

A Consortium for CONvection-scale modelling  
Research and Development

## 6th ACCORD STAC meeting

25-26 October 2023 14:00-18:00 &  
09:00-12:00 local time  
Brussels ([hybrid](#))

### Draft minutes

#### In-Situ:

- STAC: Claude Fischer, Anne-Lise Dhomps, Saji Varghese, Yelis Cengiz, François Bouyssel, Xiaohua Wang, Sami Niemela, Rafiq Hamdi,
- MG: Martina Tudor, Eric Bazile, Carl Fortelius, Alexandre Mary, Daan Degrauwe, Jeanette Onvlee, Daniel Santos, Beni Strajnar
- ECMWF Observer: Stephen English,

#### Remotely:

- STAC: Christine Lac (until 17:30 on Wednesday), Alain Joly, Christoph Wittmann, Kristian Horvath,
- MG: Henrik Feddersen, Ludovic Auger, Meto Shapkalijevski, Patrick Samuelsson (absent on Wednesday)

#### Excused:

- STAC: Simona Tascu, Haythem Belghrissi (absent)
- MG: Piet Termonia (SPTR was represented by Daan)

### Draft Agenda

Item:	Introduced by:	Documents
1. Opening	Chair	
2. Adoption of the draft agenda	Chair	<a href="#">2. Agenda.pdf</a>
3. Reports by PM: a. achievements of the RWP2023 actions b. realisation of the manpower commitments	PM	<a href="#">3.Report_PM.pdf</a>
4. Point of information regarding IPR with DEODE	PM	
<b>Coffee Break 15:30-15:45</b>		
5. Review of proposal for 2024 a. RWP2024 actions b. manpower commitments	PM	<a href="#">5.RWP2024.pdf</a>
6. HLQ for strategy a. Reviewing by MG of the MG roadmap b. Status of STAC/MG input to the HLQ c. Proposal of task teams	PM	<a href="#">6.a.Roadmap-Review.pdf</a> <a href="#">6.b.Status_HLQ_for_Strategy.pdf</a> <a href="#">6.c.Task Teams.pdf</a>

d. Opening of discussion on HLQ for Strategy		
<b><i>END OF DAY 1 meeting at 18:00 at the latest (Item 6 will continue on Day 2)</i></b>		
<b><i>Resume at 9:00 local on DAY 2 (to be confirmed end of DAY 1)</i></b>		
6. HLQ for strategy a. Discussions to be continued		
<b><i>Coffee Break 10:00-10:20</i></b>		
7. Reviewing of recommendations from STAC (on all items)	<i>PM</i>	
8. Date of the next STAC meeting About at least one week after the strategy workshop?	<i>PM</i>	
9. A.O.B.	<i>Chair</i>	
10. Closing	<i>Chair</i>	
<b><i>END OF DAY 2 meeting at 12:00 at the latest</i></b>		

*preparatory documents distributed on 19 October 2023*

*preparatory documents distributed on 20 October 2023*

## 1. Opening

Saji opened the meeting and thanked RMI for hosting this hybrid STAC+MG meeting and more specifically Piet, Rafiq, Béatrice and the involved colleagues from RMI for the organisation. Saji welcomed the STAC members, the ECMWF observer and the members from the ACCORD MG.

## 2. Adoption of the draft agenda

Saji introduced the items of the agenda and opened the floor to comment on the agenda or make proposals for A.O.B.

No comments.

Agenda was adopted.

## 3. Reports by PM:

Claude presented the Scientific Report of the activity in 2023. He first reminded of the arrival of the new Area Leaders in DA and Physics in spring 2023, who very efficiently have taken up their role from the spot, especially w/r to DAP2023 and RWP2024.

Anne-Lise Dhomps has joined as new CSS from 1 September.  
 Call for Documentation Officer: one applicant will be interviewed in the beginning of November.

Next, Claude presented a few headlines from the content of the scientific reporting document.

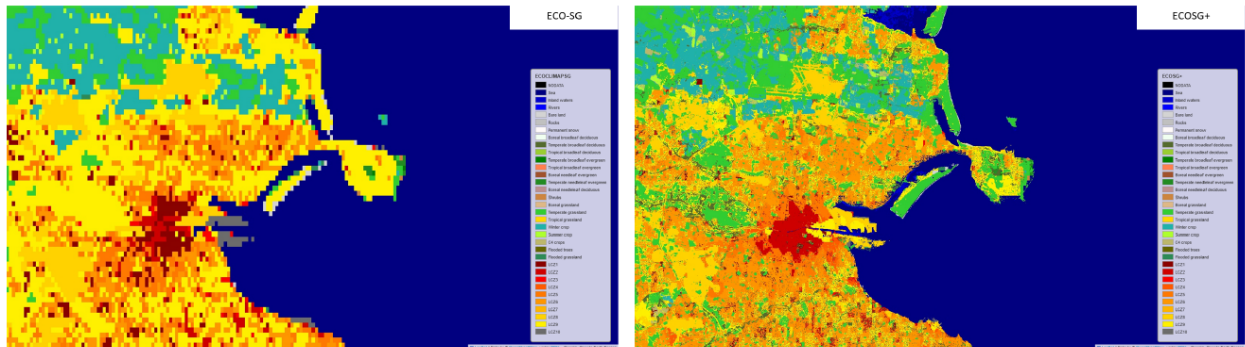
## a. achievements of the RWP2023 actions

### Dynamics

- define stable configurations at 500m and 200m grid mesh resolution, in link with DEODE (in phase 1, the focus was on 500m grids) - in close connection with Physics and “HR”
- further improvements of options in the current ST SI-SL dynamical core:
  - SL interpolations
  - degrees of freedom of NH behaviour in NL and SI operators
  - alternative formulations (vertical divergence, SIPRA term etc.)
- FVM: 3D test case over the Alps, vertical coordinates close to those of ACCORD models (in terrain following z-coord.), make a fair comparison of cost and stability

### Surface

- Surface model
  - compatibility of surface with TOUCANS scheme (Alaro)
  - evaluation of ISBA-DIF, of TEB (Harmonie-Arome)
  - snow cover, T2m/Q2m summer diurnal cycle are addressed in Arome
- physiography
  - using an AI-based tool to improve VHR land cover map over Europe



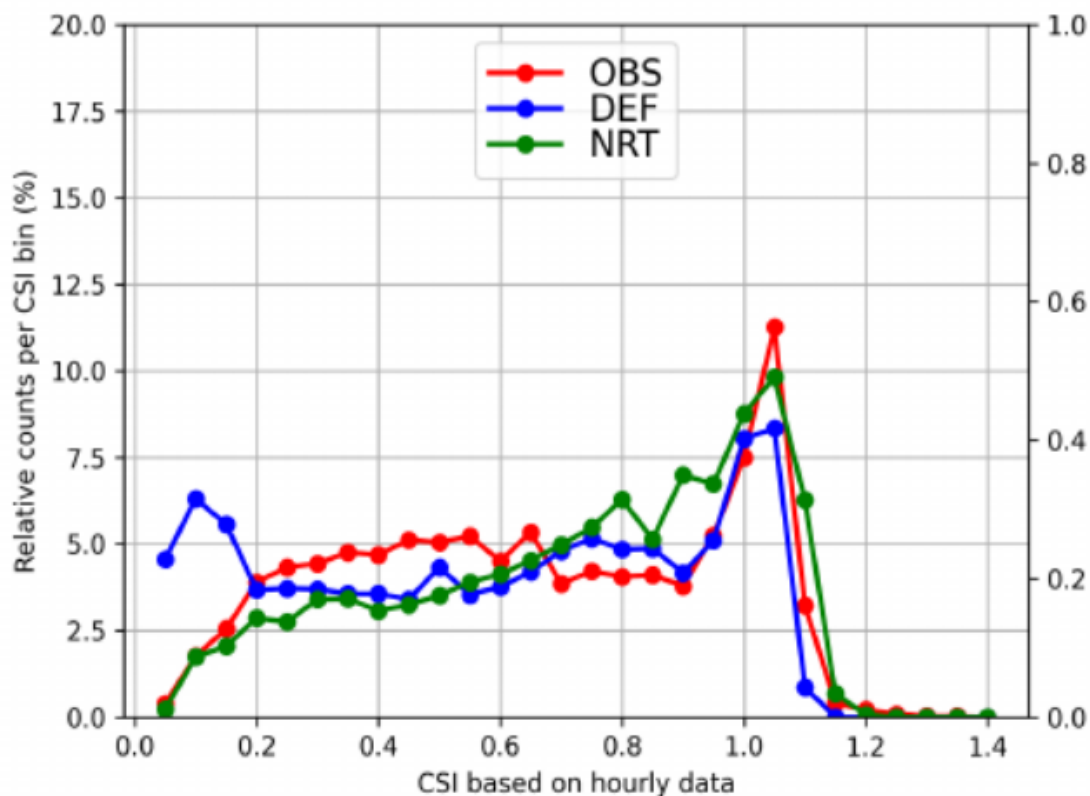
- surface assimilation
  - assessing the use of satellite products in SEKF
  - snow assimilation in Harmonie-Arome
  - 2D-Var with OOPS work in progress
- a common SURFEX code version now is in place in both the IAL and the Surfex repos

### Physics

Claude explained that a new organisation of the Physics Area has been implemented in 2023, as agreed in late 2022 and the adoption of the Physics interoperability roadmap. The work now is

organized along the main thematic (turbulence and shallow convection, radiation, microphysics), not anymore according to CSCs. Additional WPs concern interface aspects (with dynamics, with surface). Meto has now taken charge to continue implementing this organization and its translation into concrete actions. Claude then stressed the results of the CAR group (PH6) and the link with diagnostic model outputs (below CSI).

