Attributing and Verifying European and National Greenhouse Gas and Aerosol Emissions and Reconciliation with Statistical Bottom-up Estimates

Deliverable 7.1
Avengers Risk Register and Quality Manual

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Attributing and Verifying European and National Greenhouse Gas and Aerosol Emissions and Reconciliation with Statistical Bottom-up Estimates (AVENGERS)

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Document history:

Version	Author(s)	Date	Changes
1	S. Houweling (VUA)	28/2/2023	First draft version
2	S. Houweling (VUA)	9/3/2023	KPI reporting period aligned with the project reporting

Internal review: AVENGERS Project Office

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1 Executive summary

The objective of this document is threefold. Firstly, the document sets out quality procedures for the production of technical reports. This stipulates a framework of collaboration in information exchange and co-authoring of technical reports to maximise the potential for higher quality innovative results to emerge and be formalised and presented with full and timely participation of all responsible partners and completed in a consensual fashion.

Secondly, it presents a framework of quality metrics with appropriate interval-based measures of assessable performance that are developed specifically for each of the work packages within the Avengers Project. These are to be applied within the project for efficient and effective evaluation of the overall quality attained by the outputs from each work package.

The final part of the document then sets out the risk management procedures. It provides detailed guidance on the risk clarification, prioritization, rating, and management and provides the risk register. This will be maintained throughout the lifetime of the project.

2 Deliverable objectives

This deliverable defines procedures for the reporting of results expected from each Work Package and its associated tasks within the Avengers project in the form of deliverables and milestones. It sets out relevant quality criteria matched to the nature of the outputs expected from each work package as a whole and identifies lower, mid, and upper ranges as measures of assessable performance that could be used as part of a framework of quality metrics to evaluate the overall quality of the outputs for the various work packages and their progress within the Avengers Project.

Furthermore, it provides the framework for risk monitoring and management, which includes the maintenance of a risk register that is made available through this deliverable.

3 Project quality assurance

3.1 Deliverable reporting procedure

The reporting of deliverables proceeds according to the agreed deliverable schedule of the grant agreement (GA), listed in Table 1 for reference, with deliverable deadlines in months after the official start of the Avengers project (1-1-2023). Delivery proceeds in the following steps:

- Step 1 (latest four weeks prior to GA submission deadline):

The lead beneficiary of the deliverable submits a first draft of the deliverable to the project coordinator (ULUND) and co-coordinator (VUA), with the coordinators of the WP that the deliverable belongs to in CC: The (co)coordinators and WP leaders decide who will carry out the internal review, according to their short-term availability and independence from the work that is submitted.

- Step 2 (latest three weeks prior to GA submission deadline):

The internal reviewer reviews and return draft the with comments to main author, CC: other WP leaders, (co)coordinators.

- Step 3 (latest two weeks prior to GA submission deadline):

The lead beneficiary updates the draft with comments from the first internal review and e-mails a second draft to the (co)coordinators for a second review (CC: WP leaders), who decide who will do the second review.

- Step 4 (latest one week prior to GA submission deadline):

The internal reviewer reviews and returns the draft with comments to main author, CC: WP leaders and other (co)coordinator.

- Step 5 (latest 2 days prior to GA submission deadline):

Lead beneficiary e-mails the final version of deliverable to the (co)coordinators in Word and PDF format, CC: WP leaders. ULUND checks the cover page for formal requirements/data, and submits final version (PDF) to EC.

Lead beneficiary must make sure to always update the table of contents before e-mailing the deliverable for submission. The e-mail subject should read: "Avengers: DX.X – ready for submission to EC" and be send with high priority. The file size of a single deliverable should remain within a maximum of 50 MB.

- Step 6 (after EC submission):

Once uploaded to the EC, ULUND archives the submitted deliverable, to be uploaded by VUA to the Avengers website.

