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	2025
Project Title:	**H**ydrogen **E**mission **S**cenarios to drive Climate **P**rojections for **E**nvironmental and **RI**sk **A**ssessment (**HESPERIA**)
Computer Project Account:	SPITBEAL
Principal Investigator(s):	Alessio Bellucci
Affiliation:	Consiglio Nazionale delle Ricerche, Istituto di Scienze dell'Atmosfera e del Clima (CNR-ISAC)
Name of ECMWF scientist(s) collaborating to the project (if applicable)	N/A
Start date of the project:	01/01/2025
Expected end date:	31/12/2027

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	(SBU)			2.8 Million	102066
Data storage capacity	(Gbytes)			4000	0

Summary of project objectives (10 lines max)

HESPERIA aims to advance our understanding of the potential climate impacts of a hydrogen-based economy, using the state-of-the-art global climate model EC-Earth. The project specifically investigates how hydrogen emissions may influence Earth's radiative balance and evaluates the broader climate implications of hydrogen adoption across various socio-economic sectors. By exploring alternative scenarios with differing levels of hydrogen deployment, HESPERIA will generate new insights that complement existing scenario-based assessments from previous Coupled Model Intercomparison Project (CMIP) efforts—offering a timely and updated perspective on potential climate futures.

Summary of problems encountered (10 lines max)

During the first 6 months of the project, no significant problems were encountered.

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

A first set of experiments aimed at estimating the effective radiative forcing associated with the release of hydrogen in the atmosphere will be designed and performed, using an atmospheric-only (AMIP) configuration of EC-Earth, under idealized forcing conditions. Step-wise increments in GHG concentrations (notably, methane, ozone and water vapour) corresponding to a +10% increase in hydrogen concentrations will be used to drive the AMIP simulations. The radiative imbalance at the top of the atmosphere determined by these hydrogen-induced GHG perturbations will be computed, providing an estimate of the indirect radiative forcing of the hydrogen.

List of publications/reports from the project with complete references

Summary of results

During this initial stage of the project, preliminary tests with the EC-Earth4 model were successfully carried out. This model—designated for the numerical experiments planned as part of the Special Project—was compiled and tested through short simulations on the Atos HPC facility. Due to the limited duration of these runs, only minimal HPC resources were required. Nevertheless, this preliminary work was essential for verifying the model's readiness ahead of the upcoming, more extensive simulation efforts.