REQUEST FOR A SPECIAL PROJECT 2025–2027

MEMBER STATE:	FRANCE
Principal Investigator[1]:	Claude FISCHER
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Other researchers:	Daniel Santos-Munoz (DMI) Alexandre Mary (Météo-France) + the other SPFRACCO registered users
Project Title:	ACCORD common codes maintenance Special Project

To make changes to an existing project please submit an amended version of the original form.)

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SPFRACCO**	
Starting year: (A project can have a duration of up to 3 years, agreed at the beginning of the project.)	2025	
Would you accept support for 1 year only, if necessary?	YES x	NO ☐

Computer resources required for project year:		**2025**	**2026**	**2027**
High Performance Computing Facility	[SBU]	20000000	20000000	20000000
Accumulated data storage (total archive volume)[2]	[GB]	10000	15000	20000

EWC resources required for project year:		**2025**	**2026**	**2027**
Number of vCPUs	[#]			
Total memory	[GB]			
Storage	[GB]			
Number of vGPUs[3]	[#]			

[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.
[3]The number of vGPU is referred to the equivalent number of virtualized vGPUs with 8GB memory.

Continue overleaf.

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Extended abstract

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

Following submission by the relevant Member State the Special Project requests will be published on the ECMWF website and evaluated by ECMWF and its Scientific Advisory Committee. The requests are evaluated based on their scientific and technical quality, and the 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 exceeding 10,000,000 SBU should be more detailed (3-5 pages).

The goal of this SP is to provide resources to the ACCORD consortium in order to (1) enhance its capability on a common maintenance of the shared NWP codes, (2) further develop and ensure the portability of the tools used for this maintenance and (3) increase the level of validation of common code versions. Hereafter are the major elements of context for this SP request, and the description of the planned activity.

These efforts fall under the strategic goal in ACCORD to maintain and strengthen a common working environment and common working practices. With respect to the previous phase of this SP (2022-2024), the scope is slightly increased to take into account elements from the ACCORD draft scientific strategy 2026-2030.

1. The ACCORD consortium

ACCORD is a consortium with a focus on R&D for very high resolution NWP modelling using limited area models (LAM). It is the result of the merger of the former ALADIN consortium with HIRLAM (whose scientific and technical activity shall be split between ACCORD and UWC by the end of 2025) and LACE (formed by Central European NMHSs). A major aim is to provide all ACCORD Members a state-of-the-art NWP system suitable for operational applications by the Member NMHSs. *Figure 1* provides an overview map of the ACCORD Members.

Figure 1. Map of ACCORD Member NMHSs. The NMHSs 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 "CSC-agnosticity" will 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 practices.

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. In ACCORD, the move toward an incremental code integration with systematic evaluation of non-regression and of reproducibility of numerical results (unless otherwise stated by a contributor) has made significant progress during the first phase of this SP (2022-2024). The testing environment will continue to be modernized, enhanced with new functions and with new tests in the next phase of this SP (2025-2027). The improvements are based on the 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).

