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CERISE: COPERNICUS CLIMATE CHANGE SERVICE EVOLUTION

Kick-off meeting, 17-18 January 2023

Agenda Day-1: 17 January 2023

Times in Central Europe Time (CET)

Plenary session (09:30-12:50)
09:30-09:50 Welcome and introduction, Patricia de Rosnay (ECMWF)
09:50-10:10 “Horizon Europe context & implementation guidelines” by Project Officer, Lukas Lanneau (HaDEA)
10:10-10:40 Partners presentation (2 min /1 slide per institute)

10:40-11:00 *coffee break + group photo*

11:00-11:20 Welcome from C3S, Carlo Buontempo (ECMWF)
11:20-11:30 WP1 Filipe Aires (Estellus), Pete Weston (ECMWF)
11:30-11:40 WP2 Patricia de Rosnay (ECMWF), Jelena Bojarova (SMHI)
11:40-11:50 WP3 Jean-Christophe Calvet (Météo-France), Tim Stockdale (ECMWF)
11:50-12:00 WP4 Hans Hersbach (ECMWF), Harald Schyberg (Met Norway)
12:00-12:10 WP5 Núria Pérez-Zanón (BSC), Anca Brookshaw (ECMWF)
12:10-12:20 WP6 Fréderic Vitart (ECMWF), Jeff Knight (Met Office)
12:20-12:30 WP7 Carla Cardinali (CMCC), Isabel Trigo (IPMA)
12:30-12:50 Project Management Tanya Warnaars (ECMWF)

12:50-14:00 *Lunch*

Breakout WP discussions (14:00-17:00)
14:00-16:00: WP1-WP2-WP4 joint meeting
14:00-15:00: WP3-WP5 joint meeting
16:00-17:00: WP3-WP5-WP6 joint meeting

Agenda Day-2: 18 January 2023

Times in Central Europe Time (CET)

Breakout WP discussions (09:30-13:00)
09:30-10:00 WP4-WP5 joint meeting
10:00-11:00 WP7 and interconnections meeting
11:00-11:30 *coffee break*
11:30-13:00 WP6 and interconnections meeting

13.00 - 14.00 *Lunch*

Plenary session (14:00-15:50)
14:00-14:10 Reporting back from WP1
14:10-14:20 Reporting back from WP2
14:20-14:30 Reporting back from WP4
14:30-14:40 WP1, WP2, WP4 interconnections
14:40-14:50 Reporting back from WP3
14:50-15:00 Reporting back from WP5
15:00-15:10 WP3-WP5 and WP4-WP5 interconnections
15:10-15:20 Reporting back from WP7
15:20-15:30 Reporting back from WP6
15:30-15:40 WP6 and WP7 interconnections
15:40-15:50: Kick-off meeting closure

Housekeeping

- Plenary sessions recorded
- Keep your mics off
- Please use the 'raise hand’ or use the chat to ask your questions
- Group photo: at 11:00

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Patricia de Rosnay

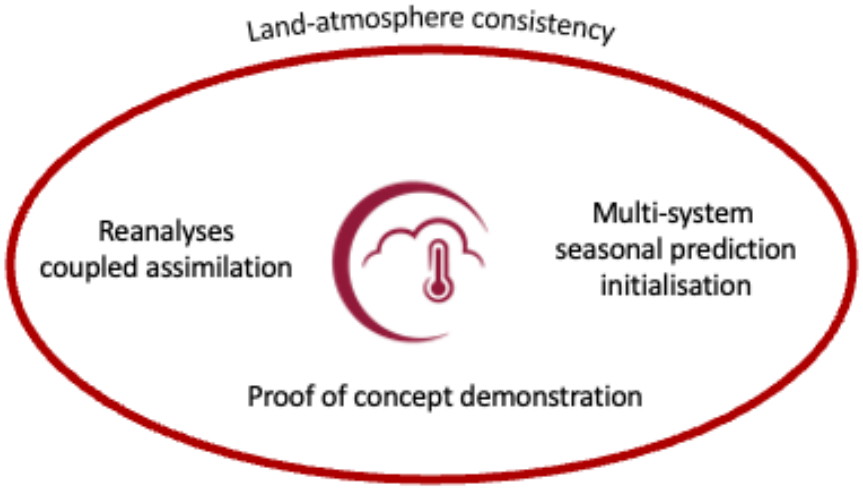
Aim of the project

Support the long-term evolution of the Copernicus Climate Change Service (C3S) climate reanalysis and multi-system seasonal prediction systems towards an Earth system approach.

The scope of CERISE is to enhance the C3S portfolio quality, with a focus on land, with the development of:

- New and innovative coupled land-atmosphere data assimilation approaches,
- Land surface initialisation techniques
- Provide the proof-of-concept to demonstrate the feasibility of the integration in the core C3S.

→ Prepare the next generation of the C3S systems.



