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9:00-9:40 Welcome and Introduction to the GA		
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CONFESS

Consistent representation of temporal variations of boundary forcing in reanalyses and seasonal forecasts

CONFESS in a nutshell

CONFESS aims at **improving the representation of global trends and regional extremes in next generation of C3S earth system reanalyses and seasonal forecasts,** by taking stock of observational data sets and model developments across different Copernicus Services on vegetation, land cover, atmospheric composition and biomass burning.

- **R2O project**: Developments under CONFESS will be implemented operationally in C3S –ERA6 and seasonal

- **Continuous development cycle**: taking stock on dataset developments within COP1 to improve Services in COP2

- **A needed steppingstone for further exploitation of Earth Observations for services :**
  the developments of CONFESS are needed for further improvements in modelling and data assimilation of land and atmospheric composition.

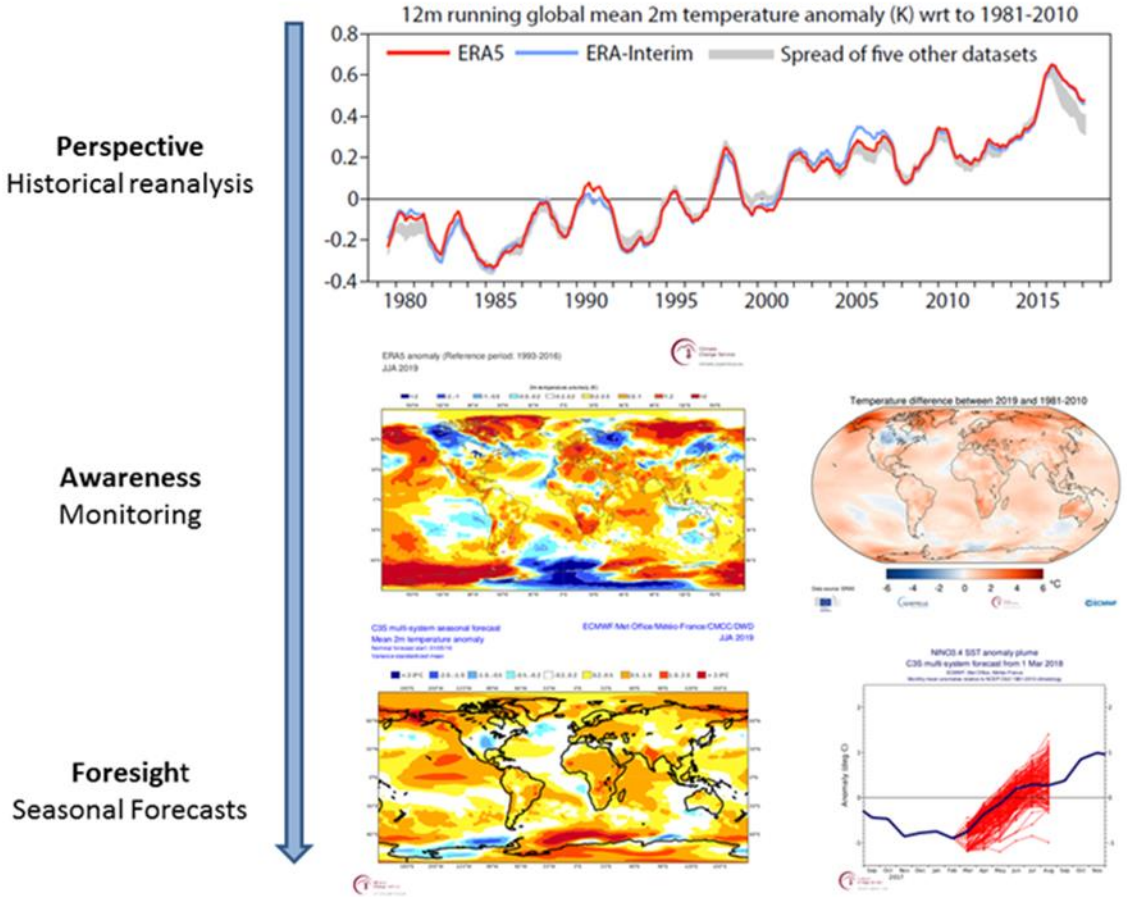
CONFESS aim

To improve the reliability and usability of C3S information by capitalizing on the synergies between Copernicus services, and pave the way for a continuous evolution of the services

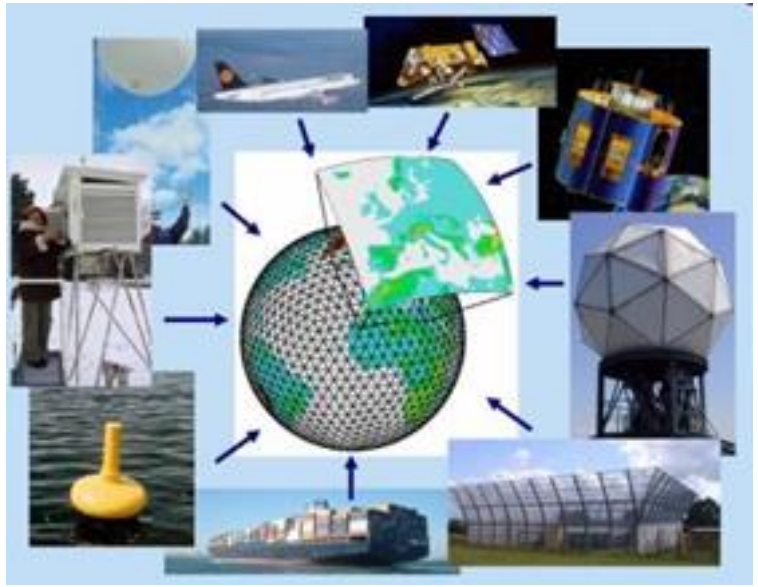
Under the undeniable threat of climate change society must now become resilient to changes in climate over the coming decades.

C3S supports society by providing **authoritative information** about the **past, present and future climate**

The quality of the C3S information has granted Europe a leading role in climate services. Maintaining this leading role **requires a continuous evolution.**



Basis of authoritative climate information



The warrant of the "authoritative" qualifier for the information provided by C3S is the use of:

1) the most sophisticated and well-validated Earth System Models (ESM)

2) data assimilation capabilities, able to consistently **integrate a**

3) wealth of Earth Observations (EO)