- study the behaviour of the ecRad radiation scheme including the different options for cloud coverage and 3D cloud effects or gas optical properties
- cloud-aerosols-radiation interaction (PH6) - preparation of a peer-reviewed paper

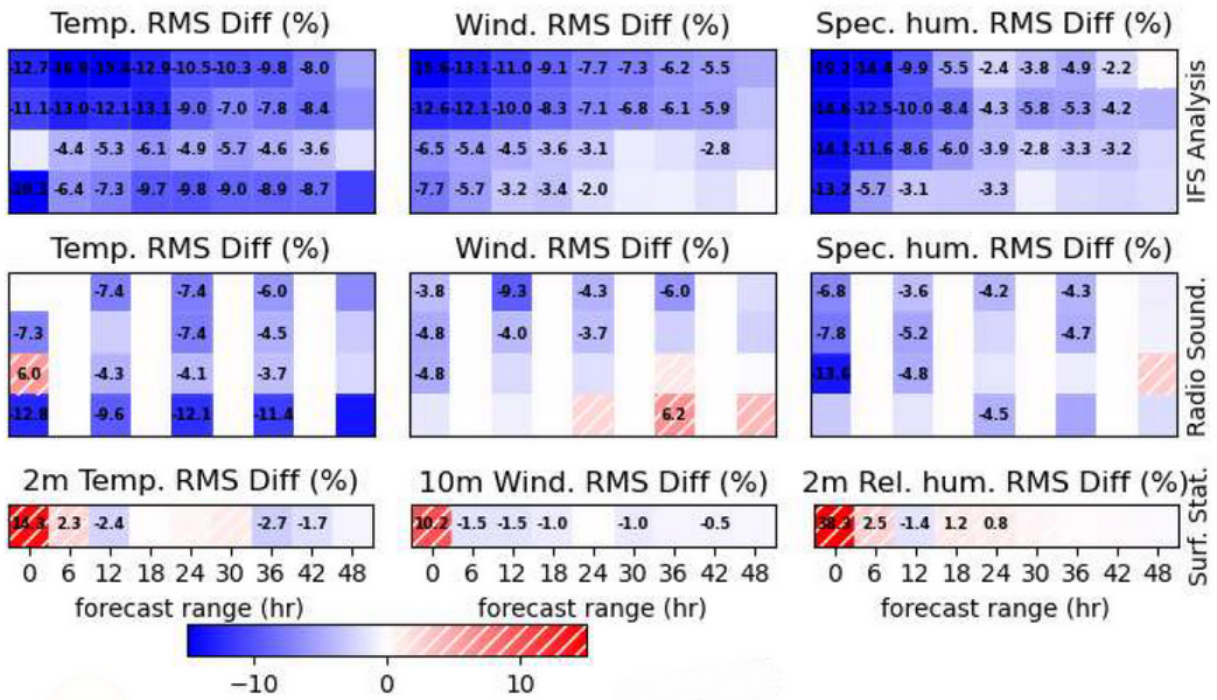


One-dimensional clear-sky index (CSI) for a Spring 2 week period. There is a noticeable improvement in low CSI cases but in general there is less cloud when NRT aerosols are used  
 $CSI = H/H_{clear}$

### (Upper Air) DA

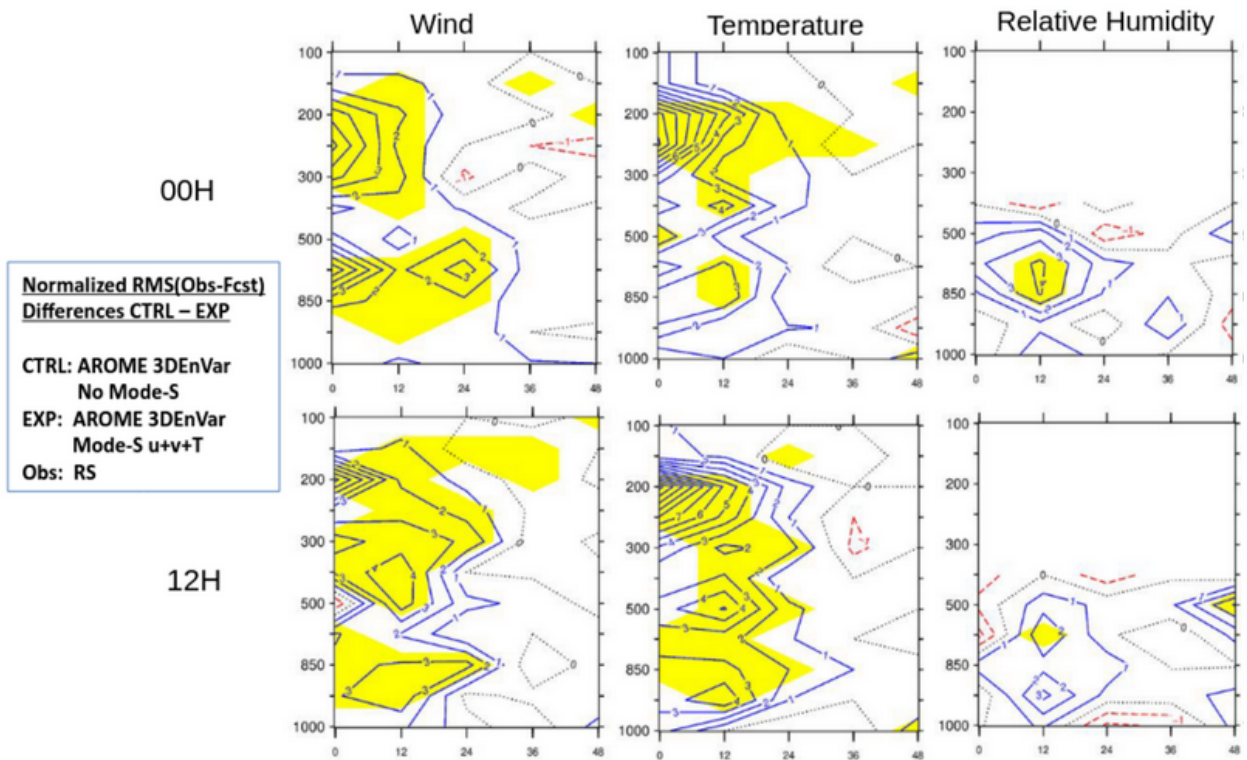
Claude noted the many reported results in DA, an Area which covers a large spectrum of activity (on observations, on algorithms). Two results were highlighted in the presentation.

- 3DEnVar with OOPS



Percentage of reduction of RMSE for 3DVar wrt. 3DVar in AROME-France for different parameters over 3 months (September-November 2022). References are IFS analyses, radiosonde and surface stations.

● Impact of Mode-S observations



Normalised RMS differences between experiments with and without Mode-S EHS data in 3DVar AROME-France over 1 month period. Improvements in blue, degradations in red.

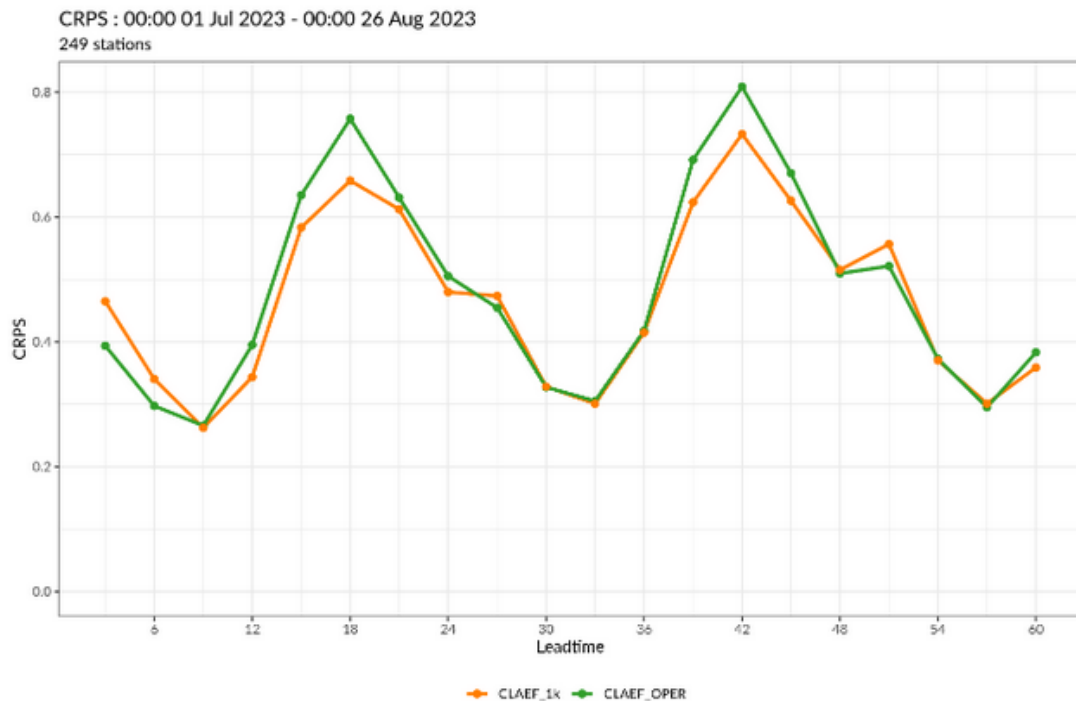
Claude emphasized that, while this result is from MF, a number of other teams across ACCORD are working with Mode-S data, and how to assimilate them. This data is one where it probably is fair to consider that ACCORD has a high level of knowledge and experience from the pretreatment stage to the use in assimilation.

