

Using model perturbations for short-range ensemble forecasting with a limited-area model

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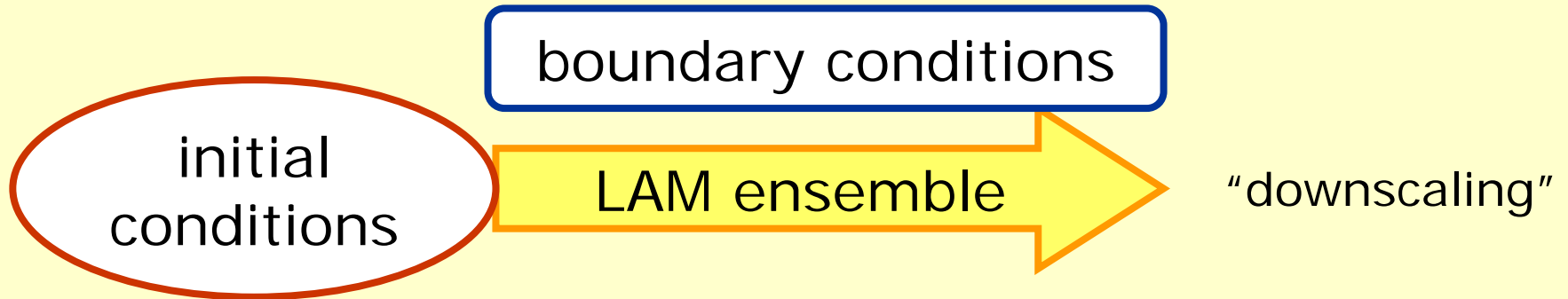
Acknowledgments: INM (J. Garcia Moya, J. Simarro and others), COSMO, ECMWF, WMO

Outline

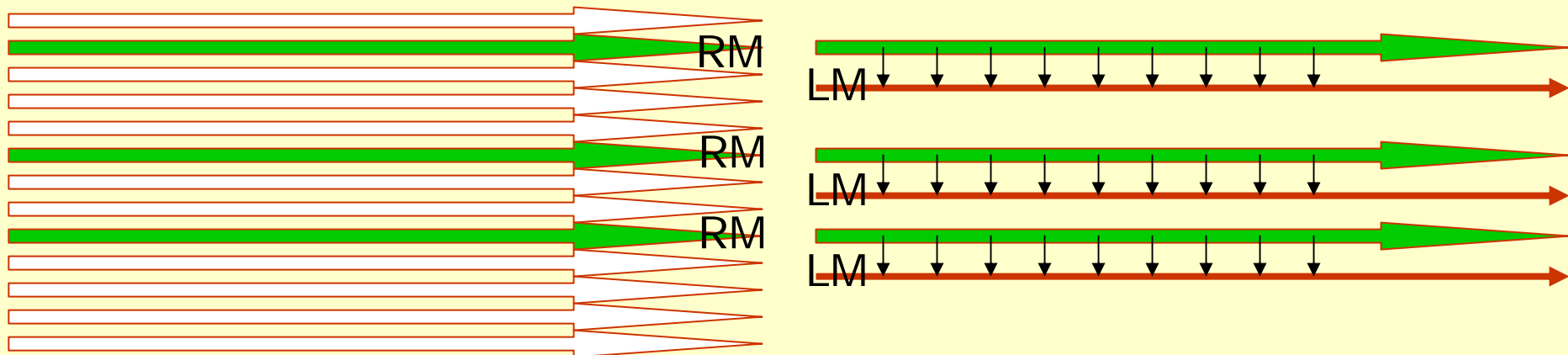
- ❖ The Limited-area Ensemble Prediction System COSMO-LEPS
- ❖ LAM ensemble for the short-range: COSMO-SREPS
- ❖ case study performance
- ❖ future work

COSMO-LEPS

early medium range (3-5 days)

