



Horizon 2020 Societal challenge 5: Climate action, environment, resource efficiency and raw materials

VERIFY

Observation-based system for monitoring and verification of

greenhouse gases

GA number 776810, RIA

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Changes with respect to the DoA This deliverable was delayed as it is based on the results of D5.3 Second report -Reconciliation of bottom-up and top-down methods at sub-national scales

Dissemination and uptake (Who will/could use this deliverable, within the project or outside the project?)

Document freely available on the website of VERIFY targeting more specifically policy makers and experts. All factsheets can also be displayed from the "product" pages of the website.

Short Summary of results (<250 words)

This deliverable is primarily to present the factsheets for the first scientific review article on multi-gas GHG budgets. There are four main factsheets for CO₂ land, CO₂ fossil, CH₄, and N₂O. The creation process is undergoing automation to permit the production of all four of these factsheets for every single country and group of countries considered in the project, but this deliverable will only present the factsheets for the EU27+UK. The factsheets for each component, and each region, will have a similar design. The top-left will show a figure based on inventories submitted by Member States to the UNFCCC, where decennial changes in the overall trend are broken-down by sector. This is to provide a link to WP1 and to set the remaining figures in context. The top right shows a map of Europe and will highlight the region under consideration to orient the viewer. The bottom part of the figure shows a comparison of sectoral emissions by bottom-up methods (left) and a comparison of the bottom-up and top-down methods. All uncertainties are shown. Country-specific factsheets will be available via a web portal, and the factsheets will be updated with each new GHG synthesis.

Evidence of accomplishment (report, manuscript, web-link, other)

All of the factsheets will be made available on the website which also shows plots used in the synthesis papers (and which serve as the basis for the factsheets).

http://webportals.ipsl.jussieu.fr/VERIFY/FactSheets/

Users can register their email address to receive the name and password to access the site.



Version	Date	Description	Author (Organisation)
V0	16/12/2020	Creation/Writing	Glen Peters (CICERO)
V1	31/12/2020	Writing/Formatting/Delivery on the Participant Portal	Philippe Peylin and Aurélie Paquirissamy
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1. Glossary

Abbreviation / Acronym	Description/meaning
GHG	Greenhouse gas



2. Executive Summary

This deliverable is primarily to present the factsheets for the first scientific review articles on multi-gas GHG budgets (essd-2020-367 and essd-2020-376, to appear online December 2020).

The VERIFY project collects and disseminates a large amount of information and data on greenhouse gas emissions across Europe. This data and information various in complexity, ranging from high-resolution spatially-explicit maps of greenhouse gas fluxes to synthesis plots which compare country-level totals between various data sources on an annual scale to allow for identification of trends and differences. Much of this information is accessible to technical experts, but less understandable to educated professionals outside of this field who may nevertheless rely on this information for decisions.

One goal of the VERIFY project is dissemination of the compiled results to multiple audiences. Three different country-level factsheets are created for this purpose. The factsheets described in this deliverable target experts who wish to see a summary of the information presented in the scientific synthesis articles submitted by WP5, in which space-constraints limited the discussion to a single region of the EU-27+UK.

There are four main factsheets separated by greenhouse gas species: CO₂ land, CO₂ fossil, CH₄, and N₂O. Each of the factsheets can be produced for all regions considered in the project, but this deliverable will only present the factsheets for the EU27+UK. The factsheets for each component, and each region, will have a similar design. The top-left will show a figure based on UNFCCC inventories, where decennial changes are shown by sector. This is to provide a link to WP1 and context. The top right shows a map of Europe and will either show regional results (EU27+UK) or highlight the region under consideration. The bottom part of the figure shows a comparison of sectoral emissions by bottom-up methods (left) and a comparison of the bottom-up and top-down methods. All uncertainties are shown. Country-specific factsheets will be available via a web portal, and the factsheets will be updated with each new GHG synthesis.

These factsheets provide convenient materials to serve as a focal-point for discussions between members of the VERIFY project and national and regional experts when searching for future research directions.



3. Introduction

The VERIFY project will produce several different factsheets, each with a different content and target audience:

- WP1: Summary of UNFCCC GHG inventories, for policy makers
- WP5: Synthesis of the GHG budgets from the science in WPs2-5, for national and regional technical experts
- WP6: Synthesis of the WP1 and WP5 factsheets (EU27+UK), for policy makers

The WP1 factsheets have been completed (Milestone 2). The WP1 factsheets are per country and show information on GHG trends over time (aggregated, sector, and GHG), shares for the latest inventory year, and uncertainty information for the last inventory year. A table and short text summarizes the key inventory results and there is a paragraph summary of each fact sheet. Each country factsheet is around five pages and collated in a single document (of around 140 pages). In addition these WP1 factsheets are also made available through the VERIFY website: http://webportals.ipsl.jussieu.fr/VERIFY/FactSheets/ (with a free registration).