Jeannette asked about the meaning of the colouring on the figure; Blue isolines show a positive impact of adding the data in the analysis, the yellow colouring indicates where the positive impact is statistically significant.

## EPS

- SPP:
  - new option to perturb the middle point of the SL trajectory (SLWIND)
  - single (mixed) precision runs enabled
- upgrades of configurations:
  - C-LAEF runs at 1km grid mesh resolution
  - Arome-France EPS: IC perturbations from 3DEnVar, 25 members, single precision
- use of AI/ML:
  - clustering by weather types (by precipitation patterns) (MF)
  - enhancement of EPS by statistically increased number of members (GAN) (MF and other members by now)

Claude presented an example from C-LAEF which is one of the Ensemble Prediction Systems developed and maintained jointly by the LACE family. In the figure below, the lower the CRPS values the better, so this illustrates the positive impact of moving C-LAEF to 1km grid mesh.



CRPS of 3h accumulated precipitation (lower right) of C-LAEF OPER (green) and C-LAEF 1km (orange) for the period July-August 2023

## MQA

Claude explained that one of the important goals of MQA is the development of common tools and harp here plays a central role in the ACCORD strategy.

- “harp” is increasingly being used for verification of operational systems (UWC-West, MetCoOp, Algeria, Austria, Belgium, Croatia, Hungary, Poland, Turkey)
- WW on spatial verification with harp (February, DMI)
- development of the “panelification” tool in order to provide a fair quick understanding of how different model versions behaved (by ranking them)

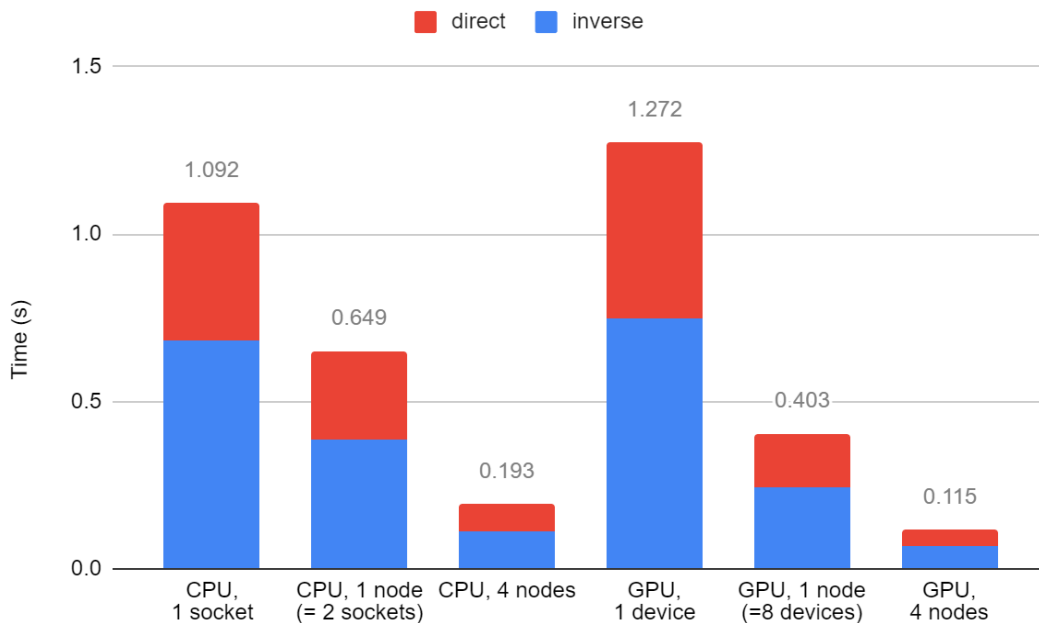
Claude further reminded that MQA also deals with providing feedback about local verification efforts to ACCORD, and implementing some of the ideas expressed in the “white paper” about R2O which was elaborated by the MG in 2022-2023. In this respect, an important goal is to organize user feedback at ACCORD level, a task for which we will use the so-called “User Representatives” (UR).

- user feedback:
  - a WG was active and provided its conclusions in spring
  - A draft procedure for organizing user feedback at ACCORD level was approved by the Assembly (on recommendation by STAC)
  - the first URs have been nominated by the LTMs

## SPTR (code adaptation)

- porting parts of the LAM codes to AMD-GPU: spectral transforms, ACRANEB2 scheme (for the latter, use LOKI for s2s code adaptation)
- create the new Méso-NH/Arome physics code library “PHYEX”
- start adapting the Arome physics interface routine APL\_AROME
- a code refactoring training workshop was held at CSC (October)

About the figure below, which shows timing results of the LAM transforms on several distributions on either CPUs or GPUs, Claude stressed that this so far mostly is a proof of the successful preparation and porting, and more work now can start in order to continue optimize the transforms for GPUs (and thus accelerate their execution).



Timings of LAM spectral transforms on AMD CPUs and AMD GPUs. The grid dimensions are 1536 x 1024 x 100, with a linear spectral truncation. Transforms include 3 scalar fields, 2 wind fields and derivative calculations.

## Integration of code contributions, source code forge for ACCORD


- use of the ACCORD source code forge and of dawai for CY49T1
- several webinars were organized by the IL in order to present the forge and how to work in this new environment
- dawai-contributors (second) WW ... this very week here in Brussels !

Claude emphasized that more and more people are using github and the ACCORD source code forge. He stressed the importance of the efforts by our Integration Leader (Alexandre) to organize tutorials in the form of webinars (three of them this year, each attracting about or more than 50 persons). There also was a positive return from many teams (as expressed also in the last LTM meeting).

### ACCORD Forge

Web platform hosting consortium-wide repositories and their associated communication environment (wiki, ticketing, integration requests, reviews...)

<https://github.com/ACCORD-NWP>

- **IAL** (IFS-Arpege-LAM) *private* repository : official portal for contributions to 49T1
- Series of **training webinars** to be organised this spring, combined with Davai webinars : information and registration on [https://opensource.umr-cnrm.fr/projects/accord/wiki/Accord\\_forge\\_Spring2023\\_Webinars](https://opensource.umr-cnrm.fr/projects/accord/wiki/Accord_forge_Spring2023_Webinars)
- Getting started :
  - Set your  **GitHub** account, **using an explicit identifier** and professional email address
  - Request membership by email to Daniel Santos Munoz and/or Alexandre Mary, indicating your Github identifier and associated email address



## System

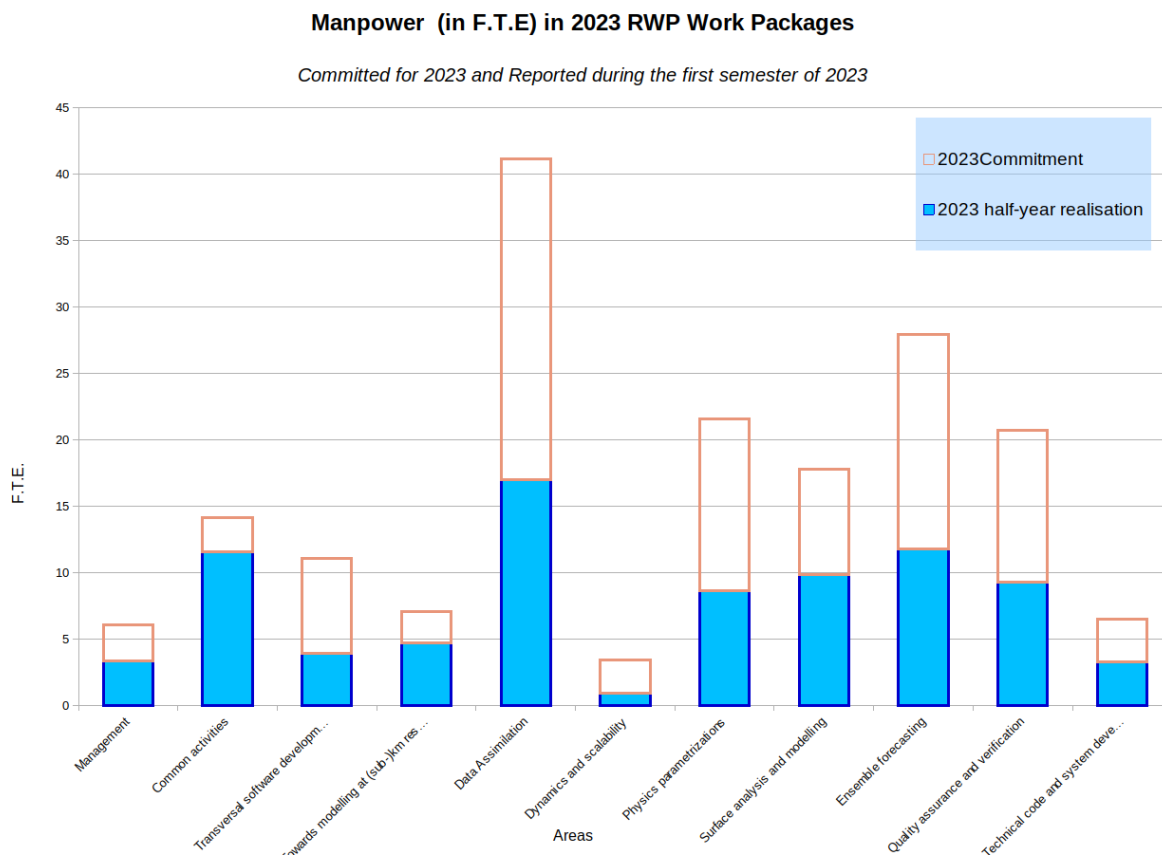
- single (mixed) precision now available in several pre-operational configurations
- joint work on a new, common scripting system: pending decision on the access and use of the scripts under development in DEODE (IPR - item 4 on the agenda)
- ECMWF Special Project “SPFRACCO”
- data available at ECMWF’s Atos

