

### Minutes

#### Participants

Flat-Rate ALADIN MoU5 Representatives	Rafiq Hamdi (Belgium)
	Yelis Cengiz (Turkey)
	Haythem Belghrissi (Tunisia)
RC-LACE-MoU5 Representatives	Christoph Wittmann (Austria)
	<i>Kristian Horvath (Croatia): excused</i>
	<i>Simona Tascu (Romania): excused</i>
HIRLAM-C Representatives	<i>Saji Varghese (Ireland) STAC Chair: excused</i>
	Sami Niemelä (Finland)
	Xiaohua Yang (Denmark)
Météo-France Representatives	François Bouyssel <b>STAC vice-Chair</b>
	Alain Joly ( <i>only until 11:30 CEST</i> )
	Christine Lac
ACCORD PM	Claude Fischer
ACCORD CSS	Patricia Pottier
ECMWF Observer	Steve English ( <i>only until 10:45 CEST</i> )
Invited experts from ACCORD Management Group	<ul style="list-style-type: none"> <li>● HARMONIE-AROME CSC Leader: Jeanette Onvlee</li> <li>● ALARO CSC Leader: Martina Tudor</li> <li>● Dynamics AL: Ludovic Auger</li> <li>● Meteorological Quality Assurance AL: Carl Fortelius</li> <li>● EPS AL: Henrik Feddersen</li> <li>● Transversal activities AL: Piet Termonia + Daan Degrauwe</li> <li>● Physics AL: Metodija Shapkalijevski</li> <li>● System AL: Daniel Santos</li> <li>● <i>Data Assimilation AL: Benedikt Strajnar (excused)</i></li> <li>● <i>AROME CSC Leader: Eric Bazile (excused)</i></li> <li>● <i>Surface AL: Patrick Samuelsson (excused)</i></li> <li>● <i>Integration Leader: Alexandre Mary: excused</i></li> </ul>

## 1. Opening

François explained that, for personal reasons, Saji could not attend the STAC meeting but he participated in the preparation of this meeting. François welcomed the new STAC Members and gave them the floor to introduce themselves: Haythem Belghrissi (Tunisia) and Yeliz Cengiz (Turkey).

MG members had been invited but several MG members were excused, mainly due to WWs.

François announced that the meeting was recorded: the video will be proposed to Saji and will be destroyed after the adoption of the minutes.

## 2. Adoption of the draft agenda

François presented the agenda items and proposed to swap agenda items 4 and 5 in order to discuss ML first. The agenda was adopted unanimously, with this permutation.

## 3. Management positions

### *a. DA & Physics ALs*

Claude reminded that the Assembly nominated on 20 March 2023 Benedikt Strajnar from ARSO as Area Leader for DA and Metodija Shapkaljevski from SMHI as Area Leader for Physics (Meto). The former WG on Physics (PM, CSC Leaders, SPRT ALs) discussed the first steps of the progressive handover of the Physics leadership with Meto, in the beginning of April.

### *b. CSS position*

Claude explained that, for the replacement of the CSS, the MF/Human Resource Dept currently is in discussion with the selected candidate (for contract agreement). She is expected to start in September (some overlap with Patricia will be arranged in June).

## 4. Roadmap & White Paper follow-on topics

This item was discussed after item 5.

Claude proposed, for this STAC, to focus on the progress regarding the white paper thematics.

### *a. Status on working methods and testing of new code releases*

Progress on testing and validation is in link with the modernization of working practices:

- the use of the ACCORD forge will start with CY49T1 (autumn 2023);
- webinars for staff have started in May-June 2023;
- same for the use of DAVAĬ (also available at ECMWF), important to add tests for CSCs, important to emphasize the role of the “DAVAĬ-contributors”;

- The MG is currently starting to consider the next steps.

### ***b. Status on O2R/R2O process at ACCORD-level***

Proposals for R2O/O2R and user feedback

- we propose to form a group of user representatives in charge of providing user feedback;
- the feedback will be based on a questionnaire, including the description of use cases;
- MG will analyze the material, and will propose to focus on a few specific issues (one or two to start);
- all data should be kept available for the R&D teams in ACCORD;
- this is a new activity in ACCORD:
  - human resource aspects: we need to staff the user representatives; it also is a new MG effort; specific task teams might be formed for addressing the issues on the NWP side;
  - we will learn from the process.

