CMUG Deliverable
Number: **D6.1**
Due date: **31 May 2022**
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Version: **3.0**

Climate Modelling User Group

Deliverable 6.1 v3

Scientific Exploitation Report

Centres providing input: MOHC

Version	Date	Comment
1.0 Draft	May 2022	Draft submitted to ESA
1.0 Final	June 2022	Final version accepted by ESA

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CMUG D6.1 Scientific Exploitation Report

Executive Summary

The Climate Modelling User Group (CMUG) project has been running since 2012 across three phases (CCI Phase 1, CCI Phase 2, and CCI+ Phase 1). Phase 1 of CCI+ began in October 2018. The Scientific Exploitation Report (SER) describes the scientific engagement and outreach activities of CMUG. This version (v3) of the SER covers the period June 2021 – May 2022. Highlights from this period for the CMUG project include:

- Continued development of the CMUG website. For example, new sections such as the 'Case Study' tab and updates to existing sections such as 'Deliverables & Documents' and 'Publications & Presentations' tabs. See Section 2.2 for more details.

- Participation in meetings and workshops. Meetings include two CMUG Quarterly Progress Meetings (QPMs) in July 2021 and February 2022, one Climate Science Working Group (CSWG) meeting in April 2022, and several 'Next Phase' planning meetings such as on 18th October 2021 and 11th January 2022. 'Next Phase' discussions also formed significant parts of the aforementioned CSWG and QPM meetings. CMUG also attended the Living Planet Symposium in May 2022 and presented an overview talk, and also hosted a stall at the Met Office Climate Services Week Event in May 2022 with a poster and leaflets. See Section 2.4, 2.5 and Annex A1 for more details on meetings and workshops.

- There are, as of May 2022, a total of 34 CMUG peer-reviewed publications from all three phases of CMUG. Some publications have an impressive number of citations, with some increasing since the previous version of this report. Many reach over 50 citations. In particular mention, Hollman *et al.* (2013) reached 336 citations as of May 2022, an increase of 33 since June 2021. Another publication of note is Eyring *et al*. (2019) with a total citation number of 244 as of May 2022. See Annex A3 and A4 for further details on publications and citation numbers.

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1. Introduction

The Climate Modelling User Group (CMUG) project has been running since 2012, with CCI+ Phase 1 running since October 2018. CMUG includes outreach and engagement activities for an audience including the climate research community (including reanalysis, climate impact studies and climate modelling), international coordinating bodies, scientific press, the general public and others with a general interest in the earth climate system.

This Scientific Exploitation Report (SER) documents the scientific engagement and exploitation activities and their outcomes/successes for CCI+ Phase 1 of the CMUG project for the period since the previous SER, June 2021 – May 2022. The COVID-19 pandemic has had an impact on the timeframe of some CMUG activities during this period.

During June 2021 – May 2022, CMUG has delivered the following engagement and exploitation activities:

1. Presentations on experiments involving ESA CCI datasets at forums such as the Climate Science Working Group (CSWG) and CCI CMUG Quarterly Progress Meetings.
2. Continued development of the CMUG website to make the community aware of the CCI datasets, content ,quality and availability.
3. High level awareness of CMUG activities at CMUG partner institutes.
4. Working level interactions with key scientists in climate modelling and reanalysis centres through the scientists in CMUG institutes and CCI/CMUG meetings.
5. Work to include selected ECV datasets on the Obs4MIPs database.
6. Link with relevant EU projects which require CCI data as input. The CMUG has a wide involvement with such projects (e.g., H2020 projects APPLICATE, INTAROS and CONFESS; see Section 2.1).
7. Give inputs to relevant WCRP activities as appropriate.
8. Coordinate outreach with CCI projects to ensure consistent messaging is given.
9. Advertise early use of CCI datasets in CMUG partner institutes.
10. By working with the CCI projects, ensure that the Climate Data Records (and associated observation operators) are easy to access and ingest in commonly used formats.

2. Engagement and Exploitation

2.1 Key engagement and exploitation activities

CMUG has continued its outreach and engagement activities to the climate modelling community (CMC), climate research community (CRC), and others (international bodies, scientific press, and the general public).

Various engagement and outreach activities are being carried out to publicise the CCI datasets to encourage their use and exploitation. Such external data exploitation to date includes the use of CCI data for climate model initialisation, prescribing boundary conditions, assimilation, reanalysis, climate monitoring, and in-situ quality control.

An example of research uptake using CCI data is the H2020 APPLICATE project (Advanced Prediction in Polar regions and beyond: modelling, observing system design and LInkages associated with a Changing Arctic climaTE) which uses the Sea Ice ECV dataset. In this project, BSC (Barcelona Supercomputing Centre, CMUG partner) explored different avenues to improve their earlier seasonal forecast system, from implementing and testing new physical parameterizations, to increase the horizontal resolution or to explore new initialisation approaches. The final delivery was to produce and evaluate an improved seasonal forecast system, including all the new beneficial features. One of them was the sea ice assimilation technique developed in CMUG.

The H2020 INTAROS project (Integrated Arctic Observation System) is another example where data from Sea Ice CCI has been used. For this project, BSC were involved in one task to explore the benefits of Arctic satellite observations, produced in the project, on climate predictions. This task aligned well with a Work Package and Deliverable (D3.8) within CMUG, for which BSC developed a nudging capability to assimilate Sea Ice Concentrations in their model, in order to eventually explore the added value of improved sea ice initialization on the seasonal predictive skill. BSC exploited the synergies between both tasks and performed a joint analysis in which they alternatively assimilated INTAROS and ESA-CCI products to initialize sea ice in their BSC seasonal prediction system, so they could evaluate the sensitivity of the results to the assimilated product. Interestingly, BSC found large added value in the assimilation of sea ice, and robust results independently of the product that is assimilated. These results are presented in a research article recently accepted for publication in Environmental Research Letters. This research article is listed in Appendix A3 (Navarro *et al*., 2022).

Furthermore, CMUG is involved with the H2020 CONFESS project (CONsistent representation of temporal variations of boundary Forcings in reanalysES and Seasonal forecasts) which aims to improve the reliability and usability of information provided by the Copernicus Climate Change service. CCI data in CONFESS are used in the CMUG work package related to land surface processes.

