



Knowledge Exchange Activities in the CCI Programme

D-3 Knowledge exchange practicalities report

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1 Introduction

This report focuses on the practicalities of delivering the Tasks set out in D2 Knowledge exchange recommendations report, covering the period from 2018-2020.

As identified in D2 Knowledge exchange recommendations report, in order to maximise the utility, visibility and accessibility of the CCI ECV data, a redesign and reconfiguration of the website together with a single, online version of a data visualisation tool is required. These improved resources can then be used in many ways and for a number of non-expert audiences.

The science community is relatively well served by CCI's current activities, but would benefit from regular communications to share knowledge in addition promoting new ECV data and developments, as appropriate.

The problem definition and objectives of the programme remain as identified in the previous report D-2, and are outlined below.

2 Problem definition

The objective of the CCI (and its extension CCI+) as approved by ESA Member States is:

To realise the full potential of the long-term global Earth Observation archives that ESA together with its Member states have established over the last thirty years, as a significant and timely contribution to the ECV databases required by United Nations Framework Convention on Climate Change (UNFCCC).

3 Objectives

In light of the above, CCI Knowledge Exchange activity should focus on achieving the following objectives [in rank order of prioritisation] in the most effective manner:

- Policy makers – to be made aware of ESA CCI input, progress and impact to UNFCCC
- Support CCI projects – to ensure they are able to develop ECV databases and data products, and enabled as programme ambassadors
- International scientific user communities --raise awareness of the ESA CCI programme, its role, R&D activity, outputs and impact among relevant
- General public – are made aware of ESA CCI impacts and have the opportunity to engage with programme outputs
- HE educators and the next generation of climate scientists (namely post-graduate and graduates) – to be made aware of, understand and have the opportunity to engage with CCI tools and data
- Primary and secondary educators – facilitate climate literacy, highlighting the role that Earth observation

4 Executive summary

The D-2 recommendations report explored and identified the deliverables necessary to meet the Climate Change Initiative objectives: here we identify the steps needed, and suggest timeframes to put those deliverables into practice.

There will inevitably be a great deal of activity in the initial stages of the process, as the priority is to revamp the existing CCI web presence as soon as possible. Incorporating visualisations of the data into the main website is also a vital element of the new strategy and will be tackled in tandem with the development of the website.

Regular meetings and reporting will help to keep the CCI team in touch with progress, and keep the team apprised of any technical or timing issues.

5 Visualisation of CCI data

Technical users of ECV data are well supported through the CCI toolbox, with options for downloading and investigating the raw data. However, for a less technical audience, the wealth of data contained in the ECVs is currently only visualised in a standalone tablet app, with a similar desktop version for use at exhibitions and conferences. This limits the audience and hence the usability of the data.

The current desktop visualisation works well for an exhibition, with a presenter selecting a route through the images and videos, and providing commentary. It is less successful as a method of providing information for the self-guided user – the graphics are only partially interactive, there are too many videos that give only a snapshot of information, and the quality of the images varies greatly.

In order to maximise the potential audience and understanding of the data, we recommend developing a new visualisation that is hosted online, and has a facility to be downloaded and run through standard browser software.

Critical elements that need to be addressed in a new visualisation include:

- The ability to explore the data at a level chosen by the visitor – being able to spin the globe to show different regions is good, it would be useful to be able to zoom in closer: some of the ECVs show localised information rather than the bigger picture, for example CCI Fire. See EarthWindMap <https://earth.nullschool.net> for a more interactive example.
- More interactive and less passive content – the current content is largely delivered in the form of short videos or static graphs. Clickable maps and graphs that allow the user to explore the information would help to encourage further reading and understanding of the subject. For example, see the NOAA website: <https://www.climate.gov/maps-data/data-snapshots/averagetemp-monthly-cmb-2011-03-00?theme=Temperature>
- Offering the option of downloading an image or clicking for a larger, higher resolution version is a simple method of allowing readers to reuse information, which is particularly useful for educators at all levels. Images should be clearly marked with copyright

information. See images in this Carbon Brief post:
<https://www.carbonbrief.org/geoengineering-carries-large-risks-for-natural-world-studies-how>

