

A-LAEF (case study)

Record rainfall in Italy 04/10/2021

Description:

A European record was broken in Northern Italy (Liguria region), where more than 740 mm of rain fell within the 12 hours period on October 4, 2021, causing floods, landslides, and several rivers broke their banks. There was also 178 mm of rainfall measured in just 1 hour (Urbe Vara Superiore), and over 900 mm in 24 hours (Rossiglione).

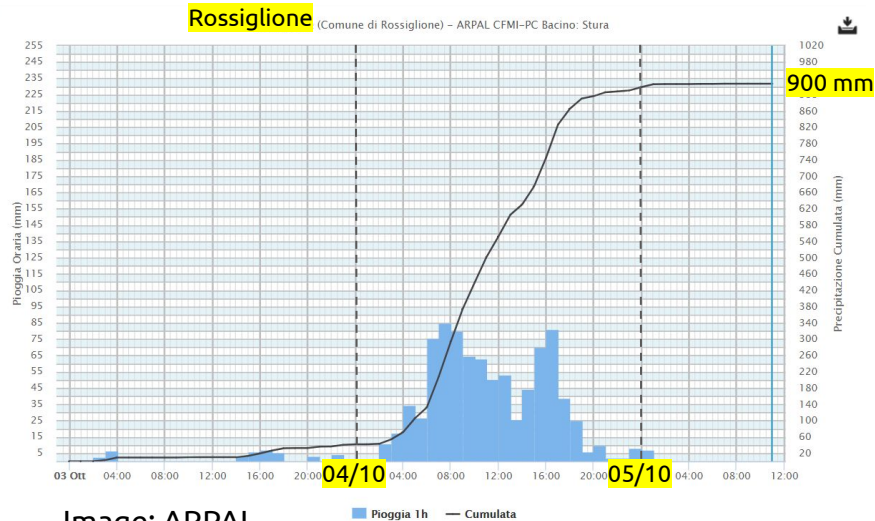


Photo: President of Liguria Giovanni Toti

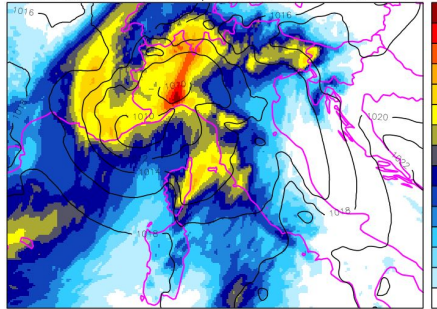
A-LAEF (case study)

Record rainfall in Italy 04/10/2021 - A-LAEF precipitation forecast (24-h accum.) - 24 h ahead

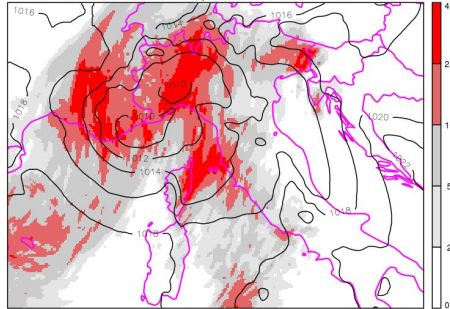
ENS MEAN, SPREAD, MIN and MAX

Probabilities for thresholds 50, 100, 150 and 200 mm

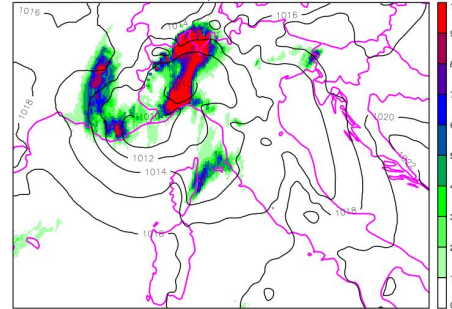
[A-LAEF] PREC [mm] (ENS MEAN) | MAX= 241.9
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



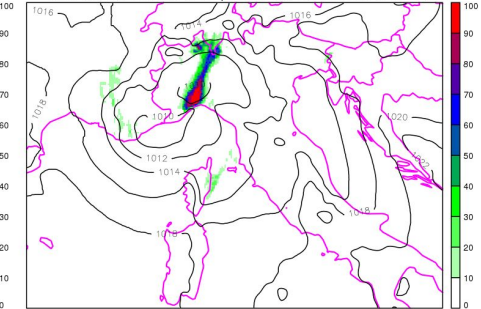
[A-LAEF] PREC [mm] (ENS SPREAD) | MAX= 102.36
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



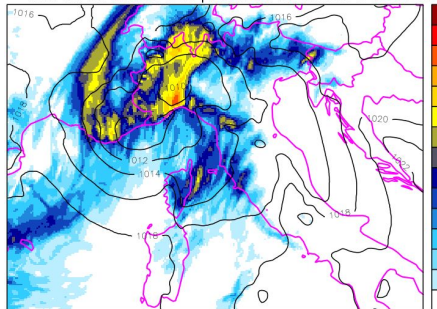
[A-LAEF] PREC Probability [%] >= 50 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



