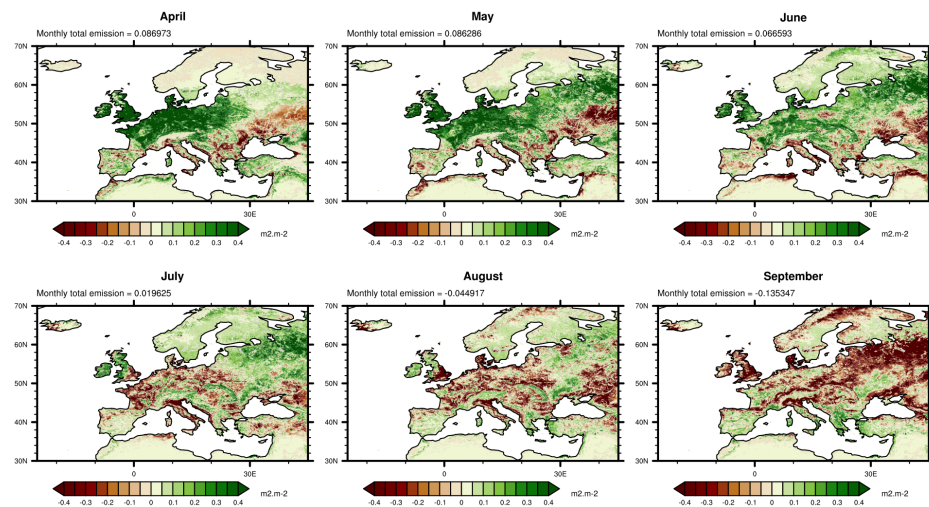
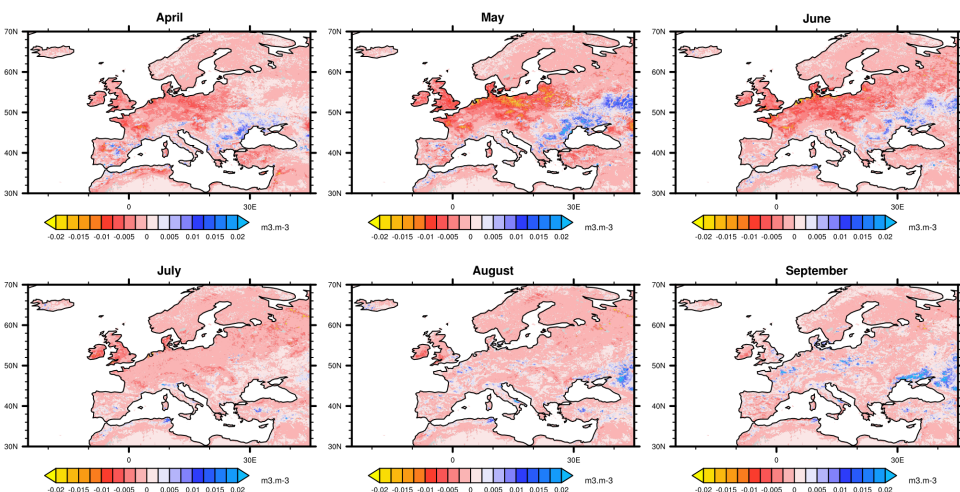
LAI 2019 – Assimilation Analysis

LAI 2019 – Assimilation Analysis minus Open Loop



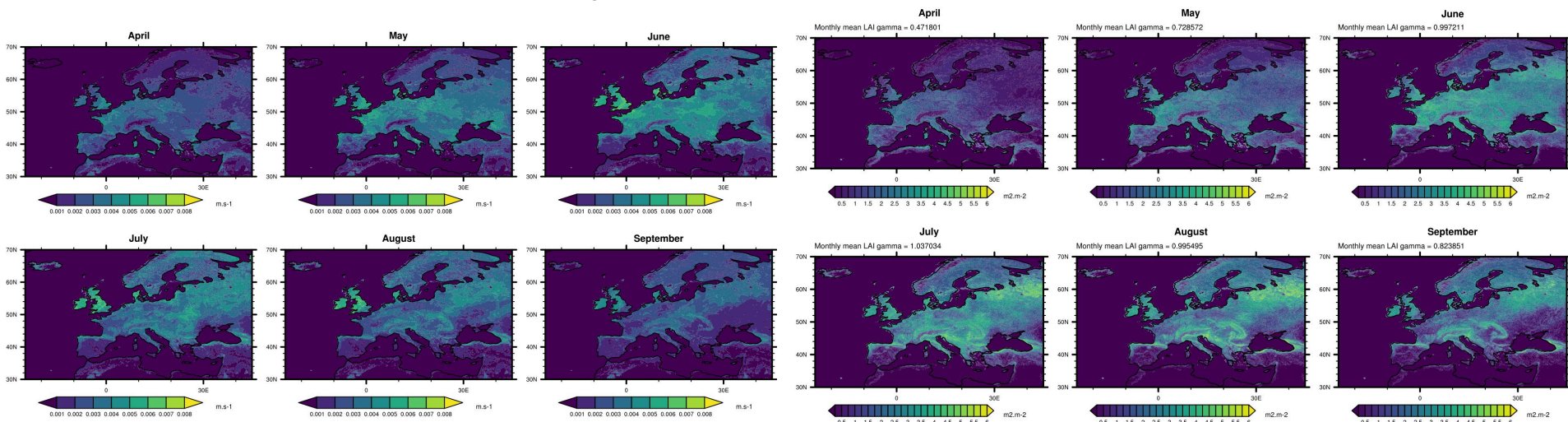
Root Zone Soil Moisture 2019 – Assimilation Analysis minus Open Loop

LAI 2019 – Assimilation Analysis minus Open Loop



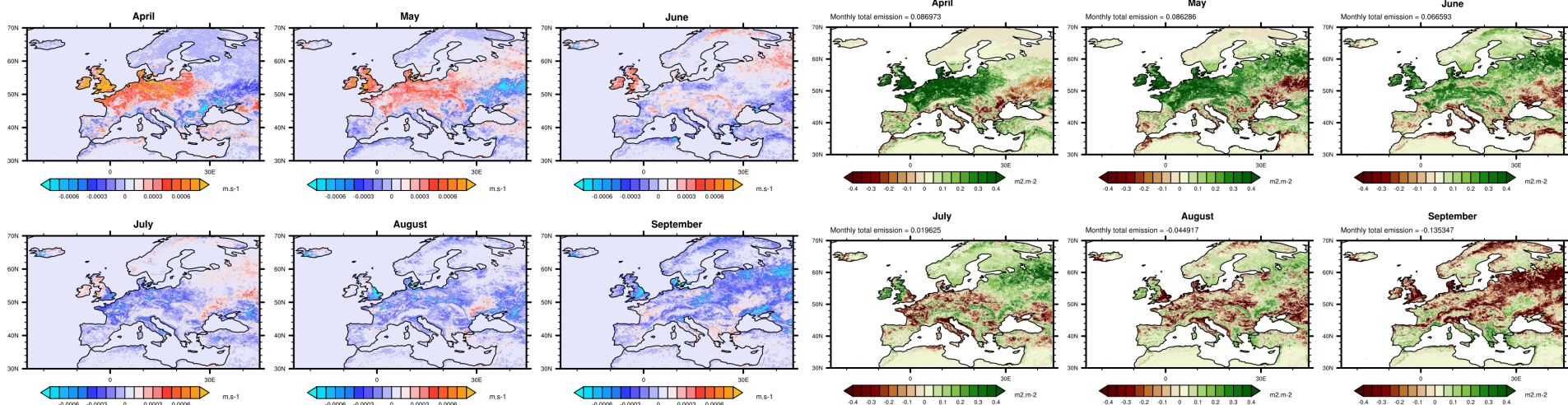
Ozone Deposition Velocity 2019 – Assimilation Analysis

