

SPECIAL PROJECT PROGRESS REPORT

Reporting year 2025

Project Title: Flow-dependence of the intrinsic predictability limit and its relevance to forecast busts

Computer Project Account: SPDECRAI

Principal Investigator(s): Prof. Dr. George Craig

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

Start date of the project: 2025

Expected end date: 2027

Computer resources allocated/used for the current year and the previous one

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)			120M	9.1M
Data storage capacity	(Gbytes)			20,000	0

Summary of project objectives

Forecast busts still occur despite significant advancements in weather forecasting, including AI-based approaches. Although rare, they can have severe societal and economic impacts, especially when linked to high-impact weather. Two main causes of forecast busts over Europe have been identified: Extra-tropical transitions (ET) of tropical cyclones and mesoscale convective systems (MCS) over North America. Such events involve complex small-scale, diabatic processes that interact with large-scale dynamics. The project aims to identify whether and to what extent forecast busts stem from true intrinsic limits or model/data-assimilation shortcomings. We will estimate uncertainty growth and improvement potential using ensemble simulations started from tiny initial perturbations.

Summary of problems encountered

None

Summary of plans for the continuation of the project

The plan involves studying two types of forecast busts using targeted ensemble simulations. For busts linked to tropical cyclones (ET-type), the focus is on capturing uncertainty growth and identifying conditions that lead to rapid forecast divergence. Multiple initial conditions and two weather models will be used to explore sensitivity and model biases. For busts related to convective storms (MCS-type), high-resolution simulations will be run to better represent small-scale processes. These runs will start at high resolution and continue at lower resolution to save computing resources while still capturing key developments.

List of publications/reports from the project with complete references

None yet.

Summary of results

So far, only a small set of test simulations have been carried out to answer technical questions and there are no scientific results yet.