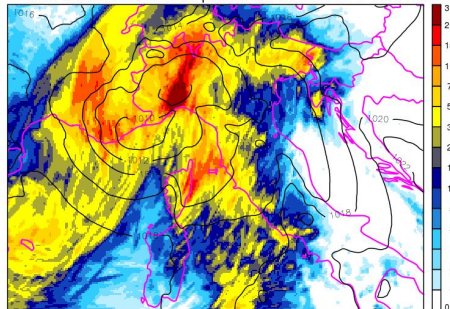
[A-LAEF] PREC Probability [%] >= 100 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



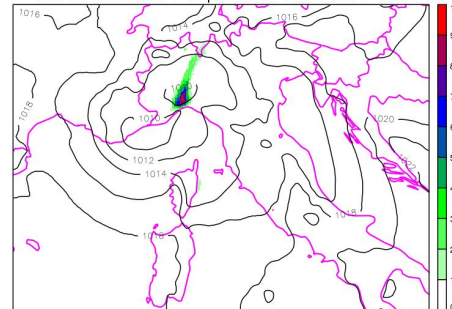
[A-LAEF] PREC [mm] (ENS MIN) | MAX= 138.22
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



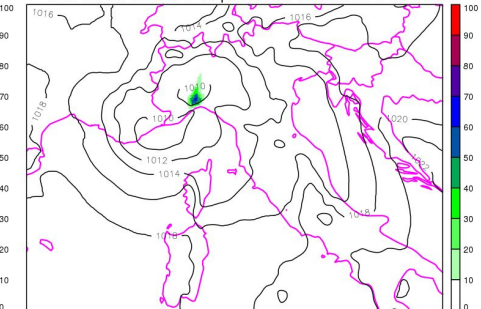
[A-LAEF] PREC [mm] (ENS MAX) | MAX= 501.46
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



[A-LAEF] PREC Probability [%] >= 150 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



[A-LAEF] PREC Probability [%] >= 200 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



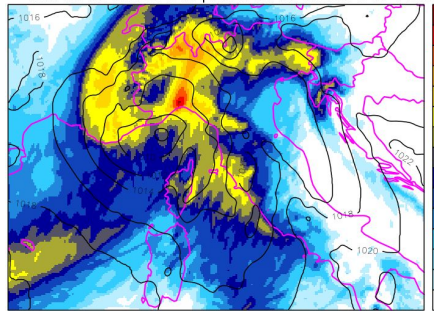
A-LAEF (case study)

Record rainfall in Italy 04/10/2021 - A-LAEF precipitation forecast (24-h accum.) - 48 h ahead

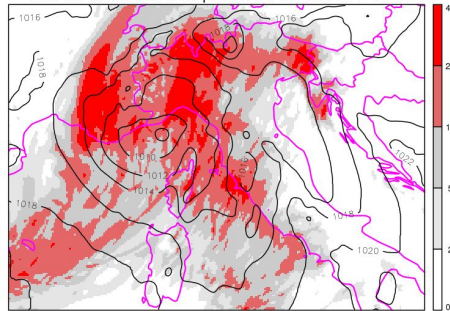
ENS MEAN, SPREAD, MIN and MAX

Probabilities for thresholds 50, 100, 150 and 200 mm

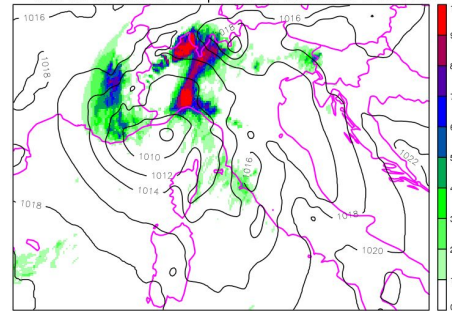
[A-LAEF] PREC [mm] (ENS MEAN) | MAX= 207
run: 03/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



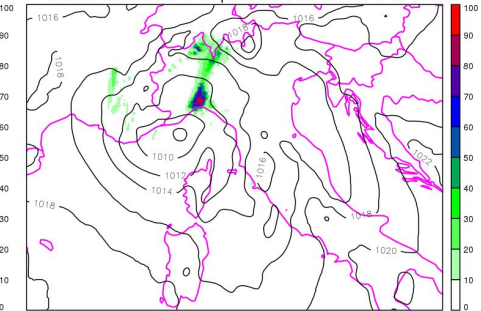
[A-LAEF] PREC [mm] (ENS SPREAD) | MAX= 103.42
run: 03/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



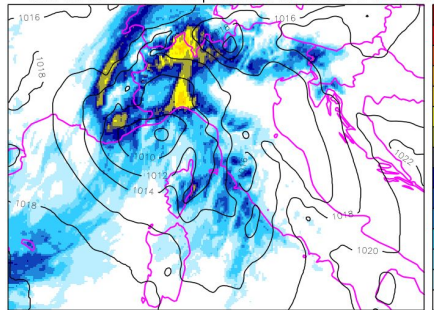
[A-LAEF] PREC Probability [%] >= 50 [mm] + MSLP [hPa]
run: 03/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



