



CO₂
Human
Emissions

Report on synergies and complementarities between CHE and VERIFY

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D6.6 Report on Synergies and Complementarities between CHE and VERIFY

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CO₂ Human Emissions

CHE: CO₂ Human Emissions Project

Coordination and Support Action (CSA)
H2020-EO-3-2017 Preparation for a European
capacity to monitor CO₂ anthropogenic emissions

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1 Executive Summary

D6.6 provides a first outline on the planned collaboration and synergies between the EU H2020 projects CHE and VERIFY. The document therefore provides the plans in the following areas:

- Interaction with inventory agencies & DG CLIMA
- Input to international programmes and society
- Sharing of CHE nature runs and feedback from VERIFY.
- VERIFY CIF – test bed for future Copernicus service and use in CHE
- Estimation of CH₄ emissions in VERIFY
- VERIFY input to CHE Strategic Research Agenda documents and vice versa
- Coordinated planning of project meetings
- Participation in advisory boards

These synergetic opportunities have been agreed between the two projects and any future new opportunities for collaboration will be included in future versions of this document.

2 Introduction

2.1 Background

After the selection for funding of the CHE (H2020-EO-2017; EO-3-2017) and VERIFY (H2020-SC5-2016-2017) projects, it was made clear by the European Commission that in order to avoid unnecessary duplication of work as well as missed opportunities in terms of exploiting synergies between the two projects, the projects should outline the complementarities and synergies in a common deliverable. This document therefore describes these aspects and acts as a reference for future work.

2.2 Scope of this deliverable

2.2.1 Objectives of this deliverable

The objective of this deliverable is to provide an overview of the synergies and complementarities of the CHE and VERIFY projects. It is a shared deliverable between the two projects and will support the collaboration in order to avoid duplication of work and especially to mutually benefit from the work performed in the projects.

2.2.2 Work performed in this deliverable

This deliverable is an outline of activities to exploit the co-existence of the two projects and to avoid duplication of work. The content has been discussed and agreed between the two project management teams. In addition, the content of the deliverable will be revised after each 'annual general assembly' of both projects to account for new synergies that may arise. As such this deliverable is a living document.

3 Project aims

3.1 CHE

The CO₂ Human Emissions (CHE) project will coordinate efforts towards developing a European operational monitoring and verification support capacity for anthropogenic CO₂

emissions (and aligned with the CO₂ Monitoring Task Force of the European Commission). This challenging target is aligned with the European Commission's stepwise approach for a requirement-driven integration of Earth observations, from remote sensing and in-situ, with enhanced modelling capabilities for CO₂ fossil fuel emissions, along with other natural and anthropogenic CO₂ emissions and transport. The project will pursue a consolidated methodology for integrating the monitoring system components, as well as innovation for estimating fossil fuel CO₂ fluxes. These include reconciling bottom-up and top-down constraints and handling systematic errors of satellite sensors. Earth observations from satellites will be combined with in-situ CO₂ observations and information from co-emitters or isotopes to support the attribution of fossil fuel emissions and uncertainty reduction. Methodological advances will include a representation of anthropogenic CO₂ variability in space and time, responding to documented shortcomings and needs, and a carbon cycle / fossil fuel data assimilation system extended to enable estimates of emission uncertainties. Strategies to separate anthropogenic CO₂ emissions from biogenic fluxes at country to global scales using observations and models will be documented. CHE will support a large community by providing a library of realistic CO₂ simulations from global to city scale to examine the capacity for monitoring future fossil fuel emissions and to adequately dimension space mission requirements. Community building will include direct collaboration across 22 European institutions, and communication and liaison with key European and international stakeholders. These coordination efforts will ensure the transfer of science and technology requirements and recommendations for strengthening existing assets with a view to developing an anthropogenic CO₂ monitoring service.

3.2 VERIFY

As the negative impacts of rising global temperatures become increasingly evident, national governments, regional authorities and private stakeholders are enhancing efforts to curb the emissions of the greenhouse gases (GHG) responsible for global warming. Measuring the effectiveness of GHG emission reduction policies against nationally determined contributions (committed by the Parties under the Paris Agreement) require accurate and precise estimates of emissions and their trends. These estimates need to be established and regularly updated using transparent methods, traceable to international standards, also in support of the global stocktake exercises envisaged under the Paris Agreement. VERIFY proposes to quantify more accurately carbon stocks and the fluxes of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) across the EU based on independent observations in support of inventories that rely mainly on self-reported statistical data.