LAI 2019 – Assimilation Analysis



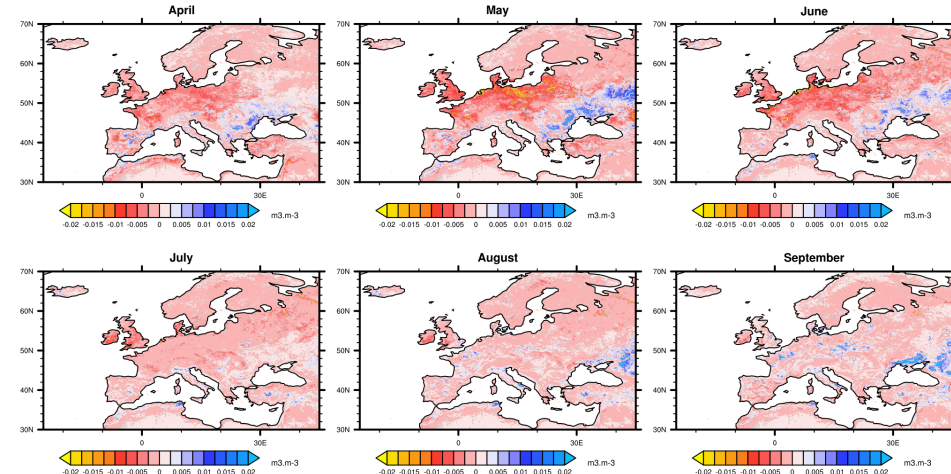
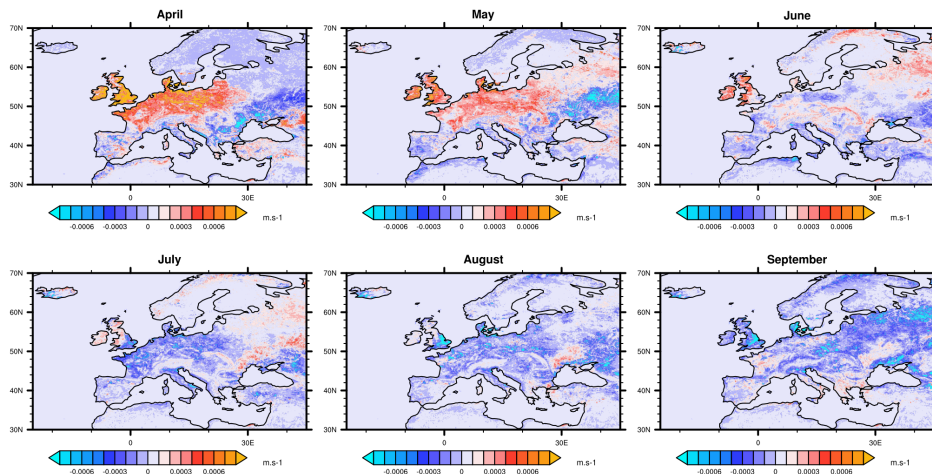
Ozone Deposition Velocity 2019 – Assimilation Analysis minus Open Loop

LAI 2019 – Assimilation Analysis minus Open Loop



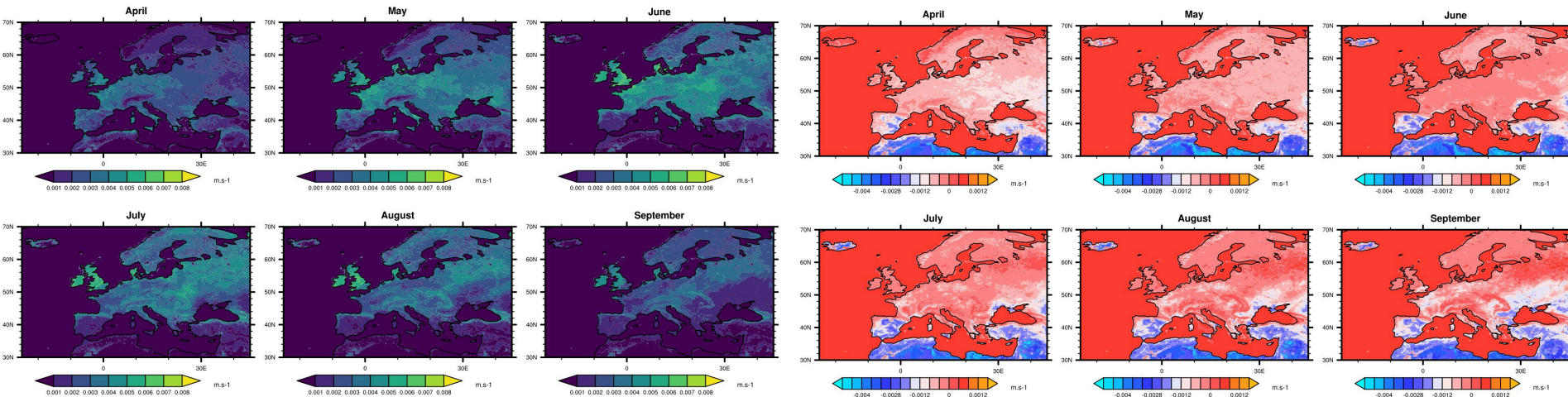
Ozone Deposition Velocity 2019 – Assimilation Analysis minus Open Loop

Root Zone Soil Moisture 2019 – Assimilation Analysis minus Open Loop



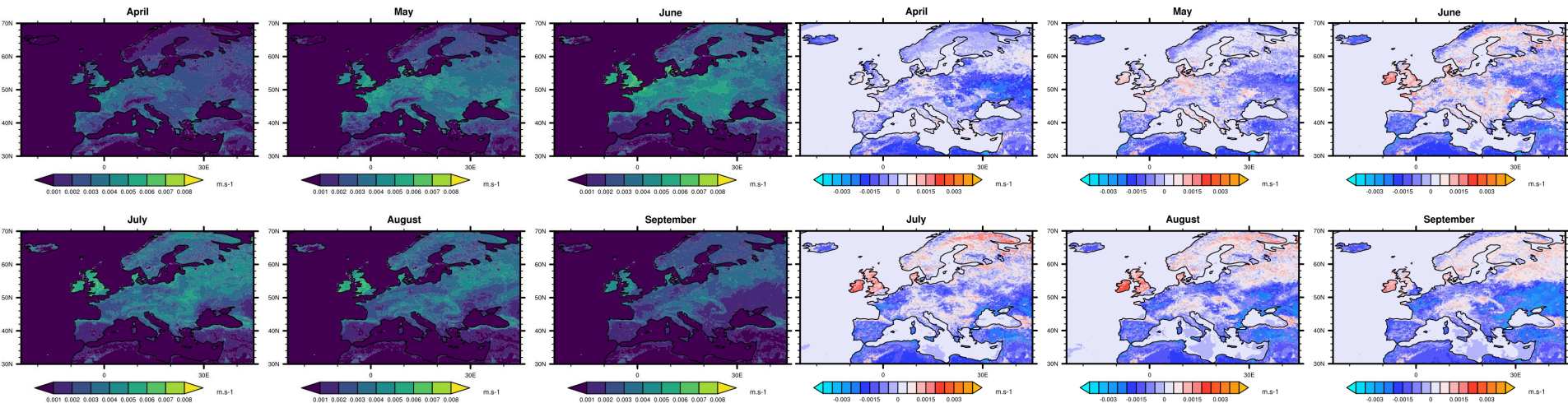
Ozone Deposition Velocity 2019 – Assimilation Analysis

