Memorandum of Understanding for the

ALADIN-LACE-HIRLAM[1] Consortium

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1 This is a provisional name for the Consortium. Members will need to agree the final name before signing the MoU.

Content

PREAMBLE

ACKNOWLEDGING that an accurate weather forecast is increasingly important to reduce weather related threats to life, health, economy and property;

WISHING to develop their individual capabilities to fulfil their national needs and responsibilities in order to bring the best available quality of service to all users of meteorological services in their countries;

WISHING to optimise the individual and collective contributions of their countries to the WMO programmes;

RECOGNISING that the maintenance and further development of state-of-the art limited-area numerical weather prediction (NWP) systems require substantial investments, in particular in terms of human resources, and that such tasks and investments are better shared for mutual benefit;

RECALLING that, to reach these objectives:

- a HIRLAM consortium has existed since 1985 to develop a limited-area NWP system (in the sense defined in the MoU of the HIRLAM consortium);

- the European Centre for Medium-range Weather Forecasts (ECMWF) and Météo-France have jointly developed the IFS-ARPEGE codes for global NWP since 1987 and have agreed rules and conditions for access and use of these codes for limited-area NWP by designated National Meteo-Hydrological Services (NMHS) – see Annex I;

- an ALADIN consortium has existed since 1991 to develop a limited-area ALADIN NWP system (in the sense defined in the MoU of the ALADIN consortium) based in part on the IFS-ARPEGE codes;

- a LACE consortium has existed since 1996 to further integrate efforts of some ALADIN Members towards common research and operational objectives;

- a Collaboration Agreement between the ALADIN and HIRLAM consortia has existed since 2005;

- these initiatives have brought the ALADIN and HIRLAM consortia to the forefront in the field of high resolution short range weather forecast;

- the ALADIN and HIRLAM consortia have issued in 2014 a declaration stating that they want to form a common consortium by the end of 2020, in order to jointly develop a limited-area NWP system (in the sense defined in this MoU);

STRESSING that further joint development of limited-area NWP codes will need to build on the legacy of the above-mentioned consortia and to protect the Intellectual Property Rights of Members as it was defined in their respective agreements;

STRESSING their continuous commitment to the joint strategic objective of enabling their respective countries to get the best possible operational forecasting system optimizing their common available resources, minimizing the duplication of efforts and to access the most advanced mesoscale modeling capabilities for research purposes;

RECOGNIZING, however, that resource constraints may limit their individual ability to fully run and exploit the most advanced mesoscale system, and that, therefore, this common strategic

objective can only be met through a flexible approach taking into account a range of these constraints;

WILLING to face collectively the challenge of providing the best possible weather forecasts services with optimized human and financial resources in their shared ambition of being the national excellence and international reference in meteorology;

WISHING to continue and expand the successful activities of the ALADIN, LACE and HIRLAM programmes in the field of high resolution short-range weather forecasts by developing the science, the know-how, the expertise and the use around a common high resolution limited-area numerical weather prediction system;

PROVIDING help to various other fields of interest such as nowcasting, regional climate, marine forecasting, pollutant transport forecasts and so on;

CONFIRMING their commitments to implement the WMO Resolution 40 (Cg XII);

RECOGNIZING the possibilities of a wider European collaboration between numerical weather prediction consortia;

The NMHSs of [list of countries],

hereinafter referred to as "the Members" and collectively as the "ALADIN-LACE-HIRLAM Consortium" or the "Consortium",

have agreed as follows:

Article 1: Definitions

1. The **Consortium** is a grouping of NMHSs having decided to share the development of common computer codes for use in short-range NWP (Numerical Weather Prediction) on limited area domains. It has no legal personality.

2. The **Members** are the NMHSs that will sign the Consortium MoU. (NB: Groupings of Members are increasingly becoming actors of operational NWP and will be given due recognition).

3. The **Assembly** is the upper governance body of the Consortium.

4. **Computer codes** (or codes) are software, including scripts, used for NWP. They can be written in different languages (Fortran, C++, Java, XML, JSON, PHP, PYTHON, R, etc...).

5. The **Rolling Work Plan** (RWP) is a document updated every year that describes with a high level of detail the activities of the Consortium. It contains three categories of activities: (i) Code engineering, phasing and quality assurance; (ii) strategic R&D; (iii) prospective R&D.

6. The codes jointly developed according to the agreed Rolling Work Plan with the prospective to enter the common repository and shared within the Consortium are called "**common codes**". This name does not imply any particular regime regarding Intellectual Property (IP). The IP regimes are defined in Article 9.

7. The **T-codes** are the common codes in the central repository in Météo-France; they are the main vehicle for integration of all Consortium developments and maintenance of compatibility of the LAM configurations with IFS/ARPEGE.

8. The **legacy codes** are the codes developed under the previous ALADIN and HIRLAM consortia. They are listed in Annex VIII. The IP and distribution policy for legacy codes are distinct from the IP and distribution policy for the codes developed under the present MoU (see Article 9).

9. **Code engineering and phasing** are activities related to the day-to-day maintenance of the existing codes, the generation and integration of all modifications, making sure that they are compatible with each other and with the existing T-codes and preserve the intended scientific content. NB: The phasing encompasses the following aspects: (i) analyse the likely impacts on the shared codes of the planned and proposed contributions at the time of submitting them and make sure that other Members are aware of both those contributions and their possible impact; (ii) merge the scientific and technical contributions developed by the Members, in compliance with ECMWF IFS rules and standards, and to do so, adapt the contributions so as to solve all merging conflicts, trying not to break those contributions; (iii) adapt the limited area codes and options to the evolution of the IFS/ARPEGE codes as well as adapt or repair IFS/ARPEGE relevant changes that break limited area codes and options; (iv) assess at technical level that a new code version provides technically acceptable results (with respect to a reference) and that numerical performances and code portability are maintained.

10. **Quality assurance** encompasses the technical validation (defined in Annex II) and a set of basic meteorological scores for those versions of the System transferable to Members for their operational use.

11. **Strategic R&D** activities are research and development projects with high priority approved by the Assembly because of their wide interest and urgency for all Members.

12. **Prospective R&D** activities are the other activities conducted by the Consortium in order to experiment with new ideas, and ensure future progress of the quality of NWP.

13. A **Canonical System Configuration** (CSC) is a configuration of the codes for which resources are provided by the Members in order to perform regular updates and maintenance. The Consortium will strive to provide maximum quality assurance for the CSCs. At the moment of signing this MoU, there are three CSCs (Arome, Alaro and Harmonie-Arome) and efforts will be made to increase their interoperability.

14. The **Common Manpower Register** is a tool designed to measure in an equitable way the human resource supplied by Members to the consortium. All activities in support of the Rolling Work Plan are noted in the register. A provisional commitment of resource is agreed every year, then the realization is monitored every three months.

15. **Intellectual Property Rights** means all patents and patent rights, trademarks and trademark rights, trade names and trade name rights, service marks and service mark rights, service names and service name rights, brand names, copyrights and copyright rights, trade dress, business and product names, logos, slogans, trade secrets, industrial models, utility models, design models, designs, rights in confidential information, know-how, rights in the nature of unfair competition rights and rights to sue for passing off, and all pending applications for and registrations of patents, trademarks, service marks, and copyrights together with all connected and similar or analogous rights in any country or jurisdiction for the full term thereof.

16. **Non-contaminating open source licences** are licences allowing the licensee to redistribute the modified code under any license of its choice. The only obligation of the licensee is to inform proactively its users concerning the IP of the initial owner, the text of the initial license, and the history and authors of the modifications.

17. **Scientific competence**: Members will ensure in their team a sufficient scientific and technical understanding of the codes to maintain the scientific content of the codes and to contribute efficiently to code engineering, phasing and quality assurance. These competences will also facilitate the operational implementations by Members.

18. **Products** are defined as outputs of the model configurations run by a Member, using the common codes in the ECOMET sense, i.e. "all real-time meteorological information in the form of pictures, charts, text or data files resulting from the transformation or processing of data".

19. **Official Duty**: all activities that take place within the organization of a NMHS, and external activities of the NMHS resulting from legal, governmental and intergovernmental requirements.

20. **Educational Use**: Any use of Products by a school, university, scientific institute or similar (private or public), solely for educational purposes, without transmission or redistribution of these products to any further third party, or use of them to generate a value added service.

Article 2: Scope and Objectives

Introduction

21. The primary purpose of the Consortium is to share limited resources for the efficient development of a state of the art NWP system and support its operational set up. The Consortium will deliver to its Members a set of common codes that can be assembled under diverse configurations to support the production of world-leading quality numerical weather predictions on limited geographical domains. To this effect, the Consortium will carry out the following activities:

   • Research to contribute to the progress of scientific knowledge relevant for short-range weather forecasting, leading to publication of scientific results in the areas of environmental science and high-performance computing;

   • Improvement of existing codes or developments of new codes to translate research results into forecasting tools;

   • Extensive testing to ascertain the technical and meteorological quality of some configurations allowed by the codes (called Canonical System Configurations);

   • Regular updates of the scientific and technical documentation of the codes for the benefit of the Members;

   • Regular maintenance of the codes in order to increase their efficiency on the latest computing architectures and facilitate their operational use by the Members.

22. These objectives are fulfilled through continuation and expansion of the activities formerly conducted under the ALADIN and HIRLAM Consortia.

23. The ALADIN common codes and the HIRLAM common codes, as defined in the final MoUs of these consortia, are constituted as a common legacy and become the initial set of common codes of the Consortium from the day of its signature, under the regime of Intellectual Property defined in Article 9.

24. The further developments will be realized in close cooperation with ECMWF and will make use of ECMWF software whenever appropriate. As the main contributor to the Consortium and in view of the long existing IFS/ARPEGE collaboration, Météo-France will remain the main contact of ECMWF to maintain the compatibility of common codes with ECMWF software at the desired level. Its agreement with ECMWF will be regularly updated to ensure that Members who are not related to ECMWF are allowed to use ECMWF software for the Consortium purposes.

25. The Consortium may also cooperate with other entities to develop the common codes. Rules for such cooperation are described in Article 8.

Strategy

26. Every few years, an updated strategy of the Consortium will be proposed by the Management Group, scrutinized by the STAC and PAC and approved by the Assembly.

Rolling Work Plan and Common Manpower Register

27. The activities of the Consortium are described with a high level of detail in a Rolling Work Plan (RWP) updated annually. This RWP is divided in three categories:

   • Code engineering, phasing and quality assurance activities useful to the CSCs in a Consortium-wide sense

   • Strategic R&D activities

   • Prospective R&D activities

   The level of realization of the RWP is one important criterium for appreciation of the progress of the Consortium.

28. The RWP is supported by a Common Manpower Register containing the commitment of manpower from all Members. Commitments are made annually, and the realization of the effort is monitored every three months.

29. Human resources devoted by Members to their local operational systems as well as to the adaptation and optimization of the common codes for their own usage are not part of the RWP and Common Manpower Register. They may however be recorded in a separate register for information and work coordination.

Canonical System Configurations

30. The common codes are organized into Canonical System Configurations, i.e. ensembles of codes for which the Consortium guarantees regular evolution, upstream compatibility and maximum quality (see also Annex II).

31. At the moment of signing this MoU, there are three CSCs: Arome, Alaro and Harmonie-Arome. While the continuity of the CSCs must initially be ensured, modernisation of the code and working methods should lead to increased modularity and interoperability across CSCs.