The main means of communication to audiences outside the CCI is the CMUG project website (see Section 2.2 for full details), which provides a wide range of information from News and Case Studies to Deliverables and Publications (climate.esa.int/en/projects/cmug/).

CMUG attendance at national and international climate research events (conferences, unions, symposia, etc.) is another key channel through which information about the CCI reaches the scientific community and a wider set of stakeholders (scientific press, policymakers and 'interested' public). This work is supported by a range of media such as oral presentations, poster sessions, flyers, news bulletins, etc. A summary of meetings for the period covered by this report is given in Annex A1.

CMUG research results are also disseminated via peer-reviewed journals (see Annexes A3 and A4), and articles in programme bulletins. This is a specialist route to the climate science community and the scientific press.

Formal communication on CMUG outreach and engagement activities has been recorded in monthly and quarterly management reports and presented at CMUG management meetings and CMUG quarterly and annual progress meetings with ESA.

2.2 CMUG website

The CMUG website, hosted on ESA's web server, is fully functional and kept up-to-date. The website is managed and updated via a website editor tool, Wagtail. The CMUG website (see Figure 1) consists of the following:

- A Home page with a brief introduction about the project and highlights of recent news and events.
- An 'About' tab with detailed information on the project, its structure, objectives, aims and main activities.
- A 'News' tab with news items relevant to CMUG.
- A 'Case Studies' tab with a showcase of recent CMUG case studies, such as ESMValTool, Obs4MIPs and several CCI ECV projects.
- A 'Deliverables & Documents' tab which lists all CMUG deliverables and documents.
- A 'Team' tab showcasing partner members and individual biographies.
- A 'Publications & Presentations' tab which lists and links to all publications (e.g., newsletters, posters, scientific papers) and presentations (e.g., presentations from each CMUG Integration meeting since March 2011).
- A 'Related Links' tab with links and short descriptions for Obs4MIPs, GCOS, WCRP and C3S webpages.
- A 'Contacts & FAQ' tab with information on how to contact CMUG for further information or with any questions, as well as a comprehensive FAQ section.

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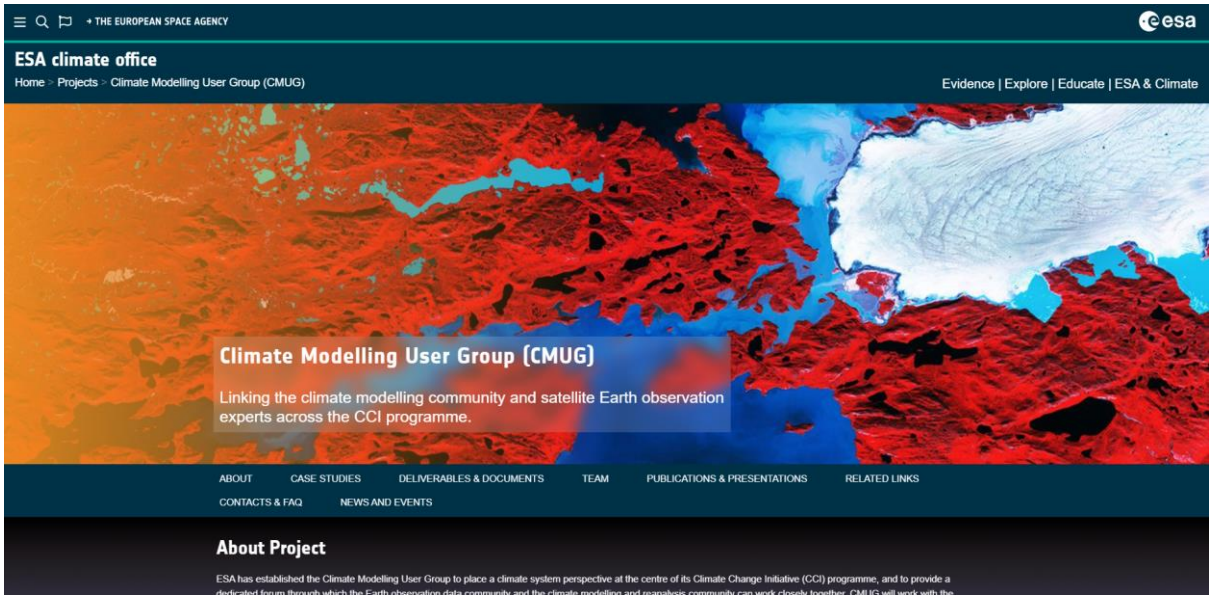

Figure 1: CCI CMUG new website screenshot (May 2022).

2.3 CMUG Website Case Studies

CMUG Deliverable 2.2 was originally the 'CMUG Data Forum' which existed on the old CMUG website. Once the new website had been fully implemented, it was found that the information once showcased on the old CMUG Data Forum was found to be a repeat or obsolete with respect to the new website content. The CMUG Data Forum as a separate webpage was removed and deliverable (D2.2) was redesigned to instead reflect the 'Case Studies' tab on the new website. Figure 2 shows the 'Case Studies' tab on the website.