### ***c. Documentation and Documentation Officer position***

Claude explained that improving the consortium’s efforts on documentation will be beneficial for all Members and for all teams. A shift of culture is needed to include the elaboration of documentation right from the start of any new development. The proposal is to define a new Support Team position to organize documentation and support this effort consortium-wide: the “Documentation Officer” (partial time position, to be discussed).

François opened the floor for questions on the three pillars of the white-paper aspects presented by Claude: testing, user-feedback and documentation.

Rafiq asked if the user-feedback only relates to the forecasters. Claude confirmed that user representatives should work with the forecasters but also take into account other users of the model and get their feedback.

Sami noted that since some groupings share operations (e.g. MetCoop or UWC-W), it is probably not necessary to have a representative from each institute. Claude will check the ToR in order to make them flexible so that there is the possibility for specific members to designate a common person to represent them, as long as it is clear which countries each user representative will be representing.

Carl commented that a potential danger with shared representatives may be that it can be difficult for such a person to reach out and receive feedback from colleagues in sister institutes.

Christoph stressed the importance of letting user representatives know what happens to the feedback they provide. Claude confirmed that this aspect of being transparent was discussed with the O2R-WG and by MG. This need has been clearly recognized however not yet fully formulated in the procedure outline. Once we have given the whole process a start, we’ll have to further address how the response to the users-feedback will be organized.

Christoph strongly supported the documentation officer position and proposed a full-time position at first. François pointed out that it might be complicated to find a full-time documentation officer. Claude proposed to leave a precise figure of manpower fairly open for the discussion with the candidates (50% could stay in the Call for Applications as a fair overall estimate and facilitate applications from ACCORD Members).

**STAC agreed on recommendations for the Assembly (see Annex I, item 4).**

## 5. Working Group on Machine Learning portfolio

Claude explained that the WG-ML was active from August 2021 through May 2023 and organized some discussions and presentations by inviting experts (EWGLAM 2021, ASW 2023). Its original main purpose was to draft a portfolio of suggested topics of R&D regarding the use of ML tools for NWP models (aka “hybrid NWP-ML models”). Recently, the WG-ML also considered other aspects (zooming out of the portfolio) such as the infrastructure for data-centric R&D (formats, archiving, access to data) including the need for a data portal, or the emulation of a full data-driven forecast system.

The portfolio was complemented with a few general questions or suggestions of how to frame the follow-on discussions about AI/ML for NWP across ACCORD teams, which also could be useful in view of strategy discussions in ACCORD: this set of high-level questions is thus repeated in the preparatory document related to the Strategy for the next phase of ACCORD ([item 6](#)).

Claude introduced the high-level questions formulated in relation to ML for NWP:

1. Regarding AI/ML tools for NWP, how can we use our knowledge or our codes to engage in studies ?
  - a. How can we use our physically-based knowledge ?
  - b. How can we use our models, produce training data sets ?
2. How much priority should ACCORD put on studying AI/ML tools for *components* of the forecast system, how should this effort be balanced with respect to our “traditional” physical-based R&D ?
3. Should ACCORD engage in studying the relevance of data-driven models for emulating a *full forecast model* ? (recently published papers show a rapid progress in this field, at least for global relatively large scale forecasts)
  - a. Should we start by importing and studying ourselves the existing forecast emulation models (inference models) ? These models however mostly address large scales with a fair low resolution
  - b. Or should we rather engage in studying emulation models with a target on fine scales (1), high-impact weather (2), extreme (and rare) events (3) ? This path is tougher because almost all aspects of the problem require exploration (datasets for training, AI/ML design, verification of the inference model, address the probabilistic aspect of the forecast)
4. What should the balance between questions (2) and (3) be ? (component-wise versus full model emulation)
5. How can we increase our knowledge on AI/ML tools, and/or should we engage more in cross-community collaboration with academia or with private sector companies ? How could we incite others to collaborate with/help us to apply ML on our model (e.g. provision of relevant reanalysis datasets for specific problems), and learn ourselves as much as possible from the experience?

