Working Area Physics

Work Plan

Prepared by:	Project Manager Martina Tudor	
Period:	2020	
Date:	16 October 2019	

Main subjects are still listed as in previous LACE physics plans, few related to Surface are added to be in line with ALADIN/HIRLAM/LACE Rolling plan 2019/2020. Two overview tables with different organization but with same content are prepared under "Summary of resources". This plan reflects the actions for the last part of 2019 as well as 2020.

1 Introduction and background

The focus of the research and developing activities inside LACE is to achieve a scale-independent ALARO physics package which allows us to produce operational forecast at the resolution between 10 and 1 km mesh-size. The developments of physics schemes for high resolution gathered into ALARO-1 has been ongoing for more than 7 years. Most of individual schemes have reached the step of the individual tuning and validation; the tuning and further validation of the whole model where these modules interact together is going on.

The operational applications in LACE countries use:

- A baseline version of the ALARO-0 (available in December 2012),

- the first version ALARO-1vA (available in December 2014)

- and also the newest second version ALARO-1vB (available February 2017).

Benefits of the high resolution with the ALARO-1 version are already seen. The goal is to obtain a baseline version of full ALARO-1.

This plan is reflected in the ALADIN/HIRLAM/LACE Work Plan for 2019 and 2020, majority of tasks are under Work Packages PH3 (Development of ALARO physics), some in PH1 (Developments of AROME (and ARPEGE) physics), aim is to contribute to work inside PH4 (Common 1D MUSC framework for parameterization validation), PH5 (Model output post-processing parameters) and HR1 ((Sub)-km configurations and turbulence R&D activity). There are also other Working packages under "Surface analysis and modeling" with contribution from RC LACE countries, SU3 (Validation of existing SURFEX model options for NWP), SU5 (Assess/improve quality of surface characterization) and SU6 (Coupling with sea surface/ocean) now included in this plan. The very high resolution experiments package is also included, although the tasks are shared with the Dynamics area.

2 Goals

The highest priority is to optimize the performance of the LAM for resolutions in the 1 to 5 km range. Quality of simulations can be improved with better representation of clouds, as

they are treated by a combination of different schemes (input to radiation, turbulence). With including of the refinements of the parametrrization of the convective drafts it is expected to achieve seamless solutions across a wide range of horizontal resolutions, including the grey zone of moist deep convection, down to 1km.

Research will continue to enhance the description of physical processes also at sub-km resolutions (study of turbulence at grey zone, two-moment microphysics scheme). Experiments in very fine resolution (with ALARO and AROME) will indicate the problems which should be tackled. Additionally enhanced description of atmosphere-surface link available in SURFEX should be implemented. Better description of the (stable) boundary layer behaviour, low cloudiness, daily cycle of precipitation and convection under unstable circumstances are one of the most wished improvements.

3 Main R&D activities

In 2020 we plan to continue the work on already ongoing topics. Main research activity in the year 2020 is the improvement of the description of cloudiness in various processes and the usage of SURFEX within ALARO-1. Validation of TOUCANS will continue. The first operational suite with ALARO-1vB at 2.3 km horizontal resolution is implemented in Czech Republic. The ALARO-1vB version is recommended for the operational use at various model resolutions. Additionally, some effort will be put to prepare new model output products which will suite to end-users.

Action/Subject: Turbulence scheme TOUCANS

Description and objectives:

The turbulence scheme TOUCANS is integrated into ALARO-1 version. This scheme has many modern options for computation of turbulent fluxes of momentum, heat, water vapour and cloud condensed water. It includes also the description of shallow convection (non-precipitating) (available in the newest version ALARO-1vB). Further validation is still needed to profit from many available options and to update the selected set-up used the operational applications (some options remained the same as in ALARO-0).

Research and developments continue on mixing length computation, some improvements are possible in the shallow convection closure. Verification of wind forecast quality and the improvement wind gust diagnostics are also possible tasks.