Levels of support

32. The Consortium commits to provide two different levels of support for the common codes:

   • higher level: codes with full quality assurance for the CSCs and fit for local installations;

   • standard level: codes shared only by some Partners and with a lower level of support.

33. By the time of signature of this MoU, the higher level of support will cover:

   • Computational, numerical and physical aspects of the meteorological forecast model

   • Land surface model coupled to the meteorological model

   • A baseline data assimilation solution

   • A limited number of atmospheric components without feedback on the meteorological model

   • A limited set of tools for probabilistic forecasting

34. By the time of signature of this MoU, the standard level of support will cover:

- More advanced components of Data assimilation (including observation operators, variational and ensemble-based codes)

- Tools for probabilistic forecasting (generation of ensembles by initial, boundary and model perturbations)

- Some quality assurance tools

These three items will be gradually moved to the higher level of support.

35. Additional items will gradually be added to the standard level of support, such as:

- Common scripting system supporting both research and operations

- Observation acquisition, storage and processing

- Framework for coupling the meteorological model with external models (chemistry, ocean, waves, etc …)

- Atmospheric composition with feedback on the meteorological model

- Sea state model coupled to the meteorological model

- Generic tools for product generation (including probabilistic products)

- Regional climate model configurations.

36. The precise content of the higher and the standard levels of support will be discussed and resourced by the Assembly year after year. In the long term, the Consortium will strive to move all items in the higher level of support, but this will require significant additional resources.

R&D activities

37. The research and development activities of the Consortium will remain at the forefront of NWP and will be guided by

- The feedback of the Members (or groupings of Members) concerning the quality of their operational forecasts. These will be collected in a formalized way at least once a year, in particular views on systematic errors, remarkable forecast failures or success cases, judgment of bench forecasters, and adaptations needed for the local context.

- The general progress of scientific knowledge, monitored through the international literature and participation to NWP conferences.

- Progress at ECMWF and other major research groups.

- The anticipated evolution of HPC architectures, monitored through regular contacts with the HPC community.

38. It is recognized that some diversity of approach for the developments of the Consortium might be desirable, in order to efficiently cope with uncertainty on scientific understanding and on the capacity and technology of future computers. The consortium will however carefully plan the use of limited resources and assess regularly if the level of diversity is of its benefit. The Programme Manager will make sure that the decisions of the Assembly will be translated into the RWP and that the activities are performed accordingly.

Integration, phasing and quality assessment

39. Whenever a new set of codes or modification is ready, it will be proposed by the developers for integration in the T-Codes repository.

40. The consortium will ensure a strict technical interoperability and upstream compatibility of the T-codes of the higher level of support, within the CSCs, via multiple technical tests realized in an automated way.Technical Quality Assurance procedures are further detailed in Annex II.

41. The Consortium will strive to verify the meteorological quality of the CSCs according to their resources, but it is not part of the Consortium mission to verify the meteorological quality for the whole diversity of applications developed by the Members. Once a new cycle of the T-codes is selected for more in-depth validation, Members are invited to port it locally and to progressively proceed to test suites. The CSC Leaders shall monitor the remaining technical validations and the meteorological quality verification with the help of the Coordinator for Network Activities (CNA) and the Local Team Managers (LTMs).

Delivery to Members

42. Pending on results of the technical and meteorological validation, the Consortium will decide to release the new version of the common codes.

43. The Members then have the task of adapting and customizing this new version to their own national context. Adaptation and optimization may be needed for several reasons: (i) specific aspects of the local climate not yet covered adequately by the common codes; (ii) specific aspects of the observations nature, volume or format used by them; (iii) specific aspects of their operational production schedule or formats of local data bases, etc... (iv) choice of resolution and domains.

44. The Members will have the task to ensure that each new version of their operational system provides forecasts of quality at least equal to the previous one.

45. Problems of forecast quality traced to a new release of the codes delivered by the Consortium will be reported as quickly as possible and addressed by the Consortium with high priority.

46. The Members remain free of deciding when they adopt a new release of the system for their operational use. It will be expected that they do so as quickly as possible. From time to time, a list of obsolete versions will be established and support by the consortium to these versions will be discontinued.

Article 3: Members and Acceding Members

47. The initial Members of the Consortium are the signatories of this MoU at the time of its entry into force. They were all signatories of the most recent MoUs under the ALADIN or HIRLAM consortia.

48. This MoU is also open for signature to new Members who, alike the initial Members:

   • Are NMHSs of WMO Member States;

- Are willing to contribute to the objectives defined above;
- Have firm plans to use the common codes for their operational activities;
- Accept all the terms and conditions of this MoU.

49. A NMHS wishing to join the Consortium shall address its application to the Chairperson of the Assembly, for consideration by the Assembly.

50. Decision to accept a new Member requires unanimity of the Assembly.

51. In case of positive decision by the Assembly, the application will also be sent to ECMWF Council to seek access and use of IFS-ARPEGE codes for the candidate NMHS.

52. After positive decision by ECMWF Council, the candidate NMHS shall enter an accession period of maximum three years, during which it shall (see also item 59):

- have full access and use of the common codes, with support from the Consortium
- contribute to the Annual Budget at a level of 50% of the Member contributions
- contribute to the manpower at a level of 50% of the Member contributions
- have no voting rights in any decision of the Assembly

53. Upon completion of this accession period, and confirmation that it actually satisfies all conditions for Membership, the acceding Member shall become full Member by:

- Signing this MoU;
- Paying an entry fee of five times the annual contribution of Members.

54. A Member may withdraw from the Consortium by giving at least one-year notice to the Chairperson of the Assembly.

55. Should one Member cease to fulfil the terms and conditions for membership defined in this MoU, the Assembly may decide to terminate its membership, after exploring possible recovery actions with that Member. The termination of membership will be effective after a one-year notice.

Article 4: Rights and obligations of Members

56. Each Member and acceding Member shall have full rights of access to and use of the common codes, including rights to modify these codes for the implementation of its own configuration, within the limits posed by the IFS-ARPEGE software protection agreement between ECMWF and Météo-France (see Annex I)

57. Each Member and acceding Member will have a share in the IP of the common codes produced by the Consortium, as defined in Article 9.

58. Each Member and acceding Member (or grouping of Members) shall have full responsibility for and control of the configuration implemented on its own computers for its research and/or operational requirements and any use authorised by this MoU.

59. Each Member and acceding Member shall contribute a minimum amount of human resources to the RWP. This minimum is defined as 2 full-time-equivalent staff (FTE) for the whole RWP, including at least 1 FTE for the "Code engineering, phasing and quality assurance"

component and 1FTE for the R&D Components. For acceding Members, these figures are reduced by 50%. The same reduction will apply to the Members listed in Annex III, in consideration of the small size of their staff.

60. In order to contribute efficiently to the RWP, each Member and acceding Member shall maintain the scientific competence of its staff. This will be facilitated by regular training sessions and workshops organized by the Consortium.

61. Each Member and acceding Member shall contribute to the annual budget as defined in Article 7[2].

62. Each Member and acceding Member shall abide by the terms and conditions defined in this MoU and do their best effort to implement the decisions taken by the Assembly.

63. Each Member and acceding Member shall respect regulations related to Intellectual Property Rights and ownership of the common codes and shall prevent unauthorized dissemination and use of the common codes. Rules for licensing the common codes to third parties are defined in Article 10.

64. A Member leaving the Consortium will conserve the right to use and modify for its own usage the common codes in the version available at the time of leaving. However any distribution of these codes to a third party by the leaving Member, either in the version available at the time of leaving, or with the subsequent modifications, will be subject to the agreement of the Consortium and to the agreement of ECMWF in conditions defined at Article 10.

65. The leaving Member will lose the right to access and use the further versions of the common codes, and the right to use the 'ALADIN-LACE-HIRLAM naming for its products.

Article 5: Governance

Assembly

66. The Assembly is the upper governance body of the Consortium. It represents the Members and acceding Members and is responsible for the implementation of this MoU, including the definition, follow-up and evaluation of all activities.

67. The Assembly consists of Directors of each of the Members and acceding Members or their mandated representatives, who may be assisted by advisers. In addition, the ECMWF Director General is invited to the Assembly meetings as observer.

68. The Assembly shall meet annually (twice per year during the first years of the Consortium). Extraordinary Assembly meetings could be held at the request of at least one third of the Members. The Assembly meetings are hosted by Members at their invitation, and can also be held as virtual meetings if felt more appropriate. In all circumstances, the Member hosting the assembly will take necessary measures to allow virtual participation and expression of votes for Members that cannot travel. The Assembly meetings will be prepared by the Programme

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2   The payment of annual membership fees may be delayed in case of "Force Majeure", as appreciated by the Assembly

Manager, under the responsibility of the Bureau (see below).

69. The Assembly shall review the progress of the Consortium, the proposals of the Programme Manager, the advices of the Committees, and take decisions on the following items (non-exhaustive list):

   • Amendments to this MoU and on all matters concerning Membership of the Consortium

   • The high-level objectives pursued by the Consortium, and the prioritization of efforts

   • The detailed Rolling Work Plan (RWP)

   • The budget of the Consortium and the financial contributions of Members and acceding Members

   • The general organization of the management of the Consortium

   • The appointment of officers to all management positions

   • The composition of the advisory committees and the designation of their Chairpersons/Vice-Chairpersons

   • Issues regarding Intellectual Property Rights and licensing of the common codes to third parties

   • External collaborations

   • From time to time, the Assembly may commission a review of the activity of the Consortium by a group of independent experts

   • External communication and image of the Consortium

70. Assembly meetings are valid if at least three quarters of the Members are represented.

71. In exceptional circumstances, a Member may represent another Member or acceding Member at an Assembly meeting. A written mandate shall be required for this purpose. The absent Member or acceding Member shall then be considered as represented, with delegated voting rights in the case of a Member.

72. All decisions of the Assembly must be duly recorded and apparent in the minutes of the meetings to be valid.

73. The Chairperson and the Vice-chairperson of the Assembly are elected for two years and may be re-elected, but no more than once.

74. The Chairperson chairs the meetings of the Assembly and represents the Consortium with respect to third parties, during the period between two consecutive meetings.

75. The Chairperson can sign collaboration agreements with third parties and commit the Consortium, on behalf and by delegation of the Assembly.

76. The Chairperson may consult Assembly members in between meetings to seek agreement on critical issues that require quick decisions, in particular with respect to third parties.

77. In case of absence, the Vice-chairperson replaces the Chairperson.

78. The responsibility of the Chairperson and Vice-chairperson is collectively supported by the Consortium, except for infringements in direct relation with their national laws.

Voting majorities

79. The Assembly shall strive to take decisions by consensus. In the absence of consensus, a decision shall be subject to a vote. The majority needed to achieve the decision will depend on the type of decision, as explained below.

80. Each Member will have one vote. However for important decisions listed below, the relative manpower contributions to the Consortium during the last eight years, as measured by the common manpower register, will be also taken into account. (For the initial years of the Consortium, the scale of manpower contributions of Members in the ALADIN and HIRLAM consortia since the start of the common monitoring in 2018 will be used, see Annex VII). In determining unanimity and the various majorities provided for below, only votes cast for or against a decision and, in cases where the Assembly acts in accordance with the procedure laid down in item 82, the relative manpower contributions of the Member States taking part in the vote, shall be taken into account.