- Offering a subset of data that has been used to produce a specific graph would be also be a good resource for educators, communicators or policymakers. These must be provided with accurate metadata.
- Any background information should be more in-depth than that currently provided – the high-level details are useful, but the ability to click through to more detailed information would be useful for multiple audiences. The current “i” buttons give only a snapshot of background detail.
- Utilise some of the short videos that are currently embedded in the visualisation, enabling them to be used independently – embedded into web pages, or shared through social media channels. Hosting videos through the main ESA portal also widens the potential audience.
- The facility to download sections of the visualisation for use offline will be very helpful for educators at all levels, as it gives the opportunity to explore the data and information in a range of settings without the need for internet access.

Development of a new visualisation will be in phases:

Phase 1 – Begin data visualisation

- Initial meeting with developers to explore possible options for the interactive visualisation, and discuss the technical requirements of the various usability and download options.
- Establish which ECVs to focus on for the initial release and agree storylines – a maximum of two ECVs to act as test versions for functionality of the visualisation. These will act as a template for the remaining variables, and should be aligned with the Education component – suggest focusing on SST in the first instance.
- Present options from the developer to CCI & ECV teams for comment.
- Write content for first ECVs and in consultation with CCI communications manager.
- Design graphs and source images for each ECV, send to developer for further work and incorporation into visualisation.
- Demonstration version of visualisation from developer for testing by CCI and ECV teams.
- Make suggested amendments.
- Design and implement user testing scheme for a small group of non-technical users.
- Make amendments to the visualisation to solve any issues uncovered during testing.
- Launch first phase.

Phase 2 – Next batch of ECVs

- Devise content and storylines for the next batch of ECVs.
- Design graphs and source images for each ECV, send to developer for further work and incorporation into visualisation.
- Conduct informal user testing to ensure the content flows and all works as anticipated.
- Launch phase 2

Phase 3 – ECVs currently under development

- Devise content and storylines for the new batch of ECVs.
- Design graphs and source images for each ECV, send to developer for further work and incorporation into visualisation.
- Conduct informal user testing to ensure the content flows and all works as anticipated.
- Launch phase 3.

6 Workflow

The next phase of CCI+ is presumed to be three years in length. For the purposes of this document, we have divided each year into quarters in order to allocate timings to the deliverables. Please note that the timings are an initial plan only and may change, particularly where external contractors are involved and bearing in mind that data for the new ECVs are not yet available.

Year 1: Q1, Q2, Q3, Q4

Year 2: Q5, Q6, Q7, Q8

Year 3: Q9, Q10, Q11, Q12

Task 1 Policy

D-1.1: Provide ESA CCI with quarterly policy-relevant summaries for the head of CCI Office to share at Science board meetings. These will be based on ECV project findings or in response to specific policy needs or demands.

- Regular discussions and contact with the ECV teams to explore what they are currently working on.
- Regular conversations with the CCI team to ensure any particular subjects are covered.
- Reports to be submitted at the end of each quarter, with content hosted on the website where appropriate.

D-1.2: Create policy guides and factsheets that address:

- **Key aspects of Earth observation satellite data and how it is processed to form ECV datasets**
- **What ECV data can be used for**
- **Uncertainty in relation to ECV datasets**

- Discussions with the CCI science team and communications manager to identify areas that ESA CCI consider need further explanation to policymakers.
- Regular contact with ECV teams to explore how the data can be used and what new information is available.
- Produce policy guides as and when required, but at least one every second quarter.

Task 2 Science

D-2.1: Quarterly newsletter specific to ECV project leaders and CCI staff to share science-specific news across the ECVs and to encourage sharing of news.

- Set up new science Twitter account, to be managed by the CCI communications manager and featuring more science and technical content.