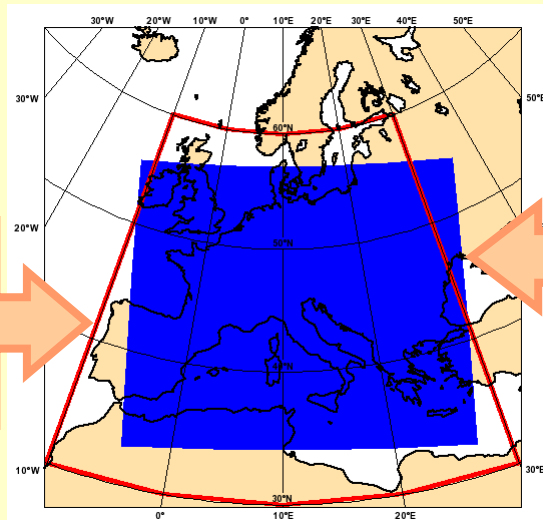
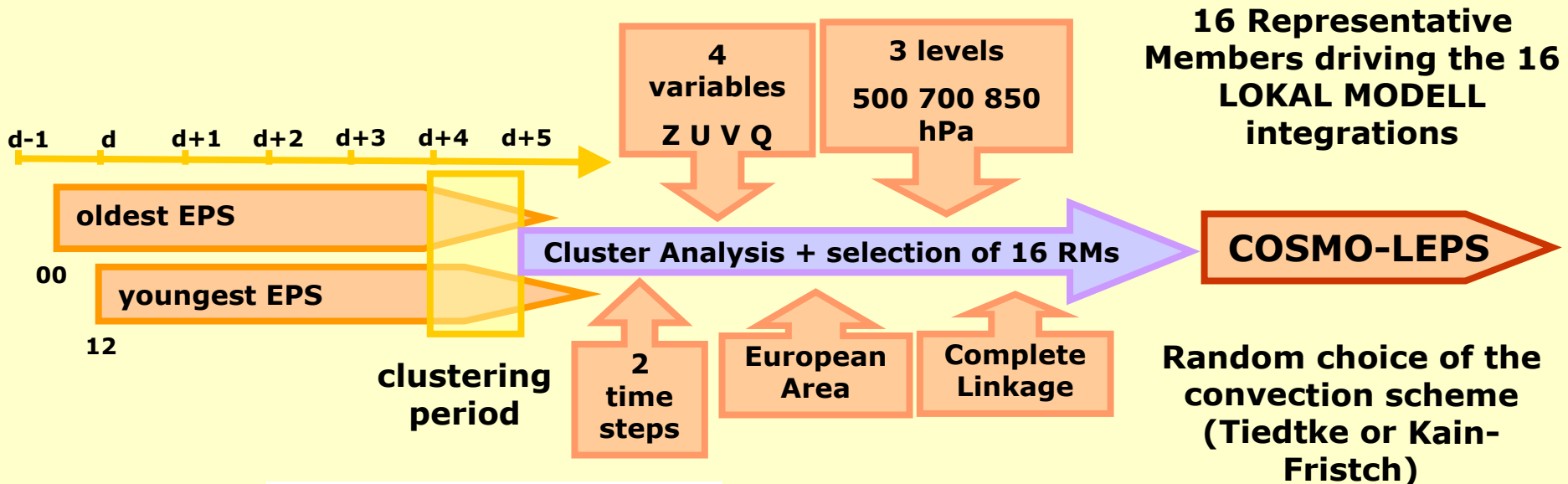


ECMWF EPS



COSMO-LEPS suite at ECMWF

(running from 5/11/2002, new suite from 5/2/2006)