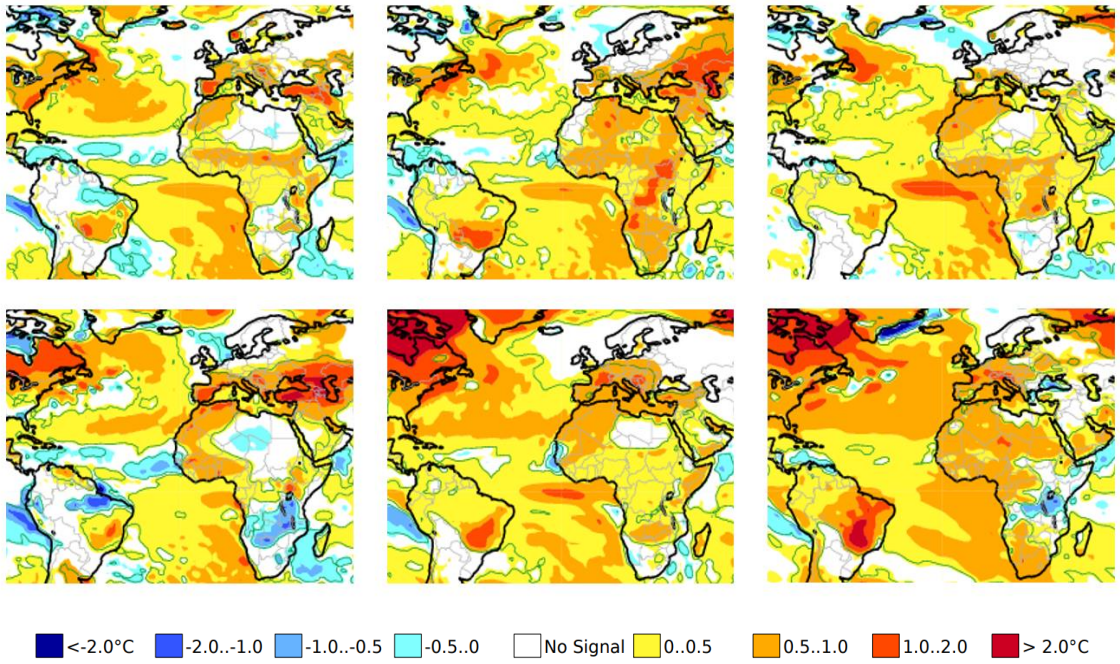
CERISE, by improving the quality and consistency of the C3S tools, will directly address the evolving user needs for improved and more consistent C3S Earth system products.

Seasonal Prediction

C3S seasonal forecast multi-system: based on ensemble forecasts from several operational systems.

They describe the evolution of large-scale modes of climate variability and cover a period of approximately six months.

The C3S seasonal forecast products include a large set of data, at high temporal resolution (subdaily), as well as a set of graphical representations of post-processed information for some weather variables.



Surface air temperature ensemble mean anomaly for June 2021 for forecasts from 1st May, from six different models in the C3S seasonal forecast multi-system

- Substantial variations between forecasts in many regions
- Major contribution of the inconsistencies in the land surface representation, both between models and initial conditions, and in terms of time evolution, with particular potential issues for initialising real-time forecasts.

CERISE → improve the quality and our understanding of land, including snow surfaces, initial conditions for the C3S seasonal forecast multi-system.

Climate reanalysis

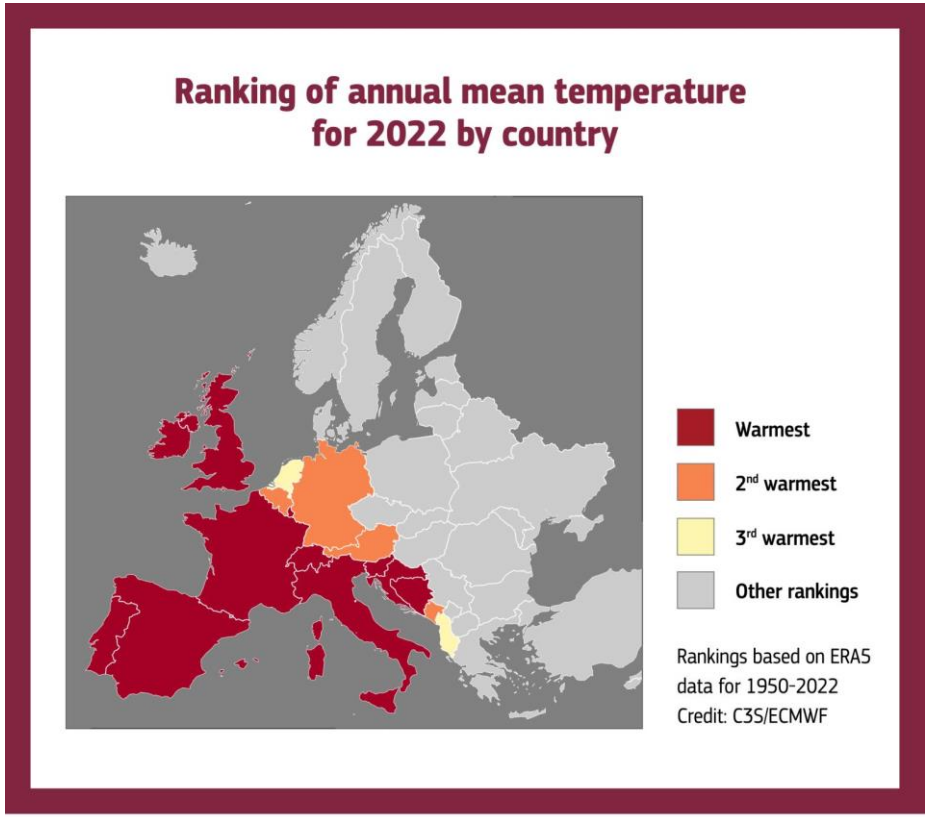
Optimal combination of models and observations to provide ”maps without gaps” of Essential Climate Variables (ECVs) as defined following the Global Climate Observing System (GCOS) concept.

