

SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year 2021.....
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Project Title: European emissions of CO2 and CH4 inferred from model inversion system and their comparison with annual national inventory reports

Computer Project Account: spitgraz

Principal Investigator(s): Francesco Graziosi.....

 University of Urbino Carlo Bo
Affiliation:
Name of ECMWF scientist(s) collaborating to the project (if applicable)
Start date of the project: 01/04/2021.....
Expected end date: 31/12/2023.....

Computer resources allocated/used for the current year and the previous one
 (if applicable)

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)	-	-	4,000,000	-
Data storage capacity	(Gbytes)	-	-	25000	300

Summary of project objectives (10 lines max)

The aim of this project is to check the consistency between CO₂ and CH₄ bottom-up national emission inventories and concentration measured in the atmosphere. Moreover, changes in emissions of CH₄ and CO₂, due to the lock down COVID-19 pandemic, will be investigated over Po basin. For this purpose, a model inversion techniques will be used to estimate the magnitude and trend over 10 years period, of emissions sources of CH₄ and CO₂ over the European domain. In order to do this, we will use a combination of atmospheric measurements, Lagrangian Particle Dispersion Model (LDPM) in conjunction with a Bayesian inversion algorithm

Summary of problems encountered (10 lines max)

Initial technical problems, e.g. transferring data to/from ECMWF, compiling and achieving acceptable model performance at ECMWF CCA cluster.

Summary of plans for the continuation of the project (10 lines max)

Perform tests to evaluate the atmospheric transport model performances, focusing on mountain monitoring stations. Driven transport model with high resolution wind field. Carry out inversions sensitivity tests. Once determinate the reference setting to the inversion system, we will extend the inversions to all period investigated.

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List of publications/reports from the project with complete references

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Summary of results

If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

To estimate the emissions fluxes on national scale, high spatial and temporal resolution measurement data of CO₂ and CH₄ are required. For this, we retrieved data from the Integrated Carbon Observation System (ICOS). During the first months of the special project we evaluate the consistency of baselines of different monitoring stations that will be used for the inversions. Moreover, several tests were conducted to evaluate the dispersion model performances adopting different wind field resolution and different model settings (release altitude, time scale of dispersion ecc.). Furthermore, a preliminary analysis of different CO₂ a priori emission fields were performed to evaluate the impact of different a priori emission fields. For this purpose we tested the NOAA carbon tracker emission field for fossil fuel, Biomass Burning, Ocean and Net ecosystem exchange emissions. The background values are retrieved from CAMS Copernicus database. All of the preliminary setting tests were conducted on an external

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