Ozone Deposition Velocity 2019 – EMEP21 minus Wesely '89



Ozone Deposition Velocity 2019 – Assimilation Analysis

Ozone Deposition Velocity 2019 – EMEP21 minus SUMO



Advances and advantages:

- Deposition for individual land surface types resolved at sub-grid scale.
- Advancements made upon existing Wesely '89 deposition scheme.
- Diagnostics available for diagnosis of model behaviour.
- Dynamic LAI supported by data assimilation.
- Land surface model permits earth system approach allowing vegetation-meteorology feedbacks.

Disadvantages, weaknesses, and areas where we need more work:

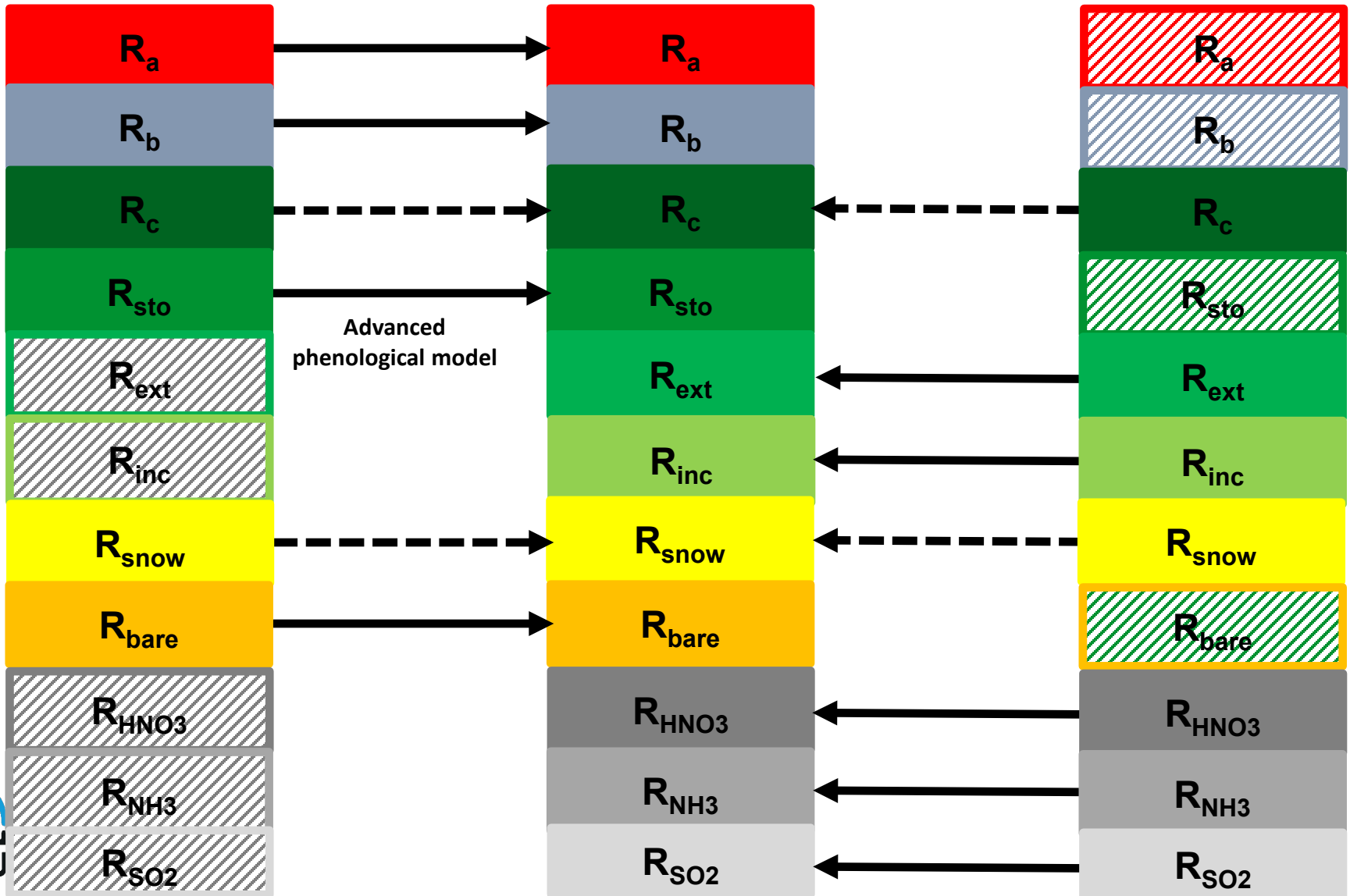
- Sandy soil resistances need to be further investigated.
- More work needed to compare to other model datasets, e.g., PINETI, EMEP, and DEHM deposition products.
- More work needed to compare to observations.

Replacement or Merging?

Wesely-SURFEX

SURFEX-Merge (EMEP21)