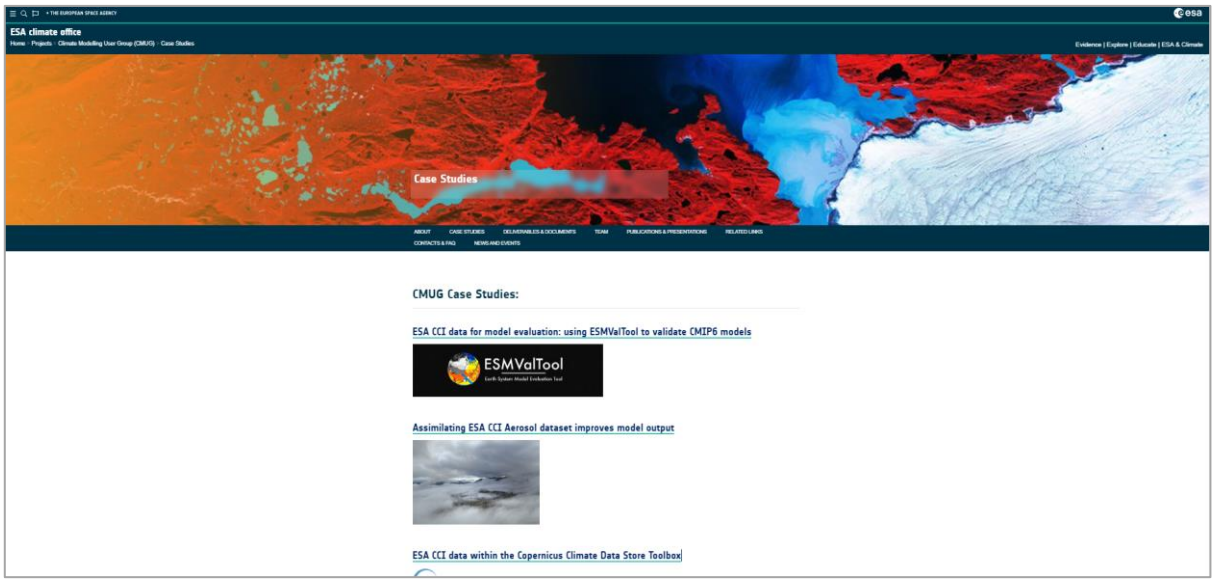

Figure 2: CMUG new website's tab 'Case Studies' screenshot (May 2022).

This page is kept up-to-date when new information is released from the CMUG partner projects. Each case study page also includes an 'About the author' section at the end. Several new case studies have been added in the period of this report June 2021 – May 2022. For example, these include information regarding the following:

- ESMValTool
- Obs4MIPs
- Copernicus Climate Data Store Toolbox
- ESA CCI ECVs such as Aerosol, Snow, Land Surface Temperature, Soil Moisture, Sea Ice, Clouds, Sea Surface Temperatures, Ozone, and other marine ECVs

2.4 Meetings

Between June 2021 and May 2022, CMUG has organised and participated in a number of significant meetings, which are also listed in chronological order in Annex A1.

CMUG Integration Meeting October 2021

There has been one CMUG Integration meeting between June 2021 – May 2022, held alongside the CCI Colocation meeting. The Integration meeting took place virtually 4-5th October 2021, with the Colocation meeting following afterwards 6-8th October 2021. This Integration meeting was the tenth Integration meeting since the start of the project in 2012.

Further information on the Colocation meeting can be found on the ESA website here. The Integration and Colocation meetings was originally planned for March 2021, but due to the COVID-19 pandemic it was postponed for October 2021 and planned to be fully virtual.

The aims of the Integration meeting were to 1) discuss achievements, including science highlights from Work Package leads; 2) gather feedback from CCI projects on CMUG outputs; and 3) plan for the next phase of CMUG, including discussions on improvements to deliverables and discussions of early ideas for experiments. A prominent meeting aim was to kick off an ongoing conversation with the ECV projects who will be invested in the CMUG outputs for the next phase of the project. The meeting was successful, with a wide range of feedback gathered on the discussion points. Breakout sessions germinated thoughts and ideas on CMUG documents and future experiments which will feed into the next phase planning for CMUG for CCI+ Phase 2. The meeting had a wide range of attendance, including CMUG, CCI Science Leads, Climate Research Group (CRG) members, CSWG members, ESA Technical Officers and other wider CCI members. The attendee numbers reached 60+ at times during the two-day meeting with at least 50 at any one time.

The meeting webpage is accessible on the CMUG website here, and includes the meeting agenda, presentation links, and posters.

CMUG Quarterly Progress Meetings July 2021 and February 2022

There have been two CMUG Quarterly Progress Meetings (QPMs) in this period; 5 July 2021 and 10 February 2022. These meetings include CMUG members with project partners, ESA, and ESA Technical Officers. Each Work Package lead provides an update via a presentation with time for questions and a short discussion afterwards. The discussions provide a valuable space for cross-partner and cross-ECV collaboration and allows the identification of needs where partner experts can contribute. The QPM in February 2022 also included a segment to discuss proposals for next phase experiments. Here, for example, cross-institute collaborations were discussed and potential new ECVs outlined.

CSWG Meeting April 2022

There has been one CSWG meeting in this period. The CSWG was held virtually on 4th April 2022.

The CSWG mainly works to examine the climate quality and consistency of CCI ECV CDRs, redefining scientific requirements of climate data users, provide feedback between ECV projects on common issues, and coordinate outreach plans to the climate research community. Each CSWG meeting focuses on a subset of ECVs.

CSWG meetings usually focus on a subset of ECVs, to discuss and facilitate cross-ECV discussion and collaboration. This CSWG, however, had a focus on ‘progress updates since the last Integration Meeting (Oct 2021) and next phase experiments’. This was due to the upcoming next phase of the project and the CSWG meeting provided a good opportunity to

get partners together to discuss further details relating to next phase plans and experiments. A newsletter was produced and circulated ahead of the meeting, to highlight the CSWG as well as outline recent CMUG news. See Annex A2 for further details on CMUG newsletters.

DEWG Meetings

The Data Engineering Working Group (DEWG) comprises one representative from each CCI project, a representative from ESA who is Chair of the working group, plus two members from ESA involved in ESA Climate Office Knowledge Exchange activities. Additional people are invited to attend meetings at the Chair's request. The objective of the DEWG is to ensure maximum usability of the datasets produced within CCI, and cultivate tools for their access, discovery and manipulation, through common CCI data standards. There have not been any DEWG meetings during this period, but discussions have taken place with the DEWG Lead and it is hoped CMUG will be more involved soon.

Living Planet Symposium May 2022

CMUG participated in ESA's 2022 Living Planet Symposium (LPS) held on 23-27 May 2022 at the World Conference Centre Bonn, Germany. The event is held every three years and was organised with the support of the German Aerospace Centre (DLR). This symposium focused on "how Earth observation contributes to science and society, and how disruptive technologies and actors are changing the traditional Earth observation landscape, which is also creating new opportunities for public and private sector interactions." (quote taken from the LPS website here). At the LPS in May 2022, the CMUG project manager presented an overview talk in the session on "Exploring the interface of observations and modelling" which generated useful discussions and feedback. This was followed up by a meeting with the heads of the CMIP and CORDEX project offices about collaboration in the next phase of CMUG. The CMUG science lead also gave a presentation in the plenary session on "The global climate: a status update" entitled "Earth Observation contributions to the IPCC AR6 WGI".

Met Office Street Event May 2022

CMUG participated in a Met Office Street Event between 9-13th May 2022. This event took place at the Met Office headquarters in Exeter, UK, and was an opportunity to advertise the project to internal members of the Met Office. A poster was produced to highlight the project and its main outputs, as well as leaflets with the same purpose, for people to take away.