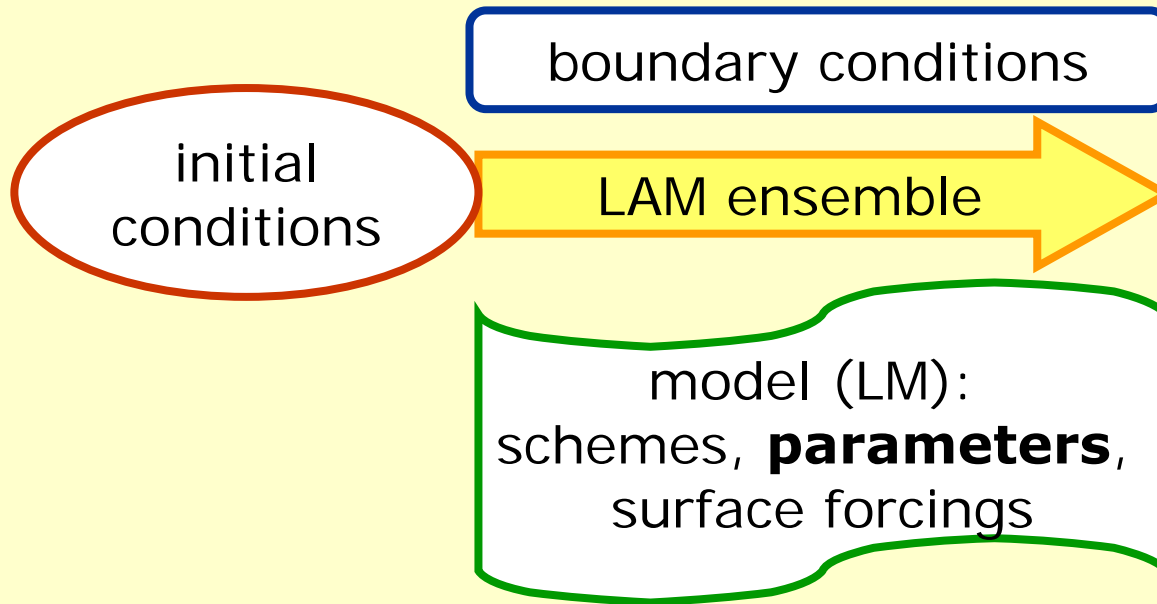
COSMO-LEPS clustering area

COSMO-LEPS integration domain

- ❖ $\Delta x = 10$ km; 40 ML
- ❖ forecast range: 132h
- ❖ computer time provided by the COSMO partners which are ECMWF member states

aims

- ❖ add LM perturbation



- ❖ develop an ensemble system for the short-range, to support the decision making process during civil protection alert

Parameter list

| parameter name | parameter description | range | default value | used |
|-----------------|---|--------------|---------------|--------------|
| PHYSICS | | | | |
| crsmin | minimal stomata resistance (part of 'terra'; sensible for much vegetation and not too dry soil) | [50,200] s/m | 150 | 50, 200 |
| c_soil | surface area index of the evaporating soil (part of 'terra'; sensible for less vegetation and not too dry soil) |]0,c:lnd[| | 0, clnd (=2) |
| plcov | plant cover (part of 'terra' and 'turbtran'; controls transpiration) | [0,1] | | |
| lai | leave area index (part of 'terra' and 'turbtran', controls transpiration) | [0,10] | | |
| rlam_heat | scaling factor of the laminar layer depth | [0.1,50] | | 0.1, 50 |
| c_diff | factor for turbulent diffusion of TKE (may influence mixing at an inversion top) | [0,2] | 1 | 0, 2 |
| pat_len | length scale of thermal surface patterns (influences mixing in the stable stratified atmosphere) | [0,10000] m | 500 | 0, 10000 |
| tur_len | maximal turbulent length scale (influences mainly stratospheric mixing) | [100,1000] m | | 1000 |
| rat_can | scaling parameter for the diagnosed canopy height (rather big influence on Td2m, but will be obsolete shortly) | [0,10] | | |
| z0m_dia | roughness length at a synop station (rather big influence on V10m, will very likely be obsolete in future) | [0.05,0.5] m | | |
| NUMERICS | | | | |
| l2tls | 2-time-level scheme | T or F | false | true |
| epsass | Asselin filter coefficient | [0.05,0.2] | 0.15 | 0.05 |

