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	2024
Project Title:	Alternative schemes to accelerate seamless weather prediction
Computer Project Account:	spgbmong
Principal Investigator(s):	Beatriz Monge-Sanz
Affiliation:	University of Oxford, Physics Department
Name of ECMWF scientist(s) collaborating to the project (if applicable)	Matthew Chantry, Peter Dueben, Antje Weisheimer
Start date of the project:	2023
Expected end date:	2025

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)	27,000,000	-	27,000,000	-
Data storage capacity	(Gbytes)	10,000	-	10,000	2,500

Summary of project objectives (10 lines max)

The new generation of Earth System Models (ESMs) required to answer pressing questions on weather extremes under climate change needs to be developed in ways that allow seamless prediction across a wide range of resolutions and timescales.

Due to computational costs, full-chemistry descriptions for the stratosphere are still mainly reserved for coarser resolutions than operational numerical weather prediction (NWP) models require, and such full-chemistry descriptions are not yet affordable for multi-ensemble long-range weather simulations.

In this project we assess the feasibility and performance of alternative fast approaches for stratospheric key radiative species that can be implemented in an ESM at low computational cost, while providing quality comparable to key chemical fields from widely used full-chemistry models.

Summary of problems encountered (10 lines max)

Groups reorganisation at Oxford and research funding priorities have shifted our IFS planned simulations to the second half of this special project.

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

The simulations we plan to carry out with IFS include:

i) Medium-range 10-day forecast experiments covering different periods of time, up to one year, with additional focus on NH winter/spring events. This allows assessment of the performance of the new approaches along the annual seasonal cycle, as well as under different atmospheric conditions and relevant meteorological patterns, such as SSWs and polar vortex breaking events.

ii) Seasonal runs with 7-month integration range and typically two start dates. These runs will cover periods of between 10 and 20 years, allowing to assess the evolution of stratospheric interannual variability in a decadal framework.

List of publications/reports from the project with complete references

Not applicable yet

Summary of results

Offline simulations of the fast approaches developed for stratospheric ozone are showing their feasibility and their good agreement with corresponding fields from full-chemistry runs.
With these runs we are not only aiming to assess the performance of the fast approaches but also disentangling contribution from chemical and dynamical processes for different periods during the ERA-Interim reanalysis period.

Results from the offline tests have been analysed for different atmospheric regions and periods along a 30-year period, with particular attention to high latitudes. Ozone behaviour over high latitudes during the 1980-2010 period is particularly challenging and scientifically relevant because of the intensity and extension of spring ozone depletion, and because of the evolution of ozone depleting substances along the period considered.

We have presented results related to this project at international conferences and invited seminars (CCMI 2023, Imperial College 2023, ONR Workshop 2023).

Online IFS planned simulations are shifted to the second half of the project. Technical tests are starting with cycle version 48r1. Simulations will use horizontal resolutions varying from that of ERA-Interim (T255) to HRES, or close to HRES resolutions, typically TCo399; simulations will use full vertical resolution L137.