Actions in 2020:
- if not finished and validated by the end of 2019, finish and validate check and examine coding of some parts of TOUCANS (still in TOMs part, after code reorganization);
- study and test mixing length computation;
- include TOUCANS into DDH (should be finished before the end of 2019 but some testing and debugging still possible in 2020)

Proposed contributors, Estimated efforts: P. Smerkol (Si), M. Hrastinski (Hr), 5 months (1.5+0.5 month LACE stays)

Planned timeframe: whole year

Planned deliverable: code modification, documentation updates

Action/Subject: **Radiation scheme**

Description and objectives:

Radiation scheme ACRANEB2 is integrated into ALARO-1 versions. Climatological aerosol optical properties can be replaced with those (daily) provided by Copernicus Atmosphere Monitoring Service (CAMS MACC products). Improvements in the cloud-radiation interaction are planed by taking into account better information on cloud cover (see under "Cloud scheme") and (in future) by getting microphysical cloud condensates into radiation scheme.

Parameterization of an impact of cloudiness on broadband surface albedo, which is an important issue for the schemes using single SW interval, can be prepared.

Adaptations to improve also climate simulations can be studied. First step is more efficient computation of clear sky fluxes.

Actions in 2020:
- code, validate and phase efficient calculation of clear sky fluxes in ACRANEB2
- preparation of single precision version of externalized ACRANEB2
- *parameterization of an impact of cloudiness on broadband surface albedo (suitable/waiting for a newcomer)*

Proposed contributors, Estimated efforts: J. Mašek (Cz) 1.5 month, *newcomer, 1 months*

Planned timeframe: whole year

Planned deliverable: code, report

Action/Subject: **Cloud scheme**

Description and objectives:

The objective is unification of the cloud-cover concept within ALARO-1. After careful analysis, it was decided not to aim at a single computation of cloudiness, like for instance in Tompkins (2002), but go for an alternative approach, to build bilateral correspondences and/or combinations for all cases where two parameterisations interact at the level of the cloud-cover definition. For example, in precipitation process combination of stratiform and deep convective cloudiness is used.

An issue is the harmonization of radiative cloud and condensates with the microphysical cloud fraction and prognostic condensates. Presently, the radiative condensates are re-estimated, the 'stratiform' part (contrary to the cloud scheme) does not include phase and mesh size dependencies, the convective condensates are re-estimated from the 'protected' historic convective cloud fraction.

At short term, cloud diagnostic in radiation should be re-tuned, in the spirit to reduce the difference with the thermodynamic adjustment. Relatively small upgrades with respect to current ALARO-1 version are needed. This transversal change is touching many feed-back loops, hence its practical consequences is quite unpredictable.

Recent case studies of winter-type stratocumulus (clouds are not kept) have shown a tendency of the model to remove the sharp gradient at the inversion top. It does not seem to be a priori a problem of the cloud scheme, e.g. when data assimilation restores the gradient, we get clouds. Therefore a more in depth analysis of the processes involved is needed.

Action in 2020:
- analysis of the process involved in dissipation of low clouds in winter situations
- unify the treatment of stratiform cloudiness in radiation and thermodynamic adjustment (modification and testing)
- further steps will be defined according to the outcomes

Proposed contributors, Estimated efforts: R. Brožková (Cz), J. Mašek (Cz), 4 months

Planned timeframe: whole year

Planned deliverable: code modification, testing and validation

Action/Subject: **Microphysics**

Description and objectives:

Current microphysics schemes in AROME are ICE3 and ICE4 (prognostic hail included but not in operational use). Evaluation LIMA scheme is ongoing in AROME. LIMA is a two-moment microphysics scheme, which treats the number concentration of cloud condensation nuclei prognostically, and thus permits a physically more realistic treatment of aerosol-cloud interactions. Scheme was developed within Meso-NH, research version is implemented in AROME.

The implementation of prognostic graupel was done by Michiel Van Ginderachter and Joris Van den Bergh few year ago (within cy38). Bogdan Bochenek phased it into ALADIN code cy43t2, technical and scientific validation should continue and it is expected some tuning inside microphysics is needed.

