

EMI R&D PROJECT PROGRESS REPORT

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

Reporting year2026.....

Project Title: ... Linear response theory and stochastic parametrizations for the investigation of response and sensitivity: A case study with an intermediate-complexity model ...

Computer Project Account: ...spitlemb.....

Principal Investigator(s): ...Valerio Lembo.....

Affiliation: ...CNR-ISAC.....

Name of ECMWF scientist(s) collaborating to the project
(if applicable)

Start date of the project: ...01/01/2024.....

Expected end date: ...31/12/2026.....

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)	7012500	21582	2000000	1781706
Data storage capacity	(Gbytes)	157500	2464	186200	23569

Summary of project objectives (10 lines max)

The sensitivity of internal variability to external forcings, as it can be distinguished from the long-term climate response, is studied in model PlaSim-LSG, with and without a Stochastically Perturbed Parametrization Tendencies (SPPT) scheme (Buizza et al. 1999). The computational advantage provided by such EMIC-class models is exploited to investigate the asymptotic response of the modelled climate in a systematic way. An experimental protocol adopting the LRT in the context of climate modelling (Ragone et al. 2016) is tested in its performance to predict the asymptotic response of a chosen observable, highlighting several crucial aspects of the climate forced response, such as the equilibrium climate sensitivity, the transient climate response etc., the reduction of the Atlantic Meridional Overturning Circulation (AMOC) or the emergence of the North Atlantic cold blob (cfr. Lembo et al. 2020).

Summary of problems encountered (10 lines max)

The last year of the project has been mainly devoted to the analysis of the produced runs. The few remaining simulations, namely the historical runs with T21 resolution and the comparison of different vertical discretizations (10 or 15 vertical levels), were carried out on other HPC infrastructures, with no problem occurred. The available SBU for this year were used instead to test the best configuration of the ECE3-ESM model to carry out one of the runs of experiment A within the TIPMIP-OCEAN protocol (Swingedouw et al. 2026, under review). The model was well integrated in the ATOS environment, so no technical issue arose when running the test, that were mainly dedicated to the tuning of the most adherent forcing to the protocol.

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

The project will be soon ending (31st December 2026), therefore the main effort will be dedicated to the preparation of the final report and the analysis of results for publication on peer-reviewed literature.

Summary of results

As mentioned above, no new simulations were carried out in the framework of the project, and the analysis is still going on. Therefore, results will be detailed in the final report of the project in due time.