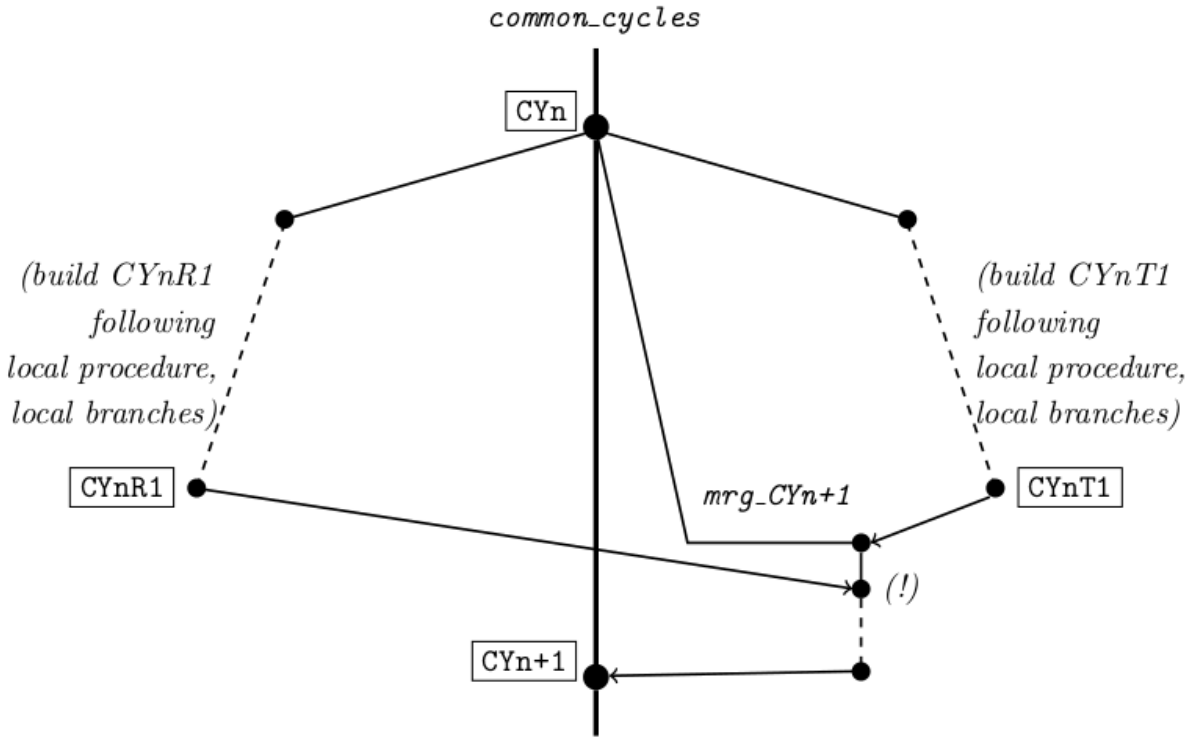

Figure 2. Code evolution process involving code changes by the ACCORD R&D teams (T-cycles for ARPEGE and the LAM versions; right) and resynchronization with the IFS releases (central branch).

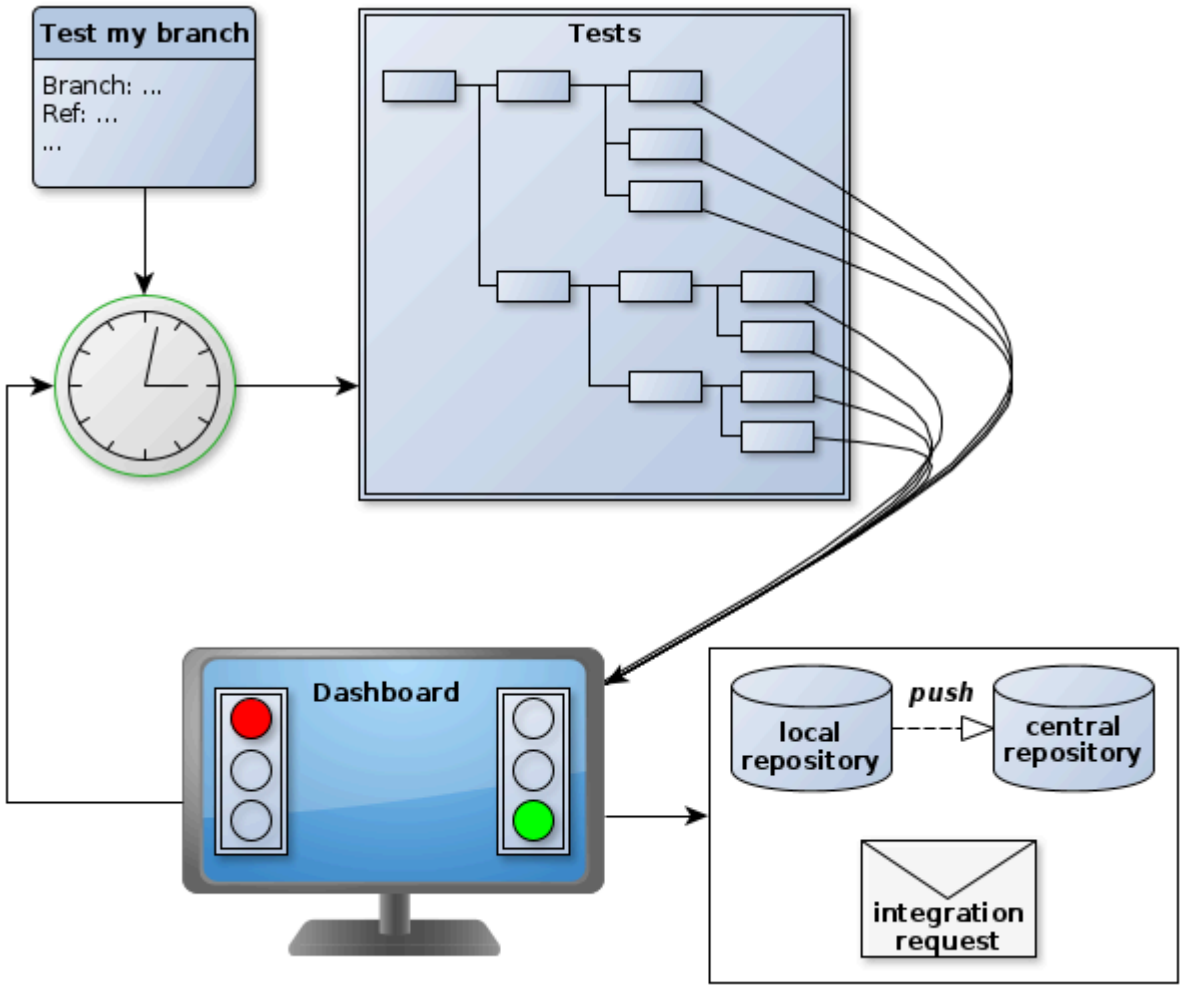

Figure 3. Schematic of the DAVAÏ testing system which enables to test a code version (new development or merge result, for instance). The steps encompass: fetching the codes to be tested, building executables, running sets of integrated or elementary test-cases (representative of canonical configurations 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.