Action in 2020:
- sensibility tests of the LIMA scheme in AROME
- finish the phasing to the most recent cycle and validation of prognostic graupel computation in ALARO-1

Proposed contributors, Estimated efforts: V. Homonnai (Hu), 2 months (1 month LACE stay **?**), *B.Bochenek (Pl), 1 month OPLACE stay*

Planned timeframe: whole year

Planned deliverable: testing and validation, report

Action/Subject: Operational applications: from ALARO-0 to ALARO-1, SURFEX

Description and objectives:

Currently 3 versions of ALARO physics package are used in the operational applications in LACE countries. Local teams are encouraged to replace the ALARO-0 baseline with the latest ALARO-1 version. Validation and tests of the newest ALARO-1vB version for the (pre-)operational will continue and experiments at resolutions around 2 km shall be performed to see benefits at higher resolutions. Support will be available.

For the model description of the surface/canopy layer and below, the externalized SURFEX framework of coupled models (for snow and ice, lake and sea, urban environment, forest and vegetation, heat and moisture fluxes in the soil etc.) is used ARPEGE and AROME. To profit from latest developments we decided to couple ALARO-1 with SURFEX version 8 which is implemented in the aladin code CY43T2.

In order to be able to use SURFEX with ALARO-1 physics package many issues have to be tackled. Modifications are needed in TOUCANS and SURFEX side (work of Rafiq Hamdi), scientifically consistent transition of ALARO from ISBA surface scheme to SURFEX should be also ensured. Attention must be paid not only to code differences, but also to different file formats and datasets used. Only after we can proceed to more advanced SURFEX options (3 layer scheme, tiling, TEB, ...).

When moving to higher horizontal resolution, the parameterization of orographic shadowing in radiation implemented inside SURFEX (used in AROME) become important. It can be coupled also with ALARO-1vB physics (TOUCANS, ACRANEB2). Validation and sensitivity study of the parameterization of orographic shadowing in radiation with respect to the primary (radiation fluxes, temperature) and secondary (convection, low stratus in valleys, local circulation) effects has lower priority.

Actions in 2020:
- validation and operational use of ALARO-1vB in local applications;
- validation of ALARO-1 coupled with SURFEX ;
- preparations for the SURFEX usage in operational ALARO applications;

Proposed contributors, Estimated efforts: R. Brožková (Cz), N. Pristov (Si), M. Derkova (Sk), M. Hrastinski (Hr), M. Niculae (Ro) ?, M. Dian (Sk), J. Mašek (Cz), S. Tascu (Ro) ?, S.Panežić (Hr); 10 months (1 month LACE stay)

Planned timeframe: whole year

Planned deliverable: report

Action/Subject: **The ALARO-1 version**

Description and objectives:

The current well-tuned ALARO-1 version is ALARO-1vB (ALARO-1vA, plus modified screen-level interpolation, shallow convection scheme in TOUCANS, exponential-random cloud overlaps in radiation and cloud diagnostics, improved sunshine duration and direct solar flux at surface, 10m wind interpolation). This is now the base for further developments. Next step is to assemble the unsaturated downdrafts (an extra extension for the 3MT scheme), prognostic graupel and improved description of cloud cover when available.

In the second stage then all other planed developments; i.e. CSD, TOUCANS evolution, prognostic graupel, unified cloud treatment. CSD stands for the complementary sub-grid draft (research work of Luc Gerard, including both up-

and down- drafts) scheme which enable a more realistic transition from parameterized to explicit convection when going to higher resolutions. Tuning of this scheme in the ALARO-1 environment will be needed.

The validation will be in the range from 5 km down to 1 km. Suitable validation testbeds (common with AROME and ARPEGE) for facilitating cross testing of various parameterizations should be also prepared. Clean comparison of ALARO and AROME can be done with 1D model.

Actions in 2020:
- *testing and tuning of non-saturated down draft inside ALARO-1vB*;
- code cleaning and reorganization, contribution for main code cycle;
- test and improve DDH for ALARO (new cycle noew code structures);
- implementation and validation of 1D MUSC with ALARO;
- comparison AROME/ALARO in 1D model;

Proposed contributors: R. Brožková (Cz), J. Mašek (Cz), B.Szintai (Hu), M.Hrastinski (Hr), 3 months

Planned timeframe: whole year

Planned deliverable: code, report, documentation

Action/Subject: Interfacing physics parameterizations

Description and objectives:

Impact study and validation of the physics-dynamics interface has high priority in ALADIN community (CPDY4). Scientific and practical constrains for redesign of physics interfaces (APL_AROME and APLPAR), which should enable the various physics packages (and also to exchange their individual parameterization schemes) are proposed. Actions are spread among many people, LACE contribution is to adopt ALARO part of computations in APLPAR routine. Radiation scheme in already in proper shape, code linked to turbulence and shallow convection should be analyzed and adopted. Very demanding part on 3MT will follow after.