- Q1 Create mailing list from CI staff and ECV team contact lists, set up mailing system and send out emails for recipients to confirm they agree to receive quarterly information. This confirmation is a requirement under European data protection law.
- Q2 Onwards – send out short, focused newsletter with ECV and project news, no images, at the end of each quarter. Subjects should link to further information on the ESA CCI website.

D-2.2: Coordinate and lead CCI-specific sessions at the annual EGU, AGU, and UNFCCC COP events to provide an opportunity to promote and discuss satellite Earth observations to understand climate change.

Begin planning for each event in advance, identify any additional printed material, images or presentation material that are required.

- **EGU:** 8–13 April 2018, 7–12 April 2019, 3–8 May 2020 – Vienna
- **AGU:** 10–14 December 2018, Washington D.C.; 9–13 December 2019, San Francisco
- **COP:** 3–14 December 2018, Poland; 11–22 November 2019, 9–20 November 2020.

Task 3 General public

D-3.1: Take part in public science-focused events to highlight how ECV data is used and developed.

- Q2, Q5, Q9 Establish a calendar of interesting external events for the general public and ensure ESA CCI has a presence there.
- Add to the social media plan to ensure the events are publicised widely.
- Create appropriate additional information for presentations and small scale print where needed.

D-3.2: Create an engagement plan to drive traffic to the CCI website, utilising a range of social media channels.

- Q1 Set up Facebook & LinkedIn pages, and promote through all available channels to build initial following – internal networks, ESA main website as well as contacts with various groups (Copernicus, PreventionWeb, Climate-L, Climate-ADAPT, & other networks and projects).
- Q1 Set up tools to help – link shortening and scheduling apps – plus develop a shared system for logging posts.
- Q1 Create generic images for use on each platform.
- Q1, Q5, Q9 – decide on a range of public science-related events and a small number of international environmental or science days for the next twelve months and build a social media plan around the events. Focus on directing people to the website.
- Ongoing work includes making the most of news stories to highlight the issues around climate change and how ESA ECV data can be used to explain and highlight the challenges.

D-3.3: Create short versions of the data visualisation for broadcast use to demonstrate how the climate is changing.

- Q3 Working with the web developers, extract elements to use as standalone items for broadcast use by TV media or online outlets.

- Make the most of global events to explain how ECV data can be used.

D-3.4: Liaise with citizen science specialists to explore potential themes with which to engage the public in aspects of EO data related to climate change.

- Q2 Begin conversations with CMUG and the science teams to develop any new ideas for citizen science.
- Continue CCI relationship with Zooniverse on their MOOC project, and develop new links with other appropriate citizen science projects.

Task 4 Tertiary education

D-4.1: Establish a user testing working group of university lecturers and students to understand the principles of good design for a CCI toolbox user interface [UI]

- Q2 Create a user testing group – this can be developed quickly using existing university contacts.

D-4.2: Run a series of workshops to identify user needs and implications for design of a UI. There should be a minimum of 3 workshops:

- Q1, Q2, Q3 workshops to explore the user's needs, resulting in a list of recommendations for the development of the user interface for the data visualisation.

D-4.3: Write a report detailing the user requirements for the CCI toolbox and support materials

- Q3 Active discussions with users and developers of the CCI Toolbox.
- Q4 Deliver report exploring the user needs uncovered in the discussions.

D-4.4: The contractor will work with the CCI toolbox development team to design and develop a functional UI for the CCI Toolbox with a specific focus on undergraduate teaching.

- Q4 through to Q7 Regular meetings with the development team to result in recommendations for the CCI toolbox developers to implement.

D-4.5: Design and deliver a module on the use of CCI data at the ESA summer school 2019 and 2020

- Q1 Have an initial conversation with the ESA team who run the summer school.
- Q1 through to Q3 Design, write and deliver the agreed module at the summer school.
- Q3 Evaluate module.
- Q4 through to Q6 Implement recommendations for next module.

D-4.6: Write a scoping strategy report to identify potential for running additional training opportunities for graduate and post-graduate students.