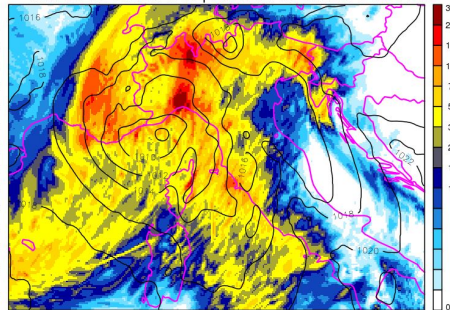
[A-LAEF] PREC Probability [%] >= 100 [mm] + MSLP [hPa]
run: 03/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



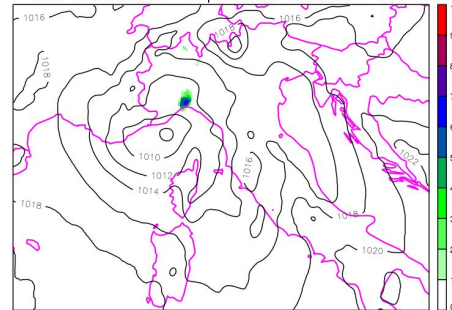
[A-LAEF] PREC [mm] (ENS MIN) | MAX= 75.8
run: 03/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



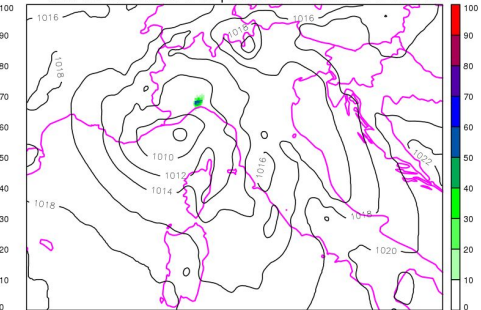
[A-LAEF] PREC [mm] (ENS MAX) | MAX= 458.49
run: 03/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



[A-LAEF] PREC Probability [%] >= 150 [mm] + MSLP [hPa]
run: 03/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



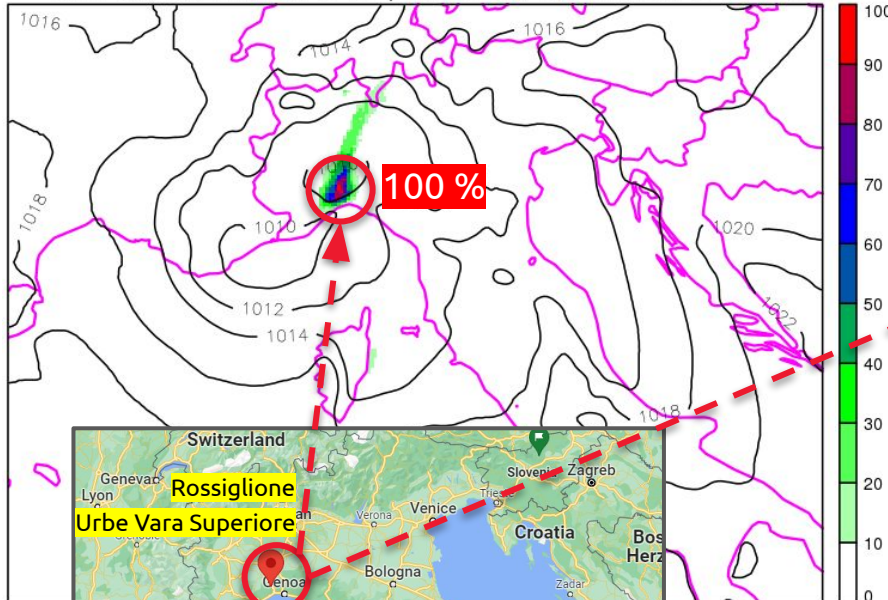
[A-LAEF] PREC Probability [%] >= 200 [mm] + MSLP [hPa]
run: 03/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



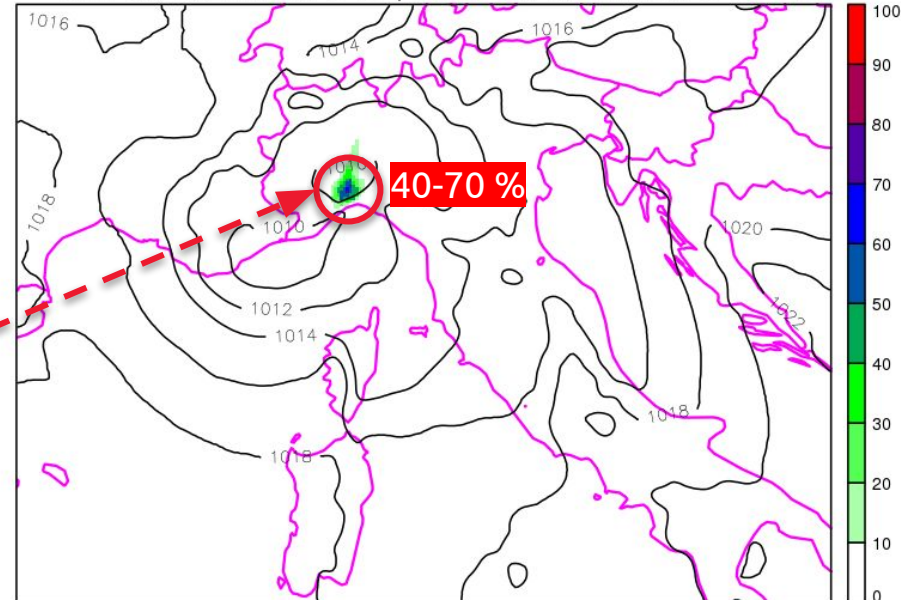
A-LAEF (case study)