81. The Assembly, acting unanimously, shall:

   • Adopt any amendment to the main text of this MoU;

   • Accept new Members and Associate Members of the Consortium (see items 50 and 148).

82. The Assembly, acting by a majority of two-third of Members, provided that the sum of the relative manpower contributions from these Members represents at least two-third of the total manpower contributions (so-called double two-third) shall :

   • Adopt the annual budget and the membership fees

   • Adopt the Rolling Work Plan and the provisional Common Manpower Register

   • Adopt any amendment to the Annexes of this MoU (except Annex I, VII and VIII that cannot be modified)

83. The Assembly will decide about all other matters by a majority of two-third of Members, with the exception of matters related to the execution of the joint ownership of the codes, for which a specific voting system is described in Article 10.

Bureau

84. The Bureau supports the PM and the Chairperson for preparing the Assembly meetings (agenda, preparatory documents, choice of speakers, etc..)

85. The Bureau is composed of the Chairpersons of the Assembly, the PAC and the STAC, the Programme Manager (PM), and the Consortium Secretary. The Assembly may designate additional members of the Bureau, based on proposals by its Chairperson, after consultation of the PAC. Experts (e.g. the Integration Domain leader) may be invited to attend meetings of the Bureau by the PM or the Chairperson of the Assembly.

Policy Advisory Committee

86. The Policy Advisory Committee (PAC) advises the Assembly on strategic and policy matters of the Consortium. The PAC meets only when requested by the Assembly. Its meetings are generally held a few weeks before the meetings of the Assembly.

87. The PAC is initially composed of eight persons (2+1 substitute from Météo-France, 2+1 from RC-LACE-MoU5, 2+1 from ALADIN-MoU5 "flat-rate" Members, and 2+1 from HIRLAM-C Members), all designated by the Assembly. In addition, the PM attends all meetings of the PAC. The PAC representatives are expected to represent their community of Members by conducting appropriate consultations before meetings. In principle, they should be senior staff not closely involved in the Consortium Project team.

88. The mandate of PAC representatives is for two-years, renewable if needed. Representatives are proposed by the component groupings and nominated by the Assembly.

89. At least two of the Members of the PAC should be also Assembly members. The Assembly designates the PAC Chairperson and Vice-chairperson among such colleagues, in order to facilitate efficient liaison with the Assembly. They are appointed by the Assembly for a period of two years and may be reappointed but not more than once.

90. The PAC can invite observers in order to have a fair representation of all Consortium actors.

91. More detail is available in the Terms of Reference of the PAC (see Annex IV).

Scientific and Technical Advisory Committee

92. The main role of the Scientific and Technical Advisory Committee (STAC) is to advise the PM and the Assembly on scientific and technical issues.

93. The STAC reviews the progress of the current RWP, expresses views and requirements of Members for future versions of the RWP and the proposed scientific strategy, and more generally synthesizes the returns of experience of all Members on the common codes and formulates recommendations. It can discuss problems reported by Members and not yet resolved by the Consortium.

94. The STAC is initially composed of three representatives for each component of the Consortium (initially Météo-France, "flat-rate" ALADIN-MoU5 Members, RC-LACE-MoU5 Members and HIRLAM-C Members). STAC representatives are tasked to consult the Members they represent to gather their opinions before the meetings. In principle, they should be senior staff selected on the basis of their expertise with either research or operational background, not directly involved in the Consortium Project team. STAC representatives shall rotate regularly in order to allow each Member to be represented directly over time. The mandate of STAC representatives is for two-years, renewable if needed. Representatives are proposed by the component groupings and nominated by the Assembly. After several years, the composition of STAC may evolve to better reflect the evolution of the Consortium.

95. The PM and relevant members of the Management Group attend meetings of the STAC. ECMWF is also invited to send an observer to STAC meetings. The STAC may invite other experts as needed.

96. The STAC Chairperson and Vice-Chairperson are appointed by the Assembly from among the STAC Members.

97. The STAC meets once per year in the period of preparation of the RWP for the following year. The Consortium will look for opportunities to pool STAC meetings with other large meetings of the European met communities in order to increase efficiency.

98. The Terms of Reference of the STAC are given in Annex V.

Article 6: Management

Programme Manager

99. The Programme Manager (PM) is the highest executive officer of the management structure of the Consortium. She/he reports directly to the Assembly and is generally responsible of the implementation of the Assembly decisions and of the progress of all activities of the Consortium.

100. The PM role represents a full-time position held by a single person. .

101. The PM is appointed by the Assembly after a wide call for applications. Each application must be supported by one or several Members.

102. The mandate of the PM is normally for the duration of this MoU (five years).

103. The Terms of Reference of the Programme Manager role are given in Annex VI.

Project team

104. The Project team is composed of staff provided by Members and Acceding Members to prepare and execute the RWP. It is led by a Management Group.

105. The Management Group is chaired by the PM and has the collective responsibility to plan the work of all staff working for the Consortium and to utilise the available competences in the most efficient way. The Management Group is responsible for the formulation of the RWP and monitors its execution (in particular the code deliverables). It also prepares the medium-range strategic plan.

106. The Management Group is composed of :

    • The three CSC leaders (Arome, Alaro and Harmonie-Arome), responsible for the continuity and the quality of their CSC
    • An Integration leader (including phasing)
    • A limited number of Area Leaders who are responsible of implementing item 31 and :
        i. whenever possible, lead the corresponding area, i.e. define a long term scientific and architectural vision for the modernisation of the code, including normative aspects, increased modularity and interoperability and take full responsibility of the delivery or the corresponding developments,
        ii. or otherwise, conduct specific actions on CSC interoperability, as decided by the Assembly and for a limited duration.
    Area Leaders are not responsible for the specific implementation of the scientific developments in each CSC, that remains the responsibility of the CSC leaders.

107. The CSCs leaders may be assisted by CSC human resources . Each CSC leader may organise its CSC human resources in the way considered most appropriate to fulfil the RWP.

108. The intention is to generalise the situation 106-subitem (i) with time.

109. Each Management Group function is corresponding to a minimum commitment of 0.5 FTE

and is delivered by one Consortium Member.

110. The CSC leader positions will be appointed by the Assembly, upon nomination by a group of Members using the corresponding CSC.

111. The Integration Area Leader position will be held by a staff of Météo-France in view of the necessity to coordinate new code cycles with ECMWF.

112. The final definition and the attribution of the other Area Leader functions will be done by the Assembly in a competitive process. Each Member interested in an Area Leader function can make a proposal, explaining how the role will be held (number of staff and commitment of time from each of them, names of the staff). The Assembly will attribute all Area Leader functions simultaneously, taking care of expertise, interpersonal skills of candidates, and geographical balance.

113. The Project team also includes the positions of Coordinator for Network Activities (CNA). The CNA role represents a 0.2FTE position.

114. The Terms of Reference for Project team roles are given in Annex VI

Support team

115. The Support team is composed of staff provided by Members and acceding Members to support the work of the Project team.

116. A full-time position of Consortium Scientific Secretary is provided by one Member to assist the PM and the Management Group in their duties.

117. Each Member shall staff a Local Team Manager function, corresponding to roughly 0.1 FTE, to assure the good liaison between the Member and the project team. This could be delivered by one or several staff, depending on the possibilities for each Member. In case the role is delivered by several staff, one of them will be designated as single contact point.

118. The CNA is the usual contact of the LTMs within the project team and chairs meetings of the LTMs.

119. The LTMs meet annually in the context of either the EWGLAM or the all staff workshops, or both, to avoid generating additional travel costs.

120. The Terms of Reference for Support team roles are given in Annex VI.

Article 7: Resources

121. Resource requirements to realize the objectives of the Consortium are reviewed and decided on an annual basis by the Assembly, based on proposals and reports by the PM, with the understanding that the administrative and budgetary constraints of the Members can tolerate only marginal changes (smaller than 10%) from year to year.

122. Two categories of resources are provided by Members and acceding Members for the implementation of this MoU: Membership fees and human resources provided in-kind by Members.

123. Membership fees are compulsory and based on a flat-rate contribution.

124. Membership fees form the basis of the Consortium budget which will be managed by the PM, with the help of the Scientific Secretary. The distribution of the expenses paid from the Consortium budget will be fair and equitable to all Members.

125. Expenses paid from the Consortium budget will comprise the following items:

   • Compensation for the salary of the PM. This compensation will be transferred to the Member employing the PM.

   • Expenses for the management and meetings of committees (in priority, travels of the PM, Management Group and Support team; travels of STAC members to STAC meetings; travels of PAC members to the PAC meetings; travels of LTMs and CNA to the LTM meetings; general logistics of the All staff workshop; Strategy meetings from time to time).

   • Travel money for scientific visits considered with highest priority by the Management Group.

   • Other types of expenses of general interest for the Consortium and agreed by the Assembly.

   • In exceptional cases, when the needed expertise cannot be provided in-kind by any Member, the PM may be allowed by the Assembly to transfer funds from the Consortium budget to one Member to hire a new human resource for a specific task in relation with the RWP.

126. The ways of collecting the Membership fees and executing the Consortium budget shall be agreed by the Assembly, taking into account the practical capacity of the Members being in charge of the implied redistribution steps.

127. With the exception of the compensation for the PM salary, human resources needed by the Consortium will be provided in-kind by Members. The Members will remain the employers of staff under their own rules complying with their national regulations, and will instruct designated staff to execute tasks listed in the RWP of the Consortium or to contribute to the management activities.

128. The Membership fees do not generate voting and IP rights.

129. The Human resources provided do generate voting and IP rights for the employer, excepted resources that are fully funded by the Consortium.

130. The realisation of the manpower is monitored on the Common Manpower Register and reported to the Assembly. The record of cumulative manpower contributions of Members and acceding Members is maintained by the Scientific Secretary and made available to Members and acceding Members. The record at the time of signature of this MoU is attached as Annex VII.

Article 8: Cooperation with other entities

131. The Assembly may decide to establish cooperation with entities (Institutes, Universities, other Consortia, NMHSs) outside the Consortium, under conditions to be determined.

132. A cooperation agreement shall specify, as the minimum, the objectives and areas of the cooperation and the rights and obligations of the parties, in particular with respect to the access to and use of the common codes.

133. A representative of a cooperating entity may be invited as an observer at the Assembly meetings.

134. When the Consortium uses codes developed by other Communities (e.g. SURFEX, Meso-NH, HARMONIE-Climate, ...), it shall establish clear working relationship with them.

Article 9: Intellectual Property Rights

135. Consortium Members must ensure that they own the IPR of the codes that they want to deliver to the T-Codes repository and are legally allowed to share it with other Members as outlined below. In the case where this would not be possible, they will inform the Assembly, which will decide of the best course of action.

136. When delivering codes to the T-codes repository, Members transfer their IP of these codes to other Members in such a way that the IP of all codes residing in the T-Codes repository is shared by all Members in proportion to their respective cumulative manpower contributions to the RWP over the full period of this MoU since its entry into force, as measured by the Common Manpower Register. This transfer is irrevocable.

137. The scale of IPR defined above will be used as voting weights for any decision of the Assembly related to the execution of the joint ownership of the common codes, for instance to grant new rights of access and usage to third parties (licensing policy, see Article 10).

138. A Member leaving the Consortium will conserve a share in the IP of the common codes, but this share will decrease progressively with time, as the Common Manpower Register will record no further effort from this Member. The leaving Member will conserve a voting right for decisions of the Consortium related to the execution of the joint ownership as long as its share of IP exceeds 5% (precise value still in discussion).

