CONFESS

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

Final Dissemination and Exploitation Report

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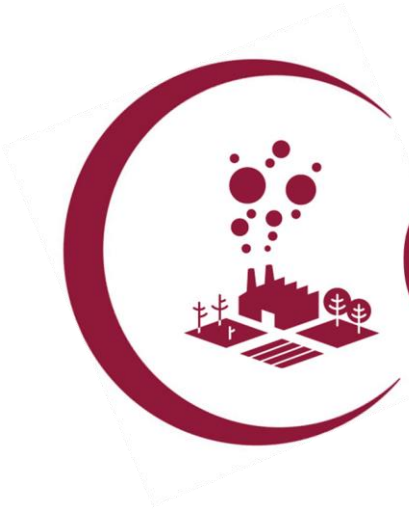
www.confess-h2020.eu

Co-ordinated by ECMWF



ONFESS

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D4.7 Final Dissemination and Exploitation Report

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Research and Innovation Action (RIA)
H2020- LC-SPACE-18-EO-2020 Copernicus evolution: Research activities in support of the evolution of the Copernicus services - Copernicus Climate Change Service (C3S

Project Coordinator: Dr Magdalena Alonso Balmaseda (ECMWF)
Project Start Date: 01/11/2020
Project Duration: 41 months

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Figures

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1 Executive Summary

To ensure that the CONFESS project remains visible and results are taken up by the wider community, dissemination and exploitation activities play a major role.

D4.7 provides an update of the activities performed by the project partners within the full 41 months of the project, and reviews both dissemination and exploitation plans.

To-date, six journal papers have been prepared of which four are published; CONFESS researchers presented their work 19 times in conferences and workshops. Additional outreach activities to ensure uptake of results were undertaken, particularly targeting the C3S community and other research projects and groups .

2 Introduction

2.1 Background

A climate resilient society requires reliable monitoring and forecasting information of the climate trends, patterns and disturbances, both at global and regional scales. Through consistent representation of temporal variations of boundary forcings in reanalyses and Seasonal forecasts, CONFESS will contribute to the emerging societal need for an enhanced Copernicus Climate Change Service (C3S) that can support adaptation and mitigation strategies facing increased frequency and intensity of climate extremes.

The aim of CONFESS is to improve the reliability and usability of C3S information in the land-atmosphere coupled system by exploiting new and improved Earth Observations data records of land-cover/use, vegetation states and surface-emitted aerosols delivered across different Copernicus Services. CONFESS developments will be integrated consistently for use in future C3S systems, enhancing the service's accuracy by representing annual changes of land use, and adding satellite-derived and prognostic vegetation states along with aerosols emissions due to hazardous/extreme events such as volcanic eruptions and large-scale biomass burning (e.g. wildfires).

The added capacity to represent temporal variations and trends of these variables and the occurrence of hazardous/extreme events will be supported by a rapid uptake of new Earth Observations. The impact on the Earth system will be evaluated by assessing the quality of global reanalysis as well as seasonal forecasts using state-of-the-art modelling systems.

The infrastructure and knowledge developed within CONFESS will contribute to improve the C3S capabilities for reliable monitoring and forecasting with particular focus on extremes.

2.2 Scope of this deliverable

2.2.1 Objectives of this deliverable

The objective of D4.7 is to report on the dissemination activities of the final period of the project and includes all activities of the 41 months and provides an update, where appropriate, to the dissemination and exploitation plans.

2.2.2 Work performed in this deliverable

As per the initial deliverables D4.3, and interim deliverable D4.6 feedback from the partners was collected in the form of questionnaires, requesting explanations of the relevant aspects pertaining to primarily dissemination and also exploitation.

2.2.3 Deviations and counter measures

No deviations have been encountered.

3 Dissemination Activities

3.1 Report on Dissemination Activities

CONFESS has been active on various dissemination streams, including publications, workshops, conferences, and ended with a final cross cutting meeting of the project in March 2024. This was organised to present the outputs and operational aspects of the CONFESS products and ensure a lasting legacy.