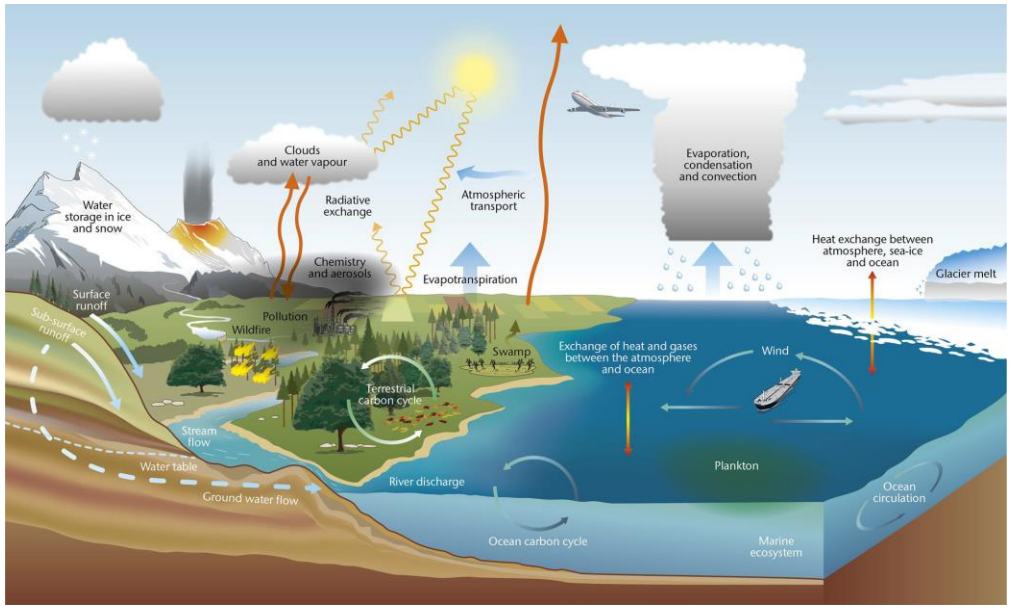
to estimate the past and present state of the climate, and to propagate this information into the future via initialised predictions

What is missing from the above list?

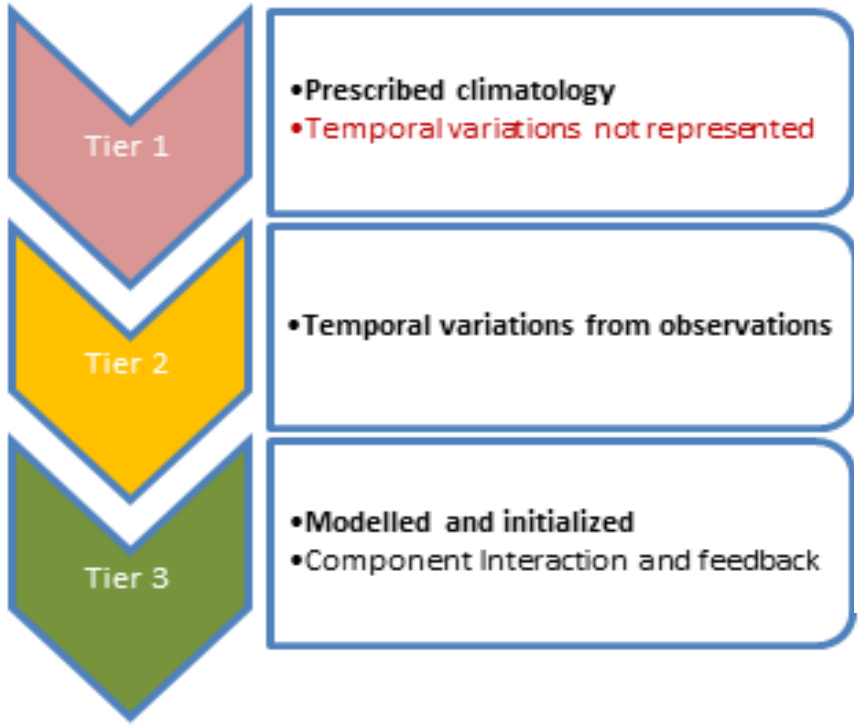
Faithful and consistent treatment of the **temporal evolution of the boundary forcings** is an essential ingredient for actionable climate information

Boundary forcings and complexity in Earth System monitoring and forecasting

- Physical basis for inclusion
- Ability to model
- Ability to initialize
- Affordability



Hierarchical representation of an earth system component



Vegetation, land use aerosols

C02 in reanalyses Solar

Atmosphere, ocean, waves, sea-ice, soil moisture, snow,

What is done now?

1) Land Cover/Use and Vegetation in reanalysis and seasonal forecasts are represented by climatological values. Suboptimal.

- This climatology needs updating.
- It is important to include time variations

2) Tropospheric aerosols:

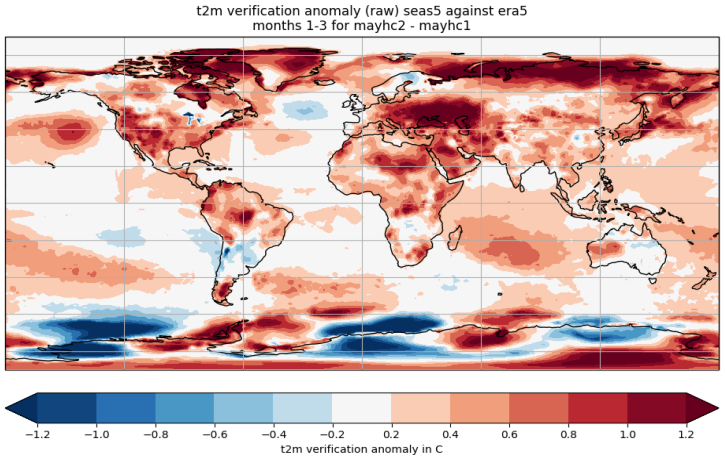
- Obsolete treatment of tropospheric aerosols in reanalyses and seasonal forecasts.
- Inconsistent specification in Weather and Climate
- Not consistency between CMIP6 and most recent state of the art CAMS estimation.

3) No capability in C3S system to react to hazardous events such as large volcanic eruptions and fires

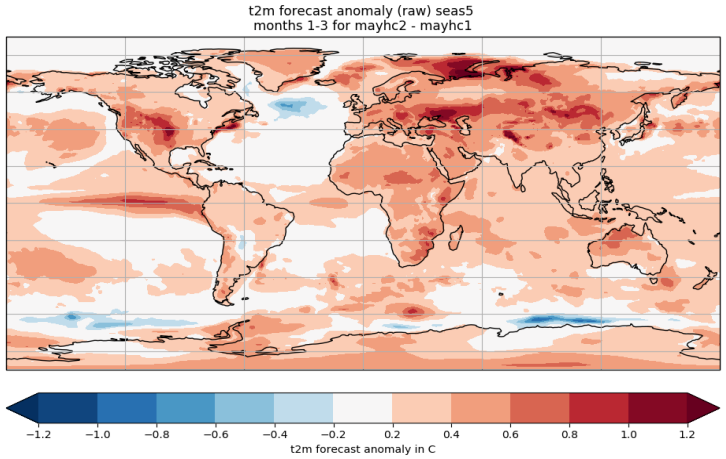
The current treatment of boundary forcing in reanalyses and seasonal forecasts is suboptimal

Seasonal Forecast errors manifest in T2m trends: JJA Period Difference 2007-2020 v 1993-2006