139. By exception, the legacy codes inherited from the ALADIN and HIRLAM consortia will remain jointly owned by Members of these consortia in the proportion computed at the end of their last year of operation (2020), as shown in Annex VIII. Decisions relative to the execution of the joint property of the legacy codes will still follow the rules agreed in the last MoU of ALADIN and HIRLAM.

140. The related IP rights will be protected by the Members under the guidance of the Assembly with the understanding that executive functions can be delegated as agreed to the PM

Article 10: Licensing the common codes to third parties

141. The Assembly shall decide its policy for licensing the common codes to third parties via a specific voting scheme. For these votes, each Member will have a weight equal to its share of the IPR, as defined in Article 9.

142. Decisions shall require a majority of two-thirds of the weighted votes, except for decisions regarding Open Source licensing, that will follow the principles explained below.

143. Any revenue generated by licensing the common codes to third parties will be redistributed to the Members with a key of repartition equal to the IPR scale. This will include Members

having left the Consortium.

144. The Consortium recognizes that distribution of codes under Open Source presents a number of advantages for engaging scientific communities in its work, and will regularly monitor the legal situation of Members and the status of ECMWF codes licensing, as well as the resources available to support the user community, in order to align policies without delay.

145. When the main contributors to a new code module delivered to the T-Codes repository express their intention to distribute this new module as Open Source, the Assembly will not oppose to this choice, provided that the chosen Open Source licence is "non-contaminating" (see definitions). The said module will be distributed in parallel as Open Source by its main contributors, and by the Consortium as part of the common codes, under the common licensing policy.

146. The decision to distribute as Open Source any other code module developed under this MoU shall require a three-quarter majority of the weighted votes (NB: this does not apply to the legacy codes, that will still follow the rules agreed in the ALADIN and HIRLAM consortia, see Article 9).

147. Any Member having left the Consortium will keep the right to use and modify for its own usage the common codes, in the version available at the time of leaving. However, he will need the agreement of the Consortium to distribute these codes to third parties, either in the version available at the time of leaving or with subsequent modifications introduced by the leaving Member. For such decisions, the voting weights existing at the time of leaving will be used, and the rules defined in the present Article will be followed. Such distribution will be also subject to the agreement of ECMWF.

148. For research purposes, a Member may grant access to the common codes, or elements thereof, to another organisation in its country, or to the NMHS of a Member or Cooperating State of ECMWF which is not a Member, after prior information of the Members. Access shall then be granted under a standard R&D licence approved by the Assembly (see the current template in Annex IX)

149. For the specific case of benchmarking or optimisation of local configurations in collaboration with computer vendors, a Member may grant access to the common codes or parts thereof to a vendor. Access shall then be granted via a standard benchmarking license approved by the Assembly (see the current template in Annex X).

Article 11: Ownership and distribution of Products

150. Every Member and acceding Member shall have full ownership of the Products that it creates either for official duty or for commercial purpose, using the configuration of the common codes implemented for its operational requirements, and full responsibility for their authorised use and delivery. In the case of grouping of Members operating NWP systems based on the common codes, the ownership of the Products will be agreed within the grouping without interference from the Consortium.

151. Products created for official duty shall be declared as "additional data" or considered as "other data" in the sense of WMO Resolution 40, with the understanding, however, that the Assembly may agree by consensus that some products can be declared as "essential data".

152. The dissemination of Products and the conditions for reuse are defined by Members according to their national legislation. The Consortium recognizes the diversity of national situations with respect to data policy issues and will not interfere.

153. The Assembly will address any issue related to data policy, taking into account the national legislation, the national sovereignty issues, respecting the spirit of collaboration that preserves the Members interests in terms of official duties, individually or mutually.

Article 12: Associate Members

154. A status of Associate Member is created for NMS interested to develop an initial expertise in limited-area NWP by operating a selection of common codes of the Consortium. It is recognized that this can be achieved only with assistance from one or several Members, and in general as part of a project offering opportunities for funding the assistance work.

155. Associate Members will be given the opportunity to install at their premises a configuration of the common codes containing only the forecast model (dynamical adaptation mode).

156. A specific licence of the common codes will be created for the Associate Members, following the rules of Article 10.

157. The status of Associate Member will not be limited in time. However, it is expected that some Associate Members will develop their expertise up to a sufficient level to become Member, and will then follow the usual procedure to do so.

158. The status of Associate Member can be terminated in case of misbehaviour of the Associate Member (for instance, not respecting its obligations as outlined in the Licence).

159. Any Member being approached by a potential Associate Member will inform without delay the other Members and explore options to share the assistance work.

160. The formal decision to accept an Associate Member will be taken by the Assembly, by a vote at unanimity. The proposal submitted to the vote must be explicit on the breakdown of the assistance work between Members, other actors if any, and on the funding scheme.

161. The approval of ECMWF must also be obtained for each particular Associate Member.

162. In case several Members of groups of Members would like to enter in competition to assist the same Associate Member via a competitive funding scheme, the Consortium will not attempt to restrict or bias this competition.

Article 13: Liability

163. Each Consortium Member or acceding Member is not liable to the other Members and acceding Members for damage or injury attributable to the execution of its responsibilities under this MoU.

164. Each Member or acceding Member will bear itself the cost of compensation for damage or injury of any kind suffered by its personnel or property within the framework of the execution of this Memorandum except in case of gross negligence or wilful act.

165. The Members and acceding Members accept no individual or collective responsibility for

damage, financially or otherwise, caused by the use of the common codes or any part thereof, other than those imposed by their respective national laws.

Article 14: Entry into force, Duration, Amendments and Termination

166. This MoU will enter into force on 1ˢᵗ January 2021.

167. This MoU will remain in force for 5 years.

168. Amendments duly recorded in the minutes of Assembly meetings will take effect immediately after adoption by the Assembly. However, the Assembly may unanimously decide to postpone the entry into force of an amendment.

169. After five years, the Members will discuss the renewal of this MoU. Should they not be able to agree on the content of a renewal MoU, the following rules will apply for the further execution of the joint IP generated during the present MoU: (i) all codes created during the present MoU will remain the joint property of all Members; (ii) the Members will be allowed to continue developing and exploiting for their own usage the common codes created during the present MoU, either alone or grouped in smaller consortia, thereby creating divergent branches of the codes; (iii) any distribution of the codes created during the present MoU to third parties will remain subject to the authorization of the Members of the present MoU and of ECMWF; (iv) such authorization will require a vote of the Members of the present MoU, with voting weights identical to those existing at the end of the present MoU, and voting majorities as defined in Article 10.

Article 15: Settlement of disputes

170. This MoU does not generate obligations under International Law. Members hereby agree that this MoU will be executed under the law of Belgium, subject to national laws or regulations of Members which would be contrary to the law of Belgium. This process does not restrict the right of the Members to adopt Court Proceedings according to their national law.

171. In the event of a dispute arising in connection with this MoU, the Members will attempt to settle their differences in an amicable manner under the responsibility of the Assembly. Members may also at any time, without prejudice to any other proceedings, seek to settle any dispute arising out of or in connection with this MoU in accordance with the ICC mediation rules. In this case, the costs of the mediation will be supported by the parties to the dispute.

172. This process does not restrict the right of the Members to adopt Court Proceedings according to their national law.

Signatures

On behalf of NMHS	Position	Signature	On behalf of NMHS	Position	Signature
Météo-Algérie (Algeria)	Director General		ZAMG (Austria)	Director General	
RMI (Belgium)	General Manager		NIMH (Bulgaria)	Director General	
DHMZ (Croatia)	Director General		CHMI (Czech Republic)	Director	
DMI (Denmark)	Director General		ESTEA (Estonia)	Director General	
FMI (Finland)	Director General		Météo-France (France)	Director General	
HMS (Hungary)	President		IMO (Iceland)	Director General	
Met Eireann (Ireland)	Director General		LHMS (Lithuania)	Director General	
DMN (Morocco)	Director		KNMI (Netherlands)	Director General	
Met Norway (Norway)	Director General		IMGW (Poland)	Director	
IPMA (Portugal)	President		Meteo Romania (Romania)	Director General	
SHMU (Slovakia)	Director General		ARSO (Slovenia)	Director General	
AEMET (Spain)	President		SHMI (Sweden)	Director General	
INM (Tunisia)	Director General		TSMS (Turkey)	Director General	

Signed on 27 November 2020

Annexes

Annex I: Agreement concerning the access and use of IFS-ARPEGE codes

**AGREEMENT
BETWEEN ECMWF & METEO-FRANCE
FOR THE ACCESS AND USE
OF THE JOINTLY DEVELOPED AND MAINTAINED NWP SOFTWARE
IFS/ARPEGE**

*As amended by the Council at its 65th session (July 2006)
Entry into force of the Agreement on 19 February 1999*

Considering:

- the successful joint project for the development of the IFS/ARPEGE NWP software that has been continuing since 1987,

- the history of the ALADIN project that has been continuing since 1991 and has developed successfully IFS-ARPEGE software integrated limited area versions,

- the history of the HIRLAM project that was initiated in 1985,

- the convergence process of the ALADIN and HIRLAM consortia, including the fact that both consortia share codes based on IFS/ARPEGE NWP software,

- the need to protect the software as developed by both projects against any unlicensed distribution and/or any unauthorized use and application,

- the interdependence of some ECMWF IFS applications and some ARPEGE developments,

- the concurrence of ECMWF and Météo-France for the promotion of ECMWF medium- and long- range NWP products,

- the interest of the IFS/ARPEGE partners to benefit from the contributions of the ALADIN and HIRLAM communities on outstanding NWP issues that may be beneficial both to synoptic- and meso-scales weather forecasting,

- the "Rules governing the distribution of ECMWF …… and Software adopted by ECMWF Council at its 51st session (December 1995) and, most recently amended by ECMWF Council at its 82nd session (July 2014),

- Annex 1 as list of those parts of the IFS/ARPEGE software that are recognized as developed mainly by Météo-France and by the ALADIN and HIRLAM partners and judged strategically important by Météo-France,

- Annex 2 as list of those parts of the IFS/ARPEGE software that are recognized as developed mainly by ECMWF and judged strategically important by ECMWF,

- Annex 3 as list of those parts of the IFS/ARPEGE software in which third parties have proprietary rights,

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- the participation to the decisions of the Council of ECMWF by several partners of the ALADIN and HIRLAM projects which are also Members or Cooperating States of ECMWF and in particular their possibility of stating their position in respect of possible co-operation agreements between ECMWF and third parties outside Member- or Co-operating States,

ECMWF and Météo-France have agreed the following:

Article 1

Access to the IFS/ARPEGE Software

Any ECMWF Member State or Co-operating State is granted access to the IFS/ARPEGE software without restriction.

For the access of any non-Member State or non-Cooperating State of ECMWF to parts of the IFS/ARPEGE software listed in Annex 1, the agreement of Météo-France, which will not be unreasonably withheld, is required.

The access by HIRLAM and ALADIN partner National Meteorological Services (∗), that are not from Member States or Cooperating States of ECMWF, to those parts of the IFS/ARPEGE software necessary for a potential extension from global to LAM research and operational applications, and including those listed in Annex 2, is granted without restriction provided that such parts will not be used to run routinely a global model/data assimilation system. A corresponding exchange with ECMWF in terms of scientific results via Météo-France is implied.