Action in 2020: Support to phasing TOUCANS scheme will be available.

Proposed contributors: R. Brožková (Cz), P. Smerkol (Si)

Estimated efforts: not planned

Planned deliverable: *code*, *documentation*

Action/Subject: Various products for users (forecasters)

Description and objectives:

Many requests from the user side, mainly forecasters, asking for additional forecast parameters has arrived. For this new features should be coded in post-processing part which would enable output of model fields. Continuation of this topic is foreseen on the base of good experience with enlarged convection diagnostics. The methods for lightening diagnostics have still to be evaluated and final solution should be proposed. Additional diagnostic meteorological parameters can be added: visibility, precipitation type (also wet snow, freezing rain), icing parameter, UV index, snowfall line, computation of real snow height.

Actions in 2020:
- validation implementation of precipitation type diagnostics (with freezing rain);
- further evaluation of lightning diagnostics;
- implementation and evaluation of the visibility computation (for ALARO and AROME);

Proposed contributors, Estimated efforts: J. Cedilnik (Si), C. Wittmann (At), J. Kemetmüller (At), N. Pristov (Si), 6 month

Planned timeframe: whole year

Planned deliverable: code, documentation

Action/Subject: Very Fine Resolution Experiments

Description and objectives:

More and more teams are now able to perform VFR experiments with ALADIN NH-based models (with AROME and ALARO physics, within or without HARMONIE framework).

Few teams have started experiments at higher horizontal resolutions with AROME or ALARO-1 package (to be used also at the kilometric and hectometric scales). Several aspects on high resolution should be investigated (low stratus in valleys, initiation of convection over orography, etc.).

Study of the turbulence in the grey zone (resolved and parameterized description of eddies) will continue. The modification of shallow convection parameterization in AROME allows now to compute the turbulence parametrization scale-adaptively, the subgrid turbulent flux is extinguishing with higher horizontal resolution (100 – 1000 m) as the resolved turbulent flux increases. The effect of this modification is visible but is small and can be only part of final solution for the turbulence treatment in grey zone. Study will continue in direction of quasi 3D turbulence.

Actions in 2020:
- continuation of research on turbulence in the grey zone – currently no manpower
- preparation and validation of VHR model set-up, comparison ALARO-1 (4 km -2 km -1 km), AROME;
- tuning of TOUCANS for the dynamical adaptation for wind – currently no manpower

Proposed contributors, Estimated efforts: J.Cedilnik (Si), M.Hrastinski (Hr), R.Brožkova (Cz), 8 months

Planned timeframe: whole year

Planned deliverable: report

Action/Subject: Usage of SURFEX

Description and objectives:

Various surface schemes are available in SURFEXv8 within cy43, in addition to standards one ISBA, TEB, Flake, also diffusion soil scheme (DIF), multi-layer explicit snow scheme (ES) and Multy-Energy Budget (MEB).

Actions in 2019:
- testing of the individual schemes;
- simulations with the FLake model;
- LAI analysis with SURFEX ISBA-Ags;
- CROCUS

Proposed contributors, Estimated efforts: B. Szintai (Hu), S.Panežić (Hr), M.Ličar (Si), V. Tarjani (Sk), 10 months

Planned timeframe: whole year

Planned deliverable: report

Action/Subject: **Coupling with sea surface / ocean**

Description and objectives:

Currently the sea surface is treated as a boundary condition represented by a rough surface (surface roughness without waves) whose temperature is prescribed from other models and/or analysis. The aim is to explore the benefits of a more realistic sea-atmosphere coupling where the state od sea surface is allowed to evolve with time during the forecast (temperature and waves) through coupling of the atmosphere with an ocean or/and wave model.

