

### LAM-EPS activities in RC LACE

#### Martin Belluš with contributions of **RC LACE partners**

ROMAN



















### Introduction

Since last EWGLAM huge effort in RC LACE was put into the preparation of new operational ensembles. A lot of technical and validation work was done. Currently, there are three independent systems developed in parallel, however they are very much different in their focus:

- 1. <u>Common RC LACE EPS</u> with 4.8 km horizontal resolution based on ALARO-1 physics running on a big European domain (**A-LAEF**).
- 2. <u>Austrian convection-permitting EPS</u> with 2.5 km horizontal resolution utilizing AROME model on a middle European domain (**C-LAEF**).
- 3. <u>Hungarian convection-permitting EPS</u> based on nonhydrostatic AROME, which is going to replace their former **ALARO-EPS**.











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Limited Area Modeling in Central Europe

## Implementation and testing of A-LAEF under TC user solving cold bias issue







### Implementation and testing of A-LAEF under TC user

#### Cold bias:

- Generally, there is a big discrepancy between the IFS soil/surface moisture fields and those of ARPEGE/ALADIN as well as for the corresponding temperature fields.
- Since the cold start of new A-LAEF was carried out from the IFS ENS boundary conditions, the soil moisture and surface moisture were initially too large and hence the surface temperature cold bias was developed within the several integration hours.
- This undesirable effect should be normally progressively reduced by the assimilation of RH2m (already after several assimilation loops). But it was not, because of null moisture increments!
- Surface moisture assimilation increments are given by the differences between the analysed and predicted T2m and RH2m values following the equation:

$$\Delta w_s = \alpha_s^T \Delta T_{2m} + \alpha_s^{RH} \Delta R H_{2m}$$

- The optimum coefficients for soil moisture analysis are modulated or <u>switched off</u> depending on several meteorological fields like **precipitation**, **cloudiness**, **surface evaporation**:

  - SURFXFLU.MEVAP.E (instantaneous evaporation flux)
    LXSOIL=.T. in NAMXFU
  - SURFXEVAPOTRANSP (instantaneous evapotranspiration)









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### Implementation and testing of A-LAEF under TC user





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  - ATMONEBUL.BASSE (cumulated low cloud cover)
    SURFXFLU.MEVAP.E (instantaneous evaporation flux)
    LXSOIL=.T. in NAMXFU
  - SURFXEVAPOTRANSP (instantaneous evapotranspiration) <sup>4</sup>









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### Implementation and testing of A-LAEF under TC user





### Implementation and testing of A-LAEF under TC user



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### Implementation and testing of A-LAEF under TC user



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#### Implementation and testing of A-LAEF under TC user







# **A-LAEF operational suite under ecFlow**

#### regular runs since end of July

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### A-LAEF operational suite under ecFlow



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equal to LACE domain

### A-LAEF operational suite under ecFlow

A-LAEF integration (and fullpos) domain:

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#### **A-LAEF operational suite under ecFlow**

