REQUEST FOR A SPECIAL PROJECT 2022–2024

MEMBER STATE: FRANCE

Principal Investigator[1]: Claude FISCHER

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Other researchers: Alexandre Mary (Météo-France), Daniel Santos-Munoz (DMI), and about 20 researchers from the ACCORD Members NMS involved in the NWP code integration and technical validation process. This number may increase steadily with time.

Project Title:

ACCORD common codes maintenance Special Project
(suggested name: SPFRACCO)

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SPxxxxxx (this is a new project proposal)**	
Starting year: (A project can have a duration of up to 3 years, agreed at the beginning of the project.)	2022	
Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Computer resources required for 2022-2024: (To make changes to an existing project please submit an amended version of the original form.)		**2022**	**2023**	**2024**
High Performance Computing Facility	(SBU)	10 MSBU	15 MSBU	20 MSBU
Accumulated data storage (total archive volume)[2]	(GB)	10.000	10.000	10.000

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

The completed form should be submitted/uploaded at https://www.ecmwf.int/en/research/special-projects/special-project-application/special-project-request-submission.

All Special Project requests should provide an abstract/project description including a scientific plan, a justification of the computer resources requested and the technical characteristics of the code to be used.

Following submission by the relevant Member State the Special Project requests will be published on the ECMWF website and evaluated by ECMWF as well as the Scientific Advisory Committee. The evaluation of the requests is based on the following criteria: Relevance to ECMWF's objectives, scientific and technical quality, disciplinary relevance, and justification of the resources requested. Previous Special Project reports and the use of ECMWF software and data infrastructure will also be considered in the evaluation process.

Requests asking for 1,000,000 SBUs or more should be more detailed (3-5 pages). Large requests asking for 10,000,000 SBUs or more might receive a detailed review by members of the Scientific Advisory Committee.

The goal of this SP is to provide resources to the ACCORD consortium in order to (1) enhance its capability towards a common maintenance of the shared NWP codes and (2) further develop and ensure the portability of the tools used for this maintenance. Hereafter are the major elements of context for this SP request, and the description of the planned activity.

These efforts fall under the more general strategic goal in ACCORD to move towards a common working environment and practice.

1. The ACCORD consortium

ACCORD is a new consortium with a focus on R&D for very high resolution NWP modeling using limited area models (LAM). It is the result of the merge of the former ALADIN consortium with HIRLAM (HIRLAM-C will however remain active until end of 2022, and a HIRLAM-D adapted program is under discussion for until 2025) and LACE (this consortium, formed of Central European NMSs, will continue). A major aim is to provide all ACCORD Members a state-of-the-art NWP system suitable for operational applications by the Member NMSs. *Figure 1* provides an overview map of the ACCORD Members.

Figure 1. Map of ACCORD Member NMSs. The NMSs that are also Members of HIRLAM or of LACE are represented in green, resp. cyan.

2. The common NWP codes of ACCORD and their release (cycle) evolution procedure

The NWP codes shared and developed in ACCORD use, to some extent, the IFS/ARPEGE global codes as backbone. Additional codes, not directly related to IFS/ARPEGE, are needed to form a full ACCORD model executable file (SURFEX surface scheme, Méso-NH physics package, specific surface assimilation codes etc.). The full ACCORD NWP system is currently being developed along 3 main model configurations, the so-called Canonical System Configurations ("CSC": AROME, HARMONIE-AROME and ALARO). The aim in ACCORD is to progressively make a transition towards fully transversal, CSC-agnostic system configurations. This so-called "convergence" should be achieved by reaching a high degree of interoperability across the CSCs on various aspects such as physics, components of DA and EPS, scripting, and quite notably a common working environment and common work practice.

ACCORD codes are regularly updated with new R&D developments, technical code overhauls and phasing with the IFS/ARPEGE backbone codes. This evolution leads to the definition of new releases over time, aka as T-cycles (*Figure 2*). T-cycles are regularly defined by the successful integration and validation of code developments from the different partners (in ACCORD, including Météo-France contributions, and impact of the IFS/ARPEGE code changes on the LAM components when relevant).