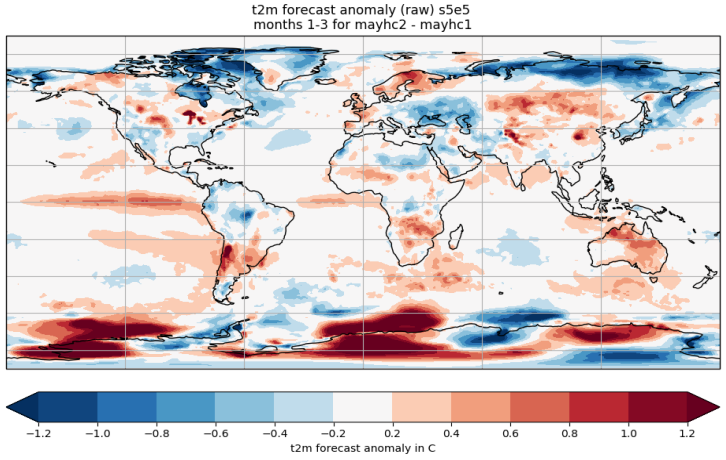
ERA5



SEAS5



SEAS5 –ERA5



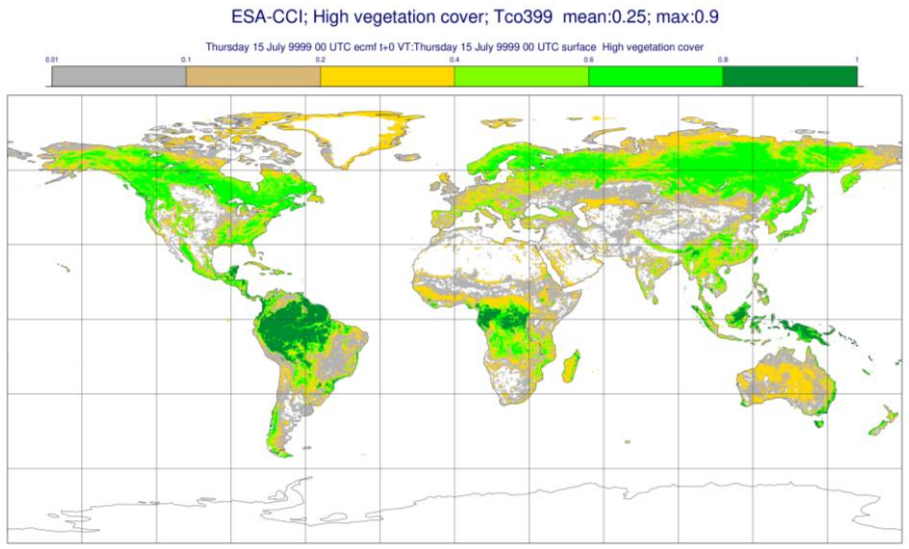
Seas5 underestimate regional trends over East Canada and Siberia areas, South Central Europe

SEAS5 overestimate T2m trends over Himalayas/Tibetian plateau, North Western Europe

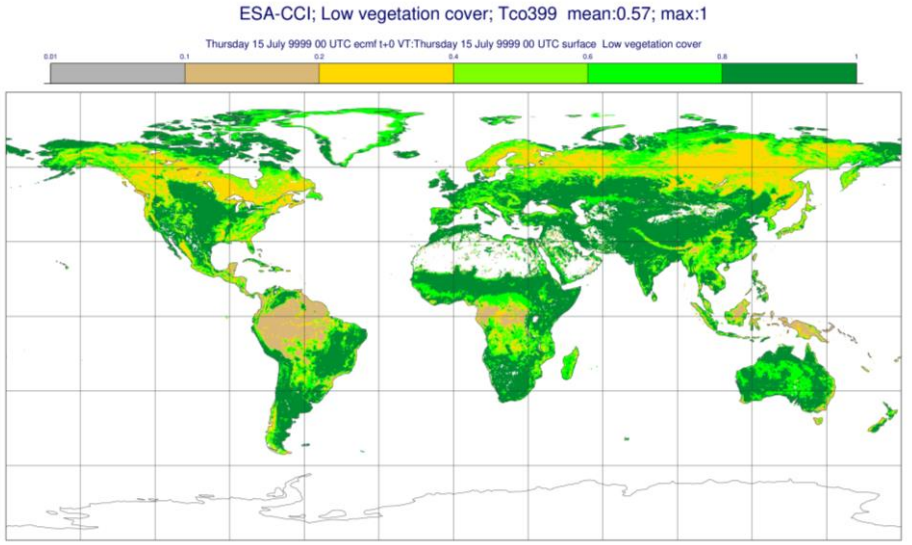
Seas5 also exhibits wrong trends in circulation and Tropical Cyclones (Vitart 2021)