Access to those parts of IFS/ARPEGE listed in Annex 2, not covered by other paragraphs of this article, will be subject to the agreement of ECMWF.

Article 2

Use of the IFS/ARPEGE software

Any use by any third party of the IFS/ARPEGE software not including those parts listed in Annex 1 is only subject to the ECMWF Rules.

Any use by an ALADIN or HIRLAM partner of the IFS/ARPEGE software not including those parts listed in Annex 2 is only subject to the Météo-France policy.

The use of the IFS/ARPEGE software by the National Meteorological Services of countries which have not yet adhered to the ALADIN or HIRLAM projects at the date of signing of this agreement are subject to the ECMWF permission, which will not be

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*Algeria, Poland and Tunisia

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unreasonably withheld and that may depend on a decision by the ECMWF Council. A corresponding exchange with ECMWF in terms of scientific results via Météo France is implied.

Article 3

Communications

Communications about access to, maintenance,development and use of IFS/ARPEGE software by ALADIN and HIRLAM partners shall be conducted with and through Météo-France and not directly between those partners and ECMWF.

Article 4

Third Party Code

If either party wishes to introduce code, which contains third party proprietary rights into the IFS/ARPEGE software, it will seek the agreement of the other party; identify the code in Annex 3 and ensure that there are no restrictions on the continuing access to and use of the modified IFS/ARPEGE software by the parties and the ALADIN and HIRLAM partners.

Article 5

Intellectual property rights

For the avoidance of doubt it is hereby expressly declared that nothing in this agreement can be interpreted to imply the transfer of any intellectual property rights.

Article 6

Annexes

Annex 1 and Annex 2 to this agreement may be modified by mutual consent of ECMWF and Météo-France from time to time as deemed necessary.

Article 7
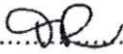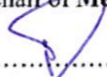
Termination

This agreement can be terminated at any time by written agreement of both parties.

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Article 8

Arbitration

In the event of a dispute arising in connection with this Agreement, the Parties should attempt to settle their differences in an amicable manner. In the event that any dispute cannot be settled, it shall be finally settled under the rules of conciliation and arbitration of the International Chamber of Commerce by three Arbitrators appointed in accordance with the said rules.

For and on behalf of **ECMWF**

Signature.................................

Name...Florence....Rabier......

Position. Director-General.....

Date*.. 21./09./2016.......

For and on behalf of **Météo-France**

Signature.................................

Name ....Jean..Marc...LACAVE

Position.........D.G...................

Date*...........21./03./2016

*The original version of this agreement was signed for and on behalf of both Parties on 19 February 1999.

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ANNEX 1

ANCILLARY PARTS RELATED TO THE VARIABLE-RESOLUTION GLOBAL MODEL GEOMETRY (historically referred to as STRETCHING)

(1) Preparation of model physiographic data (aka configuration '923'): routines listed in the directory "arpifs/c9xx"

(2) Parts of the Full-POS software that are specific to a change of geometry from one ARPEGE configuration to another one, including the TRACARE and TRARECA routines (change of grid with stretching)

(3) Conversion between two ARPEGE variable-resolution geometries in spectral space (TRAGEO software and preparation of the MATDILA, MATCONT matrices)

(4) Parts of the model dynamics and horizontal diffusion that are specific to the variable-resolution geometry (codes conditional to RSTRET>1 or NSTTYP>1)

(5) Semi-implicit scheme option LSIDG=.T.

ALADIN RELATED PARTS

(6) Non hydrostatic code in "arpifs/adiab" under key LNHDYN

(7) Radiative Upper Boundary Condition code (for its part common to ARPEGE and ALADIN

(8) EGGX package in "ifsaux/utilities/eggx.F90" (geometry routines for sub-domain calculations)

DATA ASSIMILATION PARTS

(9) DFI (Digital Filter Initialisation), routines listed in the directory "arpifs/dfi"

(10) CANARI (Optimum Interpolation analysis), routines listed in the directory "arpifs/ canari"

(11) Ground-based radar observation operators and codes for monitoring and screening of radar data (reflectivity, Doppler winds): "arpifs/op_obs/reflsim.F90, reflsim_2dop.F90"

GENERAL MODEL PARTS

(12) ARPEGE/ALADIN/ALARO/HIRLAM Physics Packages called below MF_PHYS (in directory "arpifs/phys_dmn")

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(13) The code defining the physics/dynamics interface, routine CPTEND_FLEX

(14) ARPEGE regularised (aka simplified) physics for 4D-VAR (in "arpifs/phys_dmn")

(15) Input/output server (in directory "arpifs/io_serv") and drivers called from IFS/ARPEGE

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ANNEX 2

VARIATIONAL DATA ASSIMILATION

Definition, computation and minimization of the cost-function for 4D-Var (excluding the parts needed by Canari).
Handling of background term and pre-conditioner.

TANGENT-LINEAR AND ADJOINT CODES

The adjoint and tangent-linear versions of the observation operators and of the forecast model.
The parts needed for the direct version of the codes and the subroutines originally written by MF are excluded as well as the software listed in annex 3 (?).

SCREENING OF OBSERVATIONS

Screening of observations developed at ECMWF, excluding the parts needed by Canari.
All subroutines under SCREEN.

ENSEMBLE PREDICTION SYSTEM

The singular vector computations.

ECMWF PHYSICS PACKAGE

Everything under directory phys_ec.

OBSERVATIONAL DATA BASE (ODB)

Everything in the project odb

VARIATIONAL BIAS CORRECTION AND VARIATIONAL QUALITY CONTROL

All subroutines named varbc_xxxx

BLACKLIST SOFTWARE

Everything under project bl

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ANNEX 3

RTTOV

Developed subject to a specific third-party agreement with EUMETSAT SAF. Distributed under the following copyright:
! This software was developed within the context of
! the EUMETSAT Satellite Application Facility on
! Numerical Weather Prediction (NWP SAF), under the
! Cooperation Agreement dated 25 November 1998, between
! EUMETSAT and the Met Office, UK, by one or more partners
! within the NWP SAF. The partners in the NWP SAF are
! the Met Office, ECMWF, KNMI and MeteoFrance.
!
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RADIATION (RRTM AND SRTM)

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AEOLUS

http://www.ecmwf.int/en/adm-aeolus-level-2b-processor-package-licence-terms

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The European Centre for Medium-Range Weather Forecasts of Shinfield Park Reading RG2 9AX England (Licensor or we);
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which includes computer software, object code, source code, the data supplied with it and any Upgrades

"Owners"   Royal Netherlands Meteorological Institute (KNMI), L'Association
    pour le Developpement des Facultés des Sciences de l' Université de
    Paris (ADFAC), le Centre National de la Recherche Scientifique
    (CNRS), Météo-France (MF) and Deutsches Zentrum für Luft- und
    Raumfahrt e.V. (DLR) and us (ECMWF) the Licensor;

FFTW (use of)

FFTW is called from IFS in tpm_fftw.F90

FFTW is Copyright © 2003– 2016 Massachusetts Institute of Technology.

FFTW means Fastest Fourier Transform in the West, Version 3.3, as further described in M.I.T. Case No. *150541,* by Steven G. Johnson and Matteo Frigo, and related documentation created by or on behalf of MIT.

FFTW is licensed by MIT to ECMWF under a bespoke license, dated 3 February 2016.

The said license gives ECMWF the rights to use, copy, modify, run and reproduce FFTW and to create derivatives of FFTW. ECMWF may also sub-licence these rights.

The said license will last until 2 February 2031, unless terminated earlier, by one party or extended further, by both parties.

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Annex II: Definition of Technical Quality Assurance Procedures

In the context of the Consortium activities, "quality assurance" has been understood under two somewhat different definitions. *Meteorological* quality assurance addresses regular monitoring of the System performance based on objective scores (such as WMO scores) and subjective verification (for instance by feedback from forecasters and users). Specific development of new tools for meteorological quality assurance is part of the Consortium R&D activity, under the general qualification of "quality assurance" or "verification".

In this annex, the focus is on another aspect of quality assurance, namely the one associated with the preparation and definition of new versions of the Common Codes. This validation process can be understood as *technical* quality assurance. A number of agreed guidelines along with specific requested steps for the technical quality assurance of the Common Codes are listed hereafter.

General guidelines (rules):

1. Code contributions must be associated with items of the Consortium Work Plan or be bugfixes. When possible, they should have been referenced well ahead of delivery, as potential contributions to the T-cycles, in the Rolling Work Plan (RWP).
2. Contributions of new developments to the Common Codes are provided as branches based on an agreed common base version, as defined in the central repository of the T-cycles in Météo-France. This base version is the last, most recently declared main T-cycle version[3], unless otherwise agreed with the Integration Leader.
3. Code changes in the Common Codes should abide by the existing coding standards (at the time of writing this note, standards exist for the core IFS/Arpege/LAM FORTRAN and the OOPS/C++ codes).
4. Each team proposing a piece of code must provide human resources for the phasing to the T-cycle (phasing is meant here as the steps of preparation, testing and integration of a new code, see the technical steps below).

Technical specific guidelines (rules):

1. Contributions must have been tested before being proposed for integration. The tests should be done with respect to the agreed shared technical bench tests[4], which form the reference results for technical verification. This testing would likely be done by the developers, possibly with some support by other experts.
2. The specific steps and decisions of the code integration process are under the responsibility of the Integration Leader. Integrating the code contributions will be done by a group of integration experts, complemented by developers (eg. those having proposed significant contributions).
3. Contributions foreseen for a new T-cycle might undergo a peer-reviewing step for code quality (norms, interoperability aspects, scientific description etc.), when this seems

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3   For clarity, the definition of "main T-cycle version" includes both versions common with ECMWF and interim versions, eg. CY47 or CY47T1 likewise

4   Current existing test tools are "mitraillette" and "davaï", developed and maintained by Météo-France

appropriate (note: peer-reviewing is listed here as a best practice, as it may sometimes prove hard to find an adequate peer expert for a review).

4. The definition process of the reference tests, to be run during the integration process, is led by the Integration Leader.

5. The list of reference tests will include unit testing (testing of code components) and testing of integrated components (usually in simplified configurations). It is anticipated that this list will grow with time. Therefore, many specific tests will require that the developers provide and maintain them (this involvement of the developers seems inevitable in order to cope with the expandable size of the test list).

6. In addition, the reference tests will include components of the CSCs, which will be provided and maintained by the CSC teams. The CSC Leaders are expected to liaise with the Integration Leader for this purpose.

7. The code changes prepared in the development branches must not break existing tests (non-regression). When technically possible, code changes should provide bit-reproducible test results, and enable upstream compatibility (input files, namelist files etc.). Changes in specific verification norms (spectral norms, gridpoint norms, TL or AD test results etc.) and the departures from upstream compatibility should be listed, explained and well documented.

8. The proposed code changes should be accompanied by a documentation suitable for the technical memorandum of a new code version. Additional material about scientific and technical evaluation is welcome or can be referenced while delivering a new code.

9. Despite the aimed high level of systematic, unit and integration testing, specific bugs[5] can appear while a given release version is being further tested and during the progressive porting from the T-cycle central repository context to pre-operational local implementation. The corrections, aka "bugfixes", will be provided as updates to the T-cycles in the central repository, and any available appropriate means for informing all Members will be used (web forum, e-mails etc.).