The code evolution process is currently undergoing a modernization in terms of work environment, process and tools (see a sketch on *Figure 3*). This evolution includes close discussion and coordination with ECMWF and Météo-France via the IFS/ARPEGE coordination process. The aim in ACCORD is to move to an incremental code integration with systematic evaluation of non-regression (of existing testing configurations), reproducibility of numerical results (unless otherwise stated by a contributor), new tests when appropriate. The intention is furthermore to make use of modern code configurations (e.g. like available with OOPS) and new testing tools (e.g. “DAVAÏ”). All model configurations are addressed in the test procedure (ie IFS, ARPEGE and the LAMs).

The efforts devoted for code and system maintenance in ACCORD are described in the yearly updated Rolling Work Plan and their staffing is regularly being reported (by the local teams) and monitored (by the Programme Management).

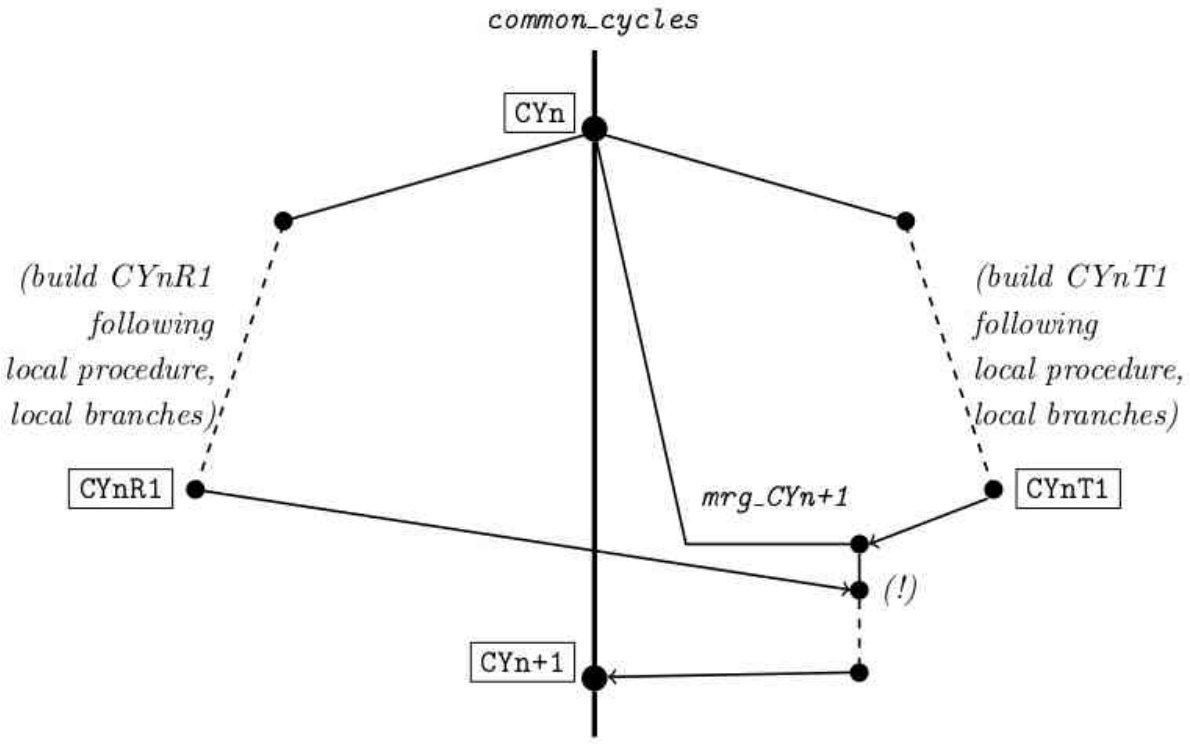

Figure 2. Code evolution process involving code changes by the ACCORD R&D teams (T-cycles for ARPEGE and the LAM versions; right) and resynchronization with the IFS releases (central branch).