## b. realisation of the manpower commitments

### Manpower figures: half-term realization

COM: the end-of-2023 realized manpower is likely to exceed the committed figure (from 2022)

Claude assumes that work spent in teams for preparing codes and phasing them for code contributions in new cycles now is better reported (COM2.1), while traditionally quite a number of teams report on local porting efforts (COM3.1). Otherwise, the overall picture is that the realized manpower at half year represents almost 50% of the committed manpower (this overall consistency already was noticed in 2022 and suggests that the teams globally commit and report manpower in a well thought and coherent way).



### All Staff Workshops

The All Staff Workshop was held in March 2023, hybrid format (Tallinn and online).

Despite that no Estonian colleague is connected today at STAC+MG, it is nonetheless an opportunity to thank them.

the 2024 ASW will be held in Sweden (Norrköping) and online: 15-19 April 2023



Saji thanked Claude for the presentation and opened the floor for remarks, questions.

Steve: expressed the difficulties with the Mode-S observations in the IFS HRES 4D-VAR. A large amount of this data had been included in the 4D-VAR at the time of the COVID pandemic in order to compensate for the sharp drop of aircraft AMDAR data. Later on, it was noticed that these data had a detrimental effect in the upper troposphere and in the stratosphere and thus, they had again to be taken out of the assimilation. They will be reintroduced however with a much more selective process.

Benedikt: in 3DVAR there was an overfitting with Mode-S; the really clearly positive results came with the testing in 3D-EnVar whose performance is better thanks to more appropriate structure functions.

Claude invites Steve to keep in touch with the main DA actors on this topic in ACCORD, Beni our DA Area Leader and the OBS team in MF (Philippe Chambon).

Sami thanked the MG for the preparatory documents, and expressed his satisfaction with respect to the large amount of work and results obtained over the last year. Sami noted the positive effect of DEODE besides ACCORD, however he asked how this feedback could be further evaluated at management level.

Claude stressed that this was indeed an interesting question, with several aspects to take into account. He suggested getting back to it later, when addressing the manpower figures for 2024.

Jeannette added that it is not only about the IPR, but also the scientific part.

Claude agreed, and explained that there is a managerial challenge on keeping the goals of ACCORD and DEODE well aligned in those thematics where a large overlap and a positive feedback effect is expected (WP2, WP3, parts of WP5), while taking into account the different conditions of both projects (ACCORD works pretty much as a research cooperation, while DEODE has to realize targets - deliverables - over a very limited time frame and with a strong liaison with

the main contracting party - here ECMWF -).

Eventually, a close while informal collaboration of both ACCORD and DEODE core management teams is very useful, if not mandatory, in order to align objectives taking account the constraints of both sides.

Kristian asked how the efficient use of Mode-S data was affecting other issues like the future spatial coverage of AMDAR data.

Benedikt answered that these aircraft data all have a strong heterogeneous spatial coverage, with a large density over specific airports and air traffic lines. The level of complementarity of AMDAR and Mode-S data types remains an issue to be followed by EUMETNET. Claude added that indeed the LAM consortia could stay prepared to participate in future sensitivity experiments in support of the EUMETNET/OBS Programme assessments on this question.

Jeanette understood from recent past EUMETNET discussions that there will be a reduction of AMDAR observations where Mode-S is available with a good density.

Claude insisted that certainly ACCORD needs to stay well informed of any future EUMETNET considerations on aircraft data coverage. It is expected that the liaison on such questions will remain active via the next C-SRNWP Coordinator (likely to come from DWD). The ACCORD DA/AL will then be in a front line position.

Benedikt agreed.

Rafiq: Regarding VHR topics in the RWP2024, only countries which are already involved in DEODE appear, then how important is this topic for other countries ? Shall we fear that a gap can appear between DEODE participants and others across ACCORD ?

Claude explained that some countries cannot join DEODE since they are not eligible, however they are interested in hectometric scale modelling. Another issue is prioritisation and the need to be able to install VHR configurations on a home computer. Sometimes, countries simply do not yet have the appropriate HPC resources, which then lowers their current ambitions.

Jeanette: Some of the small teams cannot afford to spend time on the VHR configurations. They have to devote their staff resources to run the operational model, and additional research is then complicated for them.

Estonia is an example where a team built on knowledge exchange with another ACCORD team (here Hirlam). They were interested in a 500m scale model, so they copied the Danish configuration.

Yelis : As for Türkiye, we are not in DEODE, nevertheless we are interested in the hectometric scale. It is not yet a priority for this year. It will become one in the next couple of years in relation to an expected increase of HPC resources at the institute.

Christoph: Is DEODE beneficial for us ?

Christoph noted that DEODE is very positive for the teams involved across ACCORD. The tight and strict deadlines boost the collaboration between the family.

How about the lower FTEs in the RWP2024 (*this question anticipated item 5 in the agenda*), is it linked to DEODE ?

Claude answered yes it is, since several teams have chosen not to commit (in advance) manpower that they expect to get after the next negotiation phase of DEODE.

Christoph: About the User Representatives ? How many UR have been nominated so far ?

Anne-Lise: 17 names, 2 more for next year. => more than 2 thirds of members have given a name. Very satisfactory for the start of the work with them. Claude expects MG and UR can start work together in December or January.

Xiaohua: agreed that DEODE had a beneficial effect for the work in ACCORD. He also noted that DEODE pushes the priority much more toward VHR modelling and the on-demand facility.

Another positive effect was that with DEODE we have to work with the same system. He gave the example of the climate file generation and the CSC definition which now all can be realized on the same code basis (CY48) with the new DEODE scripting system.

Claude: we should adopt a balanced view on the benefits of DEODE in ACCORD. The short deadlines and the contract-based descriptions of the work on the deliverables, makes clearer what the target is and when it has to be reached. However, that also means that the teams tend to define their DEODE targets taking into account the timeline within the contract, which is significantly shorter than the timeline of a research development. Thus research aspects are much more difficult to be supported in the DEODE context and there is a risk that research work is somehow slowed down when our experts are too much taken by DEODE tasks.

Jeanette: One of the advantages of DEODE is that it puts some pressure on the technical aspects. Then DEODE also provides some more resources to tackle such technical questions, when we didn't have them before.

Saji: concluded that ACCORD indeed benefits from DEODE, via the strict deadlines which puts some pressure on targets, and the dedicated manpower it provides.

Martina: confirmed that one can see DEODE as an additional project that has fostered collaboration and commitments across the teams.

Saji: added that regarding ACCORD/SPTR and DEODE/WP2, Met Eireann will provide additional staffing (2 persons hired).

*Coffee Break 15:30-15:45*

## **4. Point of information regarding IPR with DEODE**

Claude shortly informed STAC about the status of discussion regarding the IPR issue on the ACCORD common codes for DEODE.

- Reminder: ACCORD has licensed the common codes to Destination Earth
- The common codes are background IPR (detailed list was provided in an Annex to the MF/ECMWF Agreement)
- improvements of the background IPR (here, the ACCORD common codes) funded by DEODE are owned by the EU (via the ECMWF Agreement). These then form the "subsisting IPR"
- MF has started to discuss with ECMWF the possibility to be assigned back the subsisting IPR (this is work in progress at an informal level for the time being)

The exchange of views and the preparation between MF/DEODE and ECMWF started at the end of September. Claude stressed that there is no strict deadline to reach a common view with ECMWF and bring the whole question toward the EU Commission. We first want to make sure that we have a shared formulation of the request which ECMWF can then also use for their own needed steps with respect to the Commission.

Jeanette: Can you re-explain what the subsisting IPR is ?

Claude: It is the difference between our licensed codes and their improvements funded by Destination Earth (ie DEODE here) and owned by the EU.

Claude will continue to keep ACCORD instances informed of the evolution.

Martina, Jeanette: PAC should be involved as well.

Claude: Depending on the outcome of the discussion and of the request, a PAC meeting may not be needed. In case of a positive feedback to us, an information to the Bureau & the Assembly, and an email to the Committees could be enough.