Management level for each decision in the integration/phasing/technical QA process:

1. The content and timing of any T-cycle is ultimately the responsibility of the Integration Leader (link with IFS/Arpege and ECMWF), after consultation with the Management Team (PM, Area Leaders, CSC Leaders).

2. The Area Leaders and the CSC Leaders list the suggested contributions for an upcoming new cycle. They provide their suggestions to PM and Integration Leader.

3. The list of suggested contributions will be reviewed and discussed at the Management Group meetings.

4. The contributions will be prepared and processed for integration, following the General and the Technical Guidelines listed above. Any violation of a guideline, or any problematic delay in time, can cause rejection of a contribution. The final decision of rejection lies in the hands of the Integration Leader.

5. Rejected contributions shall be re-discussed by the Management Group. In case of specific difficulties, advice from STAC might be searched (this is a step under the responsibility of the PM, in coordination with the Integration Leader).

6. After all steps of unit, integrated and CSC testing have been completed, a new code release[6] is being distributed under the responsibility of PM and the Integration Leader. The survey of

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5   In software language, a "bug" is a code error causing a crash of the program, or causing wrong results

progress of installation in Members Institutes is done by the Coordinator for Network Activities.

7. Information about bugs, problems encountered during local installation are expected to be sent to the Coordinator for Network Activities, with copy to the Integration Leader and the CSC Leaders.

In addition to the above guidelines and rules, the Consortium Members agree on the following working practices:

1. The R&D and code work on scientific innovation usually takes a longer time than the gap between Common Code releases. Therefore, developers may face the issue of porting their developments towards a more recent Common Code base version, while their own work is not yet ripe for integration. This process is usually named "forward phasing" and is *under the responsibility of the developers*, or teams of developers who work on the corresponding code. The Integration Leader, in coordination with the Management Group, may ask contributors to perform forward phasing for the planned code contributions in the RWP.

2. The steps of technical quality assurance, described in this Annex, likewise apply to the build of any new, joint Common Code version with ECMWF. The major practical difference between an IFS/Arpege joint cycle (eg. CY47 or CY48) and a MF/LAM-partners joint cycle (eg. CY47T1) is that, in the former, there would be no specific scientific contribution, apart from merging a code version from ECMWF (eg. CY47R1) with a code version from the MF central repository (eg. CY47T1). It is being stressed that the LAM configurations are being technically evaluated in both types of cycles. The Consortium Members agree to provide resources for the construction of ECMWF joint cycles, as part of their overall manpower commitment for maintenance.

3. Porting of any release version, from the T-cycle central repository context to local, pre-operational implementation, is done by each Member or Group of Members. The associated testing and validation efforts, including the local meteorological quality assurance, are of the responsibility of the Members or Groups of Members.

4. Declaration for Operations of any ported local version remains under the responsibility of the Members or Groups of Members.

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6   The distributed code release usually is called an "export version". It may, in the details, be different from a plain T-cycle labeled in the MF repository. The distributed version will however always have a clear identification in the central repository.

Annex III: List of Members entitled to have lower manpower commitments

The PMs will provide the initial list to the next PAC-HAC meeting.

Annex IV: Terms of Reference of the Policy Advisory Committee

The PAC is convened only when necessary, on request of the Assembly, to review any subject of importance to the Consortium and prepare decisions of the Assembly. Subjects discussed by the PAC may include, among others:

- Negotiation of strategic collaboration agreements, based on negotiation mandates defined by the Assembly

- Issues on the IP of codes

- Relations with emerging countries

- Issues on code licensing or any unforeseen use of the codes

- Amendments proposed to the present MoU

PAC Members are tasked to consult among the grouping of Members they represent, in order to acquire a broad vision of the diversity of points of view, interests, constraints and aspirations of Members. PAC must consider the legal regulations of the Members.

The PAC reports its conclusions to the Assembly, generally under the form of recommendations. These recommendations shall be decided by consensus of all PAC members. Whenever the opinions of the Members discussed at the PAC session are not amenable to consensus, the PAC should report all presented opinions.

Annex V: Terms of Reference of the Scientific and Technical Advisory Committee

The STAC reviews annually the progress of the Consortium, based on reports by the PM on the realisation of the manpower commitments of Members and acceding Members, and the achievements of the RWP actions.

The STAC reviews annually the RWP proposed by the Project team, and the commitment of manpower by Members and acceding Members, as presented by the PM.

The STAC reports its conclusions to the Assembly, generally under the form of recommendations. These recommendations shall be decided by consensus of all STAC members. Whenever the opinions of the Members discussed at the STAC session are not amenable to consensus, the STAC should report all presented opinions.

From time to time, the STAC reviews the Strategy of the Consortium and advises the PM and the Assembly on this matter.

STAC Members are tasked to consult among the grouping of Members they represent, in order to acquire a broad vision of the users opinions, on-going developments, and progress of the scientific basis of NWP.

Annex VI: Terms of Reference for management and support team positions

Programme Manager

The PM reports to the Assembly and has authority on the Project and Support teams.

The PM leads the Management Group and chairs its meetings. He/she can propose to the Assembly to reorganize the Management Group, Project team and Support team in order to increase efficiency.

The PM establishes appropriate consultation and interaction mechanisms with the Members, via the LTMs, in order to enable smooth coordination and resolve day-to-day difficulties.

The PM leads the preparation of the RWP and any Strategy document by the Management Group and makes the necessary arbitrations between members of the Management Group. During this process, the PM has authority to exclude an item from the RWP if he/she feels that it is too far from priorities previously adopted by the Assembly.

The PM manages the Consortium budget with the help of the Scientific Secretary.

The PM monitors the human resources committed and actually delivered by Members, via the manpower register regularly updated by the Scientific secretary.

The PM attends all sessions of the governance bodies and the annual workshop of all staff . He/she formulates, with the help of the Scientific Secretary, the agenda proposals for these meetings.

The PM produces with the help of the Management Group and the Scientific Secretary all preparatory documents for the above meetings.

During the sessions of the governance bodies, the PM usually presents and comments the preparatory documents. He/she may delegate some of these presentations to other members of the Project team.

The PM draws the attention of the governance bodies to any discrepancy between the manpower register and the progress of the RWP. More generally, he/she draws the attention of the governance bodies to any difficulties hindering the progress of the Consortium objectives.

The PM regularly reviews the status of contributions to the T-codes and reports to the Assembly as appropriate.

The PM prepares and negotiates any co-operation agreement, taking into account guidelines from the Assembly, and the advice of designated committees.

More generally, the PM strives to implement any decision or action required by the Assembly.

Consortium Scientific Secretary

The Scientific Secretary assists the PM in all matters, in particular:

- Preparation of the agenda and logistics aspects of sessions of the governance bodies
- Preparation of documents for these meetings and minutes of these meetings
- Annual updates of the RWP and manpower register

- Agenda and logistics of the annual workshop of all staff
- Newsletter and Website of the Consortium
- Collection of the Membership fees, preparation of the budget and transfer of funds to Members to realize agreed actions

Management Group

The Management Group (MG) is chaired by the PM and has the collective responsibility to plan the work of all staff working for the Consortium and to utilise the available competences in the most efficient way. The MG is responsible for the formulation of the RWP and monitors its execution (deliverables). It also prepares the medium-range strategic plan.

Integration Area Leader

The Integration area leader mission is to implement the highest possible standards for sustainability, efficiency, technical interoperability and upstream compatibility of the common codes, and of their usability by the Members.

He/she proposes the appropriate organization and tools to achieve this mission, with a view of maximizing the synergy between the CSCs, increasing their interoperability and ultimately reducing their number.

He/she implements any decision regarding the above objectives under the authority of the PM.

The Integration area leader attends all meetings of the MG.

The Integration leader supervises the process of integration of new codes (described in Annex II). He/she can propose an evolution of this process to the MG. During integration phases he/she regularly informs the MG on progress and difficulties, and proposes modifications to the content of the new cycle if needed. The Integration Leader has the final technical authority on the content of the central code repository, in coordination with the PM. For his/her task, he/she will strive to ensure the following scientific and technical goals:

- Ensure the consistency of the code contributions for any given new code version
- Ensure the consistency of the code contributions with the IFS/ARPEGE codes
- Preserve the integrity of the IFS/ARPEGE System.
- Conversely, he/she will take into account the impact of the IFS/ARPEGE code evolution on the consistency and the integrity of the System

The Integration Leader may ask for assistance to other members of the MG or to specific Project team members, as required on behalf of the needed expertise or origin of a development.

Area Leaders

The Area Leaders[7] (see item 106-i and 106ii) are responsible of implementing item 31 and :

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[7] The initial list of Area Leaders positions and roles has been agreed at the Joint GA/HC meeting in June 2020 and is presented in another document.

    i.   whenever possible, lead the corresponding area, that is define a long term scientific and architectural vision for the modernisation of the code, including normative aspects, increased modularity and interoperability and take full responsibility of the delivery or the corresponding developments,

    ii.   or otherwise, conducting specific actions on CSC interoperability, as decided by the Assembly and for a limited duration.

Area Leaders are not responsible for the specific implementation of the scientific developments in each CSC, that remains the responsibility of the CSC leaders.

The intention is to generalise the situation (i) with time.

The Area Leaders provide input for all documents prepared under the responsibility of the PM for the governance bodies.

The Area Leaders also contribute to the preparation of the Strategy documents when needed.

The Area Leaders may be called by the PM to make presentations to the governance bodies in their area of expertise.

The Area Leaders attend meetings of the MG when their area of expertise is needed. For their evaluation of scientific novelty and implementation in the common codes, they will take into account the desired synergies between the three CSCs, their interoperability and ultimately reduction of number.

CSC Leaders

The CSC leaders are responsible for the regular progress of their respective CSC, including short-term developments, code engineering and quality assurance.

To this effect, they lead their respective CSC team.

They attend all meetings of the MG.

They regularly inform the MG of the list of entries to the T-codes proposed by their CSC team (including names of developers responsible for the delivery of documented branches containing modifications). They take part in discussions of the MG concerning the content of future cycles. Once this content has been agreed, they decide which of the modifications included in the next cycle will be used by their CSC. During the integration process of code modifications into a new version of the T-codes, they may be tasked by the Integration Leader with specific actions (link with developers, advice on any technical issue, etc.).

The CSC leaders also maintain a permanent contact with the Members using this CSC to monitor its technical and meteorological performances. They maintain a list of both technical and meteorological quality weaknesses to help all Area Leaders with RWP planning. With the help of CNA and Area Leaders, they also care about the scientific and technical documentation specific to the CSC.

Coordinator for Network Activities

The Coordinator for Network Activities shall assist the PM and the Integration and System leaders in the following tasks:

- Preparation and chairmanship of the LTM meeting and the coordination of actions to be

taken by the LTMs

- Supervise changes in the preparation of input files necessary for the Members, in order to run local versions of the System (for example: coupling files, climatological files)

- Coordinate the tests of new versions of the System: help on the local installation, distribute the needed technical tasks among the Members, ensure relevant technical information is made available among Members

- Participate in MG meeting when needed

Local Team Managers

The mission of the LTM function is to liaise between the Project team and the Members, including the following tasks:

- Help the MG to elaborate the RWP by proposing contributions from the Member in various domains of the RWP, including maintenance and phasing

- Confirm final commitments of manpower from the Member shortly before the Assembly session

- Provide the necessary information about the achievements in their teams to the PM and the MG to write the annual reports.

