



Report on Impact and Sustainability Analysis

Final report

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1. Scope of the document

This report assesses the overall impact of the CAMS NCP NL project regarding the uptake of CAMS products and the collaborations with CAMS in the Netherlands.

Given the objectives of the CAMS NCP NL project we assess in this Impact and Sustainability Analysis the overall uptake of CAMS in The Netherlands as well as the internal and external collaborations between the project partners and users. In order to achieve long-term sustainable impact we investigate the user needs and we define a couple of actions.

2. Short summary of the contract's objectives

The overall objective of the proposed project is twofold. The first objective is to deliver (updated) downscaled CAMS regional air quality products at a spatial resolution of 1-2 km over the Netherlands. This will include air quality forecasts as well as source contributions making use of the CAMS European air quality service and policy support services.

The second objective is to stimulate the uptake and adaptation of CAMS global and European-scale products for feeding national environmental information systems and services. Through this, the project will lead to a better uptake of CAMS products in the Netherlands.

3. Contract impact at national level

The activities and discussions that took place as part of the CAMS2_72NL contract have intensified the collaboration between the three large national parties involved in Netherlands (RIVM, KNMI and TNO) when it concerns the provision of air pollution information.

During the first phase of CAMS NCP we discussed the different roles TNO, KNMI, and RIVM (as key user) have within the Air Quality domain within The Netherlands. For example, both KNMI and RIVM are governmental bodies that work together to serve society and inform the general public, albeit with different legal tasks. RIVM is the national authority to issue air quality forecasts and warnings to the general public, while KNMI is primarily responsible to issue weather warnings and further maintains the infrastructure to provide 24/7 operational weather and air quality forecast data. TNO is a research organisation with another role (provide innovative research) in society than government institutions.

Some challenges have been identified due to the different mandates and also due to the use of different tools by the project partners. Through regular discussions cooperation has been intensified. Important progress has been achieved in the consistency and use of tooling which is anticipated to increase visibility and use of CAMS products during the second phase of the CAMS2_72NL project. The CAMS2_72NL project has facilitated the uptake of the regional CAMS ensemble forecast by RIVM as well as a better coordination between KNMI and RIVM on the downscaled air quality forecasting activities.



3.1 Specific impact of the use of CAMS products in supporting the objectives of national operational and policy services (incl. mandatory reporting)

Overall, the project helped to have a better understanding of the contribution to and use of CAMS Services by Dutch entities in the Air Quality domain. An overview of all CAMS contributions in the Netherlands (which projects are NL involved in, who is involved, what are the products and who are the contact persons) has been produced in the project, and the Dutch CAMS Community has been activated. The CAMS (downscaled) services are put in perspective to existing national tools and services to identify complementary value and increase visibility, understanding, and use of CAMS data. The requirements for these products have been established through a dedicated workshop on CAMS downscaled source apportionment and RIVM inputs on their needs with respect to (downscaled) air quality forecasts. Importantly, RIVM has started to actively use the CAMS European ensemble to support their national air quality forecasts and smog warnings.

3.2 Appropriateness of the proposed solutions for other competent entities within the country to perform their mandates

The downscaling of CAMS air quality forecast will be tested by the prime user RIVM, to see if it produces better results than the current solution (data taken from CAMS Services). This activity will take place in the second phase of the project.

Moreover, the possibility to produce air quality forecasts 2 times a day (once in the night, once before mid-day) is expected to improve the air quality services provided by RIVM to the Dutch population, most importantly in case of pollution events. Implementation will be proposed in phase 2.

The CAMS downscaled source attribution service has been used by DCMR (the joint environmental agency of the Province of South Holland and thirteen municipalities in the Rijnmond region) in an analysis of woodsmoke contributions. This work was presented during the organized CAMS downscaled source apportionment workshop and the data was identified as useful for their specific interest. Also some additional user needs were formulated (e.g. having a specific woodsmoke label instead of the more general residential combustion label).

The tooling on which the service is based is also used offline within projects with the city of Eindhoven and the provinces of Noord-Holland and Zuid-Holland.

3.3 Assessment of potential integration and interoperability with other countries

The downscaling activities are developed and tested using the LOTOS-EUROS model at resolutions down to $1 \times 1 \text{ km}^2$. This model is already part of the CAMS Regional Services while the downscaled air quality forecasts for the NL are consistent with the LOTOS-EUROS CAMS regional forecasts in that they use the same model version, the same meteorological driver (ECMWF's IFS model), and emissions in some sectors (e.g. shipping and GFAS fire emissions). It will also be possible to integrate the downscaled air quality forecasts for the NL at $1 \times 1 \text{ km}^2$ on the same regional map with downscaled $1 \times 1 \text{ km}^2$ forecasts from other countries, although here we should keep in mind that the NL downscaled forecasts in this phase of the CAMS NCP were nested into the CAMS LOTOS-EUROS forecasts and not the CAMS ensemble forecasts, which may lead to some inconsistencies at the border of domains.