C3S products include the global atmospheric reanalysis ERA5, the downscaled global land product ERA5-Land, and the Copernicus Arctic and European ReAnalyses, CARRA1 and CERRA.

Copernicus Global Climate Highlights 2022

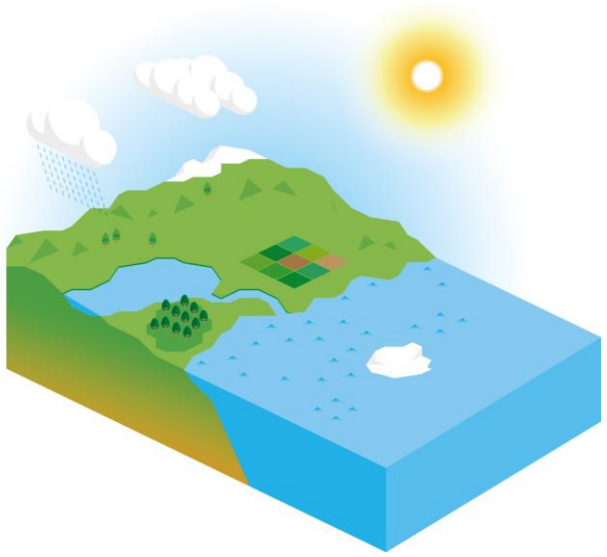
Several high-temperature records were broken both in Europe and across the globe, while other extreme events such as drought and flooding affected large regions.

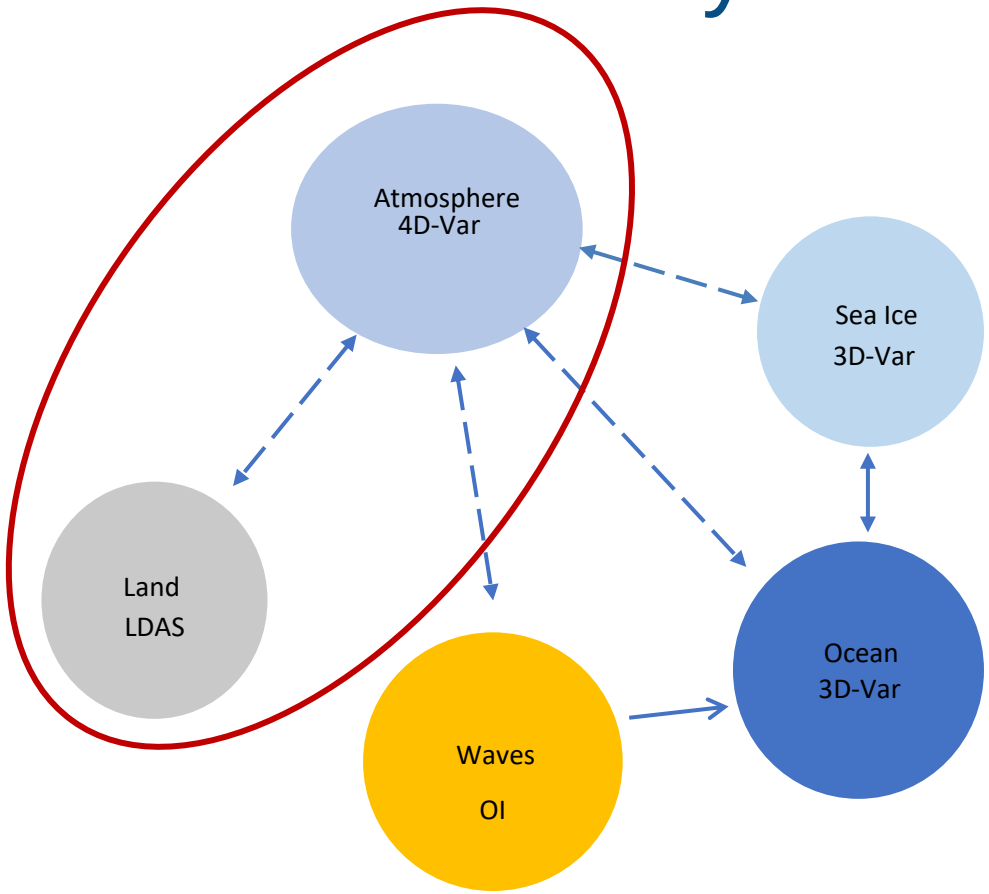
For Europe:
2nd warmest year on record
Summer was the hottest ever recorded.
Autumn was the third warmest on record.
Prolonged and intense heatwaves affected western and northern Europe.
Persistent low levels of rainfall, in combination with high temperatures led to widespread drought conditions.