Vegetation cover

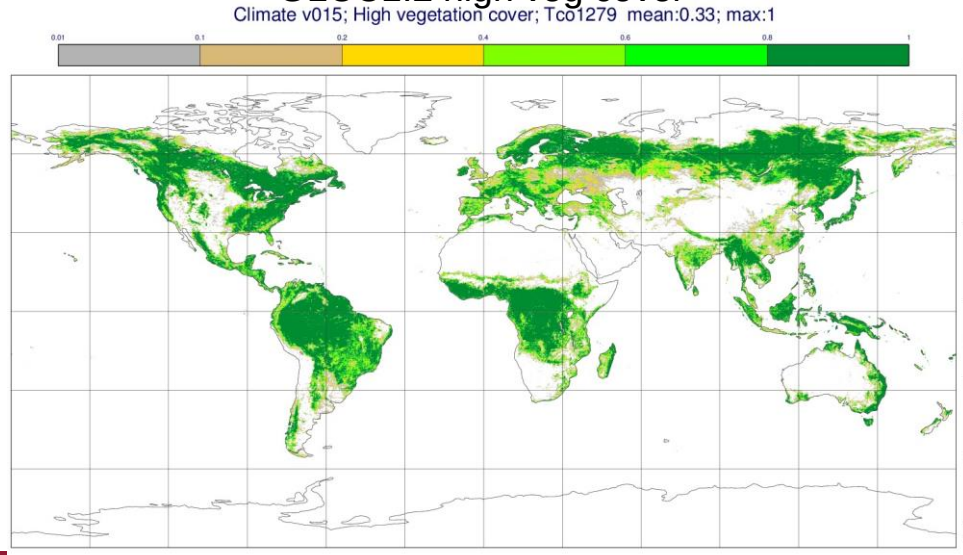
ESA-CCI high veg cover



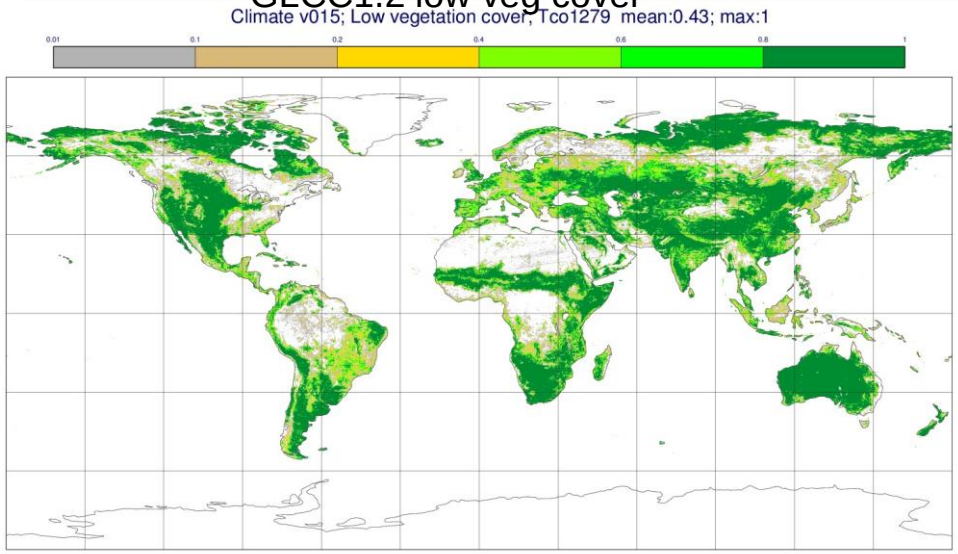
ESA-CCI low veg cover



GLCC1.2 high veg cover



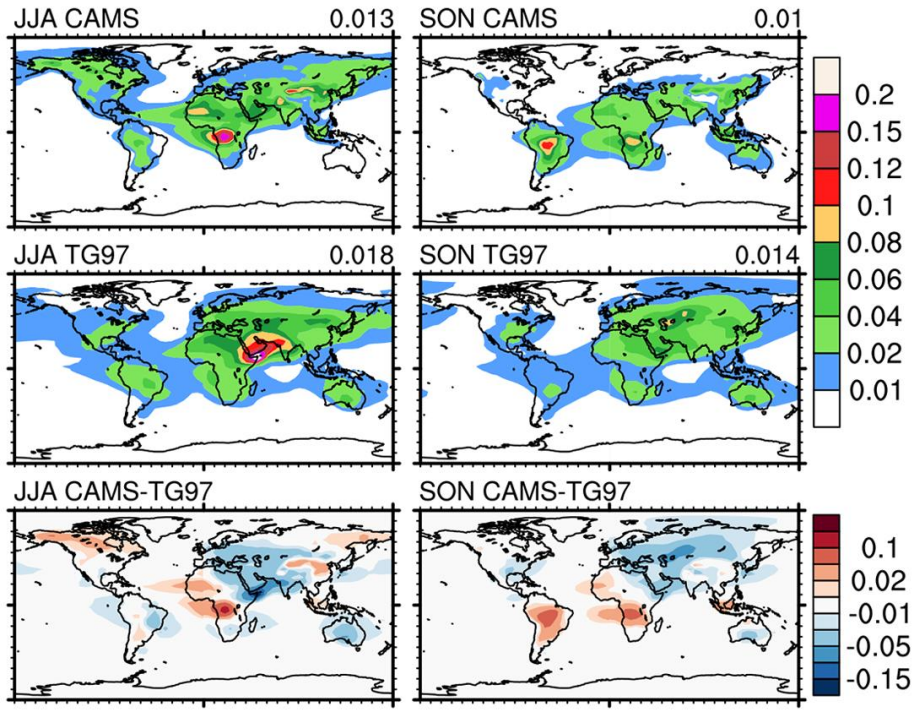
GLCC1.2 low veg cover



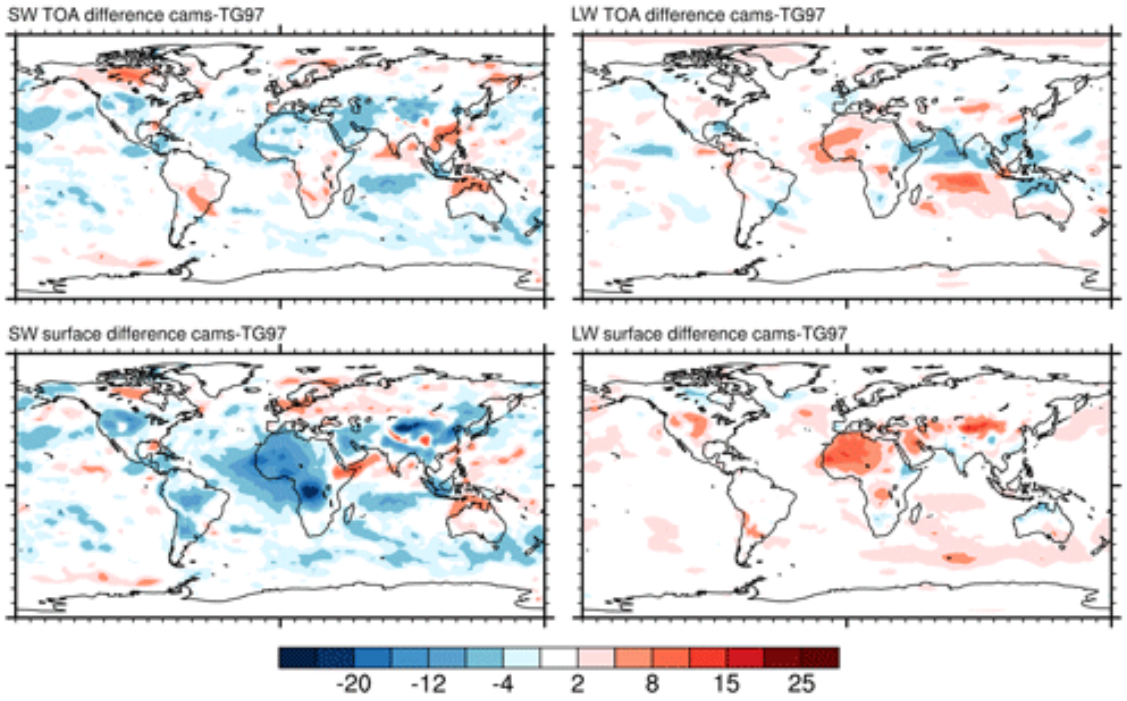
A substantial increase in low vegetation and decrease in high vegetation fraction.