The WP5 factsheets are based on the data and model runs in WP2, WP3, and WP4. These factsheets are key summarises of the GHG budget synthesis (D5.9 First scientific review article on multi-gas GHG budgets – AFOLU and D5.3 CO₂ and CH₄ and N₂O syntheses papers recently submitted to ESSD). These factsheets cover CO₂ from fossil sources, CO₂ from land-use and land-use change, CH₄, and N₂O. The WP5 factsheets are significantly more complex than those in WP1, presenting detailed top-down and bottom-up results that will be updated several times throughout the project. A more systematic approach is needed to develop the WP5 factsheets to avoid them overburdening the project. There also needs to be consistency with the scientific reviews for which the factsheets are based.

The general strategy for the WP5 factsheets is to link them to the analysis conducted for D5.3 and thereby automate their generation for easy updates and online access. The VERIFY web portal contains all the datasets (<u>http://webportals.ipsl.jussieu.fr/VERIFY/</u>) which are then processed into figures and factsheets (<u>http://webportals.ipsl.jussieu.fr/VERIFY/</u>). A user interface allows the user to select the GHG and plot variants and country/region which to plot. A further link allows premade factsheets to be selected, for WP1, WP5, or WP6.

The WP5 factsheets go hand-in-hand with the GHG budget synthesis (also WP5). The factsheets and synthesis should therefore be completed at (approximately) the same time. At the end of each GHG budget synthesis, the factsheets will be "frozen" to provide version control. The figures and factsheets are then updated in the next GHG budget synthesis round, additionally including user feedback on the design and content.

This deliverable shows the general structure, content, and workflow of the factsheets. Sample factsheets are shown for each GHG, but design, content, and summaries will be all be finalized with the GHG budget synthesis (D5.3). This deliverable only shows factsheets for the EU27+UK,



but the web portal will ultimately have factsheets for all EU countries and regions studied in the GHG budget synthesis (currently 79 different countries and groups of countries). Note that currently the web portal displays already all figures that will form the individual country factsheets.



4. Sample factsheets by greenhouse gas

4.1. CO₂ from fossil sources



Fossil CO_2 emissions have **declined slightly** in the European Union over the past two decades, with most reductions occurring in the manufacturing and energy industries.



Disagreement exists between datasets largely due to different reporting approaches, which also makes comparison by sub-categories more challenging due to inconsistencies with how various emissions are reported. **Overall emission trends are similar** for the past decade, even if the absolute numbers show differences.





4.2. CO₂ from land sources



Carbon dioxide emissions reported to the UNFCCC from the land use, land use change, and forestry sector are a **strong sink** over the past three decades, with variation resulting primarily from harvested wood products.



Top-down and bottom-up scientific research models **agree** that the sector is a strong sink of atmospheric CO2, showing much greater year-to-year variability than NGHGIs due to **heighted response to climatic variation**.





4.3. CH₄



Methane emissions reported to the UNFCCC show a significant reduction over the past three decades, with reductions occuring primarily in the waste sector supported by smaller reductions in energy and agriculture.



Top-down and bottom-up scientific research models **agree** that the sector is a strong sink of atmospheric CO2, showing much greater year-to-year variability than national greenhouse gas emissions inventories due to **heighted response to climatic variation**.



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4.4. N₂O



Top-down research models show good agreement with reported inventory results, but this is largely due to the **high uncertainty** in the inventories. The top-down models **disagree** with inventory results on the **overall trend**, with top-down models showing more stable emissions over the past decade.





5. Conclusions

This deliverable presented motivations for and examples of summary factsheets based on the scientific synthesis analysis carried out in WP5 of the VERIFY project. There are four main factsheets: CO_2 land, CO_2 fossil, CH_4 , and N_2O .

Each of the factsheets can be produced for all regions considered in the project, but this deliverable only presented the factsheets for the EU27+UK due to space limitations and considering the goal of this deliverable is not to provide detailed analysis of the data but the first "concept" of these factsheets. The factsheets for each of the four components have similar layouts, while the factsheets for each region with a specific component have identical layouts and only differ in the content of the text and the data shown in the figures:

- The top-left shows a figure based on Member State submissions to the UNFCCC, where decennial trends are broken down by subsectors to identify drivers of change. This is to both provide a link to WP1 and also to establish context for the dataset comparisons which follow.
- The top right shows a map of Europe with the region/country of interest shaded in gray to immediately orient the reader.
- The bottom part of the figure shows a comparison of sectoral emissions by bottom-up methods (left) and a comparison of the bottom-up and top-down methods (right). All uncertainties are shown where available.

Country-specific factsheets will be compiled through an automated process and made available via a web portal. This will permit the factsheets to be updated with each new GHG synthesis while reducing the amount of human intervention required to assemble 79 factsheets each for four different GHG species. The next deliverable, D5.7 (Second - Fact sheets with national observation-based GHG Budgets from project results), will provide an update of the factsheets (around March 2021) with a first version of all 79 factsheets, provided through the web portal. Note finally that we had to select a few plots only from a larger ensemble of diagnostics made for each country (CO2 fossil: 2 figures; CO2land: 8 figures; CH4: 6 figures; N2O: 3 figures; all available from the website) and that such choice may be revised in the next deliverable with possibly more diagnostics.