ic and bc: multi-model approach

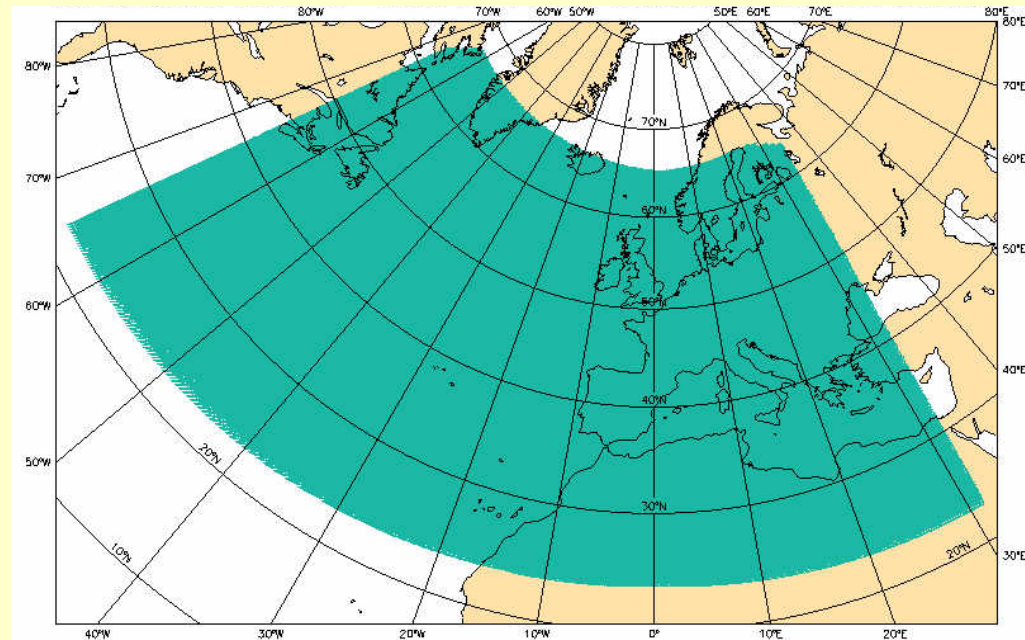
- ❖ a Multi-Model Multi-Boundaries ensemble is operational at INM (Spain): 4 different limited-area models (HIRLAM, HRM, MM5, UM) are nested on 4 different global models (IFS, GME, AVN, UM) => 16 members ensemble (25 km horizontal resolution)
- ❖ from May 2006 LM has been added

IFS LM 25km

GME LM 25km

AVN LM 25 km

UM LM 25 km



Courtesy of INM

COSMO-SREPS

(Short-Range Ensemble Prediction System)

short range (up to 3 days)

IFS – ECMWF global

LM at 25 km on IFS

GME – DWD global

LM at 25 km on GME

UM – UKMO global

LM at 25 km on UM

AVN – NCEP global

LM at 25 km on NCEP

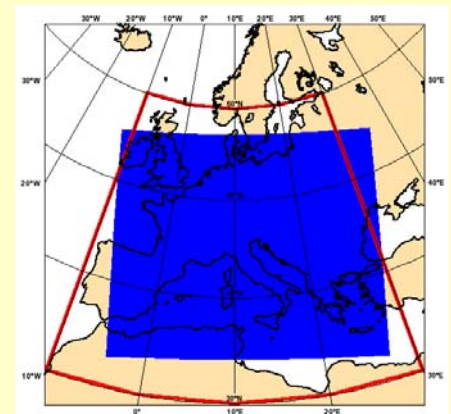
P1: conv. scheme (KF)