- Q2 through to Q3 Explore a range of existing courses in order to devise a strategy for a CCI training module.

Task 5 Primary & secondary education

D-5.1: Create and maintain an education area of the CCI website that will act as a central repository for CCI-related educational materials, resources and information.

- Q1 Define initial ideas on structure and format of the education area of the website.
- Q2 Ideas to be incorporated into design and build of revised website (D-6.1).
- Ongoing: Design and upload new materials for ECVs as it becomes available.

D-5.2: Develop and maintain a discrete, catalogued database on the CCI website of climate-focused ESA-derived satellite, space and Earth observation images.

- Q1 Brief web developers on the need for a small-scale catalogue of images, accessible from the website.
- Q2 Catalogue facility built into revised website.
- Q3 onwards: Populate the catalogue with ESA-derived photographs, satellite images from other open-source libraries, along with new graphics and any other media that would be useful for educators.

D-5.3: For each of the prioritised ECVs [SSTs, greenhouse gases, sea level rise, ice sheets and glaciers] the following resources should be developed that focus on supporting STEM subjects at Primary and Secondary level:

- **Suggested teaching activities for the data visualisation**
 - **Discussion topics**
 - **Age appropriate data sets for the students to plot**
 - **Hands-on activities that reflect the underlying concepts**
 - **Relevant images from the ESA library**
 - **Suggested extension activities**
 - **Ways to differentiate activities**
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- Q1 Ensure an education section is incorporated into the menu design and subsequent build of the website.
 - Q5 Develop teaching activities to accompany the data visualisation.
 - Q4 through to Q6: Create the resources identified – discussion topics, data sets, hands-on activities, images, and extension activities.

D-5.4: In addition to the ECVs identified in D-5.3, the contractor shall also develop equivalent teaching resources for the ocean colour and land cover ECV for Secondary level students.

- Q7 Develop teaching activities to accompany the data visualisation.
- Q7 through to Q8: Create the resources identified – discussion topics, data sets, hands-on activities, images, and extension activities.

D-5.5: Develop Primary teaching schemes of work using the following ECVs: SSTs, greenhouse gases, sea level rise, ice sheets and glaciers.

- Q9 Develop teaching activities to accompany the data visualisation.
- Q9 through to Q10: Create the resources identified – discussion topics, data sets, hands-on activities, images, and extension activities.

D5.6: Develop Secondary teaching schemes of work using the following ECVs: SSTs, greenhouse gases, sea level rise, ice sheets and glaciers, ocean colour, land cover.

- Q9 Develop teaching activities to accompany the data visualisation.
- Q9 through to Q10: Create the resources identified – discussion topics, data sets, hands-on activities, images, and extension activities.

D-5.7: Develop 3 online STEM teacher training courses to help them understand how to use CCI Earth observation data and data visualisations in a classroom.

- Q6 Scope the most appropriate STEM subjects in relation to the Earth Observation data, design the course structure and identify what resources need developing.
- Q8 Write course material, build the managed learning environment, and start testing
- Q10 review the courses developed and consider the next courses to be developed

Task 6 Website social media & visuals

D-6.1: Design, write and edit content for a new CCI website, incorporating all CCI content and ECV information into a single domain.

- Q1 Create initial design and layout for the website using the ESA style guidelines, and so it is easy to read and pleasing to look at.
- Q1 Brief the developers on the style and format of the website.
- Q1 Develop a revised structure and test the new structure with a small group of users. This need only be a small-scale trial of three or four users, as the framework should reflect good practice. Menu items should be self-explanatory to help search engines prioritise content, and to fit in with what the audience expects.
- Q1 & Q2 Assess and edit the current content of the main CCI website, so it is consistent in style and tone across all of the ECVs and background information from each of the independent ECV sites. Ensure the content is appropriate for the policy and public audiences and written in easy to understand language.
- Q2 External developers commence build of website:

- Ensure the underlying technology is up to date, responsive, and based on open source, enterprise-level software such as Wordpress.
- Modernise the code so it conforms to the latest best practice standards – usability, accessibility, clean and accurate HTML5 and CSS
- Ensure Google Tag Manager is installed to enable tracking and assessment of user journeys.
- Q2 Check the revised content with the science team and the CCI communications manager for accuracy and messaging. Notes on writing for the web will help technical authors to appreciate the need for a different style of writing.
- Q2 Implement the new structure and add revised content.
- End Q2 Release new CCI website with accompanying social media push.
- Q3 Work with the CATE toolbox developers to improve synergies with the main CCI website, once the new site is live.
- Ongoing – create new content, add blogs, images, news and general updating as required.

D-6.2: Create writing for the web guidance for CCI content contributors.

- Q1 Research current best practice for writing for the web.
- Q1 Create guidance for web authors to ensure consistent writing style and an understanding of how web content differs from academic writing.

D-6.3: Develop a browser-based online version of ‘Climate from Space’ that also works offline and can be easily distributed, updated and downloaded to a desktop.

This is the major piece of work that will provide a focus for the main web content and for all non-technical users, from the general public to educators at all levels.

It will be an iterative process, with the initial stages taking time to establish how the various elements will work, and work together. The details will depend on the final design of the content and the complexity of the interactive elements.

- Q1 Initial meeting with developers to explore possible options for the interactive visualisation, and discuss the technical requirements of the various usability and download options.
- Q1 Establish which ECVs to focus on for the initial release and agree storylines.
- Q2 Present options from the developer to CCI & ECV teams for comment.
- Q2 Write content for first ECVs and in consultation with CCI communications manager.
- Q2 Design graphs and source images for each ECV, send to developer for further work and incorporation into visualisation.
- Q3 Incorporate outcomes from D-4.2 user interface workshops with tertiary education panel.
- Q3 Demonstration version of visualisation from developer for testing by CCI and ECV teams.
- Q3 Make suggested amendments.
- Q3 Design and implement user testing scheme for a small group of non-technical users.
- Q3 Make amendments to the visualisation to solve any issues uncovered during testing.
- Q3 Address any issues highlighted in D-4.2 user interface workshop with tertiary education panel.
- Q4 Launch first phase.
- Q5 Devise content and storylines for the next batch of ECVs.

- Q6 Design graphs and source images for each ECV, send to developer for further work and incorporation into visualisation.
- Q6 Conduct informal user testing to ensure the content flows and all works as anticipated.
- Q7 Launch phase 2
- Q7 Devise content and storylines for the new batch of ECVs – *please note that the timing of this will be dependent on when the new data is available.*
- Q8 Design graphs and source images for each ECV, send to developer for further work and incorporation into visualisation.
- Q8 Conduct informal user testing to ensure the content flows and all works as anticipated.
- Q9 Launch phase 3.

D-6.4: Conduct user testing to report on the functionality of revised website content, including any new interactive visuals, to ensure it is user-friendly and appropriate to the audience.

- Q1 Devise new navigation for website and test ideas informally with colleagues.
- Beginning Q2 Devise a testing scheme for a small group of users to carry out on the new website to ensure the important content is easily discoverable and appropriate.

D-6.5: Develop a range of graphics in a variety of formats:

- Q2 Website images – source photographs and design graphs, both static and for interactive use.
- Additional graphs for presentations when required.
- Q1 Create social media generic images, with production of additional imagery as and when required.
- Print material, for example posters, leaflets etc. for events as and when required.

D-6.6: Develop a series of guidelines to further the reach and activity of current social media accounts – Twitter, GEOSS Communicators network – and explore which other platforms can be utilised.

- Q1 Social media – agree process for tweeting with CCI communications, where to find news, what sort of content to tweet and how frequently.
- Q1 Discuss any other social media channels to add – Facebook and LinkedIn initially with others later if deemed necessary.
- Q1 Join the GEOSS communicators network.
- Q2 Develop guidelines based on above discussions.