Figure 3 shows the poster, and Figure 4 shows the leaflet.

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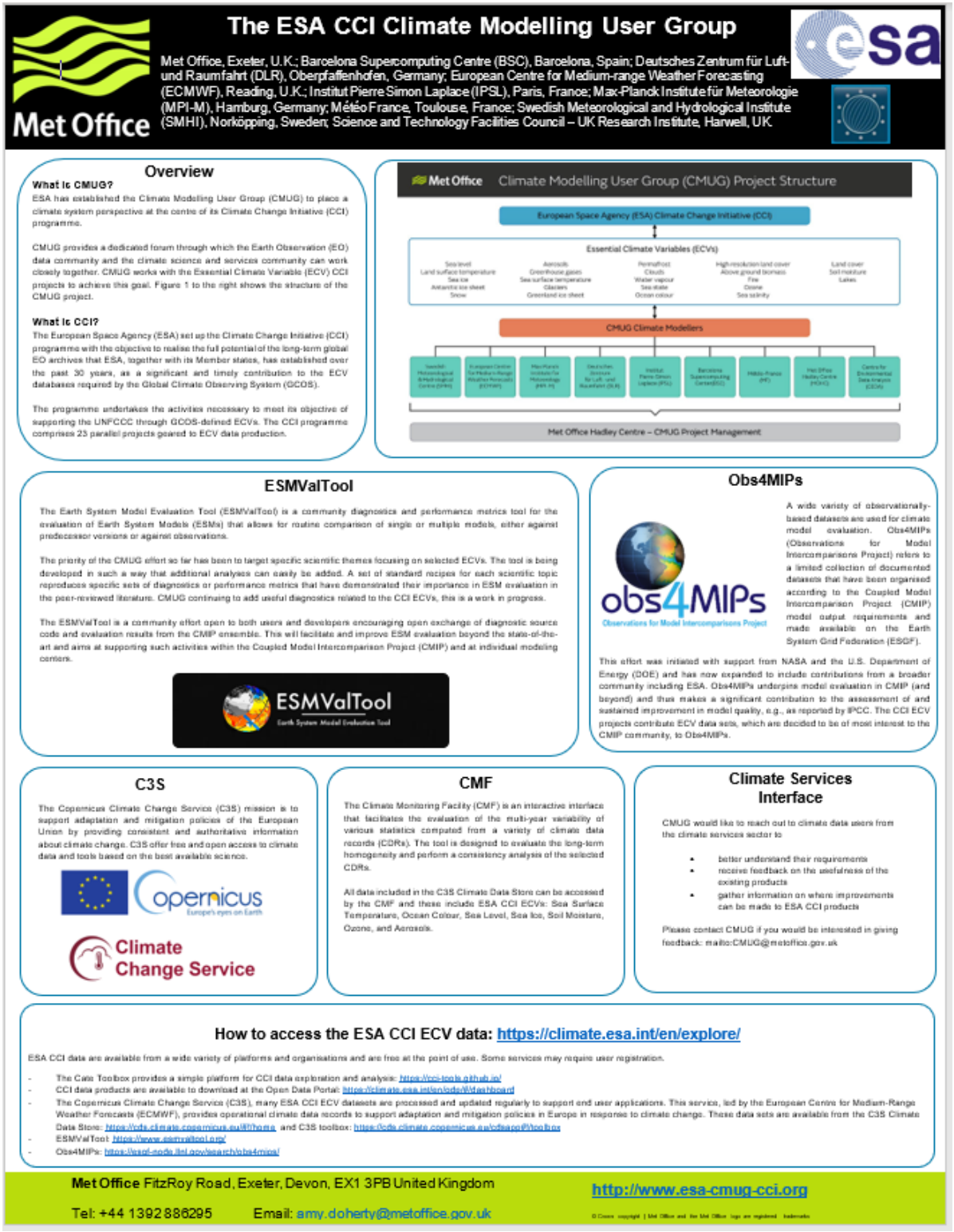

Figure 3: CMUG poster for the Met Office Street Event, May 2022

Figure 4: CMUG leaflet for the Met Office Street Event, May 2022

Other CMUG Meetings

CMUG has continued monthly internal management meetings as well as monthly meetings between CMUG and ESA. These meetings discuss any outstanding points, such as due deliverables or upcoming events, as well as keep a record of ongoing actions to complete by designated deadlines. Alongside these, CMUG members organise ad-hoc meetings where needed, such as to discuss an ongoing deliverable or upcoming event (e.g., ahead of the Integration Meeting, October 2021).

2.5 Workshops

Between June 2021 and May 2022, CMUG has participated in one workshop of note, which is also listed in chronological order with CMUG meetings in Annex A1.

This workshop was the '2nd Technical ESMValTool Workshop 2021' which took place virtually 23-25 November 2021 with 34 participants from BSC, DLR, Met Office, NLeSC, PML, SMHI, U Bremen and U Reading. The main goal of the workshop was to bring together the development community, discuss future strategies and provide updates on progress since the previous workshop in May 2021. The workshop included topics and side meetings on the following:

- Latest developments (e.g., mamba installation, highlights from v2.4 etc.)
- Native model grids and diagnostics for monitoring model runs
- Support for regional models

- Testing recipes
- Non-backward compatible changes
- General discussions
- Side meetings on user engagement, cross-team meeting, and pinning dependencies

A workshop summary report for this workshop, as well as previous workshops, is available on the ESMValTool website here.

2.6 Other reports

CMUG has continued to produce monthly and quarterly reports to ESA. These reports summarise the previous month or quarter's progress within CMUG, including management, Work Package progress, contract / finances, deliverables status, meetings, ongoing actions, and an up-to-date journal paper publications list. The monthly reports are more in-depth summaries whereas the quarterly reports are more concise and condensed versions of the previous few months' worth of reports.

Each CSWG meeting has been accompanied by a newsletter, produced and circulated to the CSWG a couple of weeks ahead of each meeting. The purpose of the newsletter is to advertise the upcoming CSWG meeting, with details and agenda outlined, as well as to highlight any relevant CMUG news, scientific or otherwise. Between June 2021 and May 2022 there have been two newsletters produced and circulated – one for the Integration Meeting in Oct 2021, and a second for the CSWG meeting in April 2022. These two newsletters can be found in Annex A2 (and all newsletters can be found on the associated webpage here).