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lace 🔺	🕕 Info 🕠 Manual 🗐 Script 👫 Job 🚇 Output 🤶 Why 👗 Triggers 🗸 V= Variables 🔗 Edit 🛐 Node log 💋 Zombies
🔻 🔤 laef 🔺	File: /sz1/tcwork/zla/sb/ECF//lae//RUN_00/main/MEM_01/canari.1 Size: 13 KB
LAEF_DATE= 20190821	Source: served by cca-log@51799 (took 3.0 s) at 2019-08-21 15:04:39
▼RUN_00 ▲ ③	[1] SST copy: CTRL_A -> ald_guess (in 2 steps):
time 07:15	+ OK: [/sc1/TMPDIR/zla/JTMP/13/zla.6897847.ccapar.20190821T074140/canari/wrk/tmp1566373578.2
👻 🔤 mars 🔺	+ OK: [/scl/tcwork/zla/lb/LAEF5F/TCC/lae/2019082012/ICMSHCC01+0012] input file ready
👻 🔄 marsens	=> STEPA was CREATED
run: 2019-08-21 00	+ 0K: [/scl/tcwork/zla/lb/LAEF5F/TCC/lae/2019082012/ICMSHCC01+0012] input file ready
status: ICMSH files ready	=> GUESS+SST20190821-00 Was CREATED
error: ok	>[time spent: 00:00:23]
▼ getobs	[2] Get and merge the observations (with filter).
place	=> OBS sub-base: conv
✓ main	+ 0K: [obs short 2019082100.tar]
▼MEM_01	SYNOP: obsoul_1_xxxxxx_hu_2019082100ready
👻 🔤 getlbc	SYNOP: obsoul_1_xxxxxy_sk_2019082100ready
run: 2019-08-21 00	SYNOP: obsoul_1_xxxxxy_at_2019082100ready
status: LBCs for member 01 have been created	SYNOP: obsoul_1_xxxxxy_cz_2019082100ready
error: ok	
tiles: 3	MERGING OBSOULS: (time window is 3600 s)
	=> READING FILE (0): /scl/TMPDIR/zla/JTMP/13/zla.6897847.ccapar.20190821T074140/canari/wrk/t
run: 2019-08-21 00	=> READING FILE (1): /sci/TMPDIR/zla/JTMP/13/zla.689/847.ccapar.20190821T0/4140/canari/wrk/t
	=> READING FILE (2): /sci/imPDIR/zia/JimP/13/zia.689/84/.ccapar.2019082110/4140/canari/wrk/t
sten: 6	-> READING FILE (3): /SCI/INFDIR/ZIA/DINF/IS/ZIA.863/64/.CCapai.2019062110/4140/Canail/Wik/C
./. /getobs == complete and getibc == complete	=> TOTAL RECORDS WRITTEN: 4525
▼ blend	
run: 2019-08-21 00	(!) Number of skipped records due to inconsistent lat/lon: 12
status: Adding ECMWF long wave spec. to ALADIN guess via blend	(!) Number of skipped records due to duplicity: 14
error: ok	
step: 8	=> FINISHED IN: 0 secs
canari == complete	
👻 🔤 laeff	>[time spent: 00:00:00]
run: 2019-08-21 00	
status: INIT:/sc1/tcwork/zla/lb/LAEF5F/TCC/can/2019082100/ICMSHC	[3] Run BATOR (observation preprocessing):
error: ok	+ BLACKLIST was copied
blend == complete	+ DADM file was furly modified
MEM_02	+ LIST GPESOL file was conjed
MEM_03	+ IOASSIGN: /scl/tcwork/zla/lb/BIN/ioassign
▶ <u> </u>	=> BATOR: /sc1/TMPDIR/zla/JTMP/13/zla.6897847.ccapar.20190821T074140/canari/wrk/tmp15663735
MEM_05	=> SHUFFLE is DONE
MEM_06	>[time spent: 00:09:52]
•MEM_07	
• MEM_08	
• MEM_09	Directory listing updated at at 2019-08-21 15:05:45
•MEM_10	Name Path Size Modified (ago) V Modified Source
• MEM_11	canari.1 /scl/trc 13 KB 6 hours ago 2019-08-21 08:29:06 served by cca-log@51799 canari.bu/ scl/trow 38 KB 7 hours ago 2019-08-21 07:41:33 served by cca-log@51799
	canari.2 /sc1/tc.wo 10 KB 35 days ago 2019-07-17 13:25:03 served by cca-log@51799













# A-LAEF operational suite under ecFlow

#### MCS case studies

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### Turkey - Flash floods of 17 August 2019

- Heavy rainfall affected several districts of Istanbul (particularly Fatih, Kartal and Bakirkoy) on 17 August causing widespread flash floods.
- According to media reports, one person died in Fatih District, some houses have been damaged and several streets were flooded leading to significant transport disruptions.