- Organize the logistics of scientific visits hosted by the Member

- Inform speedily the MG on any difficulties with the committed manpower

- Report quarterly manpower actually delivered to the RWP via the manpower register

- Liaise with the Scientific Secretary regarding the collection of Membership fees and the execution of the Consortium budget

- Inform regularly the MG on the status of operational systems used by the Member

- Collect returns of experience on the operational use of the common codes by the Member and inform the MG regularly on this

- Encourage and monitor the adoption of recent export versions of the common codes by the Member.

- Answer all inquiries from the PM or CNA or CSS.

LTMs should attend at least one of their annual meetings. They may be, on an exceptional basis, represented by a substitute from the same Member.

LTMs offer their full support for the organisation of the annual ALADIN Workshop. At minimum, they should monitor the match between the Workshop's programme and the choice of the attendees from their teams as well as the latter's proposed contributions.

LTMs encourage scientific and technical communications of the work performed at their NMHS, or by their staff remotely. Hence, LTMs should play a role of animation and encouragement towards the scientific and public recognition of the Consortium.

Work Packages leaders

The RWP will be organized in Work Packages (WP) by the MG.

The MG will identify each year the WP and WP leaders. WP leaders will be either members of MG, or members of the CSC management structures, or senior staff working on the RWP. WP leaders will have, in principle, a responsibility to help formulating their WP, lead the execution and report to the MG.

The staff is allocated to each item of the RWP and is reporting to Work Package leaders.

The WP leaders collect proposals of staff for their WP, and discuss these proposals with the staff and with members of the MG.

They monitor the progress of their WP and alert the MG of any difficulty.

Annex VII: Manpower provided by Members since the creation of the Common Manpower Register

Provisional data based on the Common Manpower Register at 30/09/2019, to be updated at 30/06/2020 for the MoU version to be signed in November 2020. The definitive figures from January 2018 until December 2020 will be provided at the first Assembly following the signature of the MoU.

(Manpower reported on the Work Packages of the common Rolling Work Plans only)

Partners	Accumulated manpower on the RWP between 1/1/2018 and 30/09/2019	
	Person.Month	Breakdown
ALGERIA	44.25	1.83%
AUSTRIA	96.5	3.99%
BELGIUM	80.25	3.32%
BULGARIA	12.5	0.52%
CROATIA	67.25	2.78%
CZECH REPUBLIC	129.5	5.36%
DENMARK	62	2.56%
ESTONIA	0	0.00%
FINLAND	55.25	2.28%
FRANCE	984.75	40.72%
HUNGARY	70	2.89%
ICELAND	11.5	0.48%
IRELAND	45.25	1.87%
LITHUANIA	0	0.00%
MOROCCO	42.75	1.77%
NETHERLANDS	104.75	4.33%
NORWAY	87.25	3.61%
POLAND	29.25	1.21%

Partners	Accumulated manpower on the RWP between 1/1/2018 and 30/09/2019	
	Person.Month	Breakdown
PORTUGAL	29.75	1.23%
ROMANIA	39.25	1.62%
SLOVAKIA	84.75	3.50%
SLOVENIA	66.5	2.75%
SPAIN	116.75	4.83%
SWEDEN	88.25	3.65%
TUNISIA	34.25	1.42%
TURKEY	35.75	1.48%
TOTAL	2418.25	100.00%

Annex VIII: ALADIN and HIRLAM legacy codes and repartition of their IP

NB: For each of these codes, the repository where it currently resides will be added before the signature of the MoU.

1) ALADIN legacy codes

The ALADIN "legacy codes" at the signature of the MoU are the following:

- all codes under key LELAM present in the IFS/Arpege codes ("arpifs" directory in the Météo-France central repository of the T-codes), which serve to implement the following main LAM features:
  - hydrostatic Eulerian and semi-Lagrangian Semi-Implicit and Iterative Centered Implicit Spectral time stepping
  - the ALADIN-NH code
  - the codes for the lateral boundary conditions and biperiodisation
  - the codes for the non-hydrostatic versions of vertical finite elements
  - the LAM version of the computation of background error covariance matrices (so-called « B » matrix) : FEMARS, FESTAT, FEDIACOV, FESTABAL
  - the LAM versions of 3D-VAR; the LAM versions of the B matrix code [note: the obs operators are, to a very large extent, shared with the global codes IFS and ARPEGE]
  - single outer loop 4D-VAR codes for LAM, including the TL/AD models, handling of the trajectory fields and scripting
  - the so-called LAMFLAG option in Bator, for observation pre-processing in preparation of ODB files
  - Full-POS for plane projection geometry
  - LAM version of the DDH model diagnostic tool
  - LAM version of CANARI/OI
  - LAM version of configuration 923
  - SLHD (gridpoint diffusion scheme on Semi-Lagrangian stencil)
  - RUBC (Radiative Upper Boundary Condition)
  - LAM version of DFI (Digital Filter Initialization) and SSDFI (Scale Selective DFI)
  - 2D plane vertical model configuration
  - MUSC: 1D model for ARPEGE/ALADIN/AROME with forcing data for several ideal cases: GABLS1, GALBS4, ARMCU, EUROCS, FIRE, RICO, etc ...
  - ECHKEVO, the code for producing model output fields along time steps
  - semi-lagrangian averaging of physics terms for the ALADIN System
  - monitoring of the coupling update frequency MCUF code

- the LAM codes in the "ald" and "tal" directories of the Météo-France central repository of the T-codes, which replace or complement the global IFS/Arpege equivalent codes. Note: these are specific LAM codes for grid point or spectral calculations, necessary to fully implement the list of configurations above. The EGGX package for defining the LAM geometry and grid (in the "ifsaux" directory of the central repository).

- several sets of FORTRAN codes can be considered as LAM-specific scientific codes for implementing the three Canonical Configurations (they are present in the Météo-France central repository of the T-codes):
  - the Méso-NH physics code package used for Arome (Méso-NH is also distributed under open source licensing cecil-c), along with the interface routines ("mpa")
  - the Surfex codes (Surfex is also distributed under open source licensing cecil-c), along with the interface routines ("mse")
  - the Alaro specific physics routines (TOUCANS, ACRANEB2, 3MT and ALARO microphysics)
  - ALADIN physics as a LAM version of ARPEGE
  - the radar data observation operator codes: calculation of the 1D-Bayesian retrievals for RH; radar reflectivity simulator; radial wind operator
  - blending using the DFI, « blend » and « blendsur » codes

- additional sets of codes for LAM in other code libraries <u>available outside the central repository of the T-codes</u>:
  - adaptations done in the OOPS/C++ and in the OOPS/IFS interface routines in order to accommodate for LAM configurations in OOPS (Unit testing, EnVar) [available in a Météo-France repository, expected to be phased to the ECMWF OOPS-IFS repository]
  - specific LAM code for OOPS-based hybrid EnVar (localization, advection, diagnostic tools) according to concepts developed in Météo-France (Desroziers, Arbogast, Berre 2016) [same location as item above]
  - LAM geometry was added to ATLAS [ATLAS repository in ECMWF]
  - OULAN pre-processing code for non-BUFR observation file formats [Météo-France "oulan" repository]
  - the radar data pre-processing code HOOF
  - OPLACE specific routines TuneBR and Obstool
  - GMKPACK for building executables [Météo-France]
  - the EpyGrAM Python library (EpyGrAM is also distributed under open source licensing cecil-c) [Météo-France]
  - the « mitraillette » and « davaï » scripting codes used for technical validation (technical quality assurance) [Météo-France]
  - A/C-LAEF data assimilation and perturbation codes and scripts
  - ancillary tools and codes : chagal, pagb, ascs, acadfa, pstemp, veral, avp, fa_api, Rfa, Rgrib, edf, ecto, frodo, gribeuse, paladin

Scale of IP for ALADIN Legacy codes:

(Provisional data at 30/09/2019, to be updated at 30/06/2020 for the MoU version to be signed in November 2020. The definitive figures until December 2020 will be provided at the first Assembly following the signature of the MoU.

Note also that the table below is not valid for the MesoNH Physics and Surfex codes, which have had contributors outside the ALADIN and HIRLAM consortia.

Partners	Accumulated manpower since 1991 until 30/09/2019	
	Person.Month	Breakdown
ALGERIA	479.50	2.47%
AUSTRIA	1031.75	5.32%
BELGIUM	1446.00	7.46%
BULGARIA	390.50	2.02%
CROATIA	853.50	4.40%
CZECH REP	1664.50	8.59%
FRANCE	7238.50	37.36%
HUNGARY	1212.75	6.26%
MOROCCO	797.75	4.12%
POLAND	630.50	3.25%
PORTUGAL	535.00	2.76%
ROMANIA	780.00	4.03%
SLOVAKIA	861.50	4.45%
SLOVENIA	793.50	4.10%
TUNISIA	424.00	2.19%
TURKEY	237.00	1.22%
TOTAL	19376.25	100.00%

2) HIRLAM legacy codes

The HIRLAM "legacy codes" at the time of signature of the MoU are the following:

- **All codes and scripts pertaining to the HIRLAM model (HIRLAM repository at ECMWF)**

- **For the Harmonie-Arome CSC:** the code resides in more than one repository. The main repository of all Harmonie-Arome Reference System codes (Fortran, scripts, tools) is the

Harmonie repository (henceforth designated H) at ECMWF. Scientifically mature and technically validated Fortran codes are also ported to the Toulouse (T) repository. The Harmonie git repository has the same setup as the Toulouse repository for Fortran codes, but has an additional part for scripts and tools. At the time of establishing this Annex, several substantial and mature code developments which presently reside in Harmonie development branches (HD) are being prepared for inclusion in a new full Harmonie release (Cy43h2.2). They will be prepared then for forward phasing with the aim to include them in Cy48T1 (FP48T) in the remainder of the year 2020.