3.2 Milestone reporting procedure

The reporting of milestones proceeds according to the agreed milestone schedule of the grant agreement (GA), listed in Table 2 for reference, with reporting deadlines in months after the official start of the Avengers project (1-1-2023).

Once a milestone has been achieved, no later than the date indicated in the Grant Agreement, the lead beneficiary of the MS sends an e-mail to the coordinator ULUND, with the WP leads in CC:, stating that MS X has been completed and by which date. ULUND registers the MS as being completed in the continuous reporting session in preparation for the periodic reporting. The subject of the e-mail should read: "AVENGERS: MSX completed by DD.MM.YYYY" and be send with high priority.

4 Project quality measurement

The following global metrics, defined as Key Performance Indicators (KPI's), have been selected to assess and evaluate progress of the Avengers project as a whole towards its objectives, as agreed in section 2.1.3 of the Avengers proposal. Each KPI is specified at the level of Target, which the project beneficiaries aim to achieve, and Threshold, which should at least be achieved during the project.

KPI	Description	Target	Threshold
1.1	Produced number of datasets of emission factors, GHG and aerosol emissions for the EU, freely available upon request	6 datasets	2 datasets
1.2	Updated the gridded maps of the three main anthropogenic GHG and aerosol emission fields to recent years	4 maps	2 maps
1.3	Results of the bottom-up estimates (WP4) and of the inverse modelling approach (WP2) are tested by a KPI number of European national environmental agencies in the 5 selected areas/regions of case-study countries	3 agencies	1 agency
2.1	Use of the data created in WP2-3-4 by a KPI number of inventory agencies inside the consortium for national inventories' verification purposes	4 agencies	2 agencies
2.2	Presentation of the results at the final event to ≥10 European inventory agencies, with emphasis on key results: reconciled emission estimates (D1.4), comparison of GHG and aerosol radiative forcing (D1.5), Flexible Inversion Tool for Inventory Compiler (D6.2) and best-practice guidelines (D6.1)	10 agencies	5 agencies
2.3	Number of attendees to the webinar on project results	60 attendees	30 attendees
3.1	Number of international programmes/ initiatives directly involved in dissemination and outreach of project results.	5	3
3.2	Number of EU and non-EU programmes, initiatives, networks and knowledge platforms with which the project will collaborate: ≥6	10	6
4.1	The Flexible Inversion Tool for Inventory Compiler is tested in KPI number of countries	4	2
4.2	The updated emissions factors of the three major GHGs are used by KPI number of EU member states.	5	3

5 Work package quality measurement

The following quality metrics, defined as Key Performance Indicators (KPI's), have been selected to assess and evaluate progress of a work package towards its objectives. Each KPI is specified at the level of Target, which the project beneficiaries aim to achieve, and Threshold, which should at least be achieved in the indicated reporting period (X/Y in the table below refer to Target / Threshold).

KPI definition	Unit of measure	M18	M42
Resources spent wrt the available total	Percentage of available PM resource	40/20	100/80
Partners representation at progress meetings	Percentage of total number of partners	90/50	90/50
Deliverables delivered to the EC in time	Percentage of due deliverables	100/80	100/80
Milestones reached on time	Percentage of due milestones	100/80	100/80
Scientific presentations	Number[#] of presentations	10/3	30/8
Scientific publications	Number[#] of publications	5/2	15/5
Official press communications	Number[#] of communications	4/2	10/4

[#]: Integrated over all WP's

6 Deliverable quality assessment

6.1 Documentation guidelines

The Avengers coordinators, WP leaders and document owners / lead beneficiaries take editorial responsibility to ensure the highest quality and timely delivery of deliverables documenting the work proposed.

Accordingly, the document owner has to:

- Create the index and assign the work;
- Prepare a schedule for completing the work;
- Change the version number of the Document;
- Distribute to respective partners a new version integrated with contributions and notify important issues to the mailing list;
- Make comments, change the document structure as deemed appropriate, etc.