EMEP

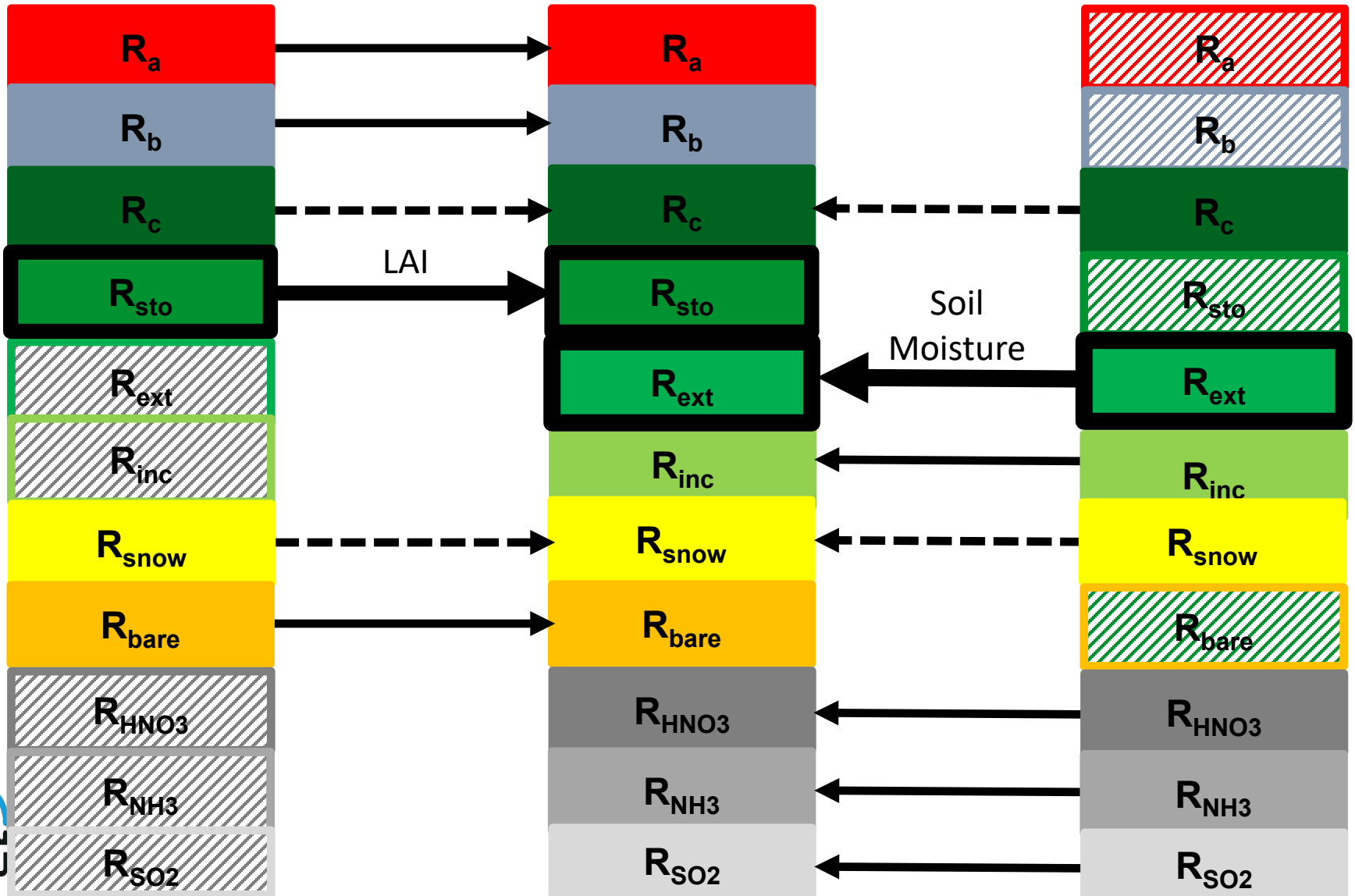


Replacement or Merging?

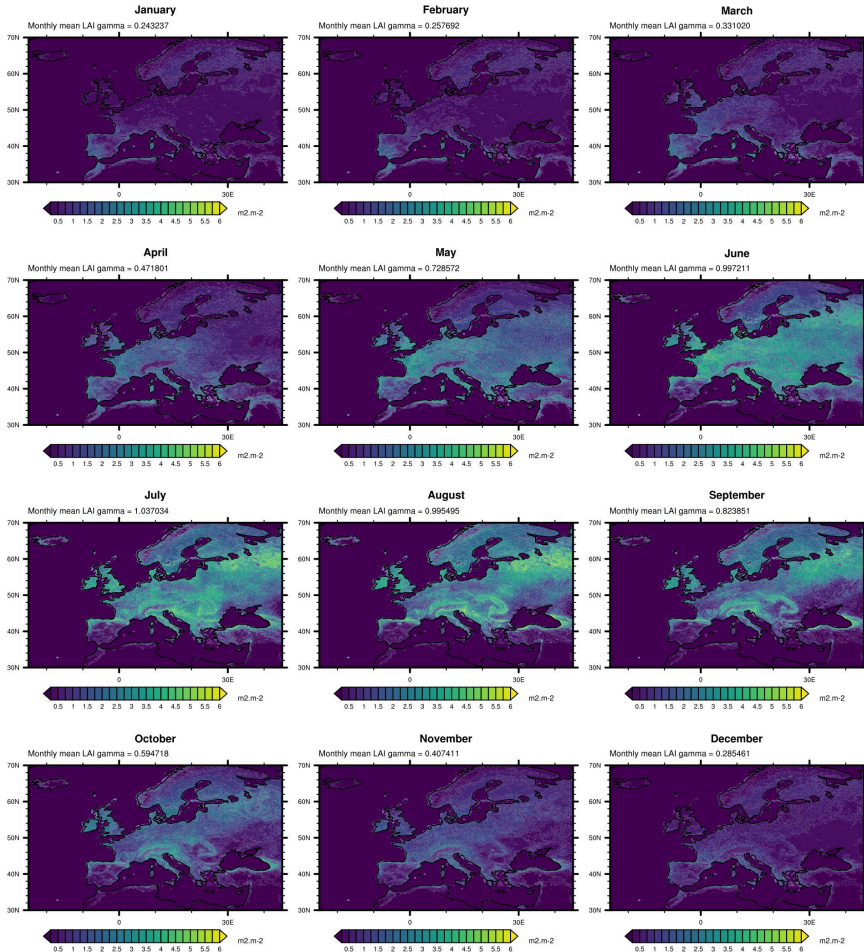
Wesely-SURFEX

SURFEX-Merge (EMEP21)