Actions in 2020:
- off-line coupling of ocean model NEMO with ALARO
- in-line coupling of wave model WWM with ALARO

Proposed contributors, Estimated efforts: Slovenian team, 8 months

Planned time frame: whole year

Planned deliverable: report

4 Summary of resources (numbers not final!)

Subject	Manpower stays	stays	ALADIN
TOUCANS	**5**	**2**	
Radiation	**1.5**		
Cloud scheme	**4**		
Microphysics	**3**	**1**	**1 (OPLACE)**
ALARO-0/ALARO-1/SURFEX	**10**	**1**	
ALARO-1	**3**		**0.25**
Physics interface	**-**		

MUSC	**1**	**1**	
Additional fields	**6**	**0.5**	
VFR Experiments	**3**		
Usage of SURFEX	**10**	***1***	
Coupling with sea surface / ocean	**3**		
Total:	**59.5**	**4.5**	**2.25+1**

TABLE: LACE contribution to the common ALADIN HIRLAM work plan and stays in LACE countries. (Numbers do not fit!)

ALADIN/HIRLAM/LACE WorkPackage description : PH1

PH1	**Developments of AROME-France (and ARPEGE) physics**		
ViHo	Viktoria Homonnai	OMSZ Hungary	2
ChWi	Christoph Wittmann	ZAMG Austria	1
Task	**Description**	**Participant abbrev.**	**Type of deliverable**
PH1.1	AROME core physics efforts: assess performance of dynamical adaptation versus DA versions, seen from the forecast model point of view, improve wind gust modelling, further improve ICE3/ICE4 especially with respect to forecast of hail, assess the dependence of AROME microphysics to model time step, tests of LIMA with a view on numerical cost versus meteorological performance. Porting of AROME configurations to next MF HPC.	ViHo, ChWi	doc, t-code

ALADIN/HIRLAM/LACE WorkPackage description : PH3

PH3	**Developments of ALARO physics**

Participant Abbreviation	Participant	Institute	PersonMonth or External project
PeSm, NePr, JuCe	Peter Smerkol (2), Neva Pristov (2)	ARSO Slovenia	4
RaBr, JaMa	Radmila Brožkova, Jan Mašek, Filip Savbik	CHMI Czech	20
MaHr	Mario Hrastinski	DHMZ Croatia	3.5
BoBo, PiSe	Bogdan Bochenek, Piotr Sekula	IMGW Poland	2
LuGe	Luc Gerard	RMI Belgium	10
MaDi	Martin Dian (2), Maria Derkova (0.5)	SHMU Slovakia	2.5

Task	Description	Participant abbrev.	Type of deliverable
PH3.1	Radiation scheme – minor improvements	JaMa	doc, t-code
PH3.2.1	TOUCANS scheme – code re-organization, cleaning, debugging	RaBr, JaMa, PeSm (2)	doc, t-code
PH3.2.2	TOUCANS scheme – mixing length computation	MaHr (2.5), RaBr, JaMa	doc, t-code
PH3.3	Cloud scheme	JaMa, RaBr, LuGe	doc, t-code
PH3.4	Non-saturated downdraught	LuGe	doc, t-code
PH3.5	Complementary Subgrid Drafts (CSD)	LuGe	doc, t-code
PH3.6	Microphysics – prognostic graupl	BoBo, RaBr	doc, t-code
PH3.7	Coupling ALARO-1 and SURFEX	NePr (2), DuAk, DaDe, MaDi, JaMa, RaBr	doc, t-code
PH3.8	ALARO-1 validation and maintenance	JaMa, RaBr,	t-code

		MaDe	
PH3.9	Improvement of DDH tool for ALARO	MaHr (1)	t-code

ALADIN/HIRLAM/LACE WorkPackage description : PH4

PH4	**Common 1D MUSC framework for parametrization validation**		
BaSz	Balazs Szintai	OMSZ Hungary	1
PH4.1	Maintain and upgrade “common MUSC” system		
PH4.2	Create and add (idealized) test cases	BaSz	
PH4.3	MUSC training and working days		