Differences in aerosol products impact model climate and circulation

Differences in absortion AOT coefficients between climatologies



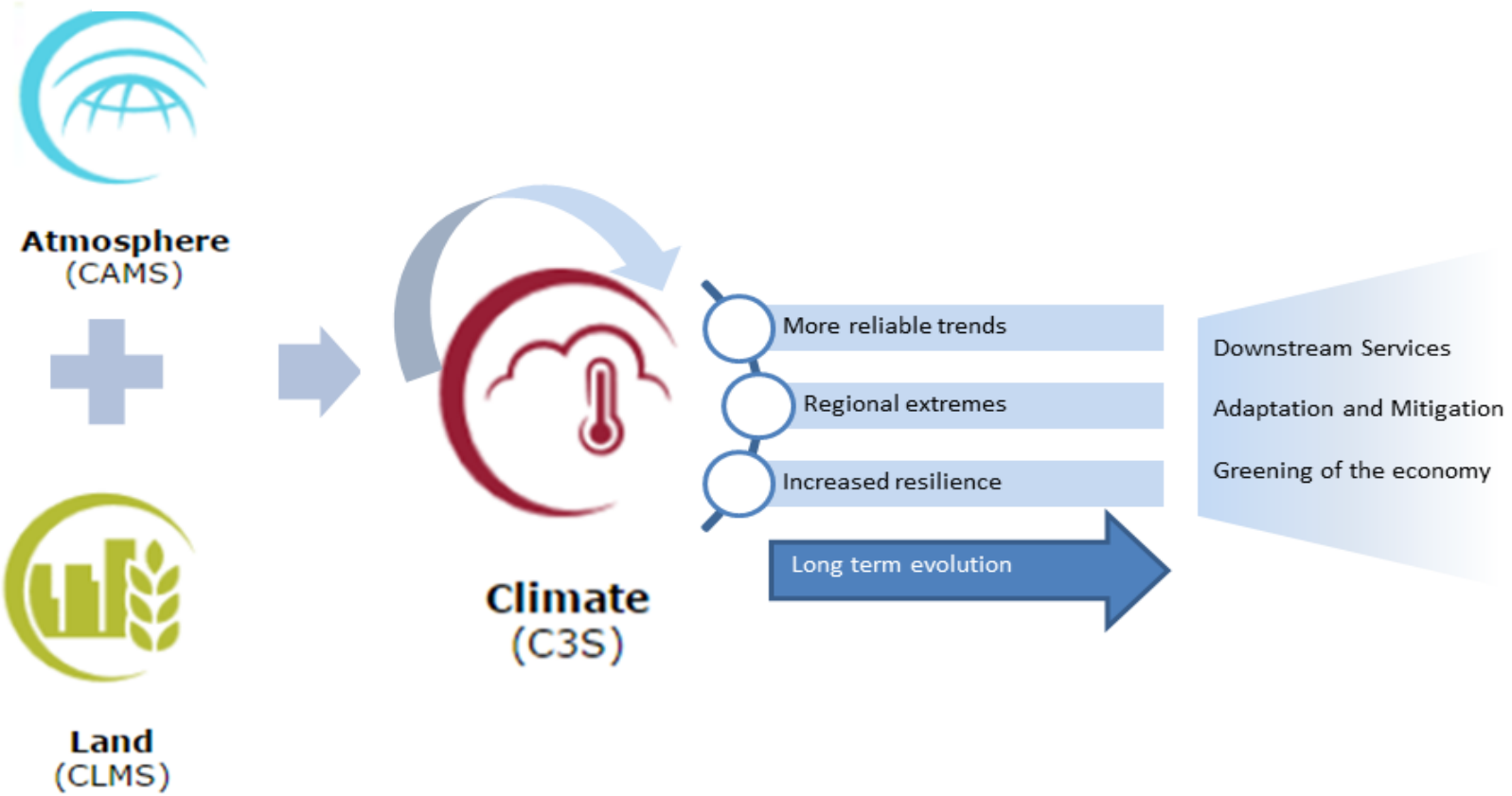
LW/SW differences induced by different aerosol climatologies (W/m2)



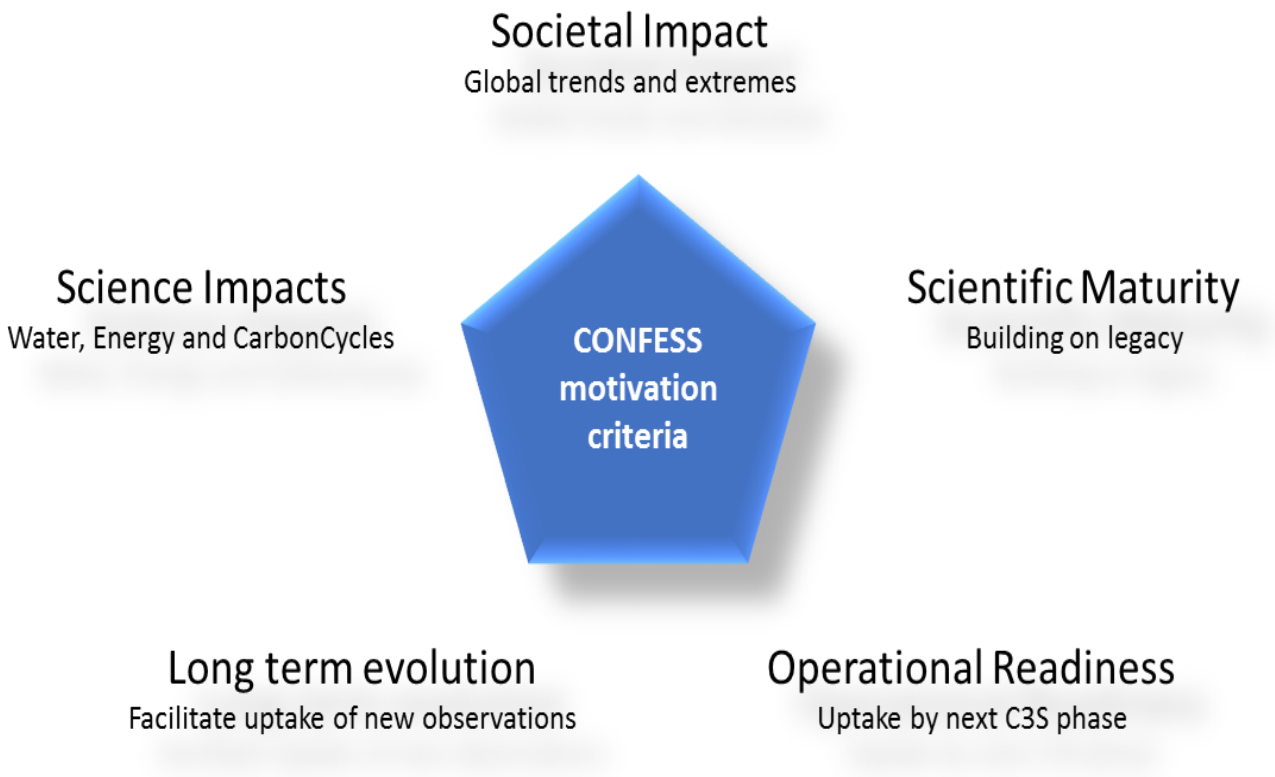
Bozzo et al, 2020

CONFESS aim

To improve the reliability and usability of C3S information by capitalizing on the synergies between Copernicus services, and pave the way for a continuous evolution of the services