→ **Near surface conditions over land of critical interest to the C3S users.**

CERISE: towards consistent Earth system C3S products

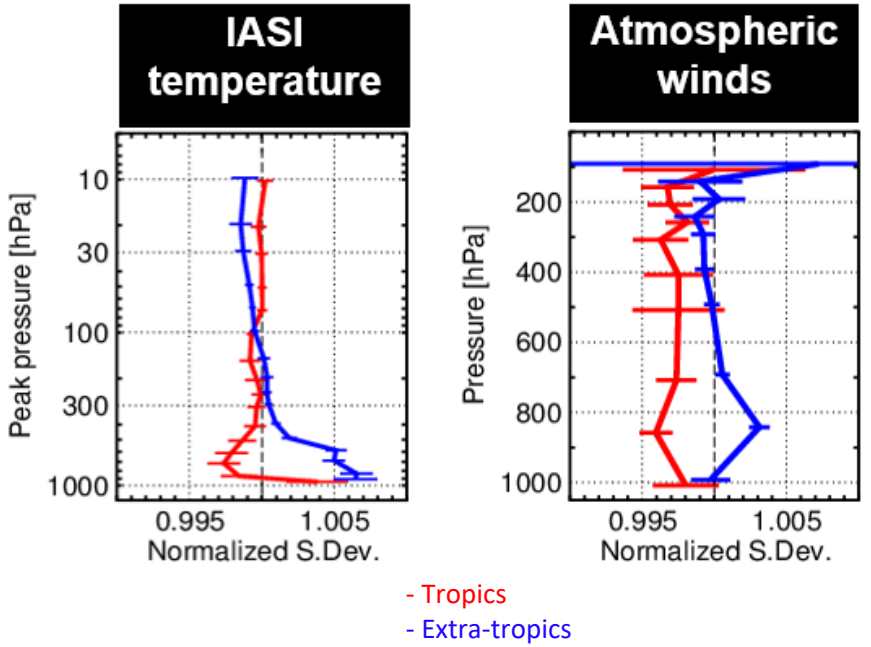




- To improve near surface climate reanalysis and seasonal prediction, flagship C3S products
- Innovative land and coupled data assimilation, initialisation, modularity & consistency between offline and coupled reanalyses, explore AI/ML for complex surfaces observation operators, exploitation of current and future interface observations, time varying vegetation and lakes

Coupled data assimilation: ERA-CLIM2 heritage

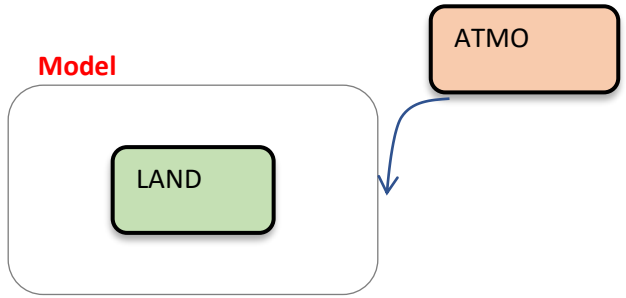
- Initiated in the context of the ESA Coupled ECMWF ReAnalysis (CERA) project followed by ERA-CLIM2
- Objective was to develop global centennial reanalysis based on coupled ocean-atmosphere DA
- CERA system → demonstrated the proof of concept and the challenges of the ocean-atmosphere outer loop coupling methodology with CERA-20C & CERA-SAT
- However, very little effort so far has been dedicated to land-atmosphere coupled assimilation or consistent land-atmosphere initialisation for reanalysis and seasonal prediction systems, despite the fact that near-surface conditions over land, including snow covered surfaces, are of critical interest to users.