D-6.7: Create a blog section on the CCI website with contributions from a range of writers, with a new post every quarter to coincide with the electronic newsletter.

- Q1 Agree with CCI communications manager on high-profile or interesting potential blog authors to launch the series on the website.
- Q2 Publish first blog post, publicise through social media and electronic newsletter for CCI and ECV teams.
- Q3 onwards – publish a new blog at least once per quarter.

- Encourage the team to contribute posts, and suggest to external contacts they may be interested in submitting an article.
- Establish links with the main ESA communications team, in order to syndicate content to the main ESA blog.

D-6.8: Create a minimum of one climate story per ECV to explore interesting features of the data, and position the story to relate to potential climate impacts.

- Q2 Create content for first ECVS (we would suggest two to begin with), creating stories to base the data visualisation on and developing accompanying imagery.
- Q5 Devise content for next set of ECVS – the process will be tried and tested, and should take less time to develop. Send to developer for inclusion into website.
- Q7, Q8, Q9 Develop stories for remaining ECVs and send to developer.

Task 7 Management & reporting

D-7.1: Quarterly review meetings.

- Set initial meeting for end of Q1, subsequent meetings at end of each quarter with annual review in Q4, Q8 and Q12.

D-7.2: Submit quarterly reports to CCI climate office.

- Bring together information on work completed, underway and work which is behind schedule, with an explanation if that is the case. Submit reports at end of each quarter.

D-7.3: Develop a measurement model to assess success of website aims.

- Agree with the CCI communications manager the most useful metrics to capture for website traffic, set objectives for the important tasks and areas of the website, and create a measurement model.
- Revisit the model every second quarter to ensure objectives are still relevant and to add anything new.

D-7.4: Submit quarterly reports of web and social media statistics to the CCI Communication manager.

- Make an initial report of webstats and social media engagement to establish a baseline in Q1.
- Submit quarterly statistics for the website, based on the metrics agreed in D.7.3.
- Submit quarterly social media statistics including followers, link clicks, retweets, comments and shares.

7 Measuring impact

Quantifying the impact of knowledge exchange is widely acknowledged as a difficult task: these suggestions stem from experience of compiling metrics for networks and knowledge exchange strategies:

- Web statistics – total visitors to measure growth in user numbers; new versus returning visitors to ensure there's a combination of both new and experienced users; geographical location to establish where the information is most used; referral URL to uncover how visitors arrived at the website; popular content to find out what visitors are reading; scroll-depth to establish how much of a page users are reading; download numbers for documents, images and data to quantify the popularity of an item; external link clicks to find out where visitors go to next. Google analytics has many useful reporting and goal setting facilities that can be utilised, as well as options to track a user's route through the site to see what they are interested in.
- Web statistics for teaching resources and data downloads are particularly useful in assessing the impact of the educational content.
- Number of students attending and interested in the summer schools.
- Number of students enrolled in any online courses.
- Social media – followers; engagement such as likes, forwards, link clicks, reach and retweets; comments or direct messages. These all give an indication of how interesting people have found the content, and provide an overview of the breadth of the potential audience.
- Post-event evaluation forms – a simple, single sheet form for attendees to complete before leaving an event gives an opportunity to collect people's immediate thoughts.
- Write a summary report following each conference to highlight numbers of attendees, where they were from and their research interests.
- Summary of numbers of attendees, conversations with and interests of attendees at public science events.
- Interviews with key stakeholders – occasional, informal interviews with the science team and external stakeholders to discover what they value in the CCI programme, what could be done better and what they feel is missing.
- Number of citations in academic journals where EO data has been used.
- Number of citations in grey literature where EO data has been used or mentioned, particularly in policy and parliamentary reports across the EU.
- Viewing figures for weather forecasts where CCI graphics have been used.
- Canvass opinions of user testing subjects to quantify their thoughts on the usefulness of the platform and content.
- Develop a series of case studies to demonstrate which ECV data is being used, by whom and for what purpose.