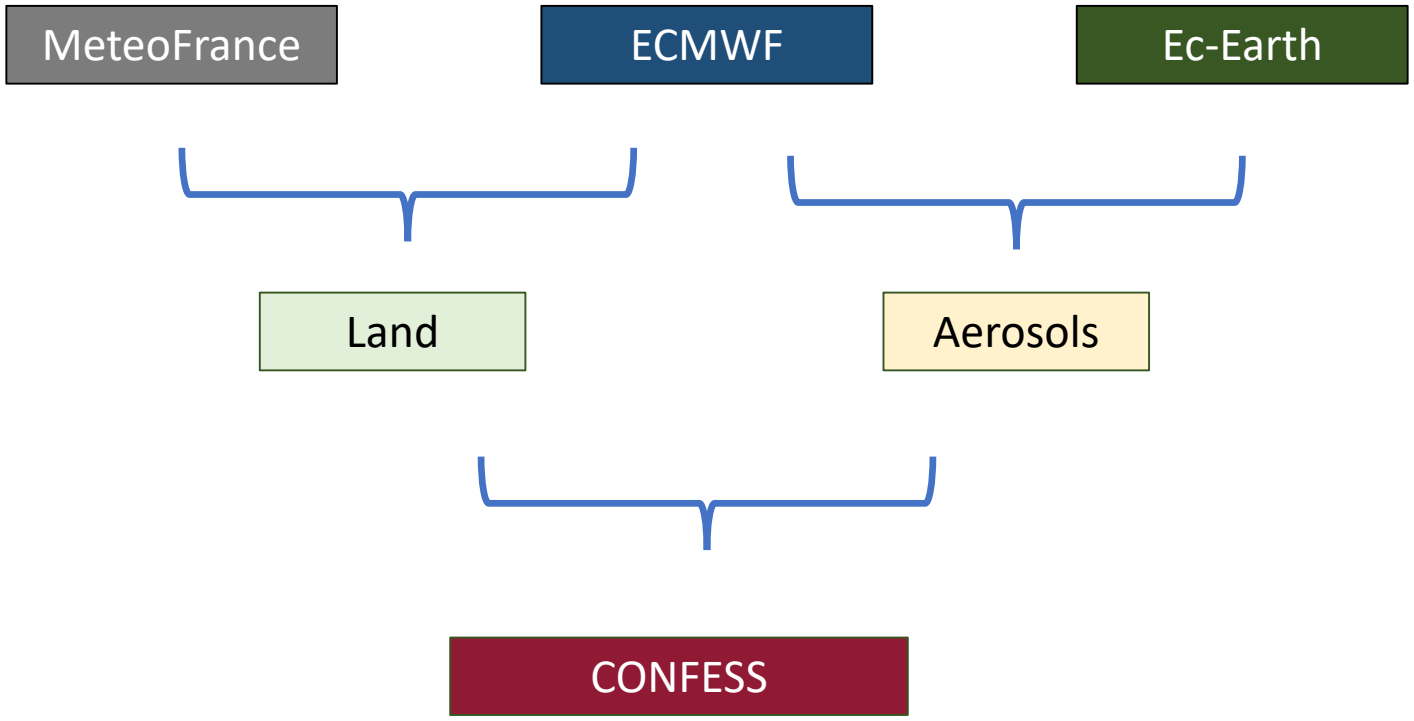


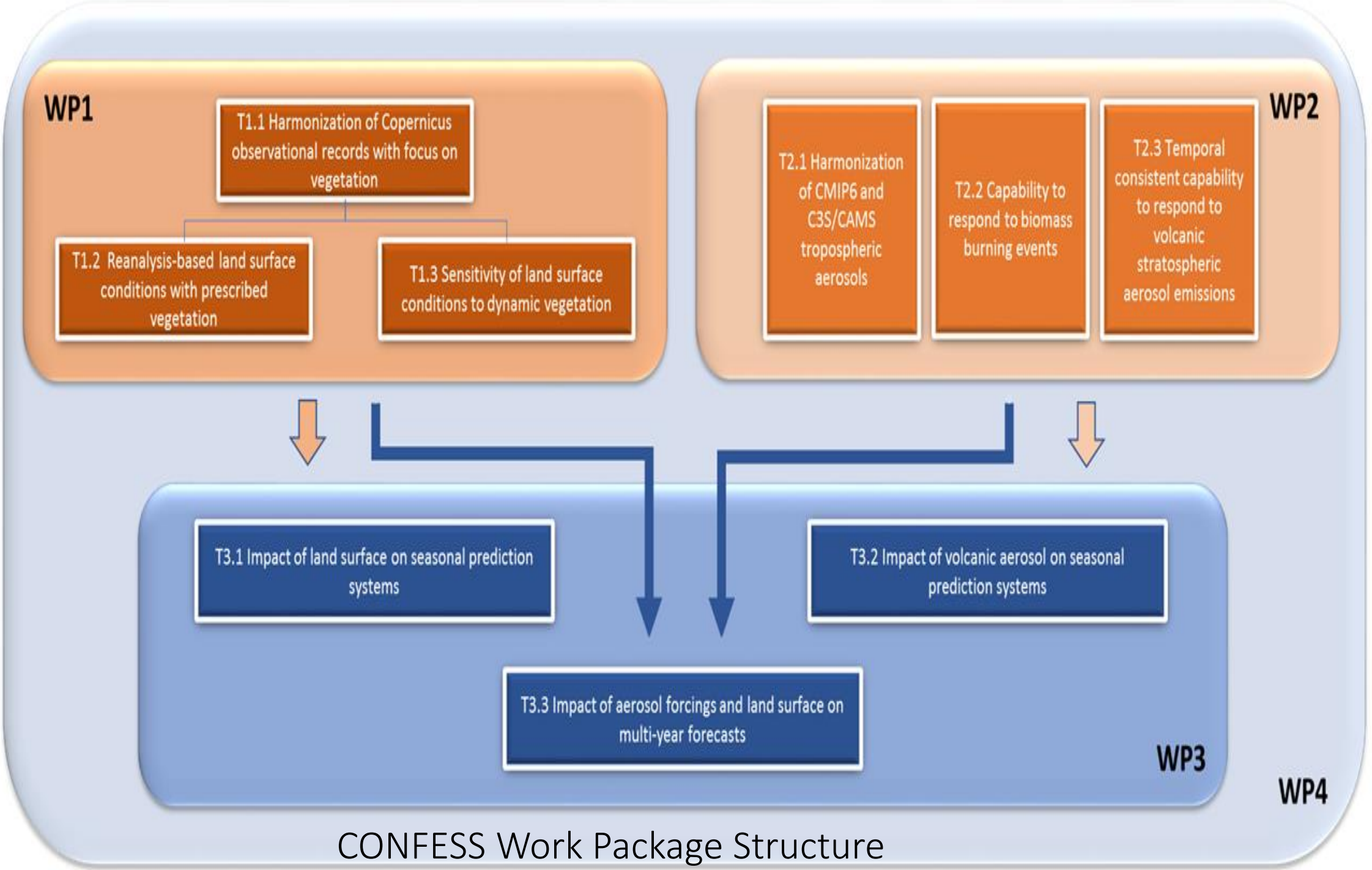
CONFESS: Criteria for selected developments



Modularity for efficient workflow - Verifiable developments - Dual System for robust assessment

Dual model approach for robustness





CONFESS Work Package Structure

CONFESS Strategic Objectives

- Representation, **for the first time**, of **temporal variations of land cover and vegetation** in C3S systems by exploiting state of the art Copernicus observational datasets

- **Improved** temporal representation of **tropospheric aerosols by harmonization of CMIP6 and CAMS datasets.**

- **Increased prognostic capabilities** by inclusion of prognostic vegetation and new capabilities for response to volcanic and biomass burning emissions.

What is done now?

1) Land Cover/Use and Vegetation in reanalysis and seasonal forecasts are represented by climatological values. Suboptimal.

- This climatology needs updating.
- It is important to include time variations

2) Tropospheric aerosols:

- Obsolete treatment of tropospheric aerosols in reanalyses and seasonal forecasts.
- Inconsistent specification in Weather and Climate
- Not consistency between CMIP6 and most recent state of the art CAMS estimation.

