REQUEST FOR A SPECIAL PROJECT 2015–2017

MEMBER STATE: JRC

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(postdocs in the framework of the projects MACC- III, ESA-GHG cci second phase project and InGOS)

Project Title: Improve estimates of global and regional CH_4 and N_2O emissions based on inverse modelling using in-situ and satellite measurements

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** _____	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2015	
Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Computer resources required for 2015-2017: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2017.)	**2015**	**2016**	**2017**
High Performance Computing Facility (units)	400000	400000	400000
Data storage capacity (total archive volume) (gigabytes)	400	400	400

*An electronic copy of this form **must be sent** via e-mail to:* *special_projects@ecmwf.int*

Electronic copy of the form sent on (please specify date): 17 June 2014

Continue overleaf

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide an annual progress report of the project's activities, etc.

Principal Investigator: Dr. Peter Bergamaschi

Project Title: Improve estimates of global and regional CH_4 and N_2O emissions based on inverse modelling using in-situ and satellite measurements

Extended abstract

Project description

EC-JRC-IES performs detailed inverse modelling studies of atmospheric greenhouse gases, using the TM5-4DVAR inverse modelling system. The objective of this special project (SP) is to further improve the estimates of global and regional CH_4 and N_2O emissions, by (1) using new in-situ and satellite observations, (2) further improving the TM5-4DVAR inverse modelling system, and (3) detailed comparisons with other inverse models. This SP will contribute to the FP7 project InGOS ("Integrated non-CO_2 greenhouse gas Observing Systems" (http://www.ingos-infrastructure.eu/), to the H2020 project MACC-III ("Monitoring Atmospheric Composition and Climate (Phase 3) ") (http://www.gmes-atmosphere.eu/) and to the ESA-GHG climate change initiative project Essential Climate Variable (ECV): Greenhouse Gases (GHG) CO_2 and CH_4) - second phase (2014-2017).

Improve estimates of global CH_4 emissions using new satellite retrievals

In MACC-III, JRC performs the pre-operational CH_4 inversions, using satellite and surface measurements (http://www.gmes-atmosphere.eu/d/services/gac/delayed/ch4_flux_inversions/). The objective of this SP is to further improve these inversions by analysing the impact of using improved satellite and in-situ observations, and by further improving the TM5-4DVAR inverse modelling system (including model resolution). We will analyze in detail the impact of using improved XCH_4 products developed with the ESA-GHG cci - second phase project.
The reanalysis of global CH_4 emission [*Bergamaschi et al., 2013a*] will be further extended.
The CH_4 inversions will include a comprehensive validation of model results, including the stratosphere (using e.g. stratospheric air core data).
Furthermore, the uncertainty estimates will be improved, developing techniques which can be used also for non-linear optimization (e.g. Monte-Carlo technique).

Improve estimates of European CH_4 and N_2O emissions using in-situ observations

Continuous in-situ observations have been demonstrated to provide significant constraints on European CH_4 and N_2O emissions [*Bergamaschi et al., 2014*]. Within the InGOS project, improved, harmonized European CH_4 and N_2O in-situ measurements are generated, which include estimates of repeatability and different components of the uncertainty relative to the WMO GAW mole fraction scale for CH_4 and N_2O. We will analyze the impact of using these improved in-situ data sets on the top-down estimates of European CH_4 and N_2O emissions. Furthermore, the TM5-4DVAR results will be compared with independent global and regional inverse models (in the framework of the InGOS inverse modeling work package, coordinated by JRC).

Improve TM5-4DVAR inverse modelling system

This SP will support the further development of the TM5-4DVAR system [*Bergamaschi et al.* [2013], including higher resolution of the transport model (aiming at 1x1 degree globally), higher temporal resolution of derived emissions, improved use of satellite data (e.g. improved bias

correction), speed-up of the model (including OpenMP parallelization), and further development of the new modular TM5-pyshell version.

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