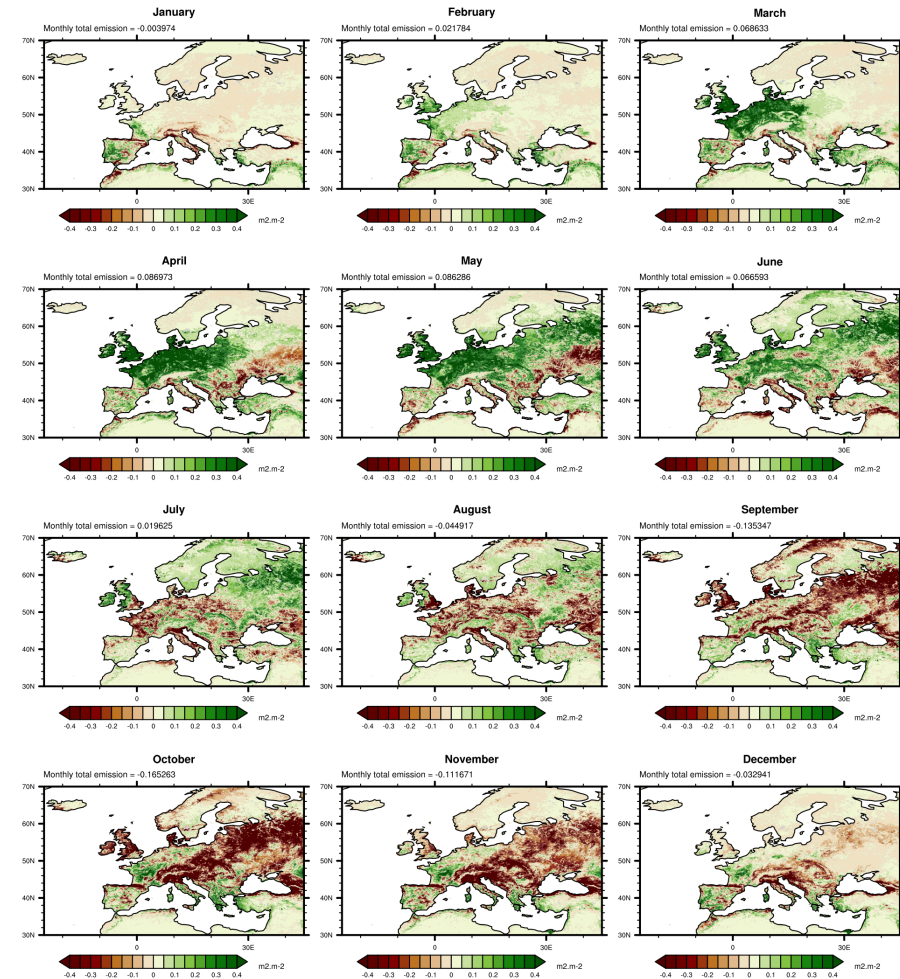
EMEP



Monthly Mean LAI Gamma Over the CAMS European Domain for 2019 - LAI Analysis

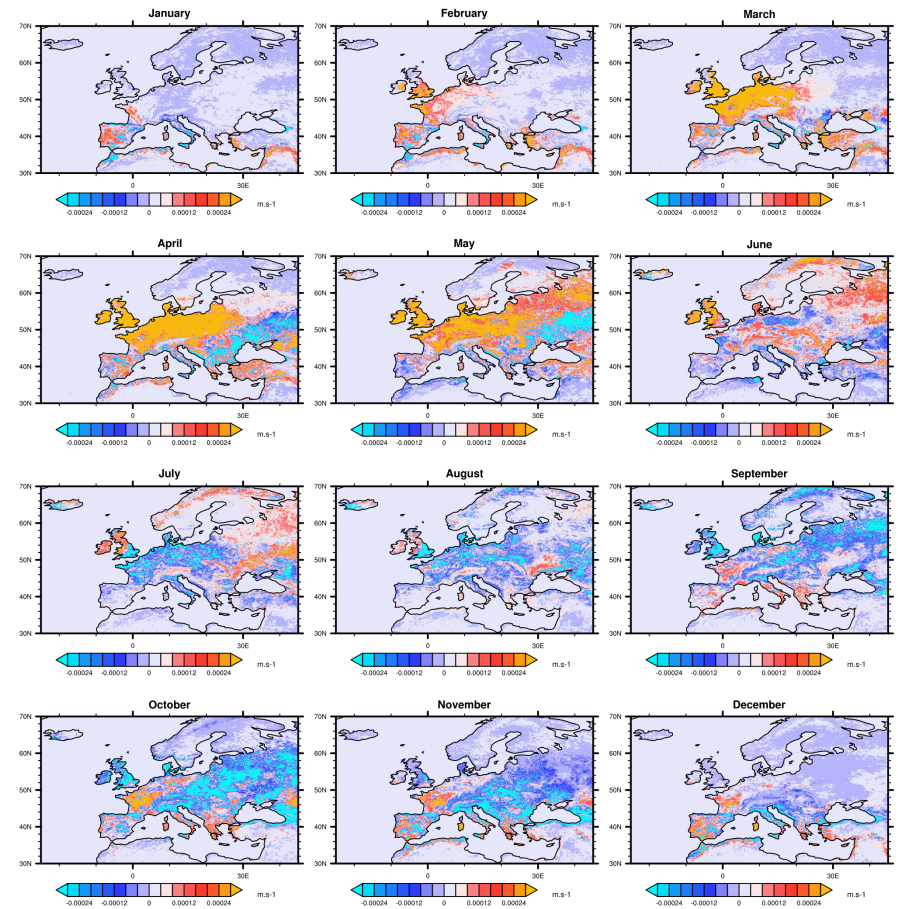
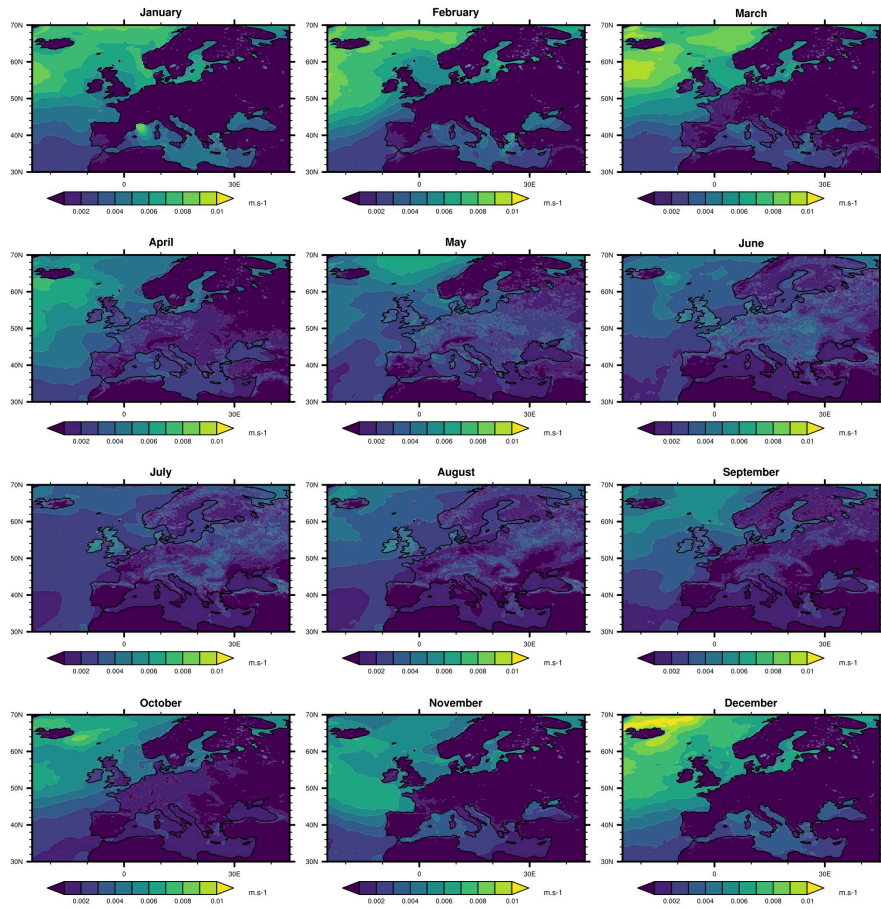


Monthly Mean Difference in Analysis Minus Open Loop LAI Over the CAMS European Domain for 2019