3) No capability in C3S system to react to hazardous events such as large volcanic eruptions and fires

CONFESS developments

1) Land:

- Land Cover/Use and Vegetation needs updating to latest estimates (e.g. ESA-CCI)
- It is important to include time variations

2) Tropospheric Aerosols

- Update temporal variations from CMIP5 to CMIP6
- Anchor recent CMIP6 loads to CAMS
- Ensure consistency between Weather and Climate applications

3) Hazardous events:

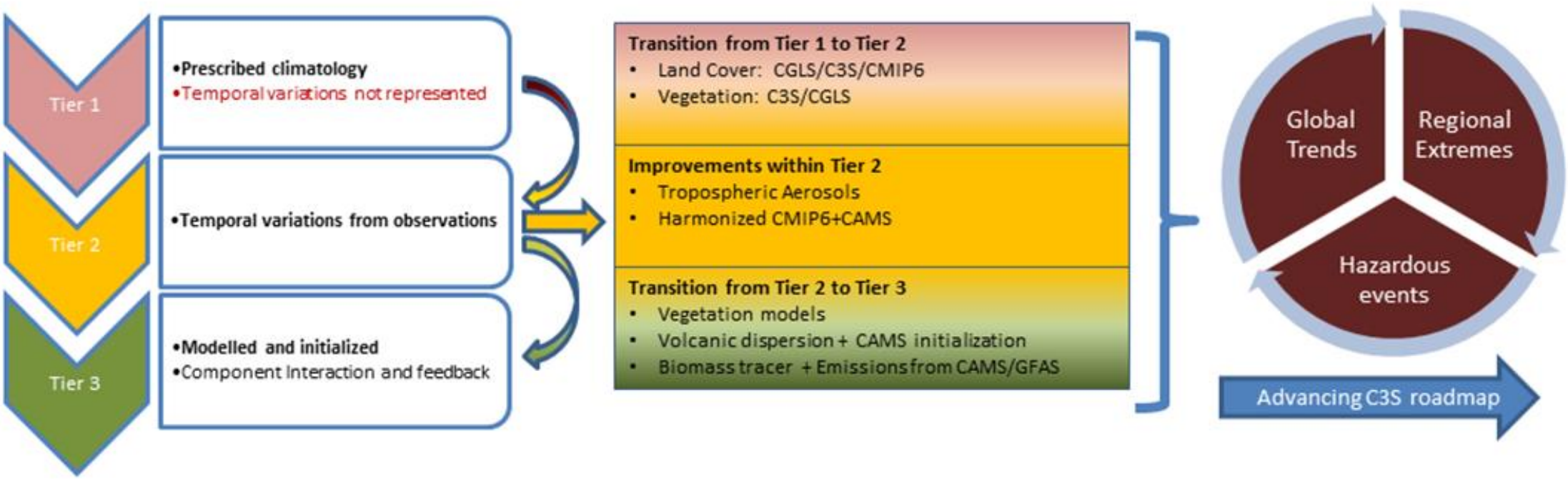
- Introduce capability in C3S to respond to volcanic eruptions
- Quantify the impact of fires

Advancing the state of the art

Hierarchical representation of an earth system component

CONFESS Developments

C3S evolution
Reanalysis and Seasonal Forecasts



WP1: Temporal Variations of Vegetation and Land cover

Participants: MF, CNR/ISAC, ECMWF

Objectives

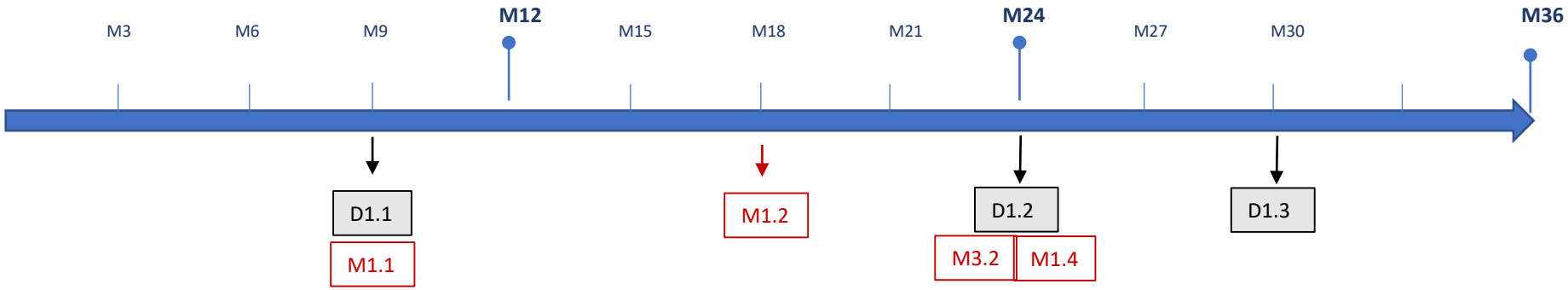
- Produce consistent and harmonized datasets of LC, LAI and FCOVER (Task 1.1).
- Produce and assess multi-year land simulations with enhanced vegetation temporal variability (Task 1.2).
- Produce and assess multi-year simulations with interactive vegetation (Task 1.3).
- Recommend suitable configurations for coupled simulations to use in reanalysis and seasonal prediction (Task 1.2; Task 1.3)

Deliverables

D1.1 Report on the vegetation dataset of LC and LAI (ECMWF, R, PU, M9)

D1.2 Report on the improved vegetation variability (CNR-ISAC, R, PU, M24)

D1.3 Report on the suitable vegetation modelling configurations (MF, R, PU, M30)



WP2:Temporal variations of aerosols

Participants: ECMWF/BSC

Objectives

- Create a consistent treatment of tropospheric aerosol forcing by harmonizing CMIP6 and CAMS datasets
- Create a capability to react to large biomass burning events
- Improve the representation of volcanic aerosols, and the capability to react to new large volcanic events

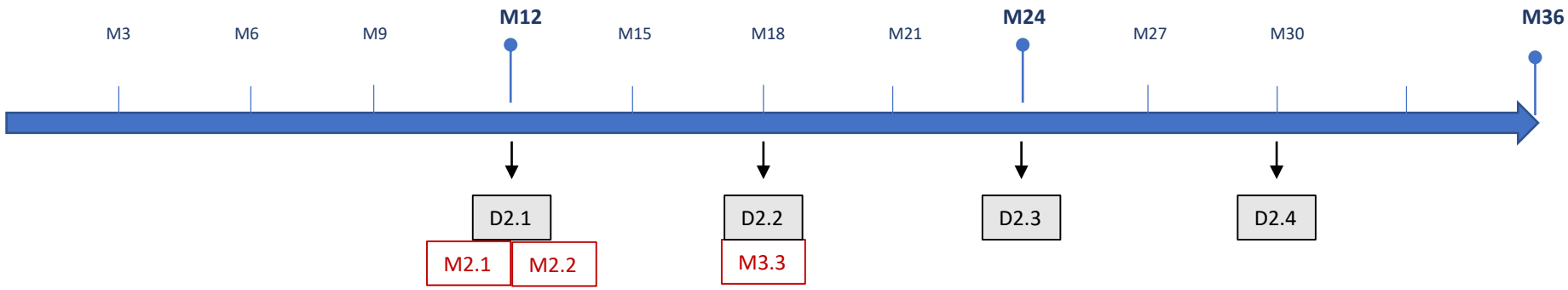
Deliverables

D2.1 Harmonized CAMS and CMIP6 datasets for aerosols from task 2.1 (ECMWF, OTHER, PU, 12)

D2.2 Report on the definition and performance of an empirical model for biomass burning emissions, benchmarked against climatology (BSC, R, PU, 18).