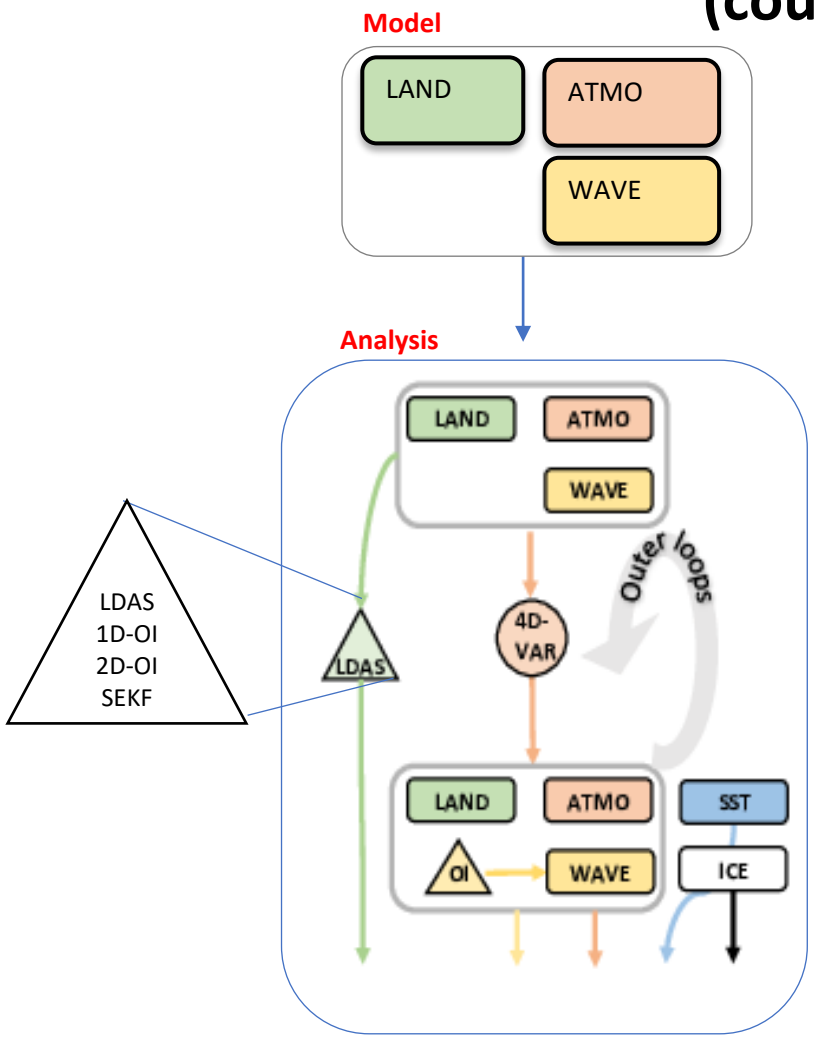
First guess fit to observations in the CERA-SAT system

Current C3S global reanalyses

ERA5-Land (offline)



ERA5 (coupled)



ERA5:

- Sequence of 1D &2D optimal Interpolation and simplified Extended Kalman Filter for Land Data Assimilation System (LDAS)
- Weakly coupled land-atmosphere assimilation (coupling from model)

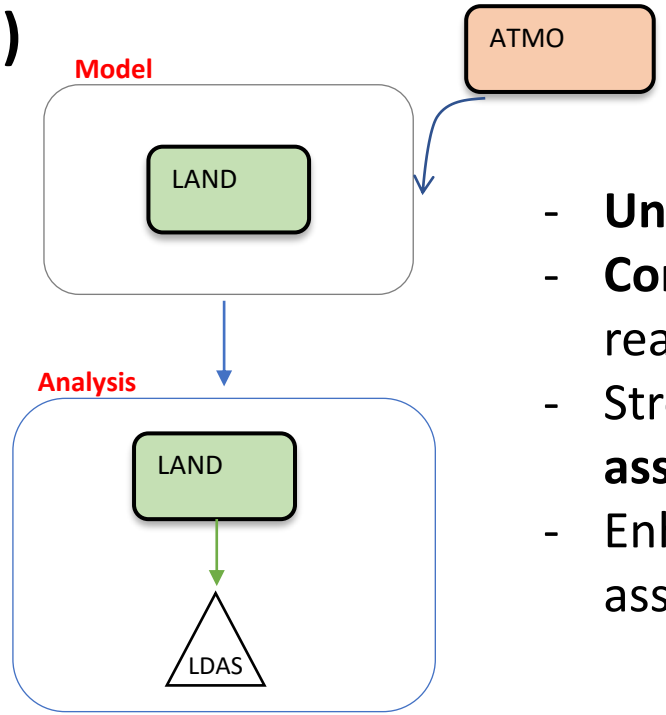
ERA5 Land:

- Model only, no data assimilation

CERISE: next generation of C3S reanalyses

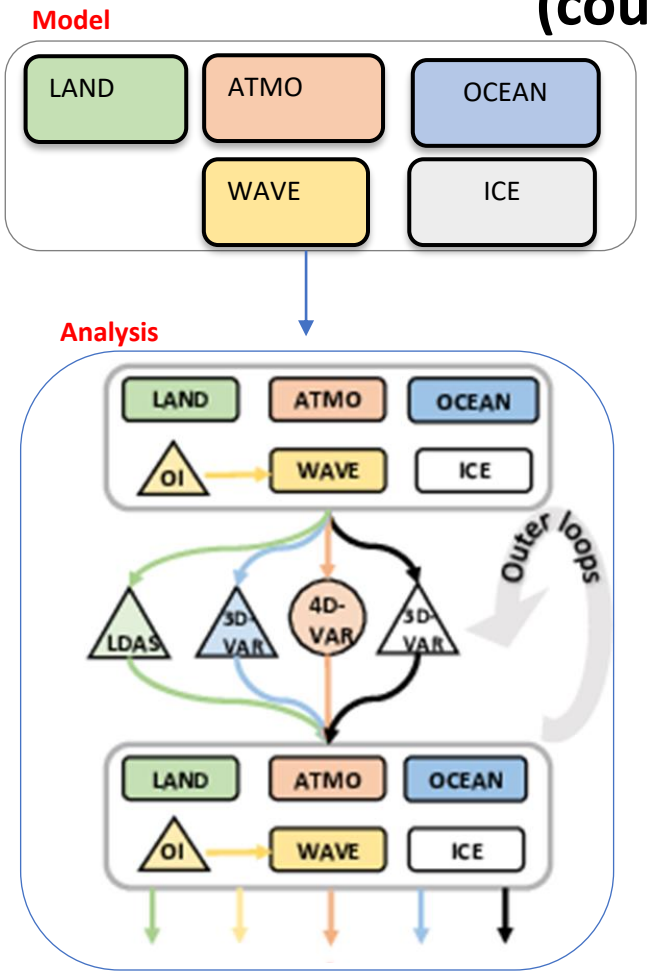
Prototypes for land and coupled reanalyses

ERA6-Land-P (offline)



- **Unified** ensemble-based LDAS
- **Consistent** LDAS for land and coupled reanalyses
- Strong surface-atmosphere **coupled assimilation**
- Enhanced **interface observation** assimilation

ERA7-P (coupled)