The three new CMUG journal papers June 2021 – May 2022 are listed in Annex A3 and all 34 CMUG journal papers up until May 2022 in Annex A4. Furthermore, both lists include the number of citations each paper has had. Some publications in Annex A4, which were included in the previous SER, show a comparison of the number of citations between now and then.

Annex A

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A1 Meetings and workshops attended by CMUG

Annex A1 table below describes the CCI programme and external science meetings between June 2021 and May 2022 to which there was a contribution by the CMUG team. Workshops with CMUG attendance or participation are also included. It excludes CCI ECV project meetings which are part of the CCI and are also attended by CMUG team members as they are concerned more with science research than outreach.

Date	Meeting/workshop	Location	CMUG role
2021			
5 Jul	CMUG Quarterly Progress Meeting	Online	Progress update meeting
4-5 Oct	CMUG Integration Meeting	Online	Discuss science highlights and plan for next phase
6-8 Oct	CCI Colocation	Online	Attend
23-25 Nov	2nd Technical ESMValTool Workshop		Bring together the development community, discuss future strategies and provide progress updates
29 Nov	CMUG Next Phase Meeting	Online	Discussions with ESA and partners on next phase planning
2022			
23 Jan	Next Phase Experiments Discussion	Online	Discussions with ESA and partners on next phase experiment ideas and potential proposals
10 Feb	CMUG Quarterly Progress Meeting	Online	Progress update meeting
4 Apr	CMUG CSWG Meeting	Online	Focus on Progress Updates since the last Integration Meeting (Oct 2021) and Next Phase Discussions
9-13 May	Met Office Street Event	Met Office, UK	Host a stall with poster and leaflets to advertise CMUG and outputs
23-27 May	2022 Living Planet Symposium	Bonn, Germany	Attendance and presented overview talk

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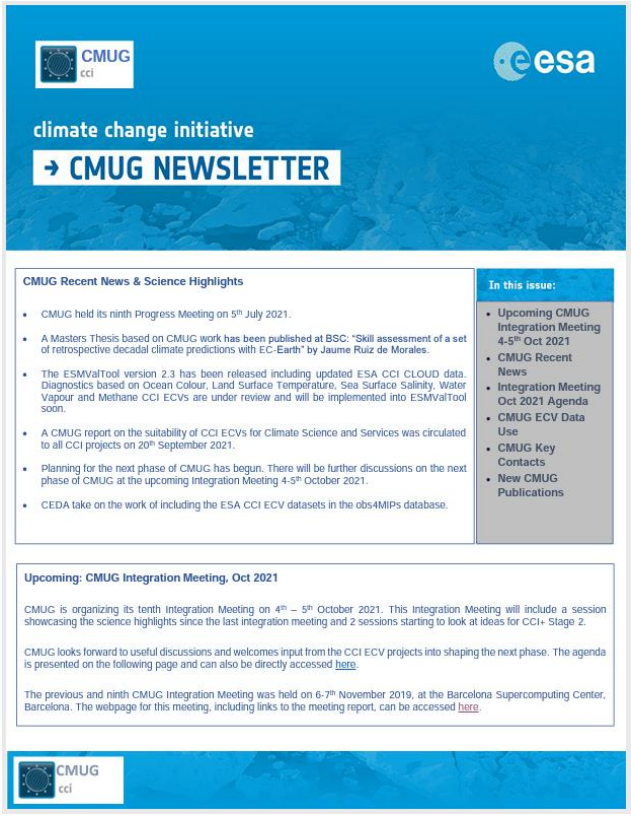
A2 CMUG Newsletters

Annex A2 showcases the CMUG newsletters, in order, for October 2021, and April 2022. All newsletters can also be found on CMUG's website page here.

Newsletter for Integration October 2021


CMUG cci

climate change initiative

→ CMUG NEWSLETTER

CMUG Recent News & Science Highlights

- CMUG held its ninth Progress Meeting on 5th July 2021.
- A Masters Thesis based on CMUG work has been published at BSC: "Skill assessment of a set of retrospective decadal climate predictions with EC-Earth" by Jaume Ruiz de Morales.
- The ESMValTool version 2.3 has been released including updated ESA CCI CLOUD data. Diagnostics based on Ocean Colour, Land Surface Temperature, Sea Surface Salinity, Water Vapour and Methane CCI ECVs are under review and will be implemented into ESMValTool soon.
- A CMUG report on the suitability of CCI ECVs for Climate Science and Services was circulated to all CCI projects on 20th September 2021.
- Planning for the next phase of CMUG has begun. There will be further discussions on the next phase of CMUG at the upcoming Integration Meeting 4-5th October 2021.
- CEDA take on the work of including the ESA CCI ECV datasets in the obs4MIPs database.

In this issue:

- Upcoming CMUG Integration Meeting 4-5th Oct 2021
- CMUG Recent News
- Integration Meeting Oct 2021 Agenda
- CMUG ECV Data Use
- CMUG Key Contacts
- New CMUG Publications

Upcoming: CMUG Integration Meeting, Oct 2021

CMUG is organizing its tenth Integration Meeting on 4th – 5th October 2021. This Integration Meeting will include a session showcasing the science highlights since the last integration meeting and 2 sessions starting to look at ideas for CCI+ Stage 2.

CMUG looks forward to useful discussions and welcomes input from the CCI ECV projects into shaping the next phase. The agenda is presented on the following page and can also be directly accessed here.

The previous and ninth CMUG Integration Meeting was held on 6-7th November 2019, at the Barcelona Supercomputing Center, Barcelona. The webpage for this meeting, including links to the meeting report, can be accessed here.

