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	2023
Project Title:	Impact of Aeolus on the prediction of tropical dynamics
Computer Project Account:	SPATSERA
Principal Investigator(s):	Dr. Stefano Serafin, Prof. Dr. Martin Weissmann
Affiliation:	University of Vienna
Name of ECMWF scientist(s) collaborating to the project (if applicable)	Michael Rennie
Start date of the project:	1.1.2021
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)	3,000,000	0	2,000,000	1,698,423
Data storage capacity	(Gbytes)	9,000	0	12,000	0

Summary of project objectives (10 lines max)

The Aeolus satellite was launched in summer 2018 and carries on board the first UV Doppler lidar in space (ALADIN). The plan for our project was to deal in year 1 (2021) with data denial experiments (with and without the assimilation of Aeolus aerosol and wind observations) concerning the Aeolus Cal/Val campaign ASKOS, originally planned for August 2020. Additional numerical experiments were planned for years 2 and 3, dealing with yet-to-be-defined periods and designed in order to determine the impact of Aelous observations on the IFS skill in simulating tropical dynamics (formation of propagation of African Easterly Waves, Kelvin Waves).

Summary of problems encountered (10 lines max)

The Aeolus Cal/Val campaign ASKOS (https://askos.space.noa.gr/) was postponed due to the COVID 19 pandemic. Preliminary campaign phases took place in July and September 2021, the full campaign took place in June-July 2022. The whole plan for our Special Project was shifted and adjusted accordingly.

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

With the computing resources of the project, we already made simulations that compare the impact of Aeolus found in data denial experiments to experiments with EDA perturbations, to put the impact of Aeolus in the context of initial condition uncertainty in the ECMWF NWP system. The plan for the remaining period is to analyse these experiments. Additionally, we will investigate the influence of Aeolus on the representation of equatorial waves in the ECMWF system.

List of publications/reports from the project with complete references

Borne, M, Knippertz, P, Weissmann, M, Martin, A, Rennie, M & Cress, A 2023, 'Impact of Aeolus wind lidar observations on the representation of the West African monsoon circulation in the ECMWF and DWD forecasting systems', Quarterly Journal of the Royal Meteorological Society, Jg. 149, Nr. 752, S. 933-958. https://doi.org/10.1002/qj.4442

Summary of results

Borne et al. (2022) explored the impact of the Aeolus wind dataset on the analyses and forecasts from ECMWF and the Deutscher Wetterdienst, focussing specifically on the West African Monsoon circulation during the boreal summers of 2019 and 2020. The publication was finalized in the reporting period. Findings include:

- Assimilating Aeolus data generally improves the prediction of zonal winds, especially for lead times above 24 hours, by reducing systematic errors in the representation of the mid-level African Easterly Jet North and the upper-tropospheric Tropical Easterly Jet.
- The regions where the influence of Aeolus on analyses is greatest coincide with large background forecast error, i.e., the Intertropical Convergence Zone (ITCZ) region for ECMWF.
- Applying a temperature-dependant bias correction to the Rayleigh-clear channel contributes to a more accurate representation of the diurnal cycle and improved prediction of West African Monsoon winds.