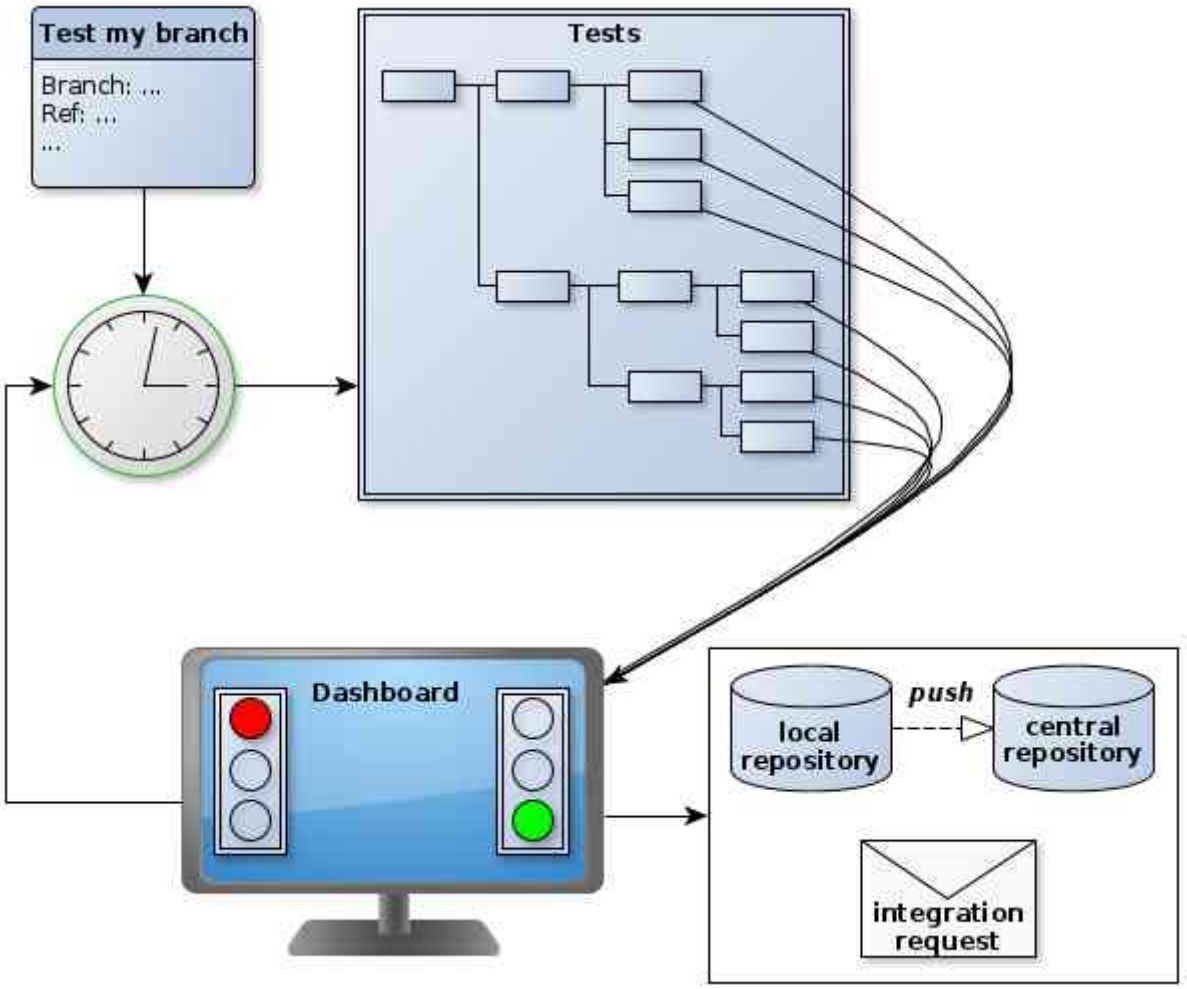

Figure 3. Schematic of the DAVAÏ testing system which enables to test a code version (new development or merge result, for instance). The steps encompass: fetching the codes to be tested, building executables, running sets of integrated or elementary test-cases (representative of canonical configurations including IFS, ARPEGE, AROME, ALARO, HARMONIE-AROME), automatic comparison of outputs to reference outputs, user-friendly display of these results. It is a crucial step in the process of integration and validation of code changes.