Record rainfall in Italy 04/10/2021 - A-LAEF probabilities for thresholds 150 and 200 mm / 24 h

[A-LAEF] PREC Probability [%] \geq 150 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



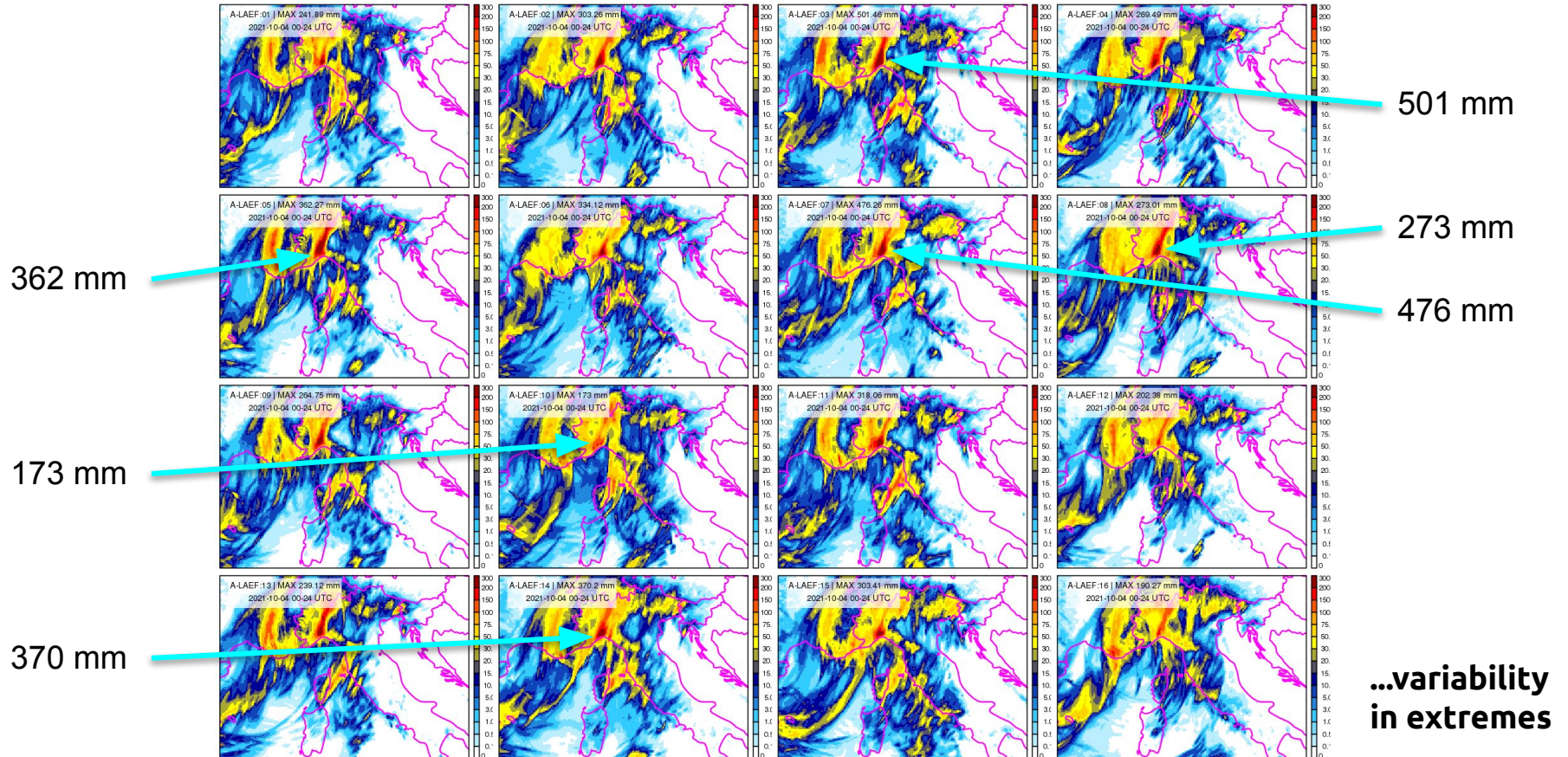
[A-LAEF] PREC Probability [%] \geq 200 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



...perfect localization of precipitation maxima
with high probabilities for extreme thresholds

A-LAEF (case study)

Record rainfall in Italy 04/10/2021 - A-LAEF precipitation forecast (24-h accum.) - 16 pert. MEMs



A-LAEF (case study)