P2: turb. parameter 1

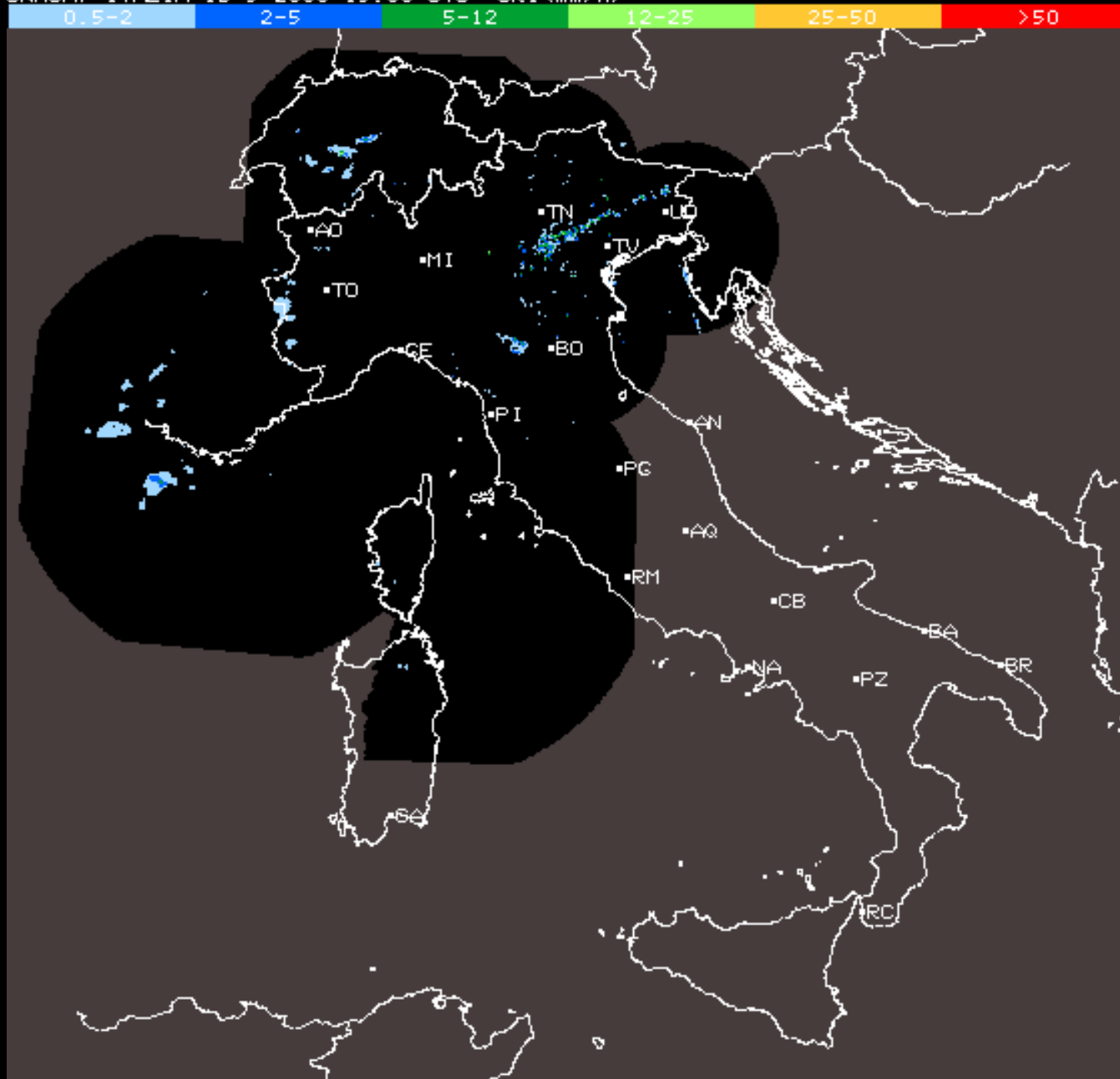
P3: time filter