## 5. Review of proposal for 2024

### a. manpower commitments

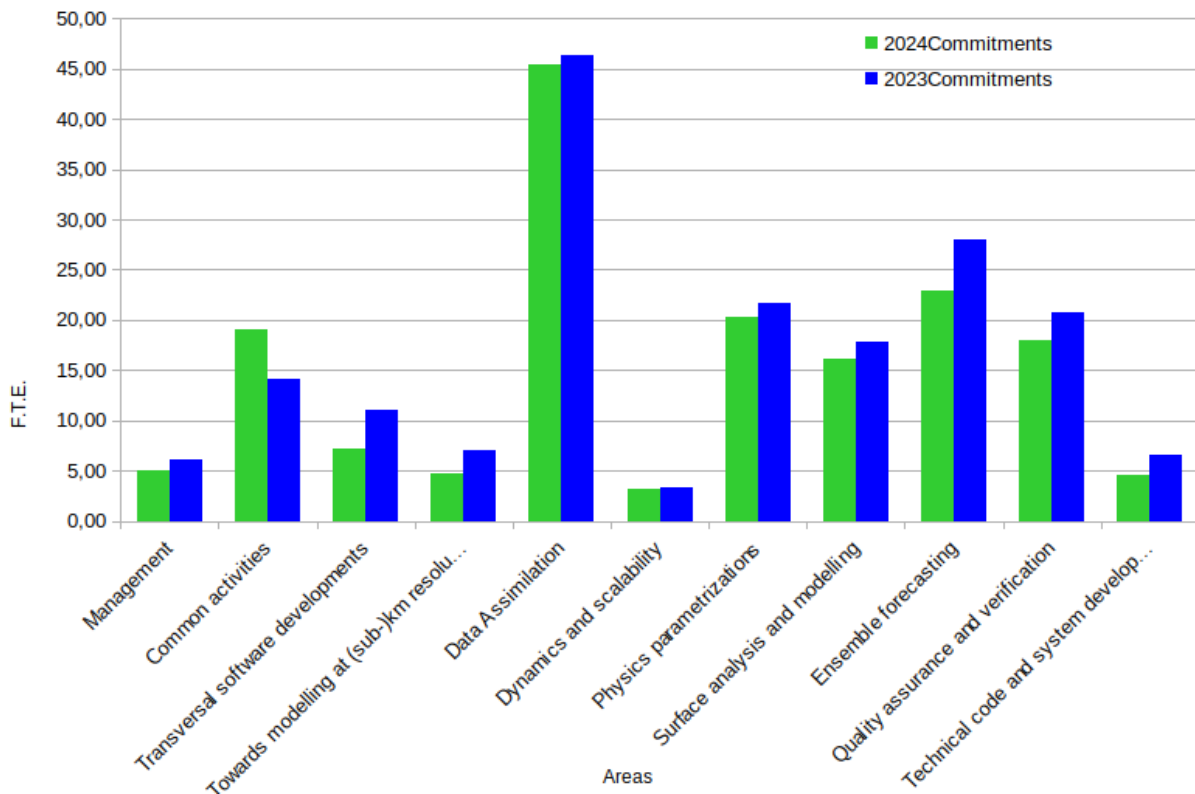
Claude presented several figures (as graphics) illustrating the manpower commitments by the ACCORD members for 2024. He reminded the main steps of preparation of the RWP2024 with the LTMs:

- a. the draft RWP2024 was prepared from April until the end of June under the lead of the MG
- b. then the document was provided online to the LTMs, for a first cross-check on its content
- c. in the end of August, LTMs were asked to provide their commitments (until the beginning of October)
- d. Claude also reminded that the MG could continue liaising with the teams and the LTMs during all the process. He also noted that the new ACCORD/CSS organized the practical steps for the commitments with the LTMs and the MG, and she also processed the figures as outcome to show to the Committees

### **RWP2024: committed manpower by LTMs and the main comments by the PM**

- committed manpower by Areas 2024 compared with 2023
- slight decrease in several Areas, mostly related to non-committed DEODE-funded manpower, awaiting the outcome of the negotiation for phase 2
- increase of manpower committed to COM (common activities)

### Commitments in RWP2023 and RWP2024



Jeanette: noted that the HR work package has been deeply reorganized. Many scientific topics have been shifted to their thematic WPs. Claude added that indeed, now the HR WP mostly is about joint work on assessing specific experiments at VHR, defining use cases and how to evaluate them.

Martina: asked whether the work with the UR is in the Common activities ?

Claude: No, in MQA (MQA3)

Rafiq: Where is the ML thematic ?

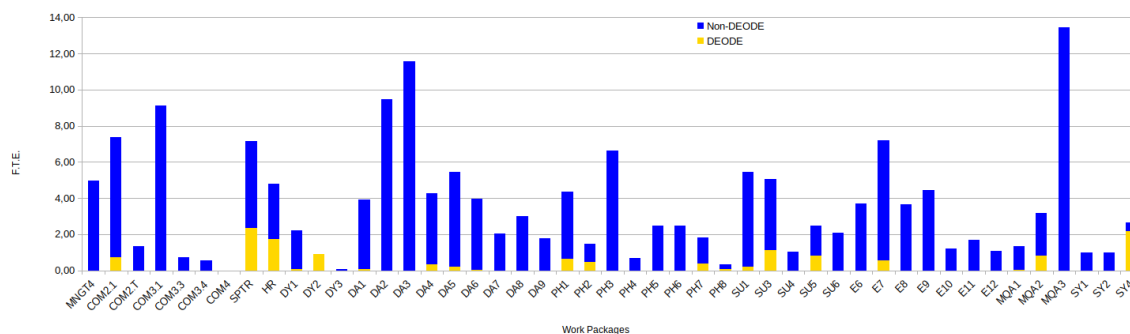
Claude: ML used to be in a specific WP one or two years ago, however the whole theme of ML for NWP is a very transversal thematic. Therefore there is no more a specific WP on ML. Instead, ML appears in a number of WPs; they actually are listed in the RWP2024 Introduction Section (Claude invited STAC members to consult the Introduction Section for further details).

Meto: confirmed that ML has a full sense in thematic WPs, for instance we find several relevant ideas and tasks in the Physics. As an AL, he was positive to accept them in our RWP.

### RWP2024: per WP and with DEODE estimated manpower

- manpower by WPs 2024 including DEODE estimates
- SPTR is partly staffed by DEODE, however this increase has two components: funding of current staff (allocated to some DEODE tasks) and recruitment
- WP towards VHR configurations (HR) also is partly staffed by DEODE
- small decrease of manpower in EPS WPs
- WPs in link with modernization of work practices: COM2.T, SY4, as well as COM2.1, SY2

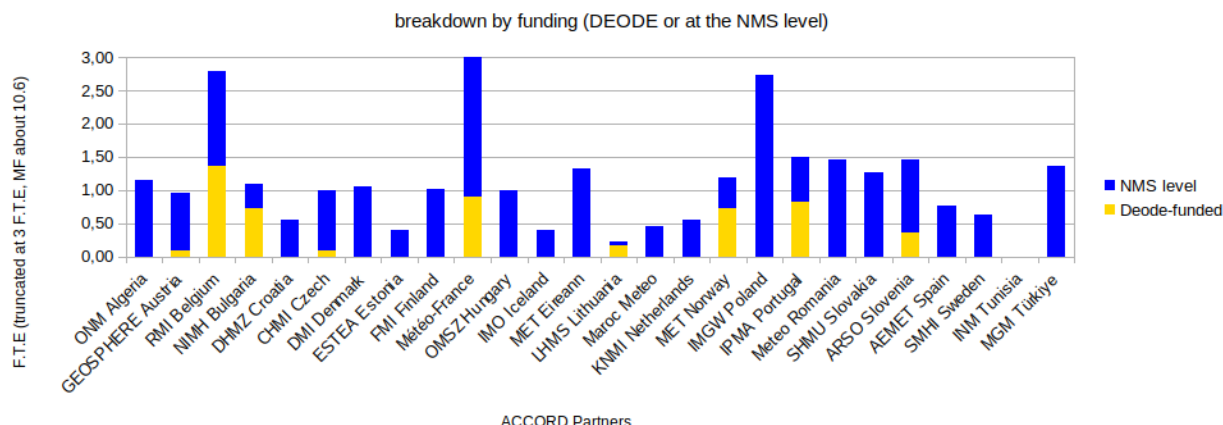
Manpower committed on RWP2024



## RWP2024: CEpQA

- reminder: each partner (except those listed in Annexe III of MoU) should realize at least 1 FTE per year on CEpQA
- CEpQA effort is evaluated from the manpower in COM2.1, COM2.T, COM3.1, SPRT, MQA3, SY2, SY4 (Assembly decision)

F.T.E. Committed by ACCORD Partners on CEpQA in RWP2024



Christoph: What about the countries who do not provide the 1 FTE ?

Claude: some members have only half a FTE to provide (i.e. those listed in the Annex III of our current MoU). The figures should be looked at over a long enough time, since there can be quite some changes in these figures from one year to another, especially for so-called “small teams”.

Jeanette: confirmed that some teams are small, thus it is not easy for them to give a whole FTE per year for CEpQA.

Anne-Lise: for these small teams, the CEpQA component often is more than 10% of their global manpower.

Jeanette: some teams might not register their local implementation efforts in COM3.1, when it is done in conjunction with a scientific evaluation with a new code release.