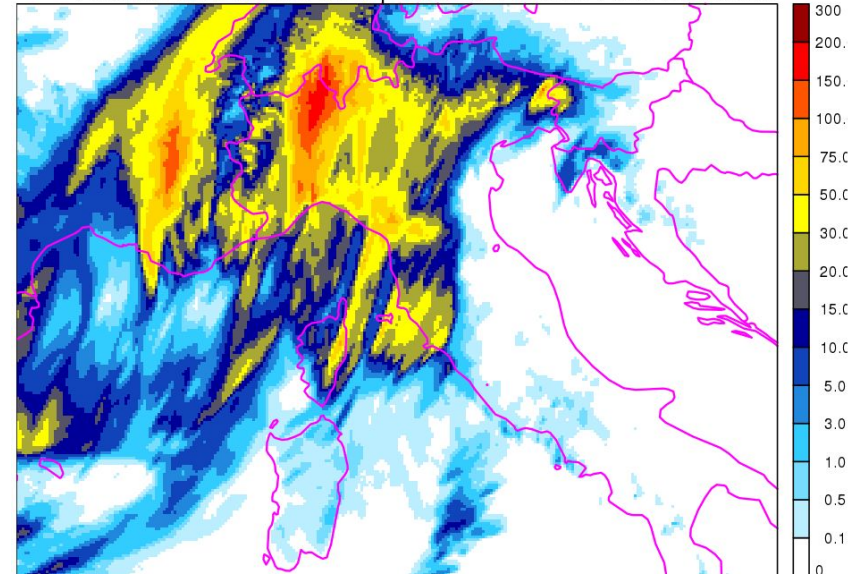
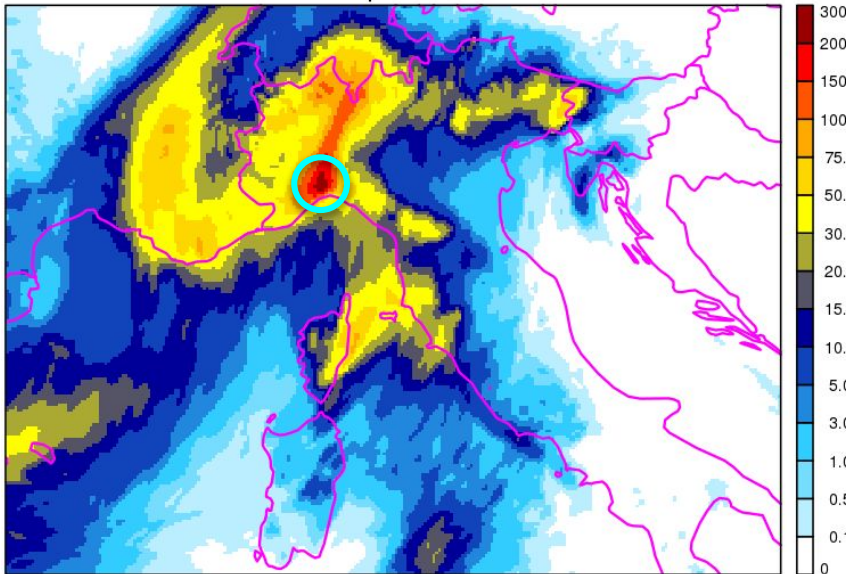
Record rainfall in Italy 04/10/2021 - **A-LAEF ENS MEAN vs. ALADIN/SHMU deterministic (oper)**

A-LAEF ENS MEAN (242 mm)

ALADIN/SHMU (198 mm)

[A-LAEF] PREC [mm] (ENS MEAN) | MAX= 241.9
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h

[ALADIN/SHMU] PREC [mm] | MAX= 197.96
run: 04/10/2021 00 UTC | valid: 04/10/2021 0 UTC + 24 h



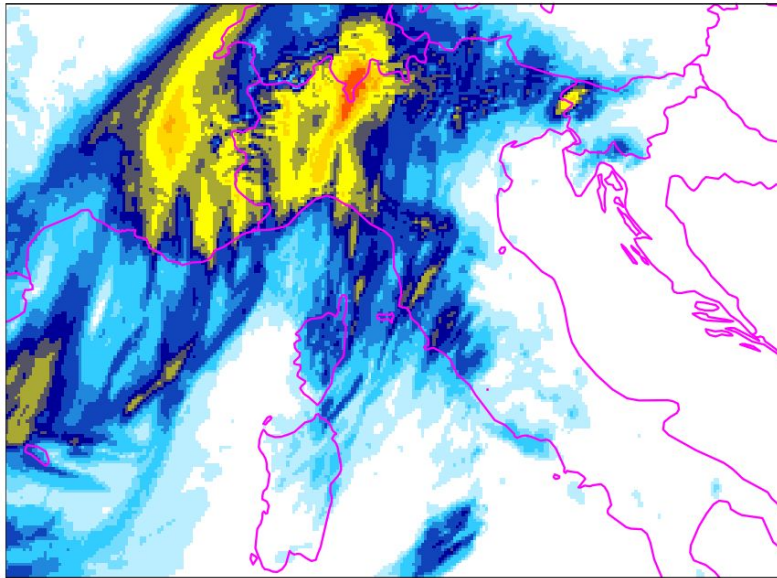
...less and at wrong location

A-LAEF (case study)

Record rainfall in Italy 04/10/2021 - **A-LAEF - coupling matters, and so the perturbations (CTRL)**

A-LAEF CTRL coupled to **cy47r2**

[A-LAEF cy47r2] PREC [mm] | MAX= 134.91
run: 04/10/2021 00 UTC | valid: 04/10/2021 0 UTC + 24 h