D2.3 Simplified volcanic aerosol prediction module validated and interfaced to IFS and EC-Earth (ECMWF, OTHER, CO, 24)

D2.4 Validation report on the experiments using biomass burning climatological and observed emissions for the selected test cases (BSC, R, PU, 30)



WP3:Evaluation in initialised seasonal and near-term predictions

Participants: ECMWF- MF – BSC – CNR/ISAC

Objectives

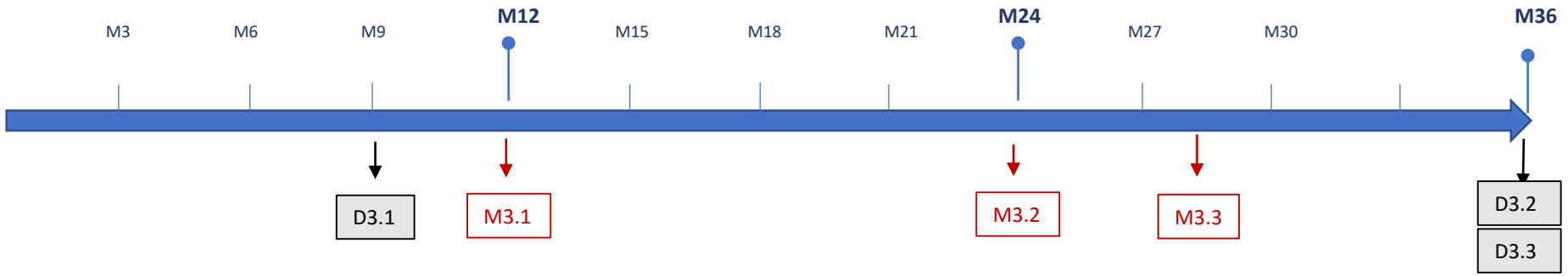
- integrate developments from WP1 and WP2 and evaluate their impact on model variability and bias at seasonal and multi-annual time scales
- assess whether and how an improved representation of land surface and aerosols translates into changes in seasonal to multi-annual forecast quality at a global and regional scale
- document the impact of enhanced initial conditions and boundary forcings on specific case studies
- guide future developments in land surface and aerosols forcings for the next generation of operational seasonal and multi-annual prediction systems

Deliverables

D3.1 Experimental protocol for land and aerosol forcing re-forecasts (MF, R, PU, M9)

D3.2 Evaluation of impact of improved volcanic forcings on seasonal and near-term predictions, including recommendations for implementation (BSC, R, PU, M36)

D3.3 Evaluation of impact of variable land cover and vegetation on seasonal and near-term predictions, including recommendations for implementation (MF, R, PU, M36)



WP4: Coordination

Led by ECMWF

Objectives

- Coordination
- Administration and financial support
- Quality management
- Risk management
- Dissemination, Exploitation and Communication

Deliverables

D4.1 Risk and Quality Management Plan (Lead: ECMWF; M2, R, CO)

D4.2 Project Website (Lead: ECMWF; M3, DEC, PU)

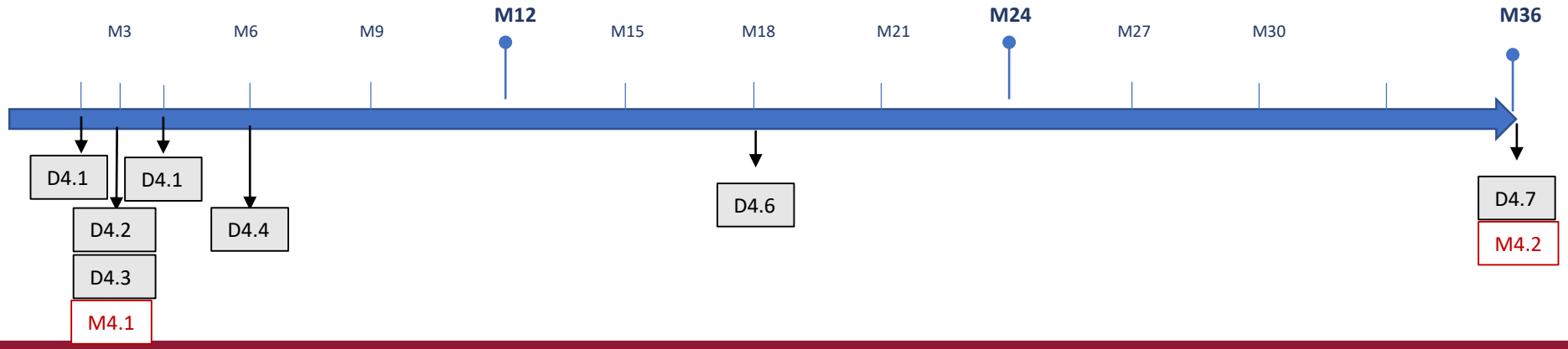
D4.3 Dissemination and Exploitation Plan (Lead: ECMWF, M3, R, PU)

D4.4 Media and Communication Plan (Lead: ECMWF, M4, R, PU)

D4.5 Data Management Plan (Lead: ECMWF, M6, R PU)

D4.6 Mid-Term Dissemination and Exploitation Report (Lead: ECMWF; M18, R, PU)

D4.7 Final Dissemination and Exploitation Report (Lead: ECMWF; M36, R, PU)



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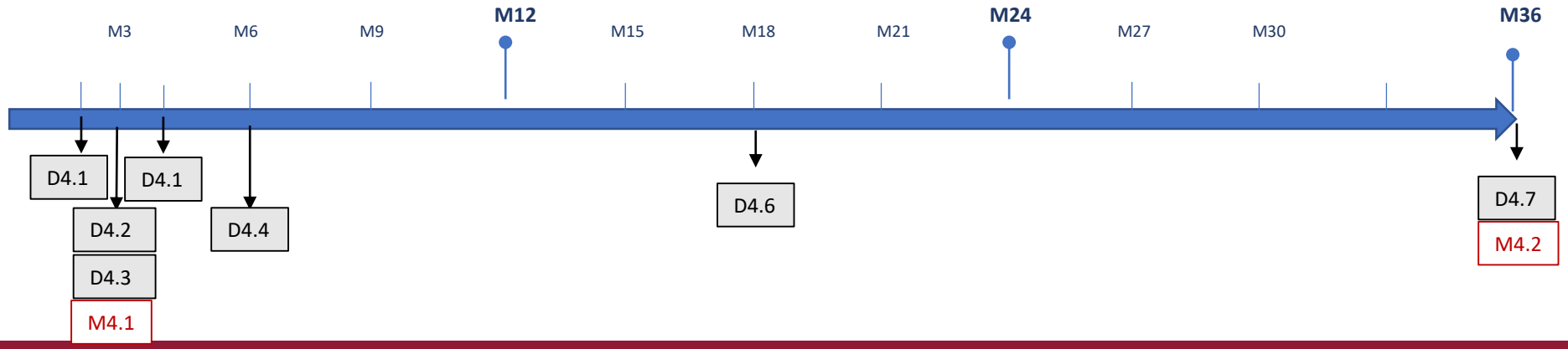

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Questions?

Magdalena A. Balmaseda
ECMWF
Magdalena.Balmaseda@ecmwf.int
www.ecmwf.int

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