P4: turb. parameter 2

16 LM runs at 10 km

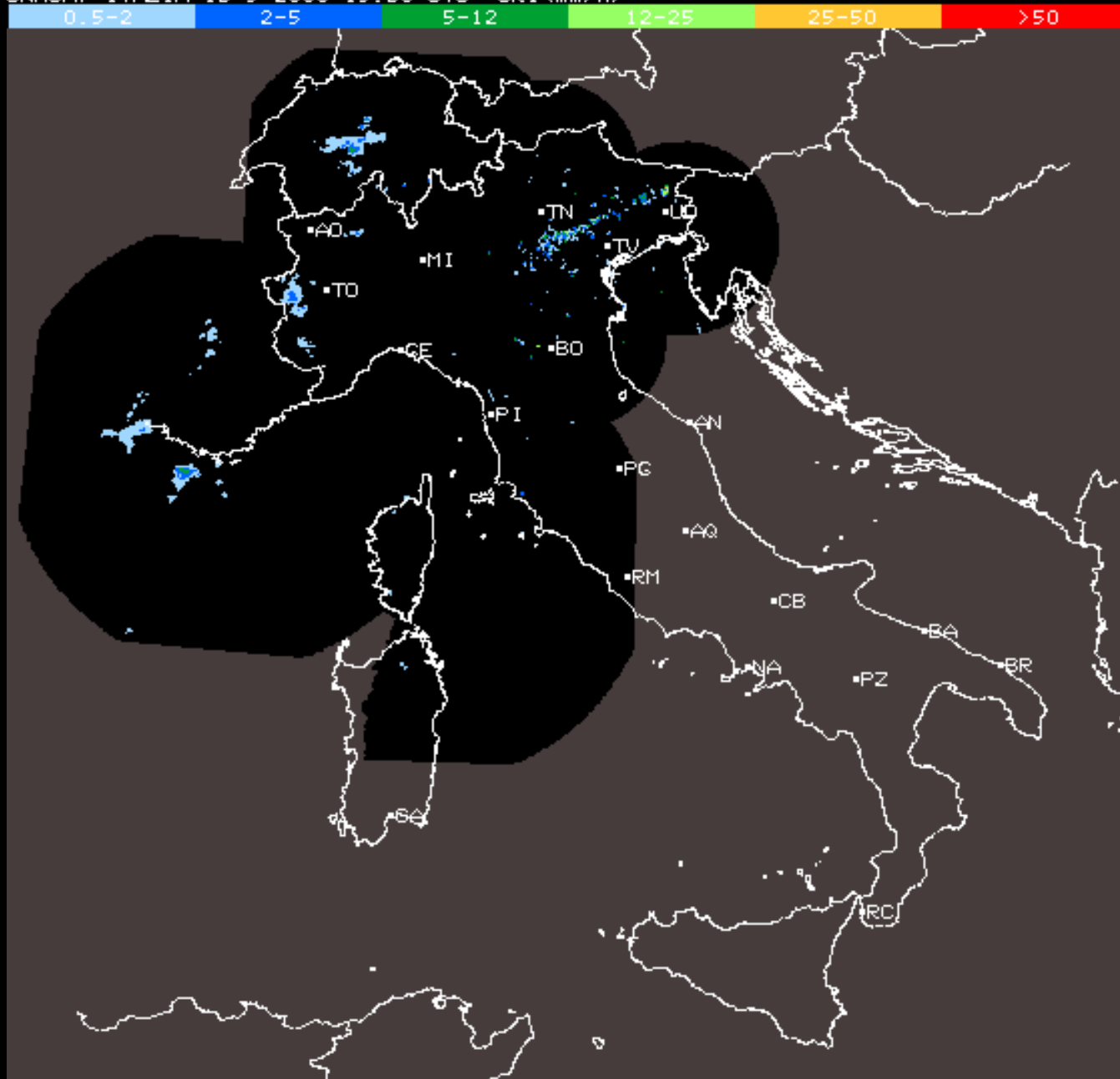


by INM Spain



