# 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** | 2022 |
| **Project Title:** | QUECLIM - Quasi-equilibrium climates at increased greenhouse forcing |
| **Computer Project Account:** | spitfab2 |
| **Principal Investigator(s):** | Federico Fabiano<br>(S. Corti, P. Davini) |
| **Affiliation:** | ISAC-CNR (Bologna) |
| **Name of ECMWF scientist(s) collaborating to the project**<br>(if applicable) | - |
| **Start date of the project:** | 01/01/2022 |
| **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) | - | - | 28,500,000 | 0 |
| **Data storage capacity** | (Gbytes) | - | - | 90,000 | 0 |

## Summary of project objectives (10 lines max)

The main goal of the project is to investigate the mean state and internal variability of the climate system at various time scales - from subseasonal to interannual and decadal - in quasi-equilibrium conditions with different levels of greenhouse forcing, by performing 500-yr and 1000-yr long integrations with the EC-Earth climate model. The simulated quasi-equilibrium worlds will be compared to the transient states at similar global mean temperature given by the CMIP6 scenario simulations, in order to disentangle the impact of fast and slow feedbacks on climate extremes.

## Summary of problems encountered (10 lines max)

Nothing to report.

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

We are planning to port EC-Earth3 on the new Atos machine shortly, to start the simulations without the need to change the setup later.

## List of publications/reports from the project with complete references

No publication is available for this project yet.

## Summary of results

The planned simulations have not started yet. Initial conditions for years 2065 and 2080 have been extracted from the SSP5-8.5 r4i1p1f1 simulation. In addition, different strategies to perform the millennial extensions at high forcing have been explored. In fact, simulating the evolution of the climate system at centennial to millennial timescales would require, in addition to the atmosphere and ocean components, a proper representation of the Greenland and Antarctic ice sheets as well. However, this is not currently included in EC-Earth3, and the ice sheets are just represented as snow-covered areas. Two compromises have been explored and tested with model simulations: one fixing the bare soil albedo of ice sheet regions to higher values (about 0.5), the other increasing the snow cover depth to a very large amount to avoid complete melting in a too short timescale. The second alternative is considered more appropriate, more realistically representing energy (melting) and freshwater fluxes.