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### Turkey - Flash floods of 17 August 2019



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### **Turkey - Flash floods of 17 August 2019**



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**Turkey - Flash floods of 17 August 2019** 

#### (pre-oper) A-LAEF cloudiness forecast:



#### SURFNEBUL.TOTALE: LAEF ENS MEAN 17/08/2019 00 UTC, +12h, MIN= 0 MAX= 100











**Turkey - Flash floods of 17 August 2019** 

#### (pre-oper) A-LAEF cloudiness forecast:



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### **Central Europe - Night storm of 24 August 2019**

- During the night hours the southwestern part of Slovakia was hit by strong thunderstorms. The total number of lightning strikes was about 15,000 with about 15 to 50 millimeters of rain.
- The thunderbolts also hit the 30-meters flagpole, which had been erected in front of Parliament by Andrej Danko, President of the Slovak Parliament.





Photo: Adam Kováč, 2019.08.24/25, Bratislava

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### Central Europe - Night storm of 24 August 2019



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### **Central Europe - Night storm of 24 August 2019**



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#### **Publications**

#### published and submitted papers

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### **Publications**

#### **Published papers:**

- Belluš, M., F. Weidle, C. Wittmann, Y. Wang, S. Taşku, and M. Tudor, 2019: "<u>Aire Limitée Adaptation dynamique</u> <u>Développement InterNational – Limited Area Ensemble Forecasting (ALADIN-LAEF)</u>", Adv. Sci. Res., 16, 63–68, https://doi.org/10.5194/asr-16-63-2019
- Wang, Y., M. Belluš, F. Weidle, et al., 2019: "<u>Impact of land surface stochastic physics in ALADIN-LAEF</u>", Quarterly Journal of the Royal Meteorological Society, 1–19, https://doi.org/10.1002/qj.3623
- Keresturi E., Y. Wang, F. Meier, F. Weidle, Ch. Wittmann, A. Atencia, 2019: "<u>Improving initial condition</u> <u>perturbations in a convection permitting ensemble prediction system</u>", published on 22 January 2019 in Quarterly Journal of the Royal Meteorological Society, DOI: 10.1002/qj.3473
- Wastl C., Y. Wang, A. Atencia and C. Wittmann, 2019: "<u>Independent perturbations for physics parametrization</u> tendencies in a convection-permitting ensemble (pSPPT)", published on 16 January 2019 in Geosci. Model Dev., 12, 261-273, DOI: 10.5194/gmd-12-261-2019
- Wastl C., Y. Wang, A. Atencia, C. Wittmann, 2019: "<u>A hybrid stochastically perturbed parametrization scheme in a convection permitting ensemble</u>", Mon. Wea. Rev., 147, 2217-2230. doi: <a href="https://doi.org/10.1175/MWR-D-18-0415.1">https://doi.org/10.1175/MWR-D-18-0415.1</a>

#### Submitted papers:

- Wastl C., Y. Wang, C. Wittmann: "A comparison of different stochastically perturbed parametrization tendencies schemes", submitted to Meteorologische Zeitrschrift
- Plenković, I. O., I. Schicker, M. Dabernig, K. Horvath: "Analog-based post-processing of the ALADIN-LAEF ensemble predictions in complex terrain", submitted to Quarterly Journal of the Royal Meteorological Society on August 2019













#### **Future plans** hot topics

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### **Future plans**

#### Hot topics:

- Commencing of the operational utilization of A-LAEF (and local convection-permitting systems).
- Implementation of **new random number generator** (SPG) suitable for LAM EPS environment in A-LAEF 5km.
- Investigation of the possibilities of **stochastic perturbation of fluxes** instead of tendencies. This should be beneficial with respect to the energy balance preservation in perturbed model.
- Preparation of **flow-dependent B-matrix** using the A-LAEF 5km operational outputs.
- Creation of new A-LAEF **probabilistic products** to meet the different users requirements.
- Implementation of A-LAEF 5km Phase II configuration involving ENS BlendVar to improve the simulation of upper-air ICs uncertainty.
- Continuation work on **analog-based post-processing** method to improve the point forecast of high-resolution wind field. Investigation of the possibility to use such method for the ensemble of other surface parameters like T2m or RH2m. Spatial implementation.
- **Calibration of precipitation**. Methodology for post-processing over the river catchments according to the needs of hydrological models.















# Thank you for your attention!

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