The following publications have been prepared to-date:

1. Andrea Alessandri, Franco Catalano, Matteo De Felice, Bart van den Hurk and Gianpaolo Balsamo, *"Varying snow and vegetation signatures of surface-albedo feedback on the Northern Hemisphere land warming"* 2021 *Environ. Res. Lett.* **16** 034023, https://doi.org/10.1088/1748-9326/abd65f
2. Fransje van Oorschot, Ruud J. van der Ent, Markus Hrachowitz, and Andrea Alessandri, *"Climate-controlled root zone parameters show potential to improve water flux simulations by land surface models"*, Earth Syst. Dynam., 12, 725–743, https://doi.org/10.5194/esd-12-725-2021, 2021.
3. Fransje van Oorschot, Ruud J. van der Ent, Markus Hrachowitz, Emanuele Di Carlo, Franco Catalano, Souhail Boussetta, Gianpaolo Balsamo, and Andrea Alessandri *Interannual land cover and vegetation variability based on remote sensing data in the HTESSEL land surface model: implementation and effects on simulated water dynamics* Earth Syst. Dynam. 14-1239-2023 https://doi.org/10.5194/esd-14-1239-2023
4. Roberto Bilbao, Pablo Ortega, Didier Swingedouw, Leon Hermanson, Panos Athanasiadis, Rosie Eade, Marion Devilliers, Francisco Doblas-Reyes, Nick Dunstone, An-Chi Ho, William Merryfield, Juliette Mignot, Dario Nicolì, Margarida Samsó, Reinel Sospedra-Alfonso, Xian Wu, and Stephen Yeager *Impact of volcanic eruptions on CMIP6 decadal predictions: A multi-model analysis* Earth Syst. Dynam. https://doi.org/10.5194/esd-2023-36

A further two (2) peer review publications are in preparation and nearly completed, but they will only be published after the project has been completed. However as the EU's portal remains open to include such publications these will be added to the list of outcome from CONFESS.

In addition there have been special features of CONFESS in the ECMWF newsletters, which has a wide general readership:

1. Newsletter Number 174 - Winter 2023 *Updating land and aerosol properties to improve reanalyses and seasonal forecasts* Magdalena A. Balmaseda Tim Stockdale Souhail Boussetta Retish Senan Gianpaolo Balsamo Angela Benedetti Tanya Warnaars

https://www.ecmwf.int/en/newsletter/174/news/updating-land-and-aerosol-properties-improve-reanalyses-and-seasonal

2. Featured media item: *Research project aims to boost Copernicus Climate Change Service* 21 February 2022 https://www.ecmwf.int/en/about/media-centre/news/2022/research-project-aims-boost-copernicus-climate-change-service

For 2024 there are two further news items submitted for the Spring newsletter of ECMWF. The planned articles include one on the CONFESS legacy and the second on tropospheric aerosols, the respective titles are:

1. Improving the boundary forcing in reanalyses and seasonal forecasts
2. A new time-varying tropospheric aerosol climatology for the IFS

However due to the timing of the Spring Newsletter these will only be available in April 2024.

The dissemination activities that were completed in the first year of the project are presented in Table 1; this is a copy of what was in D4.6 and provides a reference of the early activities of CONFESS. The following table 2 is a list of the different workshops and conferences where CONFESS was presented. Together both these tables provide an overview of the dissemination activities partners engaged in.

The final activity supported by the project was the General Assembly meeting that was built along the two main themes of the project: Land and Aerosols. This took place at the ECMWF office in Reading, from 5-6 March 2024 and is descried on our website. Each theme consisted of a half day of presentations covering the different tasks in CONFESS as well as presentation from other projects who are already benefitting from the work done by CONFESS; notably the CERISE project (www.cerise-project.eu) and another related S2S project focused on the biomass burning emissions at the seasonal timescale. The GA meeting finished with a Pannel discussion that included the three members of our advisory board and other expertise:

Carlo Bountempo (AB, C3S) Gabi Hegerl (AB, University of Hamburg, WCRP LHA safe landing climates) Paul Dirmeyer (AB, George Mason University, Lead of S2S Land Focus group) Claire MacIntosh (ESA Climate Office, WCRP ESMO steering group)

The overall view of the pannel was that CONFESS has shown the importance of a new generation of reanalysis and seasonal forecasts. While there is further work to be done it has set the path on further development in this area.