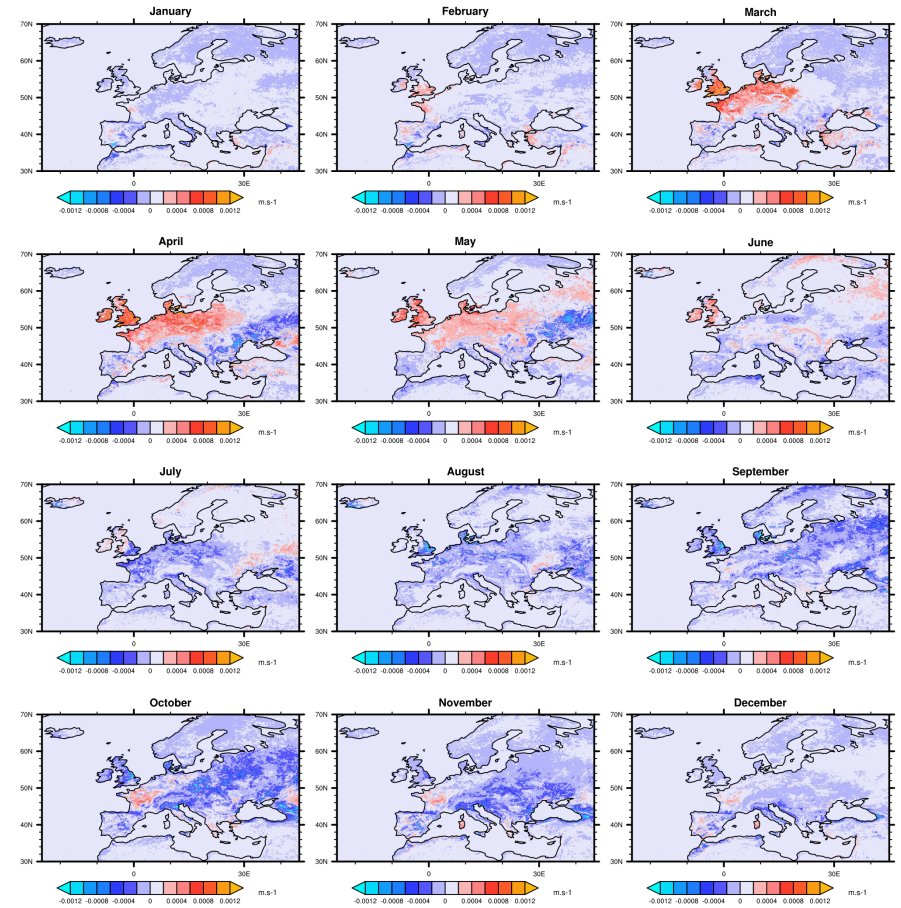
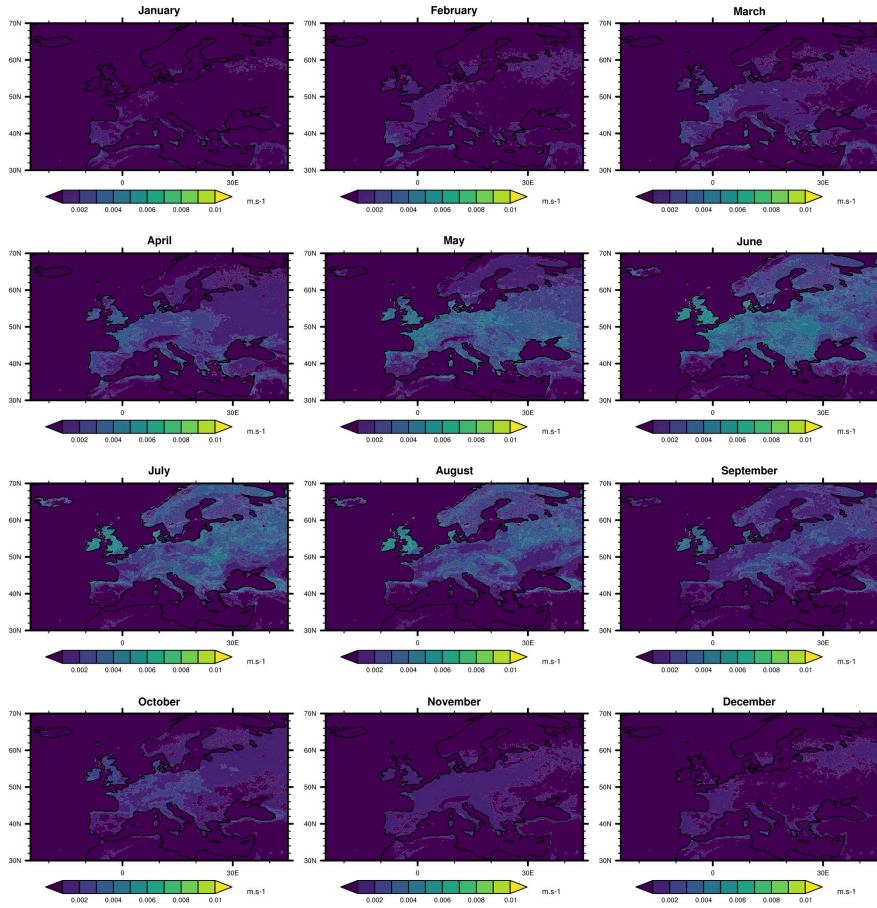
Monthly Mean SO₂ Deposition Velocity Over the CAMS European Domain for 2019 - LAI Analysis

Monthly Mean Difference in Analysis Minus Open Loop SO₂ Deposition Velocity Over the CAMS European Domain for 2019 - EMEP21



Monthly Mean NO₂ Deposition Velocity Over the CAMS European Domain for 2019 - LAI Analysis