The person responsible for a section has to:

- Do the first effort to produce the sections. It has to be done in time, it has to mark on the section title the list of partners (after the lead Partner's acronym) who have to contribute, provide new deadlines for successive iterations;
- Resolve all comments in the section (solving problems, filling in gaps, completing) to its pre-final stage and pass it to the document owner.

The reviewer is responsible for:

- Verifying that the deliverable is achieving its objectives in line with the planned work for the respective WP throughout the development process.

6.2 Rules for file naming and management

The person responsible of the document produces a file complying with the file name convention,

Avengers_DX.X-Y-VZ.DOC

with X.X the deliverable version number, Y a suitable label for the deliverable topic, and Z the version number.

Additional requirements for the document are listed below:

1) Do not change the file name structure, the name does not contain any spaces or "."
2) The version can be changed only by the document-responsible / lead beneficiary.
3) Major and minor version increment is decided and performed only by the document responsible / lead beneficiary.
4) When a partner contributes, they append their acronym to the end of the file name. Partners can contribute to any version of the document, and should do so before the current version deadline expires.
5) The contribution is sent to the Lead Beneficiary, who takes care of its integration as appropriate.

6.3 Internal review procedure

To ensure that Avengers deliverables are of the highest standard, an internal review procedure has been put in place. A coordinator from the project who has not directly contributed to the respective deliverable will perform an independent review to ascertain the following aspects:

- Is the content clear?
- Does the document comply with formatting standards?
- Are there any errors (spelling, technical, conceptual)?
- Does the document achieve its objectives as per the project description?

If both coordinators are involved in the deliverable and therefore cannot act as independent reviewer, then the WP leaders will be asked to review. If they are also not independent, then someone else in the consortium will be assigned to perform the review.
The review will proceed in two iterations of comments and corrections (unless further iterations are deemed needed), after which the final version of the deliverable is submitted to the EC and published in the project website.

7 Risk Management

The objective of Risk Management Procedures is to provide the Avengers team and stakeholders with the information necessary to develop effective risk handling strategies and plans. Hereafter whenever we refer to a risk, we refer to anything that may have an adverse impact on the success of Avengers.

There are several techniques to face and handle risk occurrence in project management. Each has specific advantages/disadvantages, yet often it is necessary to combine several techniques to ensure the best possible result in terms of risk management depending on the situation, the context, the set of involved actors and the specific risk being addressed.

Therefore, the Avengers team will exploit, some, or all, of the risk management techniques set out below depending on the project actual needs and possibilities.

7.1 Risk management procedure

Whenever a risk (or signals of its potential occurrence) is detected the following steps are to be followed:

1. Notify risk occurrence or potential occurrence:
    a. The actor that detects signs of an occurring or incipient risk should complete the Risk Identification form (as per the Annex 1) describing what was noticed and why it is considered either a potential or an effective risk;
    b. Report to the Project Manager (PM)/ Work Package Leader (WPL);
    c. If available suggest any useful solution coming from previous experience or performed activities.
2. Clarify the risk:
    a. The PM/WPL examine the Risk Identification form and proceed to clarify the current risk notice;
    b. The team will determine the potential impacts, involved actors, related scenarios as far as the core aspects of each of these issues are concerned;
    c. Results of the clarification process should be noted in the attachments of the Risk Identification form.
3. Prioritise the risk:
    a. The PM/WPL examine the results of the clarification process (reported in the Risk Identification form) and proceed to prioritise the current risk;
    b. Results of the prioritisation process should be noted in the attachments of the Risk Identification form.
4. Assign the Risk management to a person or group:
    a. The PM/WPL assigns the current risk handling to a specific person or a group within the Avengers team;

   b. Results of the assignment process should be noted in the attachments of the Risk Identification form.