Table 1: Dissemination Activities carried out in first 12 months of the project

Type	Description
Participation to a conference	1. CNRS-ISAC: EGU General Assembly 2021 – vEGU21 Gather Online: A. Alessandri, Varying Signatures of Surface Albedo Feedback on the Northern Hemisphere Land Warming title, https://cnrsc-my.sharepoint.com/:b:/g/personal/andrea_alessandri_cnr_it/EQkUfME3AK5OgPxI1VlZfyUBSH3UF3OQG4iVBJKcVGDnow?e=dMhVon 2. CNRS-ISAC: EGU General Assembly 2021 – vEGU21 Gather Online, F. van Oorschot, 'Climate controlled root zone parameters show potential to improve water flux simulations by land surface models'

	3. BSC: EGU General Assembly 2021, Roberto Bilbao, Implementing the capability to respond to large volcanic eruptions in the C3S prediction systems.
Participation to a workshop	1. CNRS-ISAC: Virtual EC-Earth meeting, A. Alessandri, Towards observation-constrained representation of land cover and vegetation/hydrology processes in the H2020-CONFESS project, https://cnrsc-my.sharepoint.com/:b:/g/personal/andrea_alessandri_cnr_it/EZYHuRQxYwNChhgIewdfg9IBKfYXJkDXI7qEorvOSDk5_Q?e=lSNH1Q 2. CNRS-ISAC: Virtual EC-Earth meeting, F. van Oorschot, 'Climate controlled root zone parameters show potential to improve water flux simulations by land surface models', https://cnrsc-my.sharepoint.com/:p:/r/personal/andrea_alessandri_cnr_it/Documents/CONFESS-onedrive/PeriodicReport_1/presentation_ecearth2021_v2_fransjevanoorschot.pptx?d=w2625fab0cd9443cabc677bca26edf2ed&csf=1&web=1&e=xDi72O 3. BSC: WCRP Workshop on Attribution of multi-annual to decadal changes in the climate system, Roberto Bilbao, Impact of volcanic eruptions in CMIP6 decadal prediction systems: a multi-model analysis.
Web-site	1. Project Website: www.confess-h2020.eu
Other	1. ECMWF: A GLACE-VEG proposal with WP1 partners was submitted as a GEO Community Activities under GEO Work Programme. GLACE-VEG was also promoted under the GEWEX GLASS panel. 2. ECMWF: With the public release of WP1 report D1-1 on Vegetation dataset of Land Use/Land Cover and Leaf Area Index, feedback on the raw data deficiencies was provided to the Copernicus services (C3S and CGLS as data providers). 3. ECMWF: Link CONFESS to the WGNE activity led by Ariane Frassoni at CPTEC, data from preliminary CONFESS biomass burning experiments will be of sent. Whilst these are not the CONFESS experiments, they can be considered precursors experiments. The data will be processed at CPTEC and compared to other S2S systems such as CMA's, NASA's and NOAA's. CONFESS has been mentioned several times, and I do think it has gained some visibility thanks to this activity. 4. ECMWF: Conversations with CAMS regarding public dissemination of the biomass burning emission climatology. 5. ECMWF: Contribute to the planning for C3S ERA6 for maximum uptake of CONFESS developments.

Table 2 Presentation Activities carried out in second half of the project M13-M41

(items that are underlined provide a hyperlink to their url location)

Name	Type of meeting	Date	Location	Presenter	Presentation title	link to presentation	number of attendees
EGU general assembly	Conference	24-28 April 2023	Vienna, Austria	Emanuele Di Carlo	Effects of the realistic vegetation cover on predictions at seasonal and decadal time scales	Presentation	~100
EGU general assembly	Conference	24-28 April 2023	Vienna, Austria	Fransje van Oorschot	Improving the temporal and spatial vegetation variability in land surface models based on satellite observations	Poster	~30
3rd International Workshop on Stratospheric Sulfur and its Role in Climate (SSiRC)	Workshop	16-18 May 2022	Leeds, UK	Tim Stockdale	Volcanic eruptions and operational seasonal forecast systems	SSiRC_poster	50-60
EGU General Assembly	Conference	23-27 May 2022	Vienna Austria	Annalisa Cherchi	Effects of aerosols reduction on the Asian summer monsoon prediction: the case of summer 2020	Presentation	~100
ESA Living Planet Symposium 2022	Conference	23-27 May 2022	Bonn, Germany	Souhail Boussetta	Inter-Annual variability of the 1993-2019 harmonized land use/land cover and vegetation state evaluated within the ECMWF system and perspectives for future reanalysis	Poster	>2000