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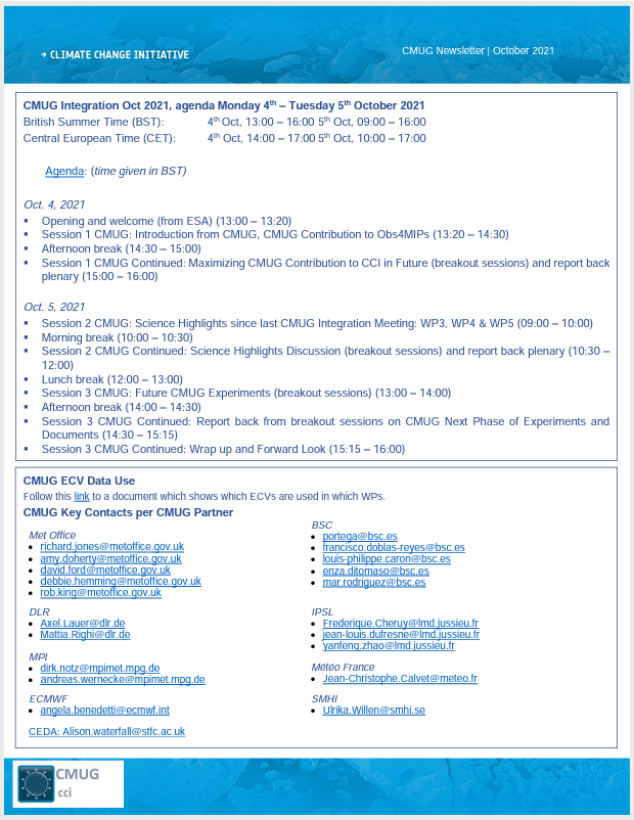
→ CLIMATE CHANGE INITIATIVE

CMUG Newsletter | October 2021

CMUG Integration Oct 2021, agenda Monday 4th – Tuesday 5th October 2021

British Summer Time (BST): 4th Oct, 13:00 – 16:00 5th Oct, 09:00 – 16:00
Central European Time (CET): 4th Oct, 14:00 – 17:00 5th Oct, 10:00 – 17:00

Agenda: (*time given in BST)*

Oct. 4, 2021

- Opening and welcome (from ESA) (13:00 – 13:20)
- Session 1 CMUG: Introduction from CMUG, CMUG Contribution to Obs4MIPs (13:20 – 14:30)
- Afternoon break (14:30 – 15:00)
- Session 1 CMUG Continued: Maximizing CMUG Contribution to CCI in Future (breakout sessions) and report back plenary (15:00 – 16:00)

Oct. 5, 2021

- Session 2 CMUG: Science Highlights since last CMUG Integration Meeting: WP3, WP4 & WP5 (09:00 – 10:00)
- Morning break (10:00 – 10:30)
- Session 2 CMUG Continued: Science Highlights Discussion (breakout sessions) and report back plenary (10:30 – 12:00)
- Lunch break (12:00 – 13:00)
- Session 3 CMUG: Future CMUG Experiments (breakout sessions) (13:00 – 14:00)
- Afternoon break (14:00 – 14:30)
- Session 3 CMUG Continued: Report back from breakout sessions on CMUG Next Phase of Experiments and Documents (14:30 – 15:15)
- Session 3 CMUG Continued: Wrap up and Forward Look (15:15 – 16:00)

CMUG ECV Data Use

Follow this link to a document which shows which ECVs are used in which WPs.

CMUG Key Contacts per CMUG Partner

Met Office
- richard.jones@metoffice.gov.uk
- amy.doherty@metoffice.gov.uk
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Newsletter for CSWG April 2022

climate change initiative

→ CMUG NEWSLETTER

CMUG Recent News & Science Highlights

- The CMUG Integration Meeting was held on 4-5th Oct 2021, this facilitated numerous useful discussions and renewed contacts between CMUG and CCI ECV projects. It also generated dialogue around plans for CCI+ Phase 2 and how CMUG might evolve further.
- A CMUG Progress Meeting was held on 10th Feb 2022.
- ESMValTool v2.5 was released on 14th March 2022, this included new ESA CCI ECVs and associated diagnostics implemented by CMUG (WV, SSS, OC, GHGS (XCH4), and LST).
- An internal Met Office seminar was held in Feb 2022 to present recent CMUG work on biophysical feedback experiments assimilating ocean colour.
- UKRI-STFC began a contract with CMUG working on adding CCI ECVs to Obs4MIPs. This will run for one year from Feb 2022.
- CMUG representation at the 2nd Technical ESMValTool Workshop on 23-25 Nov 2021.

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- Upcoming CSWG Meeting 4th April 2022
- CMUG Recent News
- CSWG 4th April 2022 Agenda
- CMUG ECV Data Use
- CMUG Key Contacts
- New CMUG Publications
- CMUG Partner Contacts per ECV

Upcoming: CSWG April 2022

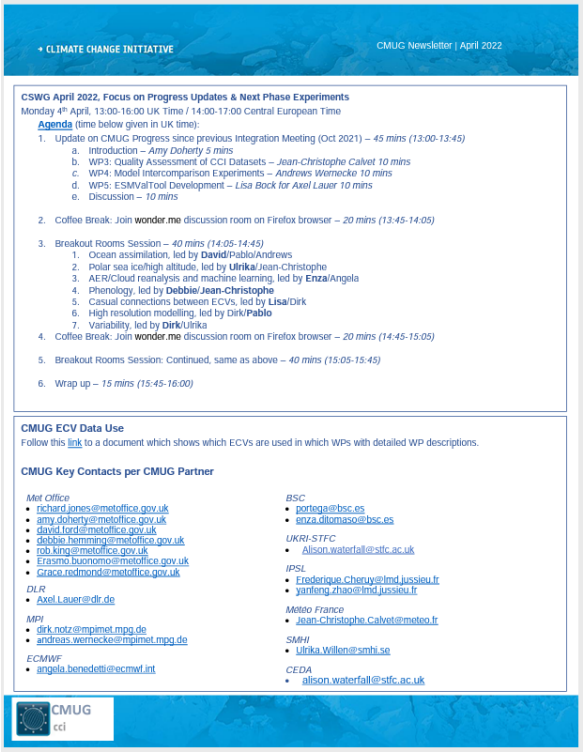
CMUG is organising its next Climate Science Working Group (CSWG) meeting on 4th April, 13:00 – 16:00 (UK time) / 14:00 – 17:00 (Central European Time). This CSWG meeting will focus on progress updates since the Integration Meeting in Oct 2021, as well as on proposals for next phase (CCI+ Phase 2) experiments. The invitation is extended to all CCI project members and CMUG partners. The agenda is presented on the following page and can also be accessed directly here. The link to join the Teams meeting is on the agenda document and is also linked here.