Benedikt thinks that it is the same for Assimilation.

## MG and ST positions; other information

Claude gave a brief overview of other management and governance issues (support team positions, recent membership issues).

- Expect to start working with a Documentation Officer, pending its nomination at the Assembly on 4 December
- Preparation of the next phase scientific strategy
- Membership (for information):
  - observership agreement in discussion with Latvia
  - associate membership with Indonesia “in the pipeline”
  - PAC has recently been addressing the more general issue of expansion of international collaboration in ACCORD. The outcome will be reported to the next Assembly

Jeanette: In which context has the expansion of international collaboration been discussed ?

Claude: Following the discussion on Indonesia at the last Assembly meeting (26th of June 2023), the Assembly decided to convene PAC in order to discuss an overall strategic vision about the expansion of international collaboration in ACCORD (taking into account resources, analyzing opportunity versus risk, identifying the relevant questions to ask a potential new members). Minutes of the PAC meeting currently are under review by the PAC participants.

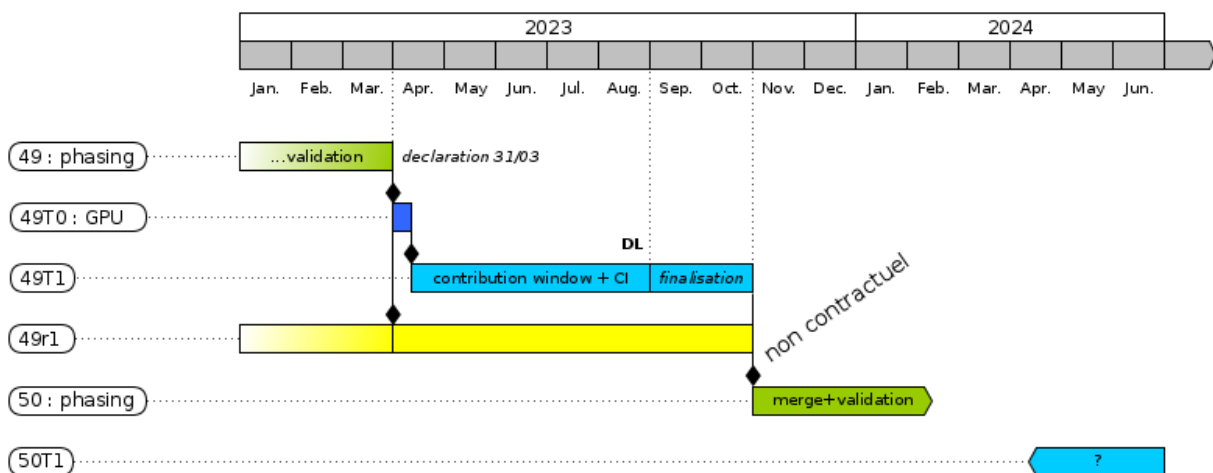
Sami: welcomed that the membership (observership) question with Latvia is moving forward.

## b. RWP2024 actions

Claude presented first a few headlines from the RWP2024, without trying to be comprehensive about all areas and WPs (impossible for timing reasons).

### Headlines from RWP2024 (methods & codes)

- modernization of working methods:
  - extend the use of the forge and of *davaï* across ACCORD
  - further build competence in the “*davaï*-contributors” team
  - start working on common scripts (DEODE-based?)
- cycles:





## Headlines from RWP2024

### P2024 (code adaptation)

- aligned with DEODE phase 1 and phase 2 targets, but ACCORD has additional work force (!)
- increase efforts on refactoring of Arome (& Harmonie-Arome) physics and dataflow [will sometimes require the input by experts from MF or ECMWF]
- address re-factoring of other parts of the IFS/Arpege and Alaro styled codes (based on knowledge gained with ACRANEB2), further adapt and evaluate the source-to-source approach
- consider also other parts of the codes, like semi-implicit code, dynamics computations (pending further discussions across teams - for SL code, expect first input from ECMWF)
- additional new staff will be available in 2024

### Headlines from RWP2024 (AI/ML items)

- About 18 WPs contain references to AI/ML mostly related to combined AI-NWP research. Claude reminded that the full list of WPs which contain AI/ML tasks is available in the Introduction Section (Part 1) of the RWP2024 document
- there actually is both motivation and an increase of competence already taking place
- How can ACCORD in the short term facilitate these efforts ?
  - revive the WG-ML as a scientific forum
  - more generally, propose a platform or a forum where the teams can discuss their plans and their potential participation in joint externally funded projects ? (proposal from LTM meeting)
- toward a strategic vision about AI/ML for NWP in ACCORD ? => refer to the scientific strategy preparation (item 6 in this STAC agenda)

### Headlines from RWP2024

- Resume the activity of the thematic WGs (as time allows, many participants might also be concerned by the strategy TTs)
  - WG-VHR: link with DEODE WP3, currently “on hold” due to lack of time by PM
  - WG-ML
  - Claude emphasized that these WGs have not been active since spring (due to other priorities by the PM who is chairing them). For their revival, one might consider how to reorganize them (composition, goals, work arrangements).

Saji thanked Claude and opened the floor to comments.

François took the floor and commented on the importance of the code refactoring. Hereafter François' comments:

Important progress has been realized over the last 18 months on GPU code adaptation:

- Refactoring the physics parameterizations control routines (Arpege and Alaro physics)

- Refactoring Arome physics and developing PHYEX external library for Arome and Harmonie-Arome physics
- Refactoring the whole grid-point computations below “cpg.F90”
- Improving the flexibility of the code with respect to the granularity of the parallelism
- Developing an improved version on “Field\_API” library
- Porting the LAM spectral transforms
- Porting some grid-point calculations, in particular some physics routines, with source-to-source translation tools (proof of concept)

Some new developments have already started or are planned on other parts of the code:

- Refactoring of “apl\_arome”
- Refactoring the Semi-Lagrangian scheme
- Preliminary porting of the Semi-Implicit scheme
- Finalizing the work on LAM spectral transform and integrating on the same repository with global spectral transform
- Porting the NH dynamics based on the already refactored code

But several other parts of the code need to be studied, prototyped and refactored:

- Semi-implicit scheme (fusion global/lam, separation of vertical and horizontal operators)
- Lateral coupling
- Inputs/outputs
- Post-processing
- DDH diagnostics (old style and flexible ones)

Automatic source transformation is **not** the basis of code adaptation to accelerators. The basis is the data flow and memory hierarchy management. This is a serious preliminary task that requires a serious effort. An increased participation of Accord code experts is much desirable in the next year or two.

Claude: Could we think about additional staffing in relation to phase 2 of DEODE ? Which parts of the list of code functions could most easily enter DEODE as part of deliverables ?

Xiaohua: I/O and the MultIO function should definitely go into that list and could be considered within DEODE

Daan: DEODE/WP2 is currently under discussion and the list above will definitely be taken into account

Benedikt: asked what would be in DEODE eventually ?

Daan: considers that the second part of François’ list could enter DEODE targets.

Daan added that for the start of DEODE/WP2 and ACCORD/SPTR, we had several newcomers who did not know anything about our codes. Therefore we focussed on source to source tools, but now we could try and shift them more to refactoring.

Claude: Perhaps we could try to form a few pairs formed by a newcomer, provided he/she is a good programmer, and an experienced scientist who can explain the meaning of a piece of code or a code function. The expert could become the “chaperon” for the newcomer but the newcomer is expected to take on the code analysis task.

Daan: we should think about it when doing the DAP 2024. Put some resources on face to face interaction.

Sami: If we manage to fulfil the objectives of refactoring, what's next? Would we then have a code portable and optimized for an operational purpose ?

Daan: not sure about the operational readiness only after refactoring.

Martina: complemented that there is no assimilation code included in any of the code adaptation current planning.

Alain: About the question, when will we be able to have an operational code, one should be aware that the refactored-only code still will have a pretty poor performance on a new architecture (this was for instance documented by the experience of our Swiss colleagues with COSMO code). A significant work remains then to be done in order to adapt the code for performance.

Jeanette: agreed that optimization work will take time as well. Confirmed the feedback from MeteoSwiss.

Alain further explained that code refactoring was certainly addressing important first steps of code adaptation, sometimes very specific to our codes, like the necessity to well encapsulate the communications (between processors) and those code components which handle memory addressing.

Claude: insisted that given the strong needs for exploring programming choices, newcomers need to have a good computing background. This seems precisely to be the case of a few recently recruited persons, so we should seriously try to engage them from the refactoring stage on, and by asking some of our expert scientists to help them get the scientific understanding of the codes they will manipulate.

Alain: insisted on the very importance of code analysis and that the first effort now must be on the refactoring, with even more staffing than already involved.

Only then focus on how to optimize the refactored codes. An additional caveat is that the technology is evolving pretty fast, so nothing is sure and any specific optimization work might sometimes be worthless after a short time.

Intermediate conclusion suggested by Claude:

We should make sure which tasks from François' list could become parts of deliverables in WP2 of DEODE.

There are then additional tasks which should be done in ACCORD.

Consider using newcomers with programming skills (in DEODE or in ACCORD), paired with a code scientific expert. Organize chaperonage or tutorials or WWs.

Saji asked how we will eventually manage this complexity ? Will we eventually be able to use the outcome of this work in which we will invest significant resources ?