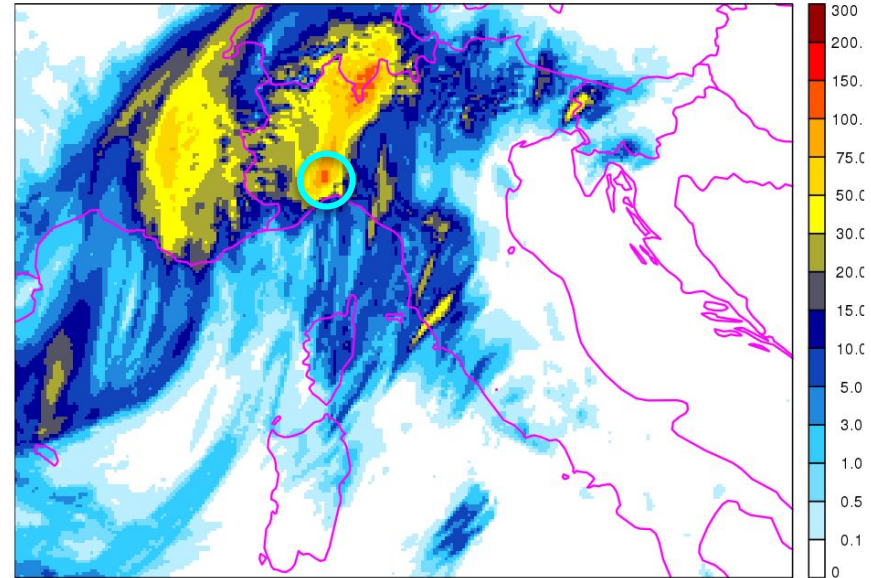


(operational on October 4, 2021)

...and still, the correct location of extreme values in ensemble mean (!)

A-LAEF CTRL coupled to **cy47r3**

[A-LAEF cy47r3] PREC [mm] | MAX= 127.87
run: 04/10/2021 00 UTC | valid: 04/10/2021 0 UTC + 24 h



(operational since October 12, 2021)

...slight improvement against cy47r2 (for CTRL)

A-LAEF (case study)

Record rainfall in Italy 04/10/2021 - **A-LAEF - cy47r2 versus cy47r3 coupling (CTRL)**

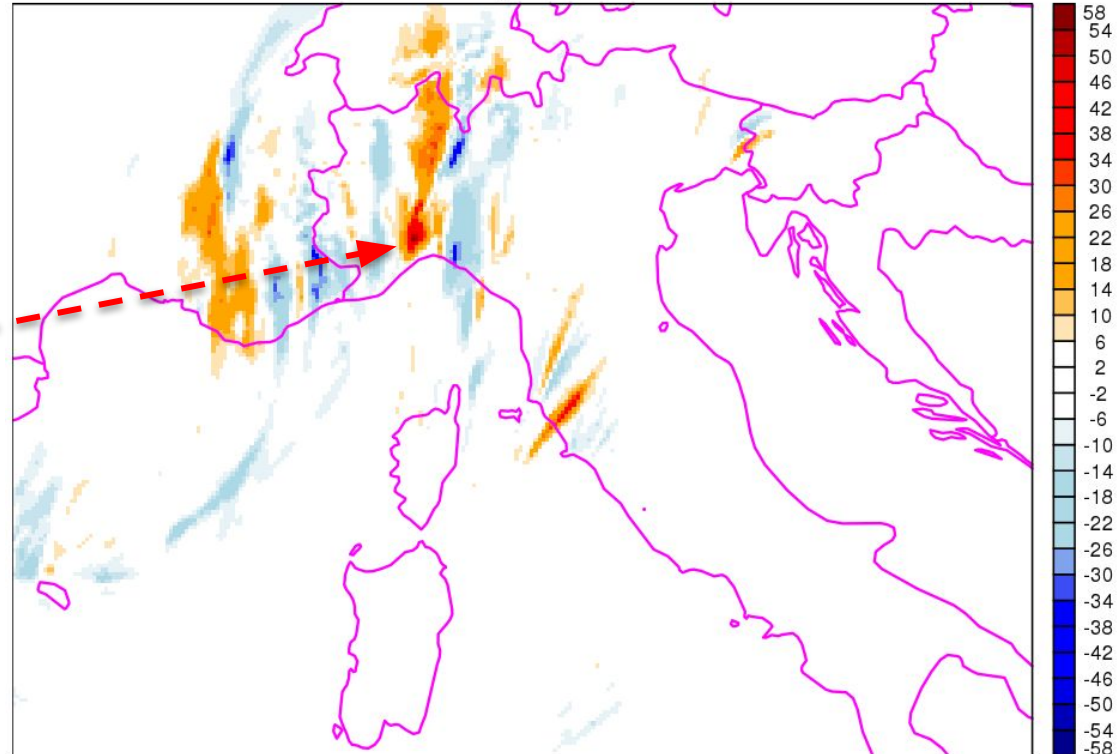
Difference in A-LAEF CTRL precipitation forecast coupled to **cy47r3 - cy47r2** (24 h accum.)