Previous: CSWG May 2021

CMUG's previous CSWG meeting was held on 7th May 2021 and focused on three ECVs: Lakes, Snow, and Permafrost. The previous CSWG Newsletter for May 2021 can be found here and the minutes from this CSWG meeting can be found here.

Previous: CMUG Integration Meeting October 2021

The CMUG Integration Meeting was held on 4-5th October 2021. The meeting included a session showcasing science highlights since the Integration Meeting before that (Nov 2019) and also included two sessions which focused on discussing ideas for CCI+ Phase 2. The newsletter for this meeting can be found here and its webpage with further details and presentations here.



→ CLIMATE CHANGE INITIATIVE — CMUG Newsletter | April 2022

CSWG April 2022, Focus on Progress Updates & Next Phase Experiments

Monday 4th April, 13:00-16:00 UK Time / 14:00-17:00 Central European Time

Agenda (time below given in UK time):

1. Update on CMUG Progress since previous Integration Meeting (Oct 2021) – *45 mins (13:00-13:45)*
   a. Introduction – *Amy Doherty 5 mins*
   b. WP3: Quality Assessment of CCI Datasets – *Jean-Christophe Calvet 10 mins*
   c. WP4: Model Intercomparison Experiments – *Andrews Wernecke 10 mins*
   d. WP5: ESMValTool Development – *Lisa Bock for Axel Lauer 10 mins*
   e. Discussion – *10 mins*
2. Coffee Break: Join wonder.me discussion room on Firefox browser – *20 mins (13:45-14:05)*
3. Breakout Rooms Session – *40 mins (14:05-14:45)*
   1. Ocean assimilation, led by **David**/Pablo/Andrews
   2. Polar sea ice/high altitude, led by **Ulrika**/Jean-Christophe
   3. AER/Cloud reanalysis and machine learning, led by **Enza**/Angela
   4. Phenology, led by **Debbie**/**Jean-Christophe**
   5. Casual connections between ECVs, led by **Lisa**/Dirk
   6. High resolution modelling, led by Dirk/**Pablo**
   7. Variability, led by **Dirk**/Ulrika
4. Coffee Break: Join wonder.me discussion room on Firefox browser – *20 mins (14:45-15:05)*
5. Breakout Rooms Session: Continued, same as above – *40 mins (15:05-15:45)*
6. Wrap up – *15 mins (15:45-16:00)*

CMUG ECV Data Use

Follow this link to a document which shows which ECVs are used in which WPs with detailed WP descriptions.

CMUG Key Contacts per CMUG Partner

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Publications

The below publications have been added to CMUG's list of publications since the Integration Meeting (October 2021):

1. Acosta Navarro, J.C., J. Garcia-Serrano, V. Lapin, P. Ortega (Submitted) Added value of assimilating springtime Arctic sea ice concentration in summer-fall climate predictions, Environmental Research Letters.
2. Klose, M., Jorba, O., Gonçalves Ageitos, M., Escribano, J., Dawson, M. L., Obiso, V., Di Tomaso, E., Basart, S., Montané Pinto, G., Macchia, F., Ginoux, P., Guerschman, J., Prigent, C., Huang, Y., Kok, J. F., Miller, R. L., and Pérez García-Pando, C.: Mineral dust cycle in the Multiscale Online Nonhydrostatic AtmosphereR CHemistry model (MONARCH) Version 2.0. Geosci. Model Dev., 14, 6403–6444, https://doi.org/10.5194/gmd-14-6403-2021, 2021.

CMUG Partner Contact per ECV

Below is a table that shows the corresponding CMUG Partner Contact information for each ECV project, including listed institutions and emails.

ECV	Corporate Author	Organisation	Website
Aerosols	Angela Benedetti	ECMWF	www.ecmwf.int
	Enza Di Tomaso	BSC	www.bsc.es
Biomass/AGB	Debbie Hemming	Met Office	www.metoffice.gov.uk
Clouds	Pablo Ortega	BSC	www.bsc.es
	Axel Lauer	DLR	www.dlr.de
	Ulrika Willen	SMHI	www.smhi.se
Fire/Burnt area	Pablo Ortega	BSC	www.bsc.es
	Etienne Tourigny	BSC	www.bsc.es
Glaciers	No CMUG contact - contact Amy Doherty CMUG project manager with queries		N/A
Greenhouse Gases	Axel Lauer	DLR	www.dlr.de
Ice sheets	No CMUG contact – contact Amy Doherty CMUG project manager with queries		N/A
Lakes	Richard Jones	Met Office	www.metoffice.gov.uk
	Erasmo Buocorno	Met Office	www.metoffice.gov.uk
	Grace Redmond	Met Office	www.metoffice.gov.uk
Land cover			
	Jean-Christophe Calvet	Météo France	www.meteofrance.com
	Enza Di Tomaso	BSC	www.bsc.es
	Frédérique Cheruy	IPSL	cmc.ipsl.fr
	Debbie Hemming	Met Office	www.metoffice.gov.uk
LST	Rob King	Met Office	www.metoffice.gov.uk
	Dirk Notz	MPI-M	www.mpimet.mpg.de
	Jean-Christophe Calvet	Météo France	www.meteofrance.com
	Frédérique Cheruy	IPSL	cmc.ipsl.fr
	Andreas Wernecke	MPI-M	www.mpimet.mpg.de
Ocean Colour	David Ford	Met Office	www.metoffice.gov.uk
	Pablo Ortega	BSC	www.bsc.es
Ozone	Angela Benedetti	ECMWF	www.ecmwf.int
Permafrost	Jean-Christophe Calvet	Météo France	www.meteofrance.com
Sea ice	Pablo Ortega	BSC	www.bsc.es
	David Ford	Met Office	www.metoffice.gov.uk
	Dirk Notz	MPI-M	www.mpimet.mpg.de
	Andreas Wernecke	MPI-M	www.mpimet.mpg.de
Sea level	David Ford	Met Office	www.metoffice.gov.uk
	Pablo Ortega	BSC	www.bsc.es
Sea State	David Ford	Met Office	www.metoffice.gov.uk
Sea surface salinity	David Ford	Met Office	www.metoffice.gov.uk
	Dirk Notz	MPI-M	www.mpimet.mpg.de
	Pablo Ortega	BSC	www.bsc.es
	Andreas Wernecke	MPI-M	www.mpimet.mpg.de
SST	David Ford	Met Office	www.metoffice.gov.uk
	Pablo Ortega	BSC	www.bsc.es
	Dirk Notz	MPI-M	www.mpimet.mpg.de
	Andreas Wernecke	MPI-M	www.mpimet.mpg.de
	Ulrika Willen	SMHI	www.smhi.se
Snow	Jean-Christophe Calvet	Météo France	www.meteofrance.com
	Frédérique Cheruy	IPSL	cmc.ipsl.fr
	Dirk Notz	MPI-M	www.mpimet.mpg.de
	Andreas Wernecke	MPI-M	www.mpimet.mpg.de
Soil Moisture	Frédérique Cheruy	IPSL	cmc.ipsl.fr
	Debbie Hemming	Met Office	www.metoffice.gov.uk
	Jean-Christophe Calvet	Météo France	www.meteofrance.com
Water Vapour	Angela Benedetti	ECMWF	www.ecmwf.int
	Axel Lauer	DLR	www.dlr.de