Name	Type of meeting	Date	Location	Presenter	Presentation title	link to presentation	number of attendees
ESA Living Planet Symposium 2022	Conference	23-27 May 2022	Bonn, Germany	Magdalena Balmaseda	The importance of Ocean and Land ECVS for S2S/S2D forecasting systems	Presentation	>2000
3rd Pan-GASS Meeting Understanding and Modeling Atmospheric Processes	Conference	25-29 July 2022	Monterey, CA, USA	Gildas Dayon	Impact of an interactive vegetation scheme on seasonal forecast	Presentation	~100
AOGS 2022	Conference	01-05 August 2022	Singapore (online)	Annalisa Cherchi	Effects of aerosols reduction on the Asian summer monsoon seasonal prediction: the case of summer 2020	Presentation	~30
WCRP hybrid symposium on Frontiers in Subseasonal to Decadal Prediction	Symposium	28 March 2023	Reading, UK	Andrea Alessandri	The role of vegetation in climate predictability and prediction	Presentation	~400
24th WGSIP Meeting	Symposium	27-29 March 2023	ECMWF, Reading, UK	Andrea Alessandri	GLACE-VEG proposal: multi model intercomparison of the effects on seasonal forecasts of a realistic representation of vegetation/land cover	Presentation	~40
24th WGSIP Meeting	Symposium	27-29 March 2023:	ECMWF, Reading, UK	Laurianne Batte	Update on H2020 CONFESS Project	Presentation	~40
WPCR Workshop on Improving Climate models using observations.	Workshop	12-14 June 2023	MIT Boston, USA	Magdalena Balmaseda	Consistent representation of temporal variations of boundary	Presentation	~100

Name	Type of meeting	Date	Location	Presenter	Presentation title	link to presentation	number of attendees
					forcing in reanalyses and seasonal forecasts		
WWRP/WCRP S2S summit	Conference	3-7 July 2023	University of Reading, UK	Magdalena Balmaseda	Towards Consistent representation of temporal variations of boundary forcing in reanalyses and S2S reforecasts	Presentation	~200
WWRP/WCRP S2S summit	Conference	3-7 July 2023	University of Reading, UK	Constantin Ardilouze	Predicting the leaf area index in a dynamical S2S forecast system	Presentation	~200
ECMWF Annual Seminar on Reanalyses	Conference	4-8 September 2023	ECMWF, Reading, UK	Magdalena Balmaseda	Towards Consistent representation of temporal variations of boundary forcing in reanalyses, reforecasts and climate integrations	Presentation	~100
EMS Annual Meeting	Conference	3–8 September 2023	Bratislava, Slovakia	Emanuele Di Carlo	Effects of the realistic vegetation cover on the large-scale circulation at seasonal and decadal time scales.	Presentation	~100
EGU general assembly	Conference	24-28 April 2023	Vienna, Austria	Annalisa Cherchi	A case study to investigate the role of aerosols reduction on the East Asian summer monsoon prediction	Presentation	~100

Name	Type of meeting	Date	Location	Presenter	Presentation title	link to presentation	number of attendees
AGU Fall meeting	Conference	11-15 December 2023	San Francisco, USA	Constantin Ardilouze	Subseasonal, Seasonal, and Longer-Timescale Predictability of Droughts/Floods and Land-Induced Forcing	Session organization and chairing + poster	~100
AGU Fall Meeting	Conference	11-15 December 2023	San Francisco, USA	Retish Senan	Impact of Time Varying Vegetation and Land Use/Land Cover on Seasonal Forecasts and Heat Extremes	Presentation	~100
American Meteorological Society 104th Annual Meeting, Baltimore (USA) https://ams.confex.com/ams/104ANNUAL/meetingapp.cgi/Home/0	Conference	28 Jan to 1 Feb 2024	Variability on Climate Predictions at Seasonal and Decadal Time Scales.	Andrea Alessandri	Effects of the Realistic Representation of Vegetation Variability on Climate Predictions at Seasonal and Decadal Time Scales.	Presentation	~200
CLIVAR workshop: Workshop on Confronting Earth System Model Trends with Observations: The Good, the Bad, and the Ugly. https://usclivar.org/meetings/confronting-earth-system-model-trends	Workshop	13-15 March 2024	Boulder, Colorado, USA (virtual)	Tim Stockdale	USA CLIVAR workshop: Workshop on Confronting Earth System Model Trends with Observations: The Good, the Bad, and the Ugly.	Poster	~150