ALADIN/HIRLAM/LACE WorkPackage description : PH5

PH5	**Model Output Postprocessing Parameters**		
Participant Abbreviation	**Participant**	**Institute**	**PersonMonth or External project**
NePr. JuCe	Neva Pristov, Jure Cedilnik	ARSO Slovenia	2
AnSi	Andre Simon	SHMU Slovakia	6
MaDe	Maria Derkova	SHMU Slovakia	0.5
ChWi	Christoph Wittman	ZAMG Austria	0.5
ClWa	Clemens Wastl	ZAMG Austria	1
FlWe	Florian Weidle	ZAMG Austria	2.5
Task	**Description**	**Participant abbrev.**	**Type of deliverable**
PH5.1	preparation of a workplan for implementation of selected postprocessing parametersinto the code	all	work plan

PH5.2	implementation of selected parameters into the common code, tuning and validation	FlWe(0.5),ChWi(0.5)	t-code, reports
PH5.3	Model output diagnostics: improvment of new visibility diagnostic, discrimination of precipitation type, lightning diagnostic, convective gust, test nearest point "interpolation" in Full-POS	FlWe(1)	notes, t-code
PH5.4	Model outputs diagnostics for aviation end-users (turbulence, icing index, coud base and top, top of convection, tropopause and jet altitude, thermal vertical velocity for gliders pilot	ClWa(1),FlWe(1)	notes, t-code
PH5.5	Diagnostic fields	NePr, JuCe, ChWi	t-code

ALADIN/HIRLAM/LACE WorkPackage description : SU3

SU3	**SURFEX: validation of existing options for NWP**

Participant Abbreviation	**Participant**	**Institute**	**PersonMonth or External project**
SuPa	Suzana Panežić	DHMZ Croatia	2
BaSz, HeKo	Balázs Szintai (2), Helga Toth Kollathne (2)	OMSZ Hungary	4
StSc	Stefan Schneider	ZAMG Austria	2
MaDi	Martin Dian	SHMU Slovakia	2
JaMa	Ján Mašek	CHMI Czech	1

Task	**Description**	**Participant abbrev.**	**Type of deliverable**
SU3.4	Test DIF in the framework of (S)EKF assimilation of SWI (Soil Water Index) in SURFEX 8.1, combined with AROME CY40/CY43. Validation with SYNOP	StSc	report

	stations.		
SU3.6	Test of FLake in the Hungarian AROME-SURFEX system	BaSz, HeKo	report
SU3.8	Fibrillation issues in ALARO-1 with SURFEX (ISBA)	SuPa (2), RaHa	report, t-code (?)
SU3.9	Validation of ALARO-1 with SURFEX (ISBA), implementation of effective roughness.	MaDi, JaMa	report, t-code

ALADIN/HIRLAM/LACE WorkPackage description : SU5

SU5 Assess/improve quality of surface characterization

Participant Abbreviation	**Participant**	**Institute**	**PersonMonth or External project**
RaBr,JaMa	*Radmila Brozkova, Jan Masek*	*CHMI Czech*	*3*
SuPa	Suzana Panežić	DHMZ Croatia	1

Task	Description	Participant abbrev.	Type of deliverable
SU5.1	ECOCLIMAP activities. ECOCLIMAP cover map, corrections and studying the impact. Corrections mainly for Iceland, Greenland, Svalbard. Correction of sea pixels deep in the continent (Iran, Mongolia). Examining for Croatia and Spain. Studying of urban areas. Improving ecoclimap over china	SuPa	database, reports, documentation, code

ALADIN/HIRLAM/LACE WorkPackage description : SU6

Participant Abbreviation	**Participant**	**Institute**	**PersonMonth or External project**

MaLi, PeSm, AnFe, BeSt, JuCe	Matjaž Ličer (1), Peter Smerkol (1), Anja Fettich (1), Benedikt Strajnar, Jure Cedilnik	ARSO Slovenia	3