Location of record values



...enhancement in new cycle

[A-LAEF cy47r3-cy47r2] PREC [mm] | MIN= -42.19 MAX= 54.86
run: 04/10/2021 00 UTC | valid: 04/10/2021 0 UTC + 24 h

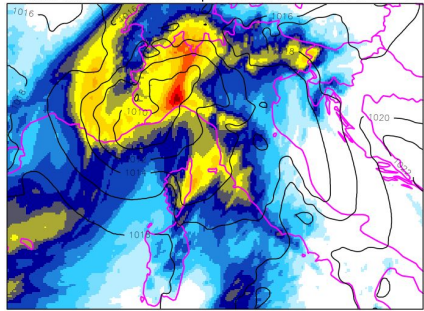


A-LAEF (case study)

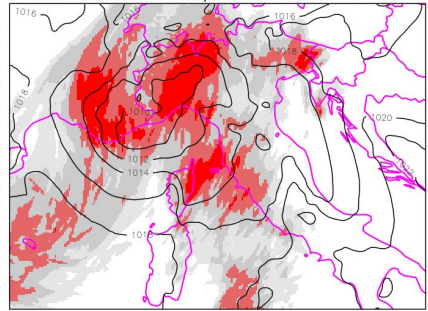
Record rainfall in Italy 04/10/2021 - A-LAEF precipitation forecast (24-h accum.) - **cy47r2** vs **cy47r3**

ENS MEAN, SPREAD, MIN and MAX (**cy47r2**)

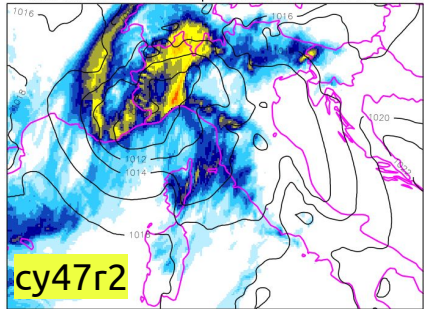
[A-LAEF] PREC [mm] (ENS MEAN) | MAX= 230.59
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



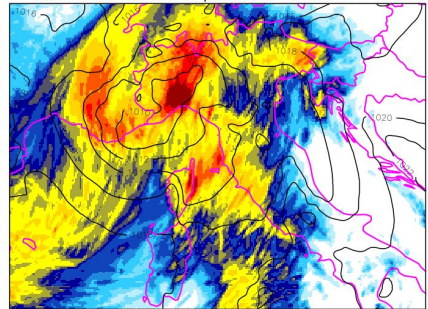
[A-LAEF] PREC [mm] (ENS SPREAD) | MAX= 110.58
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



[A-LAEF] PREC [mm] (ENS MIN) | MAX= 128.4
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h

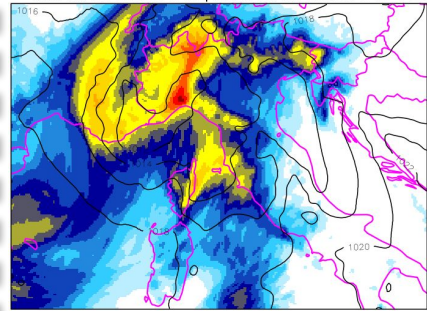


[A-LAEF] PREC [mm] (ENS MAX) | MAX= 533.56
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h

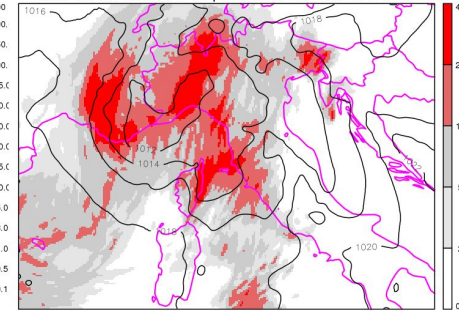


ENS MEAN, SPREAD, MIN and MAX (**cy47r3**)

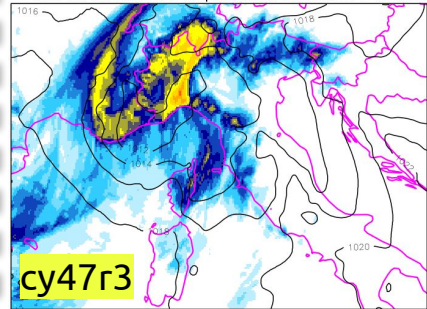
[A-LAEF] PREC [mm] (ENS MEAN) | MAX= 224.59
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



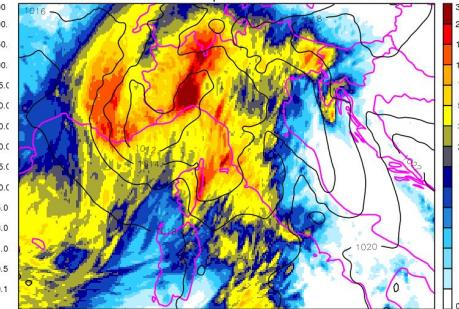
[A-LAEF] PREC [mm] (ENS SPREAD) | MAX= 109.33
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



[A-LAEF] PREC [mm] (ENS MIN) | MAX= 104.83
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