Alain: What are the expectations by the partners to use DEODE results operationally ? What are the plans for the use of DEODE products ?

Sami: At the moment it is too early to answer.

Jeanette: The answer may depend on what phase 1 DEODE product is considered.

Xiaohua: We will start being our own users in phase 2, the involvement of other, external users will remain experimental in phase 2.

Martina: For pushing further code refactoring and code adaptation, we need the people to have access to GPUs and to accelerators so that they can test.

Claude: There are several ways to get access to CPU-GPU. DEODE provides access (for DEODE participants). For others, there could be bilateral contribution agreements signed between a partner who has access to such resources and another one who can contribute to code analysis or testing. ACCORD also has set up a Special Project for compute resources at ECMWF, however it is not clear whether the S.P. can provide access to GPUs as well.

Saji: forwarded the question to Steve. How about access to GPUs at ECMWF (for Member States, Cooperating States or participants in S.P.) ?

Steve: ECMWF does not have a large resource of GPUs, and therefore these resources are already fully used by ECMWF itself. Do not really expect to get any significant GPU resource from the Center's allocation.

Daniel: We could make a joint venture with another computer center, like for instance BSC. Hirlam already has been considering this for code porting and profiling.

Jeanette: Could we envisage creating a pool of GPUs ?

For instance in the EuropeanWeatherCloud, each country does have a national resource allocation. If we manage to put these resources together, that could be great.

Claude: We could consider listing the solutions to share GPU (ie CPU-GPU) resources, however the code refactoring effort should not be fully kept out of sight. To analyze and reorganize (refactor) our current codes will be first done on our traditional CPU computers.

Claude also reminded that code adaptation in the ACCORD-wide community involved several important projects across partners. We have in the landscape "hybrid 24" at ECMWF, a specific code benchmarking effort at MF (focussing on Arpege with very short timelines), DEODE WP2 and the SPTR plans in ACCORD. These projects in the details have different organizational constraints. Claude suggested that within the main ACCORD actors, a yearly or twice-yearly management meeting could be organized only to address plans, progress and resource issues (PM, SPTR/ALs and MF representatives for instance).

Conclusion from this STAC/MG discussion: pulling more staff on code refactoring should remain a priority in relation to the RWP2024.

## **6.HLQ for strategy**

### **a. Reviewing by MG of the MG roadmap**

Claude introduced the reviewed version of the MG-roadmap:

- the MG-roadmap was presented to STAC in 3-4 November 2022
- the MG has been monitoring the progress of the goals and milestones, leading to a reviewed version
- The reviewed version contains indications on goals and milestones that are done, on-track, delayed and sometimes had to be reformulated. Also new goals/milestones have been defined

*END OF DAY 1 meeting at 18:00 at the latest (Item 6 will continue on Day 2)  
Resume at 9:00 local on DAY 2 (to be confirmed end of DAY 1)*

### **b. Status of STAC/MG input to the HLQ**

Claude reminded STAC and MG about the main milestones of the procedure for preparing the next phase scientific strategy of ACCORD. The procedure includes regular status reporting to the

ACCORD bodies, mainly STAC and the Assembly.

## Preparation of the 2026-2030 strategy - reminder of the timeline

- STAC+MG to address the high-level questions, propose choices or answers, provide guidelines => **STAC-6 on 25-26 October 2023**
- **Assembly-7 on 4 December**: assess the outcome on the high-level questions and details on the next steps
- Task Teams (TT) are formed and work during the winter, using the outcome of STAC+MG as strong guidance. The material from the TT is an input for the strategy workshop => **TT output ready for April'24**
- **A strategy workshop meets in spring'24 (May?)**, participation is on invitation only. The outcome of the workshop is an input for the strategy drafting team
- **the spring'24 Assembly** is presented with a progress report and the organization of the (final) drafting steps
- the strategy drafting team works during the summer'24 => **draft strategy document ready for October'24**, to serve as a preparatory document for STAC in the autumn'24
- **the end of 2024 Assembly** could then approve the final version of the strategy

Claude then introduced the preparatory document for this meeting. He reminded everybody of the previous joint discussions on the high level questions, in May during the online STAC and on 3 October in an additional STAC+MG video-meeting. As an outcome, Claude revisited the available material, the formulation of the high-level questions and the comments from the previous meetings, and explained that this led him to propose an overhaul of this material in the form of a “PM digest”.

## Status of STAC+MG input for the strategy preparation

- the PM proposes a “digested material from the previous discussions, including sometimes reformulated or added questions, as well as proposals for scientific options
- the structure of the preparatory document follows closely the one from the last videocon meeting: general goals, context, scope, AI for NWP, organization and governance questions
- the “digested” material is the **text in blue, open to discuss**
- the outcome of STAC+MG will be provided to the Task Teams
- note: the organizational and governance questions are only for track-recording and visibility. The PM suggest not to propose them to the TT later on but to handle them separately (for the preparation of MoU2)

Claude then listed a few headlines from the revisited, “digested” material. These headlines materialize either as still open questions, or options to trigger further discussions in STAC+MG.

## Context analysis by 2030

- How relevant will limited area modelling (LAM) be by 2030 ?
- There are sources of uncertainty:
  - targets of global NWP systems by 2030, example of ECMWF
  - rapid evolution of data driven forecast systems (emulators)
  - future observational data, very high resolution high quality (MTG as an example)
- How to deal with them in a strategic thinking ?

## **(Scope:) overview**

- Main items:
  - common activity on the NWP codes (in the general scope of today's RWP content) - IFS-Arpege-LAM based
- the focus is on R&D, however with an aim to facilitate the handover of the codes to the members, who are responsible for their operational implementation
  - codes definitely include a variety of tools, such as common scripts
  - build knowledge on AI/ML tools and how to efficiently use them with our current models
- Specific elements discussed so far:
  - interoperability: a key concept
  - link with ECMWF: IFS/Arpege/LAM, DE\_330
  - system: ecosystem, increasing complexity
  - CSCs
  - coupling
  - R2O & white paper thematics: testing, user feedback, documentation
  - use of observations for VHR

## **(Scope:) leftover questions**

- Post-processing:
  - some activity under PH5 (model outputs)
  - high priority component in EPS, in order to shape the extremely large amount of information for the users
  - data driven emulators might provide NWP tools that intrinsically merge the forecasting and the post-processing steps
  - adopt a pragmatic approach, ie consider PP in the scope of ACCORD only where of high priority, high added value ?
- how to deal with the avalanche of data ?

## **(Scope:) AI for NWP**

- data driven emulators:
  - try not to develop our own, however look for pragmatic, useful joint work
    - make existing ones available to all members,
    - address transfer learning, statistical downscaling ...?
- What level of ambition regarding training data sets ?
  - [A] organize ACCORD-wide collaboration around an "intelligent inventory"
  - [B1] organize a common data-centric work environment ?
  - [B2] create an ACCORD-own regional reanalysis ?
- study the combined use of AI/ML and physics-based NWP (as already is described in the RWP2024)
- collaborations: still a large variety of possibilities ?! => ECMWF to stay a privileged partner ?

For the sake of completeness with respect to the suggested itemised list above, Claude commented

that fully data driven forecasting currently rather was considered to be left out of the scope of ACCORD. One reason that was mentioned several times in previous discussions was that data driven forecasting will continue to be intensively explored by external groups (big tech labs and academia, ECMWF, several NMSs as such) and it would be very difficult for ACCORD to engage in these studies with the same level of proactivity. However, Claude also mentioned that specific issues in strong liaison with data driven modelling could be topics to consider for the future in ACCORD, provided a pragmatic approach can be taken (for instance, study transfer learning by using existing fully data driven forecast models from-the-shelf). It furthermore seems very difficult, for the scientific competitiveness of ACCORD, to stay completely out of AI/ML thematics.

Claude also mentioned a few considerations regarding resources, though these questions could be seen as being on the edge between scientific strategy and organizational matters (they are actually listed under “organizational questions”).

## Resources

- how to find additional resources ?
  - external funding like EU-funded
  - How could ACCORD facilitate partnerships involving its members ? (there is the example of how DEODE started)
- how to “shift” resources ?
- PM+MG will further reflect on these questions for their own

Eventually, Claude introduced the proposal of the ToR for the suggested Task Teams (the details are in the preparatory document for item 6c).

## c. Proposal of task teams

- 5 thematics:
  - Forecast model and coupling to other Earth model components (including surface)
  - DA and coupled DA (including surface)
  - Code & system including testing strategy from unit to integrated
  - EPS & probabilistic forecasting
  - MQA including user feedback
- Tasks and working practices as described in the preparatory document (6c.Task Teams)

## d. Opening of discussion on HLQ for Strategy

Saji opened the floor for comments.

Martina: most of the questions should be addressed by PAC. Should ACCORD become a data provider ? This would be an important new orientation for the consortium. To answer such a question cannot be done without changing the timeline of the strategy preparation. The questions also imply important issues on the resources (human, computer, archiving).

Saji explained that we should not talk about resources now. We have to define the priorities first.

Martina: it must be made clear that we need more people if we want to increase the scope of ACCORD.

Sami: Precisely, and we are at the point of discussing the scope.

Jeanette: At what stage do you expect to have this broad discussion ?

Saji: We have to address the main scientific questions here.

