REQUEST FOR A SPECIAL PROJECT 2021–2023

MEMBER STATE: AUSTRIA

Principal Investigator[1]: Leopold Haimberger

Affiliation: University of Vienna

Address: Althanstraße 14, 1090 Wien, Austria

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Other researchers: Michael Mayer, Michael Blaschek, Johannes Mayer, Federico Ambrogi, Alexander Bihlo

Project Title: Mining 5th generation reanalysis data for changes in the global energy cycle and for estimation of forecast uncertainty growth with generative adversarial networks

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP**ATLH00	
Starting year: (A project can have a duration of up to 3 years, agreed at the beginning of the project.)	2021	
Would you accept support for 1 year only, if necessary?	YES ☐	NO X

Computer resources required for 2021-2023: (To make changes to an existing project please submit an amended version of the original form.)		**2021**	**2022**	**2023**
High Performance Computing Facility	(SBU)	10000	10000	10000
Accumulated data storage (total archive volume)[2]	(GB)	1000	2000	3000

Continue overleaf

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide annual progress reports of the project's activities, etc.

[2] These figures refer to data archived in ECFS and MARS. If e.g. you archive x GB in year one and y GB in year two and don't delete anything you need to request x + y GB for the second project year etc.

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Extended abstract

This special project is a follow on and extension of special project "Coupled energy and freshwater budgets from and early upper air data enhancements for reanalysis" which will end in 2020.

The project will help identifying changes in the global energy and freshwater cycles as well as potential inhomogeneities, particular in the early period of ERA5 (1950-1978), which has been completed in 2020. It will also be devoted to further improve the numerical representation of certain energy budget terms, particularly the horizontal total energy flux divergence, which still appears noisy over ragged terrain. We also plan to diagnostically evaluate the land soil energy budget more systematically, since we found quite interesting preliminary results from such an evaluation over the subarctic and arctic region (see interim report of above mentioned special project).

In this project, we will also try out very recent methods of machine learning for ensemble prediction. In particular, we will train deep convolutional adversarial generative networks to learn from the ERA5 reanalysis and ensemble data to forecast the ensemble spread of various meteorological fields, including geopotential height and temperature. As a separate problem we will investigate whether it is possible to use the reanalysis data alone for forecasting the spread, which, if successful, would allow generating ensemble forecasts much cheaper than with presently used numerical methods.

The ERA5 data set seems perfect for this due to its high degree of homogeneity in the satellite era as well as due to its accurate state estimates.

The computer resources needed for this special project are moderate, however the efficient and convenient access to data and documentation as it is available with an ECMWF user account is of great importance for the success of these efforts.