5. Analyse the risk and develop a strategy (and a plan when appropriate):
   a. The partner responsible analyses current risks.
   b. Based on the evaluation of current risk specific management procedures are selected and activated;
   c. The risk mitigation plan is made and noted in the Risk Identification form;
6. Handle the risk and report on risk management:
   a. Assigned responsible implements the specific handling procedures selected and activated with the help of involved actors;
   b. Results of the risk management process are reported in the attachments of the Risk Identification form (this could happen once or several times depending on the time and effort required to perform recovery actions).
   c. Depending on risk status evaluation the process is either re-iterated or closed.

7.2 Risk register

Table 3 provides the risk register for the Avengers project. This is to be considered a living document, to be updated continuously and as necessary during the lifetime of the project

Appendices

Table 1: List of deliverables

Deliverable (number)	Deliverable name	WP number	Short name of lead participant	Type	Dissemination level	Delivery date (month)
D7.1	Consortium Agreement	7	ULUND	R	SEN	1
D7.2	Risk and quality management plan	7	VUA	R	PU	2
D7.3	Project website	7	VUA	DEC	PU	3
D7.4	Data management plan	7	ICOS	R	PU	6, 24, 42
D7.5	Dissemination Plan	7	ULUND	R	PU	6, 24
D3.1	Input data for aerosol inversions	3	TNO	DATA	PU	5
D2.2	Data set on observations	2	ULUND	DATA	SEN	12
D1.1	User stories (case-studies) and user needs	1	UBA	R	PU	16
D1.3	Target quantities for future observing capabilities in WP5	1	UBA	R	PU	18
D3.2	Posterior aerosol emissions inventory	3	VUA	DATA	PU	24
D5.1	Preliminary scenarios and assessments in WP5	5	iLab	R	PU	20
D2.1	Prior emissions for for European inversions and national case studies	2	TNO	DATA	SEN	24
D3.3	Aerosol forcing estimates and uncertainties	3	VUA	DATA	PU	26
D1.2	TOPAS_CH_4 service	1	TNO	DEC	PU	28
D2.3	European CO_2 inversions	2	iLab	R	PU	30
D2.4	European CH_4 inversions	2	VUA	R	PU	30
D2.5	European N_2O inversions	2	EMPA	R	PU	30

D2.6	National case-studies GHG inversion	2	ULUND	R	PU	30
D4.1	Modelled C and N_2O fluxes and emission factors	4	ULUND	R	PU	30
D4.2	Attribution of European methane emissions	4	VUA	R	PU	30
D3.4	Intercomparison of emissions and forcings	3	ULUND	R	PU	33
D2.7	Synthesis and recommendations on GHG inversions	2	EMPA	R	PU	36
D3.5	Impact of observations from future missions	3	VUA	R	PU	36
D4.3	Method for spatially explicit LULUCF GHG emissions	4	ISPRA	R	PU	36
D6.2	Guidelines for supporting national inventories	6	CMCC	R	PU	40
D1.4	Reconciliation of top-down and bottom-up estimates	1	VUA	R	PU	42
D1.5	GHG and aerosol national contributions to radiative forcing	1	VUA	R	PU	42
D5.2	Final scenarios and assessments in WP5	5	iLab	R	PU	42
D6.1	Flexible Inversion Tool for Inventory Compilers	6	iLab	Other	PU	42
D6.3	Project contribution to international initiatives	6	CMCC	R	PU	42
D7.6	Technical and financial reports	7	ULUND	R	SEN	42

Table 2: List of milestones

Milestone number	Milestone name	Related WP(s)	Due date (in month)	Means of verification
M7.1	Project initiated	7	2	Minutes of KO meeting
M3.1	Test sets for aerosol emissions data	3	3	data provided to model teams
M4.1	Model input data for DGVM	4	6	Data quality validated
M1.1	First set of case-studies	1	7	Requirements made available
M1.2	TOPAS_CH4 demonstrator	1	12	Website running
M2.1	First set of prior emissions	2	12	Data made available to project partners
M5.1	Initial observation scenarios	5	12	list of scenario specification
M7.2	General assemblies	7	15, 29, 42	Minutes of meetings
M2.2	Inverse models setup	2	18	Model runs demonstrated for test periods
M3.2	Estimates of aerosol forcings	3	24	Data made available to project partners
M4.2	DGVM runs completed	4	24	Model output available
M6.1	Progress on contribution to international initiatives	6	24	Report published
M1.3	Python inventory verification software tool	1	30	Software tested