The same approach will also be tested for the United States, China and Indonesia, in collaboration with foreign partners. Accurate characterization of the space-time variations of GHG fluxes, separating their anthropogenic and natural components and their drivers, will be based on advanced modelling approaches using atmospheric GHG measurements, tracer transport inversions and various arrays of land observations, in-situ and from space. The improved knowledge of GHG budgets from VERIFY will be used to improve national inventories, in collaboration with national inventory agencies, and to deliver policy-relevant information to track progress of the EU mitigation efforts to meet the targets of the Paris Agreement on Climate, in line with international cooperation mechanisms promoted by the UNFCCC, the IPCC and the WMO.

4 Opportunities for collaboration

As described in Section 3, both projects have their own particular aims. CHE is fully focused on scoping the requirements of and making the first steps towards the envisaged future Copernicus service to support member states with their efforts to reduce fossil CO₂ emissions as part of the Paris Agreement. VERIFY is broader, providing observation-based estimates not just of fossil CO₂ emissions, but also of CO₂ sources and sinks related to land use change

and forestry and emissions for CH₄ and N₂O. CHE is a Coordination and Support Action bringing together the expertise in Europe and connecting with the expertise outside Europe to ensure the future Copernicus service is based on international research efforts and part of international coordination. VERIFY is a research project and therefore has more resources available for further development of the tools needed for observation-based estimates. VERIFY is also more Europe-focused, although it does aim to connect with international efforts through specific case studies. For these reasons, it is very beneficial to have both projects running in parallel allowing direct communication and exchange of ideas and results to take place in an agile way. One should also notice that such communication will be facilitated given that half of CHE partners also participate to VERIFY. The sub-sections below identify initial topics for collaboration.

4.1 Combining resources

Before going into specific actions in the following sub-sections, it should be pointed out that having two similar projects in parallel with a significant overlap in partners also allows properly resourcing more comprehensive activities. For instance, VERIFY will deliver high-resolution emission data for a past period and the current situation over Europe, while CHE will deliver high-resolution emission data for future scenarios, thus together delivering a more comprehensive data set that can be used in the various project-internal and external studies. This is only possible in an efficient way by funding the relevant groups through the two projects. Another example is the use of CCDAS/FFDAS systems to estimate anthropogenic emissions and natural fluxes in VERIFY, while the same systems will be used in CHE to assess the uncertainty propagation and to provide input to the scoping of the future observing system. Combining the resources within the two projects therefore allows to move forward faster than if the projects would have been funded sequentially.

4.2 VERIFY WP1 & WP6 – Interaction with inventory agencies and DG CLIMA

The VERIFY project has a significant activity on the interaction with inventory compilers and national governmental agencies in their Work Package 1 and to DG CLIMA with the Climate Change Committee Working Group 1 in Work Package 6. The main objective of WP1 is to assess the current and future needs of inventory agencies and of the UNFCCC Task force on national GHG inventories, and to help design the framework of VERIFY's subsequent work packages based on the identified measuring, reporting and verification (MRV) requirements. The VERIFY WP1 and WP6 provide input to this aim.

VERIFY WP1 will create a User Requirement Document (URD) for a monitoring and verification system of GHGs to be developed by the subsequent work packages. To do this, it will define accuracy, comparability and comprehensiveness, and timeliness targets for the products of such a system, with the aim to serve policy at various temporal and spatial scales and consistent with existing UNFCCC inventories. The work package will provide an overview of approaches used in GHG inventories at the national scale, and of available methods for verification and their gaps and obstacles.

It has been agreed that representatives from CHE will be invited to relevant WP1 meetings to ensure that CHE keeps a good link with this important part of the future user community. Relevant outcomes will be included in the relevant documents that are being maintained by CHE. This is a cost-effective way to feed more detailed user requirements into the scoping of the future CO₂ service.

VERIFY WP6 links with DG CLIMA and aims to develop for them a decision support tool, in which all information is combined to the knowledge DG CLIMA needs for the climate negotiations. The decision support tool will combine the different data flows into graphs and maps, visualising the knowledge with observation-based evidence on the emission levels, their trends and distributions. Representatives from CHE will be invited to relevant WP6

meetings to ensure that CHE keeps a good link with the policy makers and in particular DG CLIMA.

4.3 VERIFY WP7 and CHE WP6 – Input to international programmes and society

The VERIFY project also has a work package on the interaction with international programmes. The overall goal of WP7 is to establish strong links between VERIFY and international efforts, such as the Global Carbon Project, IG3IS and GCOS. VERIFY can strengthen the European leadership role at the international level by showing that European emissions are as transparent as possible, and by demonstrating that VERIFY makes use of results and activities that are already ongoing on global level. This fits nicely with coordination activities in CHE WP6, which aim at strengthening the interaction between European and global coordination activities.