[A-LAEF] PREC [mm] (ENS MAX) | MAX= 495.2
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



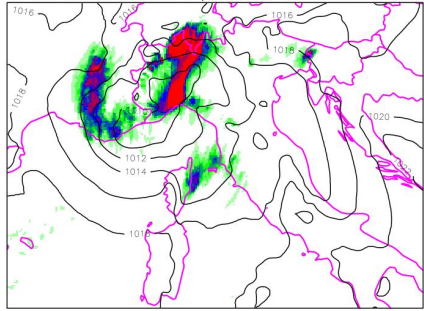
...ENS statistical scores are very similar in terms of MEAN, SPREAD, MIN and MAX

A-LAEF (case study)

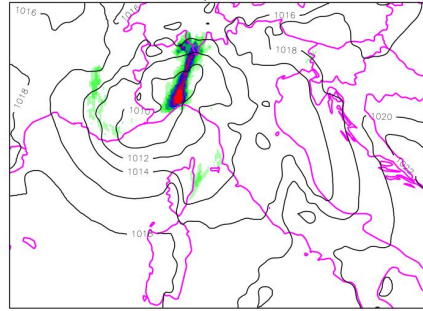
Record rainfall in Italy 04/10/2021 - A-LAEF precipitation forecast (24-h accum.) - **cy47r2** vs **cy47r3**

Probabilities for thresholds 50, 100, 150 and 200 mm | Probabilities for thresholds 50, 100, 150 and 200 mm

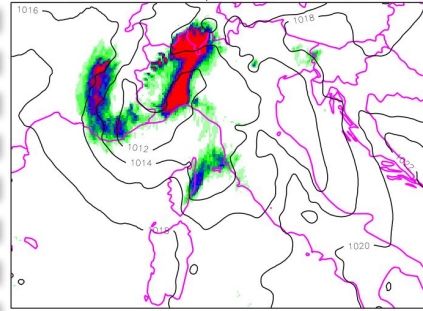
[A-LAEF] PREC Probability [%] >= 50 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



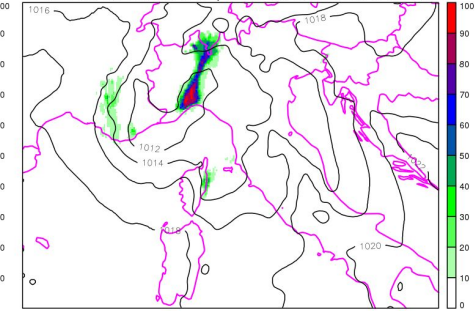
[A-LAEF] PREC Probability [%] >= 100 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



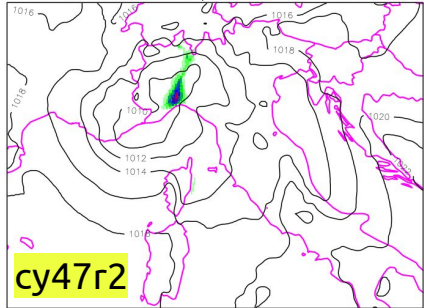
[A-LAEF] PREC Probability [%] >= 50 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



[A-LAEF] PREC Probability [%] >= 100 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h

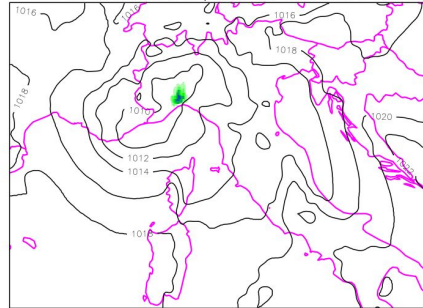


[A-LAEF] PREC Probability [%] >= 150 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h

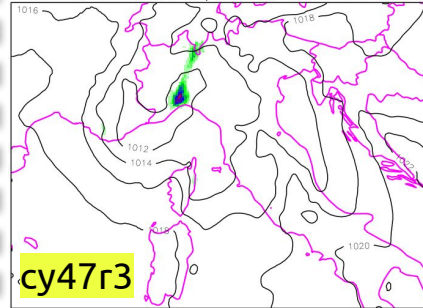


cy47r2

[A-LAEF] PREC Probability [%] >= 200 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h

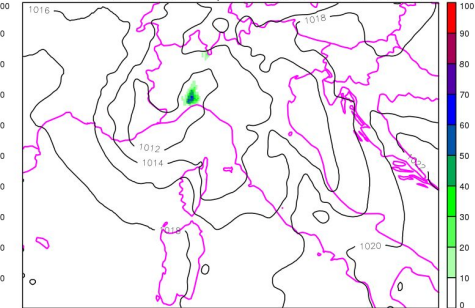


[A-LAEF] PREC Probability [%] >= 150 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



cy47r3

[A-LAEF] PREC Probability [%] >= 200 [mm] + MSLP [hPa]
run: 04/10/2021 00 UTC | valid: 04/10/2021 00 UTC + 24 h



...even the probabilities are equal to each other with the exactly same localization of extremes

A-LAEF (case study)

Record rainfall in Italy 04/10/2021 - **A-LAEF precipitation forecast (24-h accum.)** - **cy47r3** - **cy47r2**