6. AI/ML tools require very large volumes of training datasets. How should ACCORD be organized to produce and handle these huge volumes ?
7. Should ACCORD engage more into collaboration with ECMWF ?
8. We should encourage more activity and collaboration across ACCORD, however how to find additional resources to engage into such studies ?
  - a. *what role could the WG-ML play in future ?*
  - b. *how could we effectively collaborate across ACCORD ?*

François congratulated the WG-ML for their great job and the nice portfolio. François opened the floor for comments.

Steve pointed out that things are moving very fast on ML. ECMWF recently decided for some change of strategy with respect to its previous AI-roadmap, and new resources are now needed (new positions or changes of subject for some staff). The ECMWF Council supports this action and encourages collaboration with member states on ML. Steve confirmed that ECMWF has started to explore the behaviour of full forecast emulators and will continue to do so.

In response to Rafiq's question regarding hybrid ML-NWP, Claude confirmed that the aim would be to use in-line component emulators, either to accelerate a component, such as part of a parameterization or a part inside the DA, or to use the ML tool to add a process for which a physical-based modelling is not available.

Sami stressed that whatever strategy we define, it may be obsolete in the next few months. To answer questions 2 & 3 above, Sami proposed focusing more on emulating the full model rather than on the components. However, it might be still necessary to study some components as well. In this case prioritization needs to be done focusing on such components that e.g. can make forecast model faster, enhance data assimilation process and/or reduce the cost of estimating forecast uncertainty. Sami was also in favor of a closer collaboration with ECMWF (question 7).

Alain pointed out that most of the currently much-discussed results come from the USA or China and had been published without peer-review. There are also several European publications on “hybrid forecast models” (although there are different approaches under this same term). Presently published emulators produce very limited results (e.g. no clouds, no precipitation) but, if their promises hold over time, companies might thrive on these emulators and might challenge the role of the NMSs by producing their own meteorological or environmental alerts.

To further tackle strategic choices, we should evaluate what our strengths as NMSs making numerical weather predictions are. Those include data assimilation controlled by observations and ensemble forecasting.

Assuming we continue to work as we do today (ACCORD members produce LAM forecasts at a higher resolution than ECMWF global forecasts, that are expected to reach 1 km resolution in the next few years), ACCORD should start thinking about emulators for high-resolution forecasts. As a very first step, ACCORD Members should organize themselves to create very fine scale data that can be used by these high-resolution emulators. Furthermore, the cost of developing a single forecast is affordable for any company, but not every company can manage a complex DA suite, the NMSs expertise in data handling and observation handling being much stronger. Similarly for managing ensembles, NMSs are also much better placed.

Regarding high resolution training data sets, Claude wondered whether this meant that ACCORD should quickly strive for making available data at 500 m or even finer grid mesh resolution ? Jeanette commented that a balance between data resolution and length of data sets has to be kept in mind (e.g. extreme events are rather rare events, as well as the need for ensembles). Furthermore,

the currently known emulators were trained from reanalysis data, however for very high resolution would not forecast fields (eg re-forecasts) be more useful ?

Xiaohua questioned the need for VHR NWP analysis /model data and observations for extreme cases, given that data for extremes are generally associated with very small scales (e.g. tornados).

Jeanette mentioned that re-forecasts could be perhaps considered to sample the very fine scales for training.

Rafiq strongly supported the idea of high resolution reanalysis 1km (in link with urban modelling) scale to feed the ML emulator.

Martina mentioned the experience in Croatia with ML applied to ocean modelling, however with sometimes a mitigated feedback from users (some users could question the physical relevance of the forecast products based on ML, when they are knowledgeable of the meteorological phenomena they are interested in). Alain pointed to results using ML obtained in Slovenia for storm surge modelling.

Haythem acknowledged a step-wise approach (to start working on some components rather than going to full model emulation) and the importance of the length of training data sets. He supported the idea of finding manpower, and for the WG-ML to share experience not only from other NMSs in ACCORD but also from academia.