Name	Type of meeting	Date	Location	Presenter	Presentation title	link to presentation	number of attendees
NCAR workshop on Earth System Predictability across time scales https://ncar.ucar.edu/predictability#:~:text=Scope,decades%2C%20and%20decades%20to%20centuries	Workshop	April 10-12, 2024	**Location:** NSF NCAR's Center Green Campus in Boulder, Colorado, and online	Magdalena Balmaseda			
Workshop on Climate Prediction and Services over the Atlantic-Arctic region (Bergen, 27-30 May 2024) https://bcpu.w.uib.no/workshop-may2024/	Workshop	27-30 May 2024	Location: Bergen	Roberto Bilbao	Impact of volcanic eruptions on CMIP6 decadal predictions: A multi-model analysis	Presentation	TBC

3.2 Review of the Dissemination Plan

CONFESS has, in deliverable D4.3, provided an initial plan for Dissemination and Communication Activities. The main activity for dissemination in the first year revolved around EGU, however in 2021, with the Covid-19 restrictions, these presentations and dissemination activities were limited. However following these restrictions being lifted the partners in CONFESS have been active in presenting the project as shown in Table 2. In particular the end of 2023 was a time when we participated in a number of large international events.

Though the number of peer – review papers is low, it is worth remembering that CONFESS had only 3 technical WPs and 4 project partners. The CONFESS project has acted to maintain and to update the website where information is shared on presentations, and all project deliverables are available either on our website or included in Zenodo repository.

4 Exploitation

Deliverable D4.3 already outlined potential exploitation avenues, as presented here again in Table 2 we have added a review of these at project closure.

Table 3: CONFESS Exploitation

	Items identified at project inception	Review at project closure
Exploitable Products	• new operational seasonal forecast system • seasonal forecast products • Improved operational decadal predictions with EC-Earth (www.decadal.bsc.es) • land reanalysis representing consistent temporal variations of land cover and vegetation for the period 1993-present • Proof-of-concept for treatment of temporal variations of land properties -land cover and vegetation- and improved radiative forcing from tropospheric aerosols in a full reanalysis. • Prototype of next generation of seasonal forecasts with treatment of temporal variations of land properties -land cover and vegetation- and improved radiative forcing from tropospheric aerosols. • Prototype of volcanic aerosols prediction module interfaced with 1 seasonal forecast. New capability for C3S.	This list of exploitable products remains valid at the end of the project and are already being used in different communities related to: • Biomass burning • LAI and vegetation maps Further definition of the TRL levels is included in our D4.8. However the products listed here are largely in use and contributing to the operational activities of C3S.

	• Proof-of-concept module for biomass burning impact interfaced with seasonal forecasts. New capability for C3S.	
Exploitation Activities during the Project	• Scientific exploitation (publication of articles, talks in international conferences) during the 3 years of the project • state-of-the-art/literature reviews, developments, competitive/ benchmark analysis • Determine the added value of the various products developed in CONFESS by quantifying the improvements in prediction skill. • liaison with stakeholders including C3S, continuous feedback	• Table 1 & 2 lists these activities • Greater recognition provided by the benchmarking analysis and D3.2 & D3.3 provide recommendations for implementation • A comparable approach is under consideration by US researchers to replicate the objectives CONFESS project for their contexts
Exploitation Activities after the end of the Project	• further developments, integration into services, research to operations • integration in the EC-Earth operational decadal system • full development of an operational seasonal forecast system with a higher degree of complexity, related to additional processes taken into account, such as interactive vegetation. This should take place within the two years following the end of the project. • Integration of prototypes into C3S	• The C3S community is utilising the methodologies and data outputs of CONFESS • Shown potential for better radiative forcing in ERA6 • vegetation maps LCU & LAI are very relevant to C3S
Consortium-wide/Joint Exploitation	• The new vegetation and aerosol forcing datasets (anthropogenic and volcanic). • Improved ECMWF reanalyses and predictions making use of them	• CONFESS products are being used and integrated int ERA6 and SEAS6 • CONFESS products used in follow on projects like CERISE

Further information on the benefits of CONFESSs has been reported in Deliverable D4.8 and it has confirmed that the products and activities described above remain relevant.

5 Conclusion

In D4.7 we have reported on the dissemination activities performed during the project, and reviewed the dissemination and exploitation plans. CONFESS has enabled a turning point on NWP systems used for reanalyses. Further uptake of quality observational datasets by climate community will facility more interaction in the community.

Document History

Version	Author(s)	Date	Changes
0.1	Tanya Warnaars (ECMWF)	18/03/2024	Initial version
1.0	(ECMWF)		Final version

Internal Review History

Internal Reviewers	Date	Comments
Magdalena Alonso Balmaseda (ECMWF)		