Claude: confirmed that in the procedure for preparing the scientific strategy, there is no input from PAC expected.

Broad questions, if indeed we consider that they have a strong impact on the ACCORD members' own strategic decisions (on resources for instance) should be directly presented to the Assembly. Then the members may still decide to formulate specific policy questions and hand them over to PAC.

Daniel: We want to define scientific objectives, however the resources then are important to consider. The point is that there are many new things, new ideas currently rising in our NWP activity, and it is a challenge to follow them and make decisions. It is however clear that we need infrastructure. We have to define what our ambitions are in this respect. How can we do anything if we don't have the appropriate infrastructure ?

Martina: We need access to the appropriate hardware.

Jeanette: Agree.

The infrastructure is needed also for research, not only for the operations.

Xiaohua: 1) In the document, interoperability is much stressed, what is its exact definition ?

2) About the operational collaborations: resources ? collaborations ? Maybe this aspect could be dealt with later ?

3) About AI/ML for NWP, there are so many different solutions on the table (example of algorithms: "transformers", "GNNs" etc.), how and when could we understand which ways to go for us ? What kind of agile management may we need ?

Claude: for interoperability, there isn't one definition. Interoperability means organization of data structures and data flow at the level of the core NWP codes, but can also mean data flow and workflow organization for instance in scripts, or standard formats and interfaces. The important thing is that all ACCORD teams and developers get the automatism to take into account the needs of other developments in the consortium when they affect the same level of code or the same thematic.

Jeanette: it is more like a change of mind / a change of culture, in order to develop things in a way that is adaptable to other options.

Martina: Back to the scope, we need to understand if and how to change the scope. Analyze and make the consequences visible to all. We cannot just write pretty words in our strategy.

Jeanette: The worst is to have the strategy without taking the consequences into account. We cannot hide the big questions, the big issues.

Saji: How about the other important aspects listed in the high level questions ?

Daniel: 1) for interoperability we want to be able to jump from one option to another, from one line of code to another, in a proper way. We do not have to converge to the same LAM with one single set of codes and options, but we want to have common interfaces.

Jeanette: Agree, we need more harmonisation and continue to insist on this.

Patrick: In the document, the notion of ecosystem should be brought higher. ACCORD already has an increasing number of common tools and we need more such sharing.

Patrick: Github and the ACCORD forge is a great thing we achieved. We need more in the same direction.

Claude: Agree we should keep these objectives very clear and in the continuation of our current scope.

Jeanette: Then how to decide on the scope for the future ? We should exploit our knowledge also with respect to new ideas. Then what should we not do, and how to decide on this ?

Martina: who or how to assess the relevance of what we should do ?

Jeanette: We must keep the general goal in mind, which is for ACCORD to provide the best



possible tools to protect people and goods, with a strong view toward forecasting Extremes and High Impact Weather.

Claude: We can think of extending the scope. From our discussions so far, the thematics that fall into an extended scope of ACCORD seem to be data provision, (common or individual) infrastructure, ML, operational collaboration. Sometimes however, we may not be able to find answers in a short or mid-term, so then how to proceed with respect to the strategy preparation ? We may need a level of agile management here.

Martina: We are not trying to replace our current systems.

Daniel: Agility also is needed for tools. Interoperability is related to technical agility, and the assessment of the large variety of hardware environment and infrastructure.

Claude: we could split the scope between what's within the current scope, with potential limited extensions, and the big questions which imply a clear new extension. Continue the scientific strategy preparation first assuming a limited extended scope with respect to the present phase ?

Martina: noted that TT teams nevertheless have to be aware of what can be achieved and what can not.

Saji: Regarding the big questions, we have to think if these questions are relevant.

Jeanette: The framing of the questions will be very important.

We should tell people what NOT to do, but also encourage them in some ways (not to close too many doors).

Martina: Regarding AI, there are currently 2 communities: ML and our traditional physics/dynamics experts.

Daniel: It is important that we understand each other better and better.

Jeanette: About the relevance of the questions on the scope, Directors would say that we have to preserve the solution that allows the best protection to the population.

Claude: suggested that we indeed have to address the extension of the scope and the big questions in the room with all members, and at the members' level. The consequences of extending the scope in certain directions should be made clear to the members, both regarding the consortium and regarding each individual member. This will take time and likely much more than the current timeline we have drafted for the scientific strategy preparation.

Meto: if we talk about NWP tools, the separation between traditional NWP and data driven tools is somewhat artificial. We should not overlay the difference, we can learn from each other.

Jeanette: Regarding the big questions in the room, there also is the link with ECMWF. At what level should this link be handled ? and how to organize the coordination of all the strategies that we currently see being discussed ? (ACCORD, ECMWF, Eumetsat, ...)

Claude: We must further think of how to address the management of uncertainty. Managing uncertainty might well become an item for itself within the next ACCORD strategy. Then we must make this idea more concrete, what does agile management mean ? How will we implement it ?

One could think of defining the one or other tool or procedure in order to be flexible in planning, or revise the next scientific strategy during the 2026-2030 period.

Claude: I will certainly continue to elaborate on this aspect in relation to the strategy preparation.

Claude tried to summarize which "big questions in the room" might require a separate, specific process with respect to all members (ie they have a significant extension of scope as a consequence):

- data sharing and a common data-centric infrastructure (or some shared resources within such an infrastructure) suitable for instance for AI/ML studies
- collaboration on a solution for a common end-to-end NWP system (from observations until

- some level of production-ready forecast products)
- toward some common operational collaboration ?
- related to the above items, issue about how to handle these questions with respect to other international collaborations (other potential partners, other initiatives like ECMWF pilot projects or the ICWED initiative, Destination Earth)

Claude suggested that he will work on splitting the material on the high level strategic questions in two groups: (1) those within the current scope including some limited extensions (assuming an affordable level of increase of resources) and (2) the “big questions in the room” as listed above.

*Coffee Break 10:00-10:20*  
*time used by Saji/Claude/Anne-Lise to review the draft recommendations*

## **6. Reviewing of recommendations from STAC (on all items)**

The draft recommendations from the preparatory documents were first adapted by Saji, Claude and Anne-Lise taking into account their analysis of the discussions on all items (3-4-6). These adapted recommendations have then been represented to STAC after the coffee break, who further commented on them.

The outcome of the in-situ STAC reviewing are the recommendations appended to these minutes (Appendix 1).

Regarding the next steps of the scientific strategy preparation, Claude suggested to first keep the TT on hold. Claude proposed that he will first discuss the outcome of this STAC+MG meeting with the Bureau, and analyze how to organize the next steps. Certainly, all relevant bodies of ACCORD will be kept informed.

## **7. Date of the next STAC meeting**

Claude reminded that the next regular STAC meeting should be scheduled for about one month after the ASW (15-19 April 2024), and one month before the spring-summer Assembly (usually at the very end of June or beginning of July). A suitable timing could be about at least one week after the strategy workshop (should the strategy workshop remain in spring next year). Two weeks could then be considered:

- 16-17 May 2024 (or so): rather position strategy workshop here ?
- 27-30 May: WMO data assimilation workshop in Norrköping
- 30-31 May: plan STAC one or two weeks after the strategy workshop (online)
- autumn STAC in-person in end of October or beginning of November 2024

It was agreed that PM+CSS will organize a framadate poll for May (spring STAC) and then also for Oct/Nov (autumn STAC).

## 8.A.O.B.

none

## 9. Closing

Saji thanked the MG and STAC participants for the good discussions.

Claude stressed that this was indeed the first joint STAC+MG meeting with in-person participation.

## Appendix 1: recommendations by STAC

### About the progress reporting for 2023 (item 3 of the agenda):

- STAC reviewed the work done in 2023 and discussed the progress report. STAC acknowledged the huge amount of work and the achievements across all thematic areas in ACCORD. STAC highlighted the benefits from the DEODE project in relation to ACCORD: increased coordination, communication and training, acceleration of technical aspects such as in code adaptation, setting up system-related configurations.
- STAC recommends the Assembly to adopt the progress report.

### About the RWP2024 (item 4 of the agenda):

- STAC reviewed the draft RWP2024 and made the following recommendation:
- STAC recognized the very high priority of code refactoring in preparation for porting the codes to GPU-CPU type of architectures. STAC acknowledged the good progress made in several areas of code refactoring over the past 18 months. STAC also recognized the new developments already started or are planned. STAC emphasized the need for more staffing on code refactoring and appropriate training.
- taking into account the above recommendations, STAC recommends the Assembly to adopt the RWP2024

### About the high level questions and the preparation of the scientific strategy (item 6 of the agenda):

- STAC welcomed the reviewed version of the MG-roadmap
- STAC with MG discussed the current status of high-level questions for the next phase scientific strategy.
- STAC recognizes the importance of the goals and challenges in relation to the current scope of ACCORD, and which need to be taken into account for the next phase (such as interoperability, how to handle the ecosystem of codes and tools etc.)
- It was recognized that some of these questions relate to an extension of the scope of ACCORD with respect to the MoU1 phase which have important consequences for ACCORD and its Members. STAC recommends that the questions relating to the extension of scope are reformulated and that the PM prepares this reformulation and their discussion inside ACCORD.
- STAC recommends taking into account the need for agility and flexibility for the preparation of the next phase strategy, and taking into account the uncertainties and how to

mitigate the risks.