- Data assimilation and use of observations
  - Software for preprocessing and quality control of OPERA radar data (PrepOpera (H, T)), Mode-S data (H, T), and slant delay GNSS data (HD; the specific code adaptations for slant total delay GNSS necessary for phasing to CY43T2_bf.10 is considered as common to ALADIN-HIRLAM as this was a joint effort).
  - Observation operators for superobbing of scatterometer data and for slant delays (H)
  - Software to perform superobbing and supermodding of various types of remote sensing data (H, FP48T)
  - multiple outer loop 4D-VAR codes for LAM, including codes required for enabling the multi-incremental steps, a weak constraint approach, handling of a large extension zone and handling gridpoint Q (HD, FP48T)
  - Hybrid EnVar development branch, according to concepts developed in HIRLAM (Gustafsson, Bojarova and Vignes 2014) (HD, FP48T)
  - LETKF development branch (HD)
  - Schemes for nowcasting approaches within a variational assimilation framework: cloud initialization (H, FP48T) and field alignment (HD, FP48T)
  - Software for conversion to different geometries, inter/extrapolation (Jbconv) and diagnostics (Jbdiagnose) of background error statistics (H, T)
  - Software to perform large scale mixing into the analysis at the lateral boundaries (LSMIXBC; H, T)
  - Offline surface data assimilation scheme SODA (H, T)
  - TITAN/gridpp software for the preprocessing of crowd-sourced data and for horizontal spatialization in the surface analysis (open source, https://github.com/metno/titanlib, https://github.com/metno/gridpp)
  - Software to assess sensitivity of analysis and forecast model to observation types (DFS, MTEN: H)
  - Scripts for continuous (overlapping window) assimilation (H scripts)

- **Forecast model**
  - Routines and options the dynamics setup used in Harmonie-Arome, including SETTLS, upper boundary nesting and vorticity de-aliasing (H, T)
  - Code for using higher-order truncation in the dynamic spectrum (cubic, quadratic and super-linear grids; H, T)
  - Routines for, and options in, physics schemes specific to Harmonie-Arome (EDMF-M shallow convection (H, T), statistical cloud scheme (H, T), HARATU turbulence (H, T), HIRALD radiation (H, T), OCND2 (H, T), aerosol-related options (HD, FP48T))
  - Harmonie-Arome specific diagnostics/postprocessing (H)
  - Contributions to Surfex (available in H, Surfex repositories): FLAKE lake model, MEB multiple energy model, subgrid-scale parametrizations for radiation and turbulence,

multiple budget model, SICE sea ice patch option in force-restore soil scheme
  ◦ Lake database and lake depth database (H, Surfex, available also via Flake site)

- **Ensemble forecasting**:
  ◦ Routines for the generation of ensemble perturbations used in HarmonEPS (e.g. SPP for Harmonie-Arome parametrizations, Brand perturbations in background error, PertCMA observation perturbations: H, T, FP48T)
  ◦ Ensemble calibration software (H, T)

- **Scripts and tools**: all in H-repository
  ◦ scripts for the configuration, compilation, scheduling, running, monitoring and postprocessing of suites and/or experiments of Harmonie and HarmonEPS (including the COMEPS approach of combining lagging and continuously updated controls on overlapping assimilation windows).
  ◦ the MakeUp tool for building executables
  ◦ the GL tool for field interpolation and postprocessing
  ◦ the Monitor package for routine verification against in-situ observations
  ◦ the Obsmon tool for visualization and quality monitoring of observations
  ◦ Harmonie Testbed infrastructure at ECMWF
  ◦ MUSC testbed infrastructure at KNMI

Scale of IP for the HIRLAM legacy codes:

Partners	Breakdown
DENMARK	10%
ESTONIA	10%
FINLAND	10%
ICELAND	10%
IRELAND	10%
LITHUANIA	10%
NETHERLANDS	10%
NORWAY	10%
SPAIN	10%
SWEDEN	10%
TOTAL	100.00%

Annex IX: Template of the Research Licence

License to use for non-commercial research the computer codes of the shared ALADIN-HIRLAM numerical weather prediction system

Considering that:

- The ALADIN and HIRLAM consortia, composed of national meteorological services of Europe and Northern Africa[1], jointly develop computer codes for numerical weather prediction on limited area domains under the generic name "shared ALADIN-HIRLAM system";
- The shared ALADIN-HIRLAM system also utilizes parts of the IFS-Arpege software jointly developed by Météo-France and ECMWF, including some codes provided by third-parties;
- Météo-France is a Member of the ALADIN consortium and an Associate Member of the HIRLAM Consortium;
- Codes owned by ECMWF are generally accessible to the Member and Cooperating States of ECMWF ;
- Météo-France has concluded with ECMWF an "IFS-Arpege agreement" that regulates the access to and use of ECMWF software by Members of the consortia who are not Member or Cooperating States of ECMWF and lists the rights of use of codes provided by third-parties;
-The ALADIN and HIRLAM consortia have signed a cooperation agreement that allows each Member of either consortium to license the shared codes to academic institutions of their home country for non-commercial research of interest to weather services;

The undersigned:

- NMSxxx, Member of the ALADIN (HIRLAM) Consortium, referred hereafter as "the Licensor", represented by xx Director
- XXXXXX, referred hereafter as "the Licensee", represented by yy, Director

Agree to the following:

1. The Licensor grants the Licensee access to computer codes of the shared ALADIN-HIRLAM system needed to conduct research in relation with project "XXXXX" described in the Annex.
2. This license is valid from xxxxx to yyyyy (period of three years maximum)

Obligations of the Licensor
3. The Licensor warrants that the list of codes provided to the Licensee include only parts owned by either Consortia, or codes of ECMWF, Météo-France or third-parties allowed by the IFS-Arpege agreement between ECMWF and Météo-France.
4. The Licensor will send to ECMWF, Météo-France, the ALADIN General Assembly and the HIRLAM Council a copy of the present License Agreement and of the list of codes provided to the Licensee.
5. The Members of the ALADIN and HIRLAM consortia do not guarantee the correctness of the licensed codes in any sense, nor do they accept any responsibility for their maintenance or updating.
6. The Members of the ALADIN and HIRLAM consortia accept no responsibility for damage, financially or otherwise, caused by the use of any part of the licensed codes.

7. The Licensor will provide assistance to the Licensee for the initial installation of the code and the resolution of technical problems encountered, within reasonable limits.

Obligations of the Licensee

8. The licensee shall not have access to the original repository of the shared ALADIN-HIRLAM system, but to separate authorized copies of the codes that he will keep under its own responsibility.
9. The Licensee shall not pass on or sell the codes licensed to him under this agreement to any third party.
10. The Licensee shall not distribute or sell meteorological or climatological products based on outputs of the codes licensed to him under this agreement. The only exception is a posteriori distribution of products in scientific publications that are the normal outcome of research activities.
11. The Licensee shall not use any part of the licensed codes for any activity outside of project XXXXX.
12. All results of research carried out with the licensed codes will be made available to the Members of the ALADIN and HIRLAM consortia, with appropriate rights to use such results. A copy of the source code of all software developed directly as a result of the research involving the licensed code shall be made available to the Members of the ALADIN and HIRLAM consortia with full, irrevocable rights to use any such software for any purpose.
13. In all publications resulting from research carried out, the origin of the codes shall be acknowledged by the following text: "this work used the shared ALADIN-HIRLAM system, developed and made available by the ALADIN and HIRLAM consortia.
14. The Licensee shall provide annually a brief summary of research carried out in relation to the license agreement.
15. The license is given for an institution, not a specific user. If a specific user at an institution granted access to use the license changes to another institution, he/she must request a license for his/her new institution. The institution given the license will maintain it rights and obligations as Licensee under this agreement even if a specific user changes to another institution.

In case of non-respect of the Licensee obligations, the Licensor is entitled to terminate this license agreement without notice and require that the Licensee destroy the codes.

Any dispute concerning this license, its validity, its interpretation or any circumstance in connection therewith shall be solved amicably if possible. An arbitration panel consisting of one member from each of the parties shall be formed and shall propose a settlement of the dispute. In case an agreement cannot be found by the arbitration panel, the parties agree here that any further dispute regarding the License or use thereof shall be governed by the national law of the home country of the parties.

Made on (date)

For the Licensor   For the Licensee

(signature)   (signature)

Annex: One-page description of the research project XXXX undertaken by the licensee

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[1] The Consortia are currently composed of the NMSs of Algeria, Austria, Belgium, Bulgaria, Croatia, Czech Republic, France, Hungary, Morocco, Poland, Portugal, Romania, Slovakia, Slovenia, Tunisia, Turkey (ALADIN), Denmark, Estonia, Finland, Iceland, Ireland, Lithuania, Netherlands, Norway, Spain, Sweden (HIRLAM)

Annex X: Template of the Benchmarking Licence

License to use for benchmarking or optimization activities the computer codes of the shared ALADIN-HIRLAM numerical weather prediction system

Considering that:

- The ALADIN and HIRLAM consortia, composed of national meteorological services of Europe and Northern Africa[1], jointly develop computer codes for numerical weather prediction on limited area domains under the generic name "shared ALADIN-HIRLAM system";
- The shared ALADIN-HIRLAM system also utilizes parts of the IFS-Arpege software jointly developed by Météo-France and ECMWF, including some codes provided by third-parties;
- Météo-France is a Member of the ALADIN consortium and an Associate Member of the HIRLAM Consortium;
- Codes owned by ECMWF are generally accessible to the Member and Cooperating States of ECMWF ;
- Météo-France has concluded with ECMWF an "IFS-Arpege agreement" that regulates the access to and use of ECMWF software by Members of the consortia who are not Member or Cooperating States of ECMWF and lists the rights of use of codes provided by third-parties;
- The ALADIN and HIRLAM consortia have signed a cooperation agreement that allows each Member of either consortium to license the shared codes to computer vendors for benchmarking or optimization activities;

The undersigned:

- NMSxxx, Member of the ALADIN (HIRLAM) Consortium, referred hereafter as "the Licensor", represented by xx,   Director
- XXXXXX, referred hereafter as "the Licensee", represented by yy, Director

Agree to the following:

1.   The Licensor grants the Licensee access to computer codes of the shared ALADIN-HIRLAM system needed to conduct benchmarking or optimization work as described in the Annex.
2.   This license is valid from xxxxx to yyyyy (period of three months maximum).

Obligations of the Licensor

3.   The Licensor warrants that the list of codes provided to the Licensee include only parts owned by either Consortia, or codes of ECMWF, Météo-France or third-parties allowed by the IFS-Arpege agreement between ECMWF and Météo-France.
4.   The Licensor will send to ECMWF, Météo-France, the ALADIN General Assembly and the HIRLAM Council a copy of the present License Agreement and of the list of codes provided to the Licensee.
5.   The Members of the ALADIN and HIRLAM consortia do not guarantee the correctness of the licensed codes in any sense, nor do they accept any responsibility for their maintenance or updating.

6.   The Members of the ALADIN and HIRLAM consortia accept no responsibility for damage, financially or otherwise, caused by the use of any part of the licensed codes.

7.   The Licensor will provide assistance to the Licensee for the initial installation of the code and the resolution of technical problems encountered, within reasonable limits.

Obligations of the Licensee

1.   The licensee shall not have access to the original repository of the shared ALADIN-HIRLAM system, but to separate authorized copies of the codes that he will keep under its own responsibility.

2.   The Licensee shall not pass on or sell the codes licensed to him under this agreement to any third party.

3.   The Licensee shall not distribute or sell meteorological or climatological products based on outputs of the codes licensed to him under this agreement.

4.   The Licensee shall not use any part of the licensed codes for any activity outside of the benchmarking or optimization work described in the Annex.

5.   The results of the benchmarking or optimization work carried out with the licensed codes will be made available to the Members of the ALADIN and HIRLAM consortia, with appropriate rights to use such results.

6.   At the end of the project, the Licensee will destroy the codes unless a renewal of the license is granted by the Licensor.

In case of non-respect of the Licensee obligations, the Licensor is entitled to terminate this license agreement without notice and require the Licensee to destroy the codes.

Any dispute concerning this license, its validity, its interpretation or any circumstance in connection therewith shall be solved amicably if possible. An arbitration panel consisting of one member from each of the parties shall be formed and shall propose a settlement of the dispute. In case an agreement cannot be found by the arbitration panel, the parties agree here that any further dispute regarding the License or use thereof shall be governed by the national law of the home country of the parties.

Made on (date)

For the Licensor   For the Licensee

(signature)   (signature)

Annex : One-page description of the work undertaken by the licensee

_____

[1]   The Consortia are currently composed of the NMSs of Algeria, Austria, Belgium, Bulgaria, Croatia, Czech Republic, France, Hungary, Morocco, Poland, Portugal, Romania, Slovakia, Slovenia, Tunisia, Turkey (ALADIN), Denmark, Estonia, Finland, Iceland, Ireland, Lithuania, Netherlands, Norway, Spain, Sweden (HIRLAM)