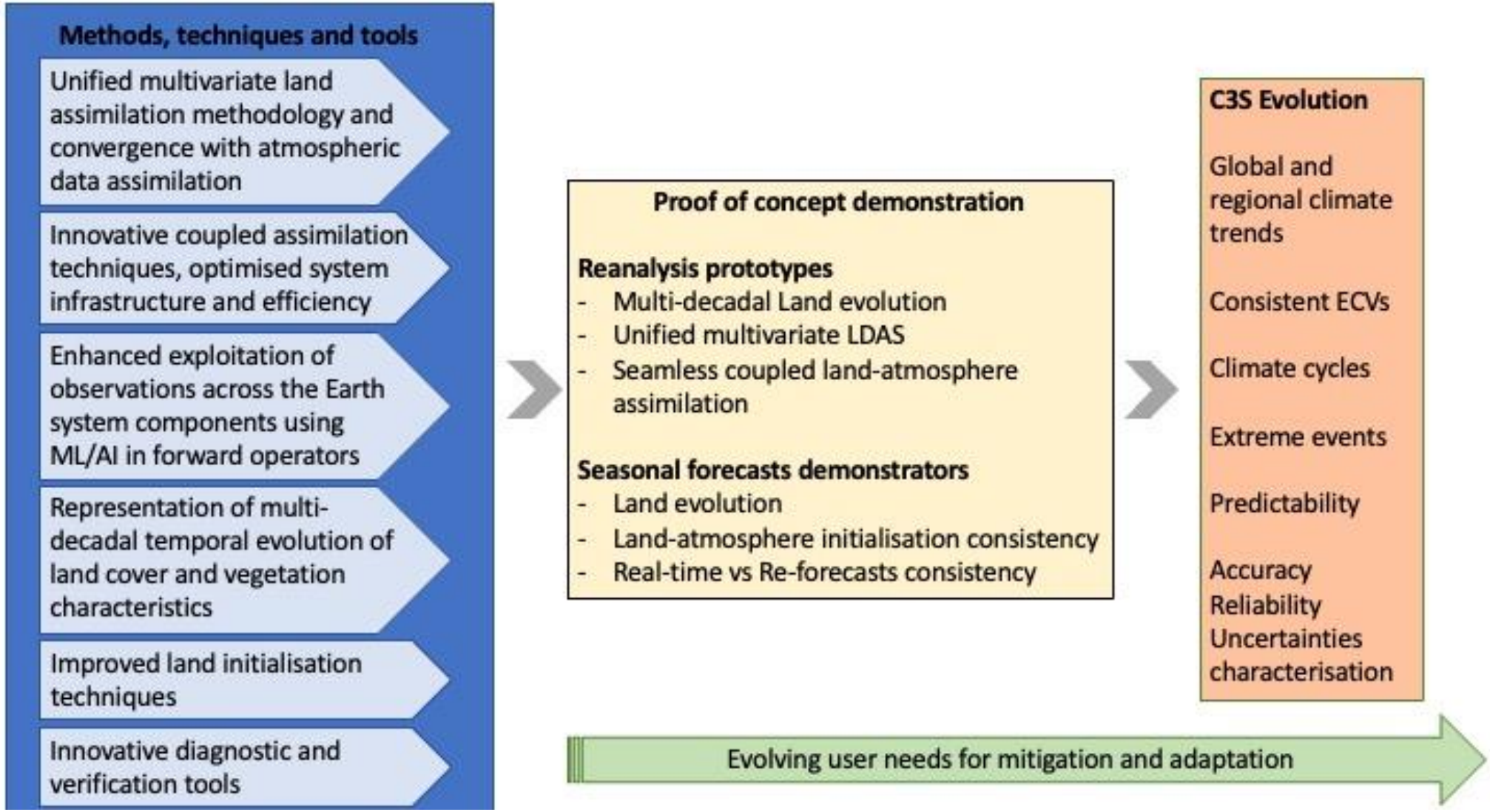


Preparation of next generations of C3S reanalysis systems.

- Global: ERA6-Land and ERA7
- Regional and Arctic: CERRA2, CERRA-Land, CARRA3, CARRA-Land, and beyond