**STAC discussed the recommendations and tasked François, Claude and Patricia to come with a final wording of these recommendations within the draft minutes (see Annex I, item 3).**

## 6. Preparation of the ACCORD Strategy for 2026-2030

Claude explained that the PM, the STAC chair and vice-chair started to address the preparation of the ACCORD Strategy together, then the PM and the MG formulated a set of high-level questions. Claude gave the outline of the proposed procedure and timeline:

- A. STAC with MG to address the high-level questions, propose choices or answers, provide guidelines => for STAC-6 in Oct/Nov'23
- B. task teams are formed and work during the winter, using the outcome of STAC+MG as strong guidance. The material from the task teams is an input for the strategy workshop => TT output ready for April'24
- C. the 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
- D. 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.

*Note: steps B-C-D above can be seen as a "guided bottom-up" approach.*

The high-level questions formulated by the PM and the MG were distributed in the preparatory document and are recalled below:

- Review our own achievements as ACCORD/MG and draft our own feedback & experience;
- Consider the context:
  - Evolution of technology and HPC,
  - Mid-to-long term strategy of global modelling (ECMWF, MF, other LAM consortia),
  - Emerging groupings devoted to shared operations, involving ACCORD members: UWC,
  - Destination Earth: the free access to km-scale data and services, the on-demand EE-DT function;
- Take into account or review the user needs, the needs in the context of a changing climate;
- How do we see the consequences for ACCORD of the emerging AI/ML techniques ? see [item 5](#).

- Address the scope of ACCORD:
  - Reminder of the main contours of our present scope:
    - R&D on physical-based NWP models, with a focus on high resolution, extreme weather events, ...
    - Our R&D work is strongly framed by the use of the common codes and the code collaboration with ECMWF ...
    - We have one strategic transversal topic which is code adaptation (SPTR)
    - Important keywords: modernization of working practices, interoperability of code components and of scientific options, increased across-family and across-CSC organization of activity,
    - The ACCORD/MG “white paper” on the interfaces between ACCORD R&D and operational-type activities in the member institutes described specific borders that might evolve with time.
  - Should there be a change of scope towards, or away from, some topics ?
  - Should there be an increased or reduced ambition in some aspects, and where ?
  - Are there “New” topics to consider ? :
    - Earth-system modelling (coupled systems),
    - AI/ML in NWP (see above),
    - how to handle the avalanche of data that NWP systems have to deal with and turn/thin them into useful information (...) ? Should ACCORD deal with more pre-processing or post-processing methods ?

Claude presented the possible working arrangements for STAC until its next regular meeting in the autumn:

- MG will review its own MG-roadmap;
- STAC members could get back to their respective families, discuss the high-level questions and prepare their input for the next meeting;
- additional ideas (with the aim of making this “homework” as efficient as possible for the whole Committee):
  - the PM could make available a shared file with the high level questions, where STAC members could edit and share their input (on google drive);
  - should an additional (online) STAC meeting be planned only to address the status of brainstorming on the high-level questions ?
  - should STAC split into smaller groups to address specific questions more efficiently ?
  - STAC members could consult with the PM or with MG members whenever useful.

François opened the floor to discuss the proposed procedure (there was no time left to discuss the high-level questions).

Rafiq proposed to invite external experts on ML during this strategy workshop and also to have a view on other equivalent NWP consortium strategies, if possible as a "benchmark". Claude agreed that inviting the one or other external experts could be considered, however depending on the topics and task teams it was less clear whether such invitations would be useful already for task teams or for the strategy workshop (perhaps this choice could be topic-dependent).

STAC agreed that, in order to be ready for the next STAC meeting, the PM should make available a shared file with the high level questions and STAC members should discuss them with their respective families and edit their input in the shared file. STAC will review this material in a dedicated on-line meeting, 3-4 weeks before the autumn regular STAC meeting. Patricia will propose a poll when the date of the STAC meeting is agreed (see item 7).

**STAC agreed on recommendations for the Assembly (see Annex I, item 6).**

## 7. Date of the next STAC meeting

STAC agreed on a two half-days meeting, hybrid (RMI premises, Brussels) with much encouraged in-person participation to review progress of 2023 (scientific reporting), to review RWP2024, to discuss the strategy high-level questions (propose choices/answers/guidelines to be taken into account by the task teams and in the strategy workshop). Rafiq confirmed the invitation by RMI and pointed that the dates 1-2-3 November would not be feasible (public bank holidays on 1-2 November in Belgium)

Patricia proposed a [poll](#) to find a date between October 23 and November 9.