Table 3: Critical risks for implementation

Description of risk (indicate level of (i) likelihood, and (ii) severity: Low/Medium/High)	WP(s) involved	Proposed risk-mitigation measures
Personnel involved or recruited not able to fulfil tasks (likelihood M, severity L)	All	Monitoring by the Project Office, and implementing adjustments within each organisation through GA.
Key researchers leaving the consortium (likelihood L, severity L)	All	Risk minimised by selecting partners of considerable size where teams consist of multiple members who are able to take over each other's tasks. Each WP (including WP7) has co-leads. Each consortium member should distribute the work internally to reduce the reliance on either one person or a small group.
Delays in recruitment affecting work effort (likelihood L, severity M)	All	Experienced, existing staff can cover for short-term absences. Partners will use their large networks to attract new co-workers.
Underperforming partners (likelihood L, severity M)	7	Close contact between WP Leaders and Project Leader, short feedback loops and personal contact, well-developed internal communication channels.
Persisting travelling difficulties due to epidemic outburst or other unforeseen events affecting consortium meetings and onsite working patterns (likelihood M to H, severity L)	All	Risk of unforeseen circumstances preventing physical access to facilities will be mitigated by use of digital repositories for the internal communication and prompt access to all deliverables of public access. Streaming facilities for the main gatherings such as general assemblies, workshops, work package meetings, training events will contribute to mitigate this risk.
Model integration and developments do not proceed as expected (likelihood L, severity M)	2, 3, 4, 5	Frequent testing and evaluation. Models will be recalibrated if necessary and documented, no new developments from scratch are foreseen.
Delays in delivery of prior emission fields for inverse modelling systems (likelihood L, severity L)	2, 3, 5	Usage of existing datasets covering previous years or with coarser spatial/temporal resolution
Atmospheric observations availability (likelihood L, severity M)	2, 3, 5	Effective and timely access to atmospheric observations will be key to the project. Addressing these critical data needs will be done by dedicated partners (ICOS, UHEI,

		SRON), use of existing datasets covering shorter time periods.
Computational resources limiting the number of inversions that can be performed (likelihood L, severity M)	2, 3	Optimizing the trade-off between inversion resolution and the time span covered by inversions. A mitigation option is to limit inversion timeseries to time slices instead of full timeseries.
Misunderstanding between participating scientists and inventory representatives causes delays or errors in results (likelihood L, severity L)	1,2	Allow for sufficient time in start phase of the project for communication between scientists and inventory representatives and closely monitor communication
Associated Partner EMPA receives less funding from Swiss government than asked for (likelihood m, severity L)	2, 5	The risk of a small adjustment of the budget is considered low, however, in case this happens EMPA adjust its work load accordingly but maintains all tasks related to co-leading WP2 of the project.

Annex I: Risk identification form

Risk Identification Form	
Date:	WP:
Originator(s):	
Have you experienced any problem or risk when dealing with the activities involved in this WP during this period? Yes / No	
If yes, please describe and rank them below:	
In your opinion, is any of these problems or risks hard enough so that the success of the project can be in danger? Yes / No	
Do you have any suggestion to avoid or tackle the problems and risks expressed above? Yes / No	
If yes, please describe them below:	
Classification	**Date**
Probability of occurrence H [_] M [_] L [_]	_____
Significance of impact H [_] M [_] L [_]	_____
Overall rating H [_] M [_] L [_]	_____
Status:	**Date:**
Assigned to:	
Handling Procedure? Yes / No	
Notification sent to:	
PM Yes / No	
WPL Yes / No	
Stakeholders Yes / No	
Annexes:	