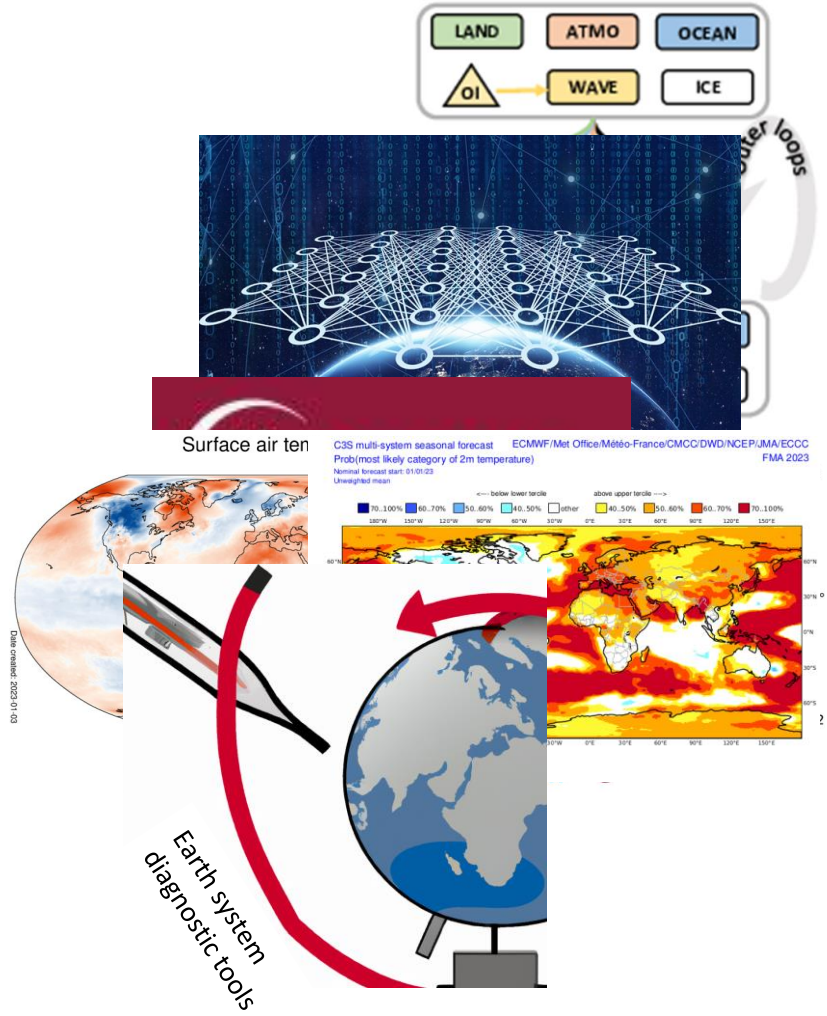
→Input for Seasonal Prediction systems

CERISE concept

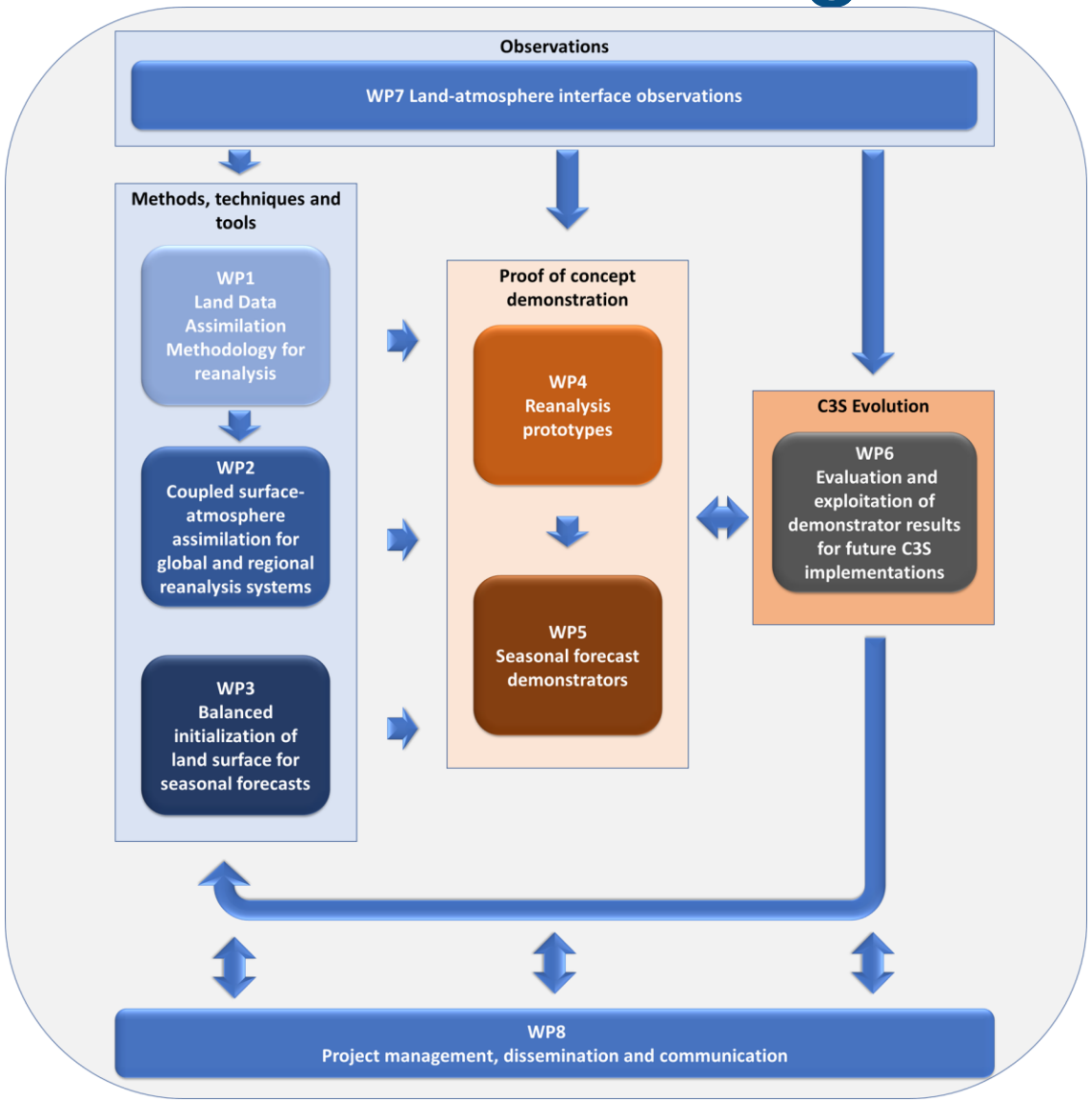


CERISE beyond the state of the art

- Land and coupled land-atmosphere data assimilation
- Exploitation of satellite observations (including Copernicus and Earth Explorers), using data driven approaches to improve observation operators (AI-based solution to link surface variables to surface-sensitive satellite observations)
- Multidecadal representation of evolving vegetation and lakes, building up on CONFESS H2020
- Seamless reanalysis and prototypes and multi-system seasonal prediction
- Novel diagnostic tools to assess physical consistency of Earth system prediction, including hot and dry extremes



CERISE Work Package structure



CERISE Consortium

- Key partners involved in C3S operational reanalysis and seasonal prediction development and production
- Strong expertise in ML/AI for satellite data exploitation
- Twelve partners from eight European countries (Denmark, France, Germany, Italy, Norway, Portugal, Spain, Sweden) and one Associated Partner from the United Kingdom.
- Strong experience in research to operations (R2O) transition.

→ Will ensure quick transition to operations and to achieve efficient integration in the C3S.

Partners	Country
ECMWF	International
MetNo	Norway
SMHI	Sweden
Météo-France	France
DWD	Germany
CMCC	Italy
BSC	Spain
MetO	UK
DMI	Denmark
Estellus	France
IPMA	Portugal
NILU	Norway

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Thank you

ECMWF, MetNorway, SMHI, Météo-France, DWD, CMCC, BSC, MetOffice, DMI, ESTELLUS, IPMA, NILU

The CERISE project (grant agreement No 101082139) is funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Commission. Neither the European Union nor the granting authority can be held responsible for them."