A3 CMUG peer-reviewed publications June 2021 – May 2022

Annex A3 table lists CMUG peer-reviewed publications for the period June 2021 – May 2022. References are given as well as the number of citations, as sourced from Google Scholar (as of May 2022).

Paper	Citations
Acosta Navarro, J.C., J. García-Serrano, **V. Lapin**, **P. Ortega,** Added value of assimilating springtime Arctic sea ice concentration in summer-fall climate predictions, Environmental Research Letters, Accepted, 2022.	**-**
Authors "Evaluating clouds using ESA CCI data" J. Clim. Submitted, 2022	**-**
Klose, M., Jorba, O., Gonçalves Ageitos, M., Escribano, J., Dawson, M. L., Obiso, V., **Di Tomaso, E**., Basart, S., Montané Pinto, G., Macchia, F., Ginoux, P., Guerschman, J., Prigent, C., Huang, Y., Kok, J. F., Miller, R. L., and **Pérez García-Pando, C**.: Mineral dust cycle in the Multiscale Online Nonhydrostatic AtmospheRe CHemistry model (MONARCH) Version 2.0, Geosci. Model Dev., 14, 6403–6444, https://doi.org/10.5194/gmd-14-6403-2021, 2021.	**4**

CMUG Deliverable
Number: **D6.1**
Due date: **31 May 2022**
Submission date:
Version: **1.0**

A4 All CMUG peer-reviewed publications up to May 2022

Annex A4 table lists all CMUG peer-reviewed publications up until May 2022. References are given as well as the number of citations, as sourced from Google Scholar (as of May 2022). Some publications include citation numbers from the previous SER (June 2021) in brackets, with the updated citation number as of May 2022 to the right of the bracket.

Paper	Citations
Acosta Navarro, J.C., J. García-Serrano, **V. Lapin**, **P. Ortega,** Added value of assimilating springtime Arctic sea ice concentration in summer-fall climate predictions, Environmental Research Letters, Accepted, 2022.	-
Adloff F., G. Jordà, S. Somot, F. Sevault, T. Arsouze, B. Meyssignac, L. Li, **S. Planton** (2017), Improving sea level simulation in Mediterranean regional climate models, Climate Dynamics, doi:10.1007/s00382-017-3842-3 https://link.springer.com/article/10.1007/s00382-017-3842-3	(24) **32**
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Authors "Evaluating clouds using ESA CCI data" J. Clim. Submitted, 2022	-
Bellprat, O., F. Massonnet, S. Siegert, C. Prodhomme, D. Macias-Gómez, **V. Guemas, F. Doblas-Reyes** (2017) Uncertainty propagation in observational references to climate model scales. Remote Sensing of Environment. Volume 203, 15 December 2017, Pages 101-108. https://doi.org/10.1016/j.rse.2017.06.034	(12) **14**
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Eyring, V., Righi, M., Evaldsson, M., Lauer, A., Wenzel, S., Jones, C., Anav, A., Andrews, O., Cionni, I., Davin, E. L., Deser, C., Ehbrecht, C., Friedlingstein, P., Gleckler, P., Gottschaldt, K.-D., Hagemann, S., Juckes, M., Kindermann, S., Krasting, J., Kunert, D., Levine, R., Loew, A., Mäkelä, J., Martin, G., Mason, E., Phillips, A., Read, S., Rio, C., Roehrig, R., Senftleben, D., Sterl, A., van Ulft, L. H., Walton, J., Wang, S., and Williams, K. D. 2015: ESMValTool (v1.0) - a community diagnostic and performance metrics tool for routine evaluation of Earth System Models in CMIP, *Geosci. Model Dev.,* 9, 1747-1802, doi:10.5194/gmd-9-1747-2016, 2016.	(54) **86**
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Lauer, A., Eyring, V., Bellprat, O., Bock, L., Gier, B. K., Hunter, A., Lorenz, R., Pérez-Zanón, N., Righi, M., Schlund, M., Senftleben, D., Weigel, K., and Zechlau, S.: Earth System Model Evaluation Tool (ESMValTool) v2.0 - diagnostics for emergent constraints and future projections from Earth system models in CMIP, Geosci. Model. Dev., 13, 4205-4228, https://gmd.copernicus.org/articles/13/4205/2020/, 2020.	(12) **14**
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Popp, T, M I Hegglin, R Hollmann, F Ardhuin, A Bartsch, A Bastos, V Bennett7, J Boutin, C Brockmann, M Buchwitz, E Chuvieco, P Ciais, W Dorigo, D Ghent, **R Jones,** T Lavergne, C J Merchant, B Meyssignac, F Paul, S Quegan, S Sathyendranath, T Scanlon, M Schröder, S G H Simis, **U Willén**. (2020) Consistency of satellite climate data records for Earth system monitoring. *Bull. Amer. Meteor. Soc.*, doi: https://doi.org/10.1175/BAMS-D-19-0127.1	(3) **10**
Sevault, F., Somot, S., Alias A, Dubois, C., Lebeauoin-Brossier, C., Nabat, P., Adloff, F., Déqué, M., & Decharme, B. (2014): A fully coupled Mediterranean regional climate system model: design and evaluation of the ocean component for the 1980-2012 period. **Tellus A,** [S.l.], Nov. 2014. ISSN 1600-0870. doi:10.3402/tellusa.v66.23967.	(75) **84**
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