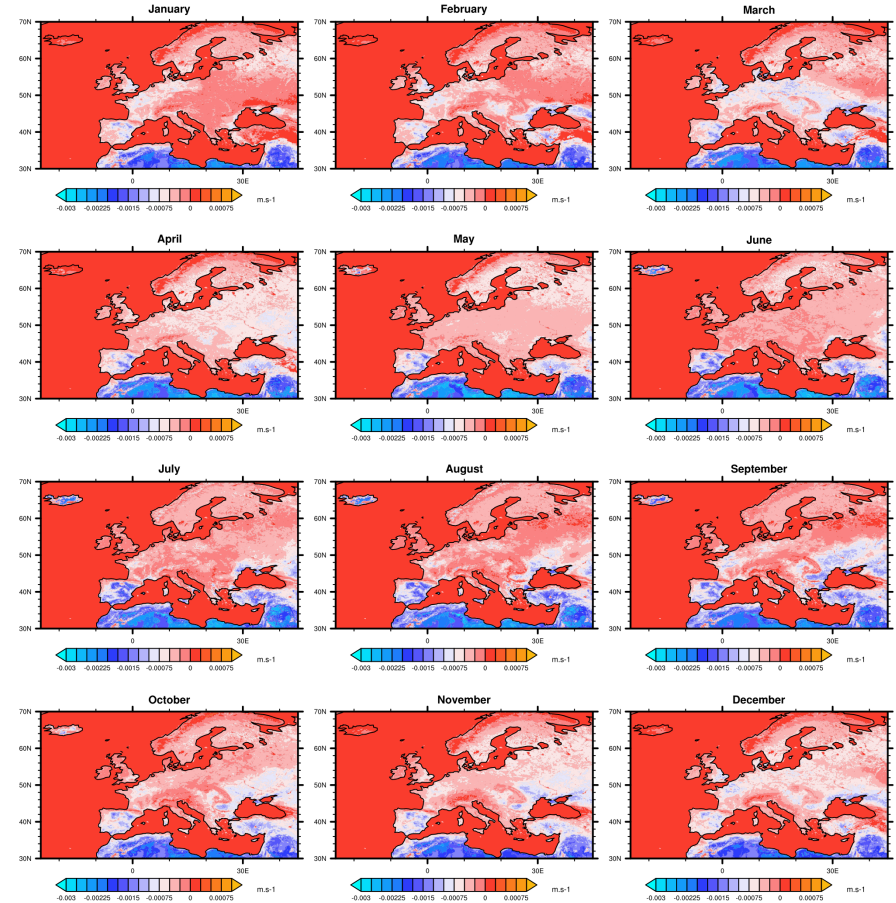
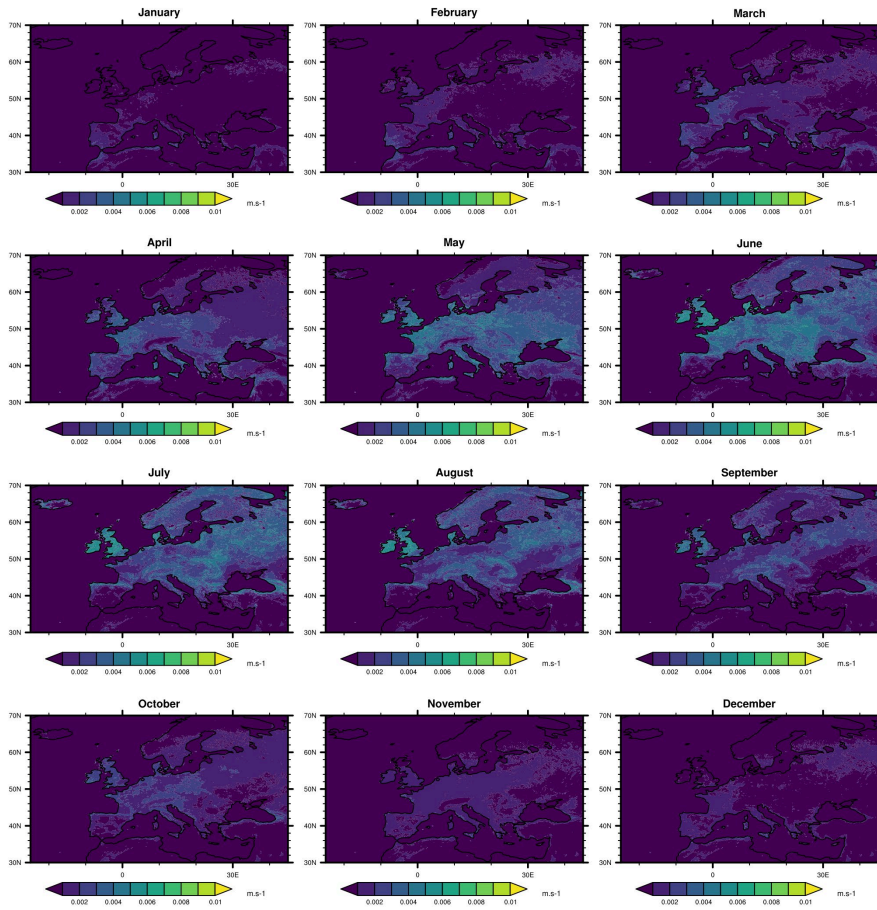
Monthly Mean Difference in Analysis Minus Open Loop NO₂ Deposition Velocity Over the CAMS European Domain for 2019 - EMEP21



Impact of New Deposition Scheme

Monthly Mean NO₂ Deposition Velocity Over the CAMS European Domain for 2019 - LAI Analysis

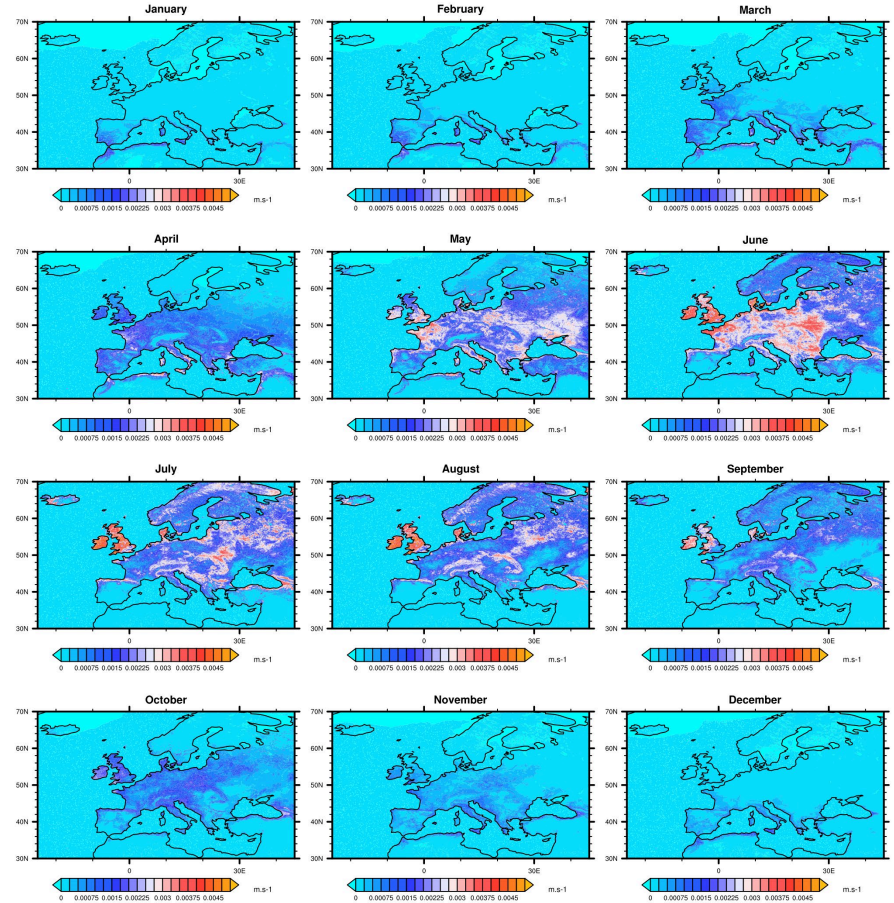
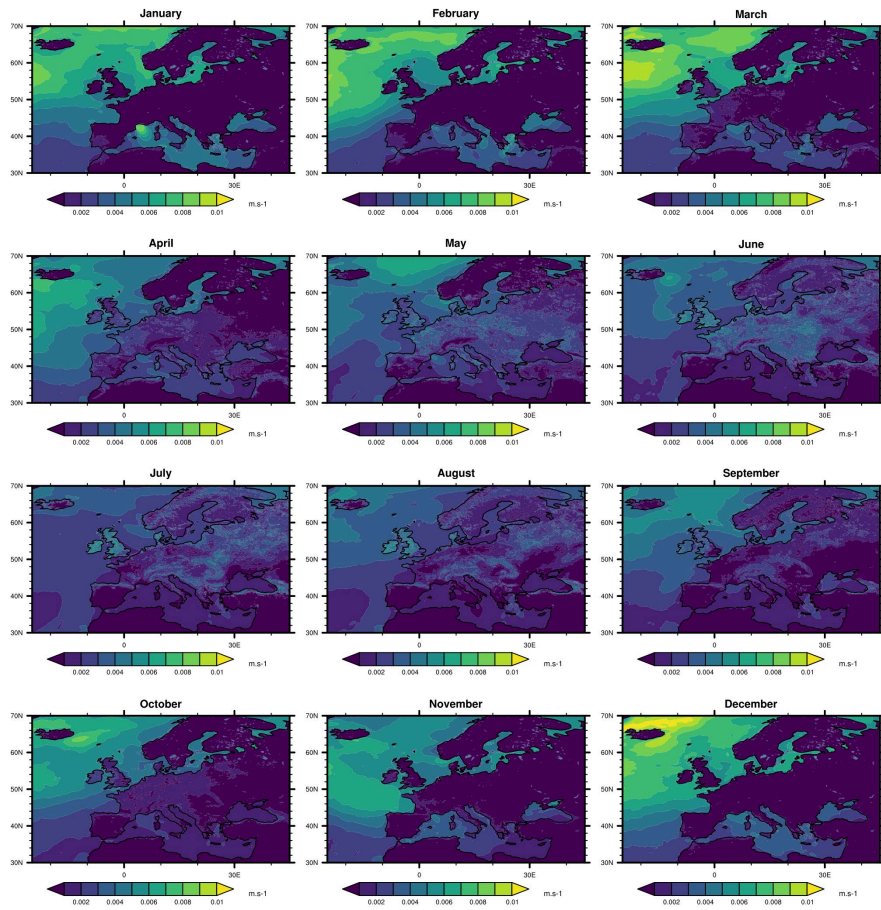
EMEP '21 Minus Wesely '89 Monthly Mean Difference in NO₂ Deposition Velocity Over the CAMS European Domain for 2019