3. The work planned within this Special Project

Currently, the major part of the T-cycles code updates and validation is organized and performed in the framework of the Météo-France HPC environment. This circumstance is not foreseen to change, however there are several clear benefits for extending the activity to other HPC platforms. At the level of technical sanity of the codes, it is of high interest to perform technical validation of new code releases on various different machines as early as possible in the code update process. In addition, complementing the MF-bound technical working environment with a second working environment will enable to adapt the procedures and the tools towards a more site-agnostic design and implementation. This extension will increase the overall sustainability of the technical code update and validation process in ACCORD.

The activity planned in this SP therefore encompasses the following tasks:

- Installation of technical validation testing tools (and testing input data), DAVAÏ (and possibly the old tool “mitraillette”). Adaptation and updates of these tools as relevant for their own improvements.
- Installation of ancillary tools used for instance for user-oriented evaluation of testing results (“ciboulaï”, web interfaces, archive of test results).
- Installation of T-cycle versions available from the Toulouse Central Repository.
- Installation of compile tools.
- Installation of user-specific code archives (e.g. “packs” for GMKPACK etc.).
- Execution of technical benchmark tests as defined in DAVAÏ (or mitraillette), by submission on the ECMWF HPC machine.

The participants to this SP will have to be members of the “***hirald***” system group at ECMWF.

For the start of the SP, it is expected that the participants will be among the major actors of code evolution in the consortium: the Integration Leader (responsible for the integration process of code contributions in the T-cycles); the System Area Leader; core staff frequently involved in preparing code contributions (from the HIRLAM System Team, the LACE System Coordinator, key contributors from the CSC teams, MF code experts involved in the IFS/ARPEGE and AROME code coordination). The total size of participants may increase slightly but steadily with time.

The outcomes of the activity in this SP are expected to be along the following lines:

1. An enhanced portability and improved capability of the code testing tools in ACCORD (DAVAÏ).
2. An enhanced definition of common working practices and work environment for ACCORD code and system activity, with a strong focus on code integration and technical validation of new cycles.
3. An improved evaluation of the portability of new code versions for ACCORD Members.
4. Through the additional testing on the ECMWF HPC (w/r to the MF HPC located testing), an improved technical quality assurance of new cycles, with feedback of potential bug-fixes or optimization fixes to the Central Code Repository.

4. Additional comments

The requested resources in this SP come in addition to the resources provided by ECMWF either for national use (by ACCORD Members) or by other consortium requests (for instance the HIRLAM specific SP). The justification is that the code and system maintenance described here concerns the ACCORD-wide collaboration, *and will include Members that are not members of any other group nor of ECMWF*.

The activity planned in this SP has a link with experimental or technical work undertaken by individual Member States or by specific groups (HIRLAM, LACE). There conversely is no other framework involving ECMWF resources for which an ACCORD-wide working environment is provided. The present SP tries to fill this gap.

5. References

Pailleux J., Geleyn J.-F., Hamrud M., Courtier P., Thépaut J.-N., Rabier F., Andersson E., Burridge D., Simmons A., Salmond D., El Khatib R., Fischer C., **2014**: Twenty-five years of IFS/ARPEGE, *ECMWF Newsletter* N° 141, Autumn 2014, pp. 22-30, www.ecmwf.int/en/about/news-centre/media-resources

Termonia P., Fischer C., Bazile E., Bouyssel, F., Brožková R., Bénard P., Bochenek B., Degrauwe D., Derková M., El Khatib R., Hamdi R., Mašek J., Pottier P., Pristov N., Seity Y., Smolíková P., Španiel O., Tudor M., Wang Y., Wittmann C., Joly A., **2018**: The ALADIN System and its Canonical Model Configurations AROME CY41T1 and ALARO CY40T1, *Geosci. Model Dev.*, vol. 11, pp. 257-281, https://doi.org/10.5194/gmd-11-257-2018

Bengtsson etal., **2017**: The {HARMONIE-AROME} model configuration in the {ALADIN-HIRLAM} {NWP} system, MWR, vol. 145, pp. 1919-1935, DOI: http://dx.doi.org/10.1175/MWR-D-16-0417.1