It has been agreed that representatives from CHE will be invited to relevant VERIFY WP7 meetings. Relevant outcomes will be included in the relevant documents that are being maintained by CHE. This will ensure consistent links with the international coordination activities.

4.4 CHE WP2 Sharing of CHE nature runs

CHE will generate a library of realistic CO₂ simulations for present-day and future emission scenarios, “nature runs”, from the global to the regional and point-source scale. These will support, in a wider framework, the assessment of the requirements for a future space mission and the development of improved inversion methods. The larger-scale simulations will not only provide the boundary conditions for the smaller scale simulations but comparing simulations at different resolutions will also allow the proportion of the spatial variability of CO₂ that is missed at a given resolution to be assessed. These nature runs will be made available for the studies in VERIFY. In particular the atmospheric inversions in WP2 and WP3 of VERIFY, focussing on anthropogenic and natural CO₂ fluxes, respectively, will benefit from these nature runs, comparing the spatial and temporal CO₂ concentration dynamic following from the inversions to these partly independent fields.

4.5 VERIFY CIF – test bed for future Copernicus service

VERIFY will develop a Community Inversion Framework (CIF) for estimating CO₂, CH₄ and N₂O fluxes using atmospheric observations as a top-down constraint. The CIF will be a modular system based on existing frameworks for estimating GHG fluxes, allowing the coupling between regional and global inversions to maintain consistency of the regional to global budgets. The interface will enable the use of different atmospheric transport models (ATMs) to provide systematic uncertainty from modelled transport, and the random uncertainty component for a given ATM. The CIF will be transparent, freely accessible and well-documented, to fulfil the needs of any operational GHG verification system and will be applicable to any region of the globe. The CIF will provide a consistent test-bed for the range of inversion models that exist in Europe. This is very relevant in preparation of a future operational Copernicus service, because it allows to assess the pros and cons of the various inversion systems and transport model configuration. With the overlap between inverse modelling groups in CHE and VERIFY and representation of CHE project management in the CIF discussions, there will be sufficient interaction between the two projects to ensure development activities in both projects stay aligned and that the CHE objectives will be taken into account in the development and use of the CIF, where possible. In particular the focus on future satellite CO₂ missions with their associated space – time observation characteristics in CHE will be factored in the design of the CIF system in VERIFY.

4.6 Estimation of CH₄ emissions in VERIFY

While CH₄ has so far not been explicitly included in the reports from the Expert Group and Task Force, it seems very likely that CH₄ will be measured as part of the Sentinel CO₂

mission. It is therefore important to build up the expertise and tools for CH₄ inversions, not only in the light of the VERIFY aims, but also in light of the CHE and Copernicus aims. The CH₄ cycle and therefore the monitoring of CH₄ emissions is quite different from the CO₂ cycle and the significant research activity in VERIFY will therefore be very relevant in light of potential extension of the future Copernicus service. The CHE Strategic Research Agenda document will take the information from VERIFY into account, where relevant.

4.7 VERIFY input to CHE Strategic Research Agenda documents

The VERIFY results, where relevant for the goals of the CHE project, will be documented in the CHE Strategic Research Agenda document together with the results from CHE itself and developments in the wider community. This will support the use of VERIFY developments in the building of a future Copernicus CO₂ service. This is especially important considering that VERIFY also aims at estimating the magnitude and patterns of LULUCF, which is not within the scope of CHE. Both fossil emissions and the anthropogenic sources and sinks due to land use, land-use change, and forestry are very much intertwined in an overall future monitoring system and the VERIFY work on this topic is therefore very relevant for the long-term goals of CHE.

4.8 Coordinated planning of project meetings

The VERIFY and CHE management boards will exchange plans on project meetings. Where relevant, representatives of the other project will be invited to participate. A first agreement has been decided for the “First ad hoc meeting for networking between national inventory agencies and the scientific community” (D1.5 of VERIFY) to be organized at month-6. Also, in cases where there is scope for co-organizing meetings, this will be explored. This will help to coordinate, make efficient use of resources and minimize the carbon footprint of travel.

4.9 Participation in advisory boards

The Principal Investigators of both projects have been invited and have accepted their position in the respective Advisory Boards. Although a fairly straightforward action, it ensures that the leadership of each project is aware of the developments in the other project and that views can be exchanged.

5 Conclusion

This document provides a first overview of coordination and collaboration activities between the CHE and VERIFY projects. The various synergetic opportunities have been agreed between the two projects and any future new opportunities for collaboration will be included in future versions of this living document.

Document History

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