Impact of New Deposition Scheme

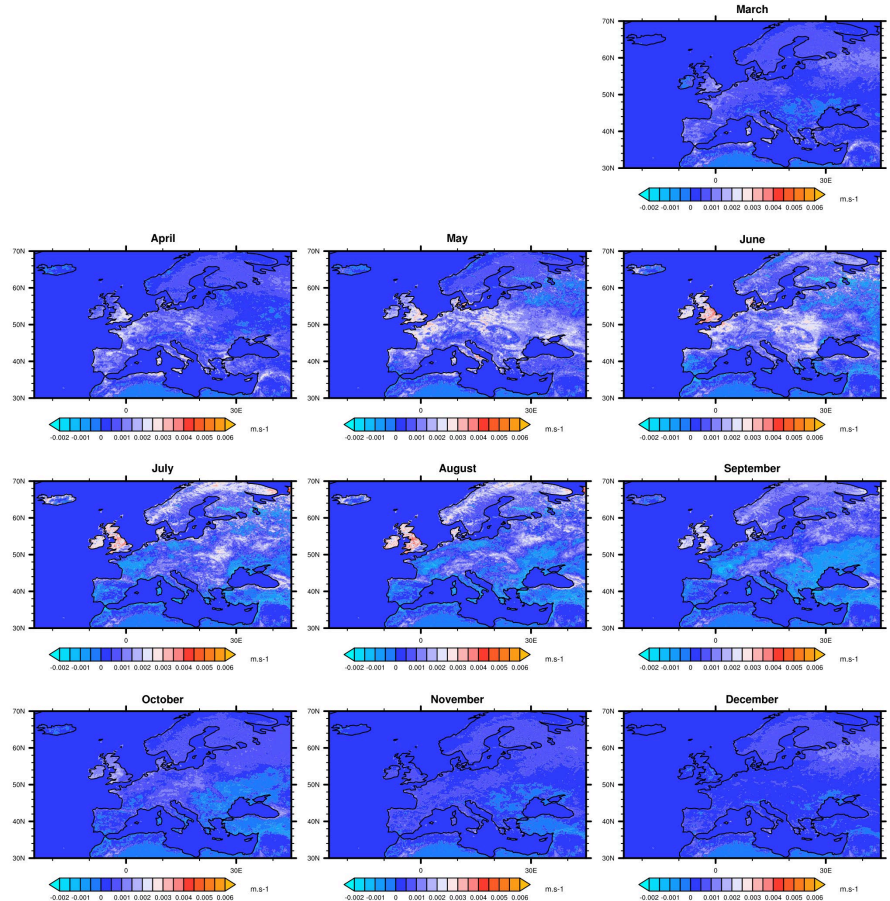
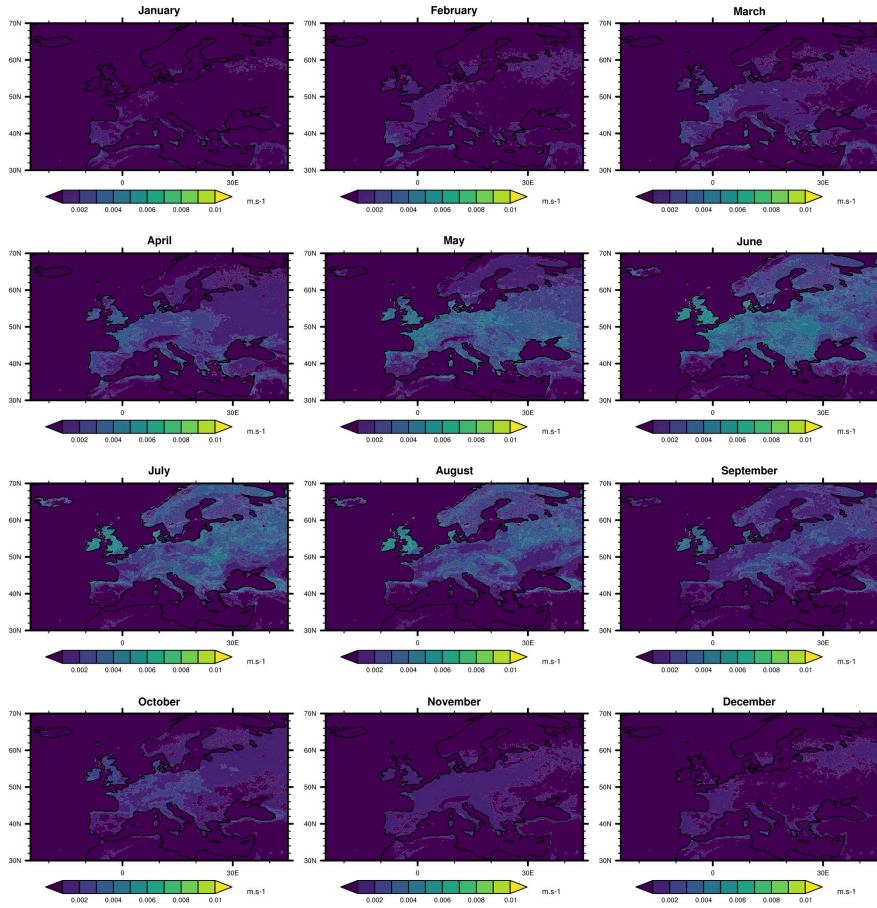
Monthly Mean SO₂ Deposition Velocity Over the CAMS European Domain for 2019 - LAI Analysis

EMEP '21 Minus Wesely '89 Monthly Mean Difference in SO₂ Deposition Velocity Over the CAMS European Domain for 2019



Monthly Mean NO₂ Deposition Velocity Over the CAMS European Domain for 2019 - LAI Analysis

Monthly Mean Difference in NO₂ Deposition Velocity Over the CAMS European Domain for 2019: SURFEX minus SUMO



Comparison to SUMO (MOCAGE)

Monthly Mean SO₂ Deposition Velocity Over the CAMS European Domain for 2019 - LAI Analysis

Monthly Mean Difference in SO₂ Deposition Velocity Over the CAMS European Domain for 2019: SURFEX minus SUMO