3.4 Impact on communication and promotion of CAMS and more widely on communications about atmospheric composition at national level

The Communication activities helped to strengthen the collaboration between the main Dutch contributors to CAMS projects (TNO, KNMI) and also with the national authority to issue air quality forecasts and warnings (RIVM). It is considered crucial that the collaboration is strong between these 3 entities for the promotion and use of CAMS products in the air quality domain in the Netherlands. This is a pre-requisite for the success of CAMS NCP in the Netherlands.

3.5 Impact on capacity building and/or identification of further training needs

We did not touch upon this topic in the CAMS NCP project.

Although capacity building and training has not been an urgent issue for the project, the long-term stability of the services and the current cooperation will need our attention in the next years. Most importantly, the availability of highly qualified specialists at TNO, KNMI and RIVM should not be taken for granted on the long term and some extra procedures might be needed to agree upon to guarantee continuation of services also in case of (unforeseen) changes in (technical) personnel.

3.6 Is the contract contributing to the country's SDG (Sustainable Development Goal) targets

The project is contributing to the following goals of the SDG of the Netherlands:

- good health and well-being: improved forecast of the pollution giving more precise warnings to the citizens;
- climate action: improved estimation of source attribution of air quality and greenhouse gases for better decision making.

4. User testimonials

We asked feedback and evaluation of our prime user RIVM per email regarding their involvement in the project and the impact the project had for them. Here is the answer of Joost Wesseling, serving as user testimonial:

“Regarding the evaluation, initially it felt like the part that RIVM was involved in was a kind of add-on to an existing project. There was a challenge to make a real connection between the downscaling work on LE (Lotos-Euros) and the other parts of the project. As we were only providing work in kind, without budget, that also made it difficult to spend a lot of effort.

However, there have been fruitful discussions in phase 1 about the possible use of a new downscaled version of Lotos-Euros, both within the consortium and between consortium and potential users. During several meetings with potential users, there was input from air quality professionals as well as from the citizen science community.

From the discussions with the potential users and TNO and KNMI, it has become more clear how a downscaled version model can be used to enhance the work of RIVM in providing more accurate air quality information for the public.



With the different construction for the second phase, where RIVM will be a full partner, there will be more opportunities for connections between the different parts (and partners) in the project.”

If needed, Joost Wesseling can be contacted at the following address: joost.wesseling@rivm.nl.

5. Long-term sustainability of actions at national level

RIVM needs accurate and frequent air quality forecasts at the Dutch regional level to provide, most importantly, timely and accurate air quality warnings to the general public. The downscaling activity is reaching towards achieving this overall goal. For example, bi-daily input data are currently not provided but considered necessary to reach these goals.

After the end of the project, the downscaled service should be developed and evaluated further and the national forecasts should keep up and stay in line with important developments that are implemented for the CAMS European regional forecasts. Moreover, the discussions on the appropriate tooling should continue.

6. Final remarks and recommendations

The overall uptake of CAMS as well as the collaborations with CAMS in the Netherlands is positive. First, the interaction with the prime user, RIVM, has been strengthened thanks to this project: the collaboration was good and we identified a need for further development of the forecast service targeted for the Netherlands. The impact is strong regarding the understanding of the need of current and potential users of the source attribution service, thanks to the workshop organised.

The impact of the project will be stronger with the next phase. Indeed, the prime user RIVM will have a stronger role (not only in-kind contribution): management and contribution of the work package Demonstrator and contribution to the work packages Communication and Emission. The overall aim of the Demonstrator work package will be to create an enhanced tool for providing air quality health related indicators at a more localized resolution and spatially refined forecast for the next days ahead.

The downscaled model is anticipated to offer improvements in frequency, resolution and accuracy for certain pollutants under certain conditions. The improved downscaled forecasts should be especially valuable for people with health concerns like adverse lung conditions. More localized and accurate predictions might help those to whom it concerns to better plan their days to avoid specific regions with enhanced pollution levels, or to avoid activities/exercise during a certain time of the day ahead.

Overall we anticipate a stronger impact of the CAMS2_72NL project regarding health and sustainability at the institutional level and hopefully also at the individual level through the development of the Health Demonstrator.



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