During phase 1 of this SP, the DAVAÏ testing tool and its ancillary tools has been successfully ported to the ECMWF ATOS machine. In 2023-2024, the use of DAVAÏ by ACCORD members has been settled and a growing number of developers in the consortium use the tool as their main reference testing device. Resources of this SP have been used in particular for preparing contributions to CY49T1 (carried out in the autumn of 2023), and the validation of cycles CY49T1 and CY49T2 themselves during their construction. The resources are currently also used in development mode for e.g. LAM/OOPS-based 4DVar developments in ACCORD.

The activity planned in the continuation of this SP encompasses the following tasks:

- Installation and updates of the technical validation testing tool (and testing input data) DAVAÏ.
- Installation and updates of ancillary tools used for instance for user-oriented evaluation of DAVAÏ testing results (“ciboulaï”, web interfaces, archive of test results).
- Installation of T-cycle versions of the common codes, as available from the Toulouse Central Repository.
- Installation and updates of compile tools.
- Installation of user-specific code archives (e.g. “packs” for GMKPACK etc.).
- Execution of technical benchmark tests as defined in DAVAÏ, by submission on the ECMWF HPC machine.
- Training activities on codes and tools for ACCORD teams

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

The list of duly registered participants to this SP has slightly but steadily increased during the first phase. Some key ACCORD scientific management persons are included: 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). A list as obtained from the ECMWF system tools is provided in Annexe 1 below. It is expected that this list will continue to grow with time.

At the time of writing this proposal, the ACCORD consortium is in the process of preparing its scientific strategy for the next phase of the consortium (2026-2030). In reflection to the content of the draft strategy as of June 2024, some widening of the scope of activity is suggested in the framework of this SP:

- design of common workflow components. A goal in the draft strategy is to design and jointly develop common scripts to run all 3 CSCs, and progressively increase their functions (data assimilation, EPS)
- design and develop enhanced tools and environments for physics-based validation. The ACCORD draft strategy includes the following goals:
    - to design tools and environments for physics-based validation of scientific developments, with an emphasis on very high resolution modelling (from the km-scale to the hm-scale grid meshes)

- to define and organize use cases with the relevant validation data. Such data may include specialized datasets for instance from field campaigns or research networks of measurement sites
- to continue to work on metrics and improve common tools for verification (eg “harp”) suitable for a regular, statistical-based verification of very high resolution model forecasts

It is proposed to use part of the resources of the SP in order to foster common R&D activity on these topics across the consortium. Upon approval of the scientific strategy, the work plans will be further discussed with the interested ACCORD teams in the framework of the ACCORD yearly management process (in link with the Rolling Work Plan).

For the sake of clarity, it is stressed that the SP resources will be devoted to design and development activity (R&D). They are not planned to be used for regular or systematic verification of model forecasts by ACCORD Members.

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) at construction time of a new code version.
2. An enhanced definition of common working practices and work environment for ACCORD code and system activity.
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.
5. New or improved R&D validation procedures commonly shared across ACCORD for scientific development.

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 design and maintenance, as well as the joint R&D 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 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

ACCORD Rolling Work Plan 2024: http://www.accord-nwp.org/IMG/pdf/rwp2024_adopted.pdf

6. Annexe 1. List of users registered on SPFRACCO (December 2023)

sp2b	-	Daniel Santos-Munoz (DMI)
dui	-	Eoin Whelan (Met Eireann)
sk1	-	Oldrich Spaniel (SHMU - Slovakia)
ltm	-	Rimvydas Jasinskas (LHMS - Lithuania)
rm9	-	Alexandre Mary (MF)
cv9	-	Daan Degrauwe (RMI)
nkl	-	Bert van Ulft (KNMI)
cza	-	Alena Trojakova (CHMI - Czech Republic)
czps	-	Petra Smolikova (CHMI - Czech Republic)
fag	-	Ole Nikolai Vignes (Met.no)
fars	-	Roel Stappers (Met.no)
snh	-	Ulf Andrae (SMHI)
sn8	-	Patrick Samuelsson (SMHI)
ltm1	-	Martynas Kazlauskas (LHMS - Lithuania)
sk9	-	Maria Derkova (SHMU - Slovakia)
dmaa	-	EL KAROUNI Kamal (Maroc-Météo)
soae	-	Abdenour AMBAR (ONM - Algeria)
soad	-	Mohamed MOKHTARI (ONM - Algeria)
hrb4	-	Bogdan Bochenek (IMGW - Poland)
nlcr	-	Chris Romick (KNMI)
acrd	-	Accord System User