## 8. AOB

8. None

## 9. Closing

François thanked Saji, Claude and Patricia for the preparation and also the MG for the quality of their work and the preparatory documents. François thanked the participants for fruitful discussions and closed the meeting at 13:20.

## Annex I: STAC recommendations

### 1. *On Roadmap and white paper follow-on:*

- STAC welcomes the steady progress on modernizing the working practices, and acknowledges the increased use of the new tools with the next common code version in the Autumn 2023. STAC encourages the MG to continue implementing the steps of modernization, including testing of new code releases.
- STAC acknowledges the efforts on tutorials regarding the new working practices and tools.
- STAC reminds the importance of forming the “DAVAĭ-developer” team as agreed in the end of 2022, and recommends the Members to staff this team.
- STAC recognizes the importance of the O2R process and supports the proposal on how to organize user feedback at ACCORD-level. STAC recommends the Assembly to also provide its support to the MG for implementing the proposal.
- STAC recommends to approve the ToRs of the “user representatives” and to task the PM to take the appropriate steps to form this group.
- STAC recommends the Assembly Members to appropriately staff the activity on O2R and the associated R2O tasks, according to the needs defined by the MG.
- STAC recognises that the increasing efforts on documentation and on modernization of the working practices come with a change of culture in the way of work, and STAC recommends the Assembly Members to be supportive and to facilitate this change of culture within each Institute.
- STAC supports the efforts for improving the production and the organization of documentation, and the proposal that an additional position in the Support Team could be defined for this purpose.
- STAC recommends to approve the ToRs of the “Documentation Officer”.

## **2. On the outcome of the ACCORD WG on ML for NWP:**

- STAC recommends that ACCORD Members should be proactive in the field of studying AI/ML tools for NWP. STAC also recognizes the rapidly evolving nature of this thematic with the risk that some strategic decisions might quickly become irrelevant.
- STAC acknowledges the strategic high-level questions formulated regarding AI/ML for NWP, and their relevance for ACCORD.
- As an attempt to start addressing some of these high-level questions in a short-term, STAC recommends that:
  - ACCORD should confirm or define what are the strengths that it must maintain in order to remain a provider of reference numerical tools feeding services relating to environmental warnings as well as environment-sensitive activities. This is needed to face a landscape within which the cost of making a reasonably good basic forecast using any "open" emulator will/is extremely low, encouraging the flourishing of small business companies. It will also help indicate on which aspect to put resources. Possibilities are: (1) mastering data assimilation with a view to enable "observation driven" systems, from now cast to fine scale forecasts; (2) mastering the provision of services based on probabilistic forecasts, as this may remain difficult for small groups, both technically and scientifically.
  - Assuming ACCORD wants to explore the potential of "data-driven" emulators, it needs as a high priority to have a corresponding data set. This is the first task to address, we recommend exploring ways and means of doing this collectively.
  - ACCORD should exchange information and collaborate with ECMWF on ML activities.
- STAC welcomes the efforts and the outcome of the WG-ML. STAC is supportive of the proposal that the WG-ML continues its activity, and could become a platform where information on local initiatives could be shared, where results could be shown, where potential collaborations or common answers to Calls for Applications could be discussed.

## **3. On the preparation of the ACCORD strategy for 2026-2030:**

- STAC agrees that a reviewing of progress based on the MG-roadmap should be made under the responsibility of PM+MG.
- STAC also agrees that the start of the preparation for the next phase strategy of ACCORD could take place in 2023.
- STAC recommends to adopt a two stage process for the strategy preparation:
  - to first address the high-level questions, as formulated during the STAC-5 meeting, in a joint PM/MG+STAC effort,
  - to then task the PM to organize a bottom-up approach (task teams, strategy workshop), with the support of the MG,
- STAC recommends adopting the general procedure and timeline for the strategy preparation as agreed in the STAC-5 meeting. STAC suggests that it will review the progress and assess the next steps at its autumn meeting.