Task	Description	Participant abbrev.	Type of deliverable
SU6.1	Code and Technical documentation of coupling process (update for cy43)		
SU6.1.1	Adaptations on atmospheric part ALARO (update for cy43)	PeSm (1)	t-code
SU6.1.2	Adaptations on atmospheric part HARMONIE-AROME		t-code
SU6.1.3	Technical documentation (update for cy43)	PeSm	documentation
SU6.2	Construct cycling with OASIS coupler in cy43	PeSm, JuCe	code (local)
SU6.3	2-way coupling ALARO and POM	BeSt, JuCe, MaLi	report
SU6.4	Ocean model coupled via OASIS		
SU6.4.1	Ocean model NEMO off-line coupling with ALARO	MaLi, AnFe	report
SU6.4.2	Ocean model NEMO coupled with ALARO using SURFEX-OASIS	MaLi (1), PeSm	code/script
SU6.4.3	Evaluation of coupled system ALARO/NEMO	MaLi, BeSt, JuCe	report/paper
SU6.5	Implementation of ocean wave model		
SU6.5.1	Wave model WAM coupled via OASIS in ALARO - techical implementation and validation	PeSm, AnFe(1)	code (local)
SU6.5.3	Coupling and implementation of wave model WWM in ALARO		
SU6.6	Set-up of coupled system ALARO/NEMO/WAM	MaLi, BeSt, JuCe	

ALADIN/HIRLAM/LACE WorkPackage description : HR1

HR1 **(Sub)-km configurations and turbulence R&D activity**

Participant Abbreviation	Participant	Institute	PersonMonth or External project
JuCe	Jure Cedilnik (1)	ARSO Slovenia	1
PeSm	Petra Smolíková	CHMI Czech	1
MaHr	Mario Hrastinski	DHMZ Croatia	1

Task	Description	Participant abbrev.	Type of deliverable
HR1.2	Experiments at sub-km resolutions. Test various horizontal/vertical resolutions using high-resolution surface elevation data (SRTM). Compare Harmonie-Arome at various hectometric resolutions against LES and observations.	JuCe(1)	report
HR1.11	Redesign of the diffusion coefficient used in SLHD and being a monotonic function of the total flow deformation along the terrain-following vertical levels.	PeSm	report, non-t-code
HR1.12	Study of the resolved versus sub-grid turbulent kinetic energy spectra in high resolution runs of ALARO, aiming to redesign the horizontal/vertical diffusion treatment.	MaHr (1), PeSm	report, non-t-code

LACE scientific stays:

- Mario Hrastinski (hr), TOUCANS – mixing length definitions, Prague, 6 weeks,
- Peter Smerkol (si), TOUCANS - code cleaning and validation, Prague, 2 weeks, 1
- Viktoria Homonnai (hu), Sensibility tests of LIMA scheme, Toulouse, 4 weeks, autumn (?)
- Martin Dian (sk), ALARO-1 coupling with SURFEX, Prague, 4 weeks, spring and autumn

- Suzana Panežić (hr), ALARO-1 coupling with SURFEX screen level, Prague, 4 weeks
- Christoph Wittmann (at) , postporcessing variables, Ljubljana, 2 weeks

ALADIN Flat-Rates Stays:

- *Luc Gerard: PH3.3 and PH3.5: update on cloudiness and CSD, 1 week, Prague for the end of 2020?*
- *stays for 2020 not yet determined*

Stay related to OPLACE:

- *not yet defined for 2020*

5 Meetings and events

1) 30th ALADIN Workshop and & HIRLAM All Staff Meeting, Slovenia, 2020
2) 42nd EWGLAM & 27th SRNWP joined meetings, Brussels, Belgium, 2020
3) MUSC working week

6 Risk and constrains

The core team for the ALARO developments is a very small one. Effort and human resources should be increased in order to keep ALARO competitive in operation and climate applications. Candidate interested to work on convection (unsaturated downdraft, CSD) is searched.

It is crucial to continue good collaboration with other ALADIN/HIRLAM partners. Topics from this plan are included in ALADIN/HIRLAM/LACE rolling work plan 2020 in various working packages. Opportunity is cloud working group where LACE scientists could become more active. Everyone can also profit from a coordinated effort on post-processing work to obtain more diagnostic fields for the end-users and from common validation tool for VFR.

One person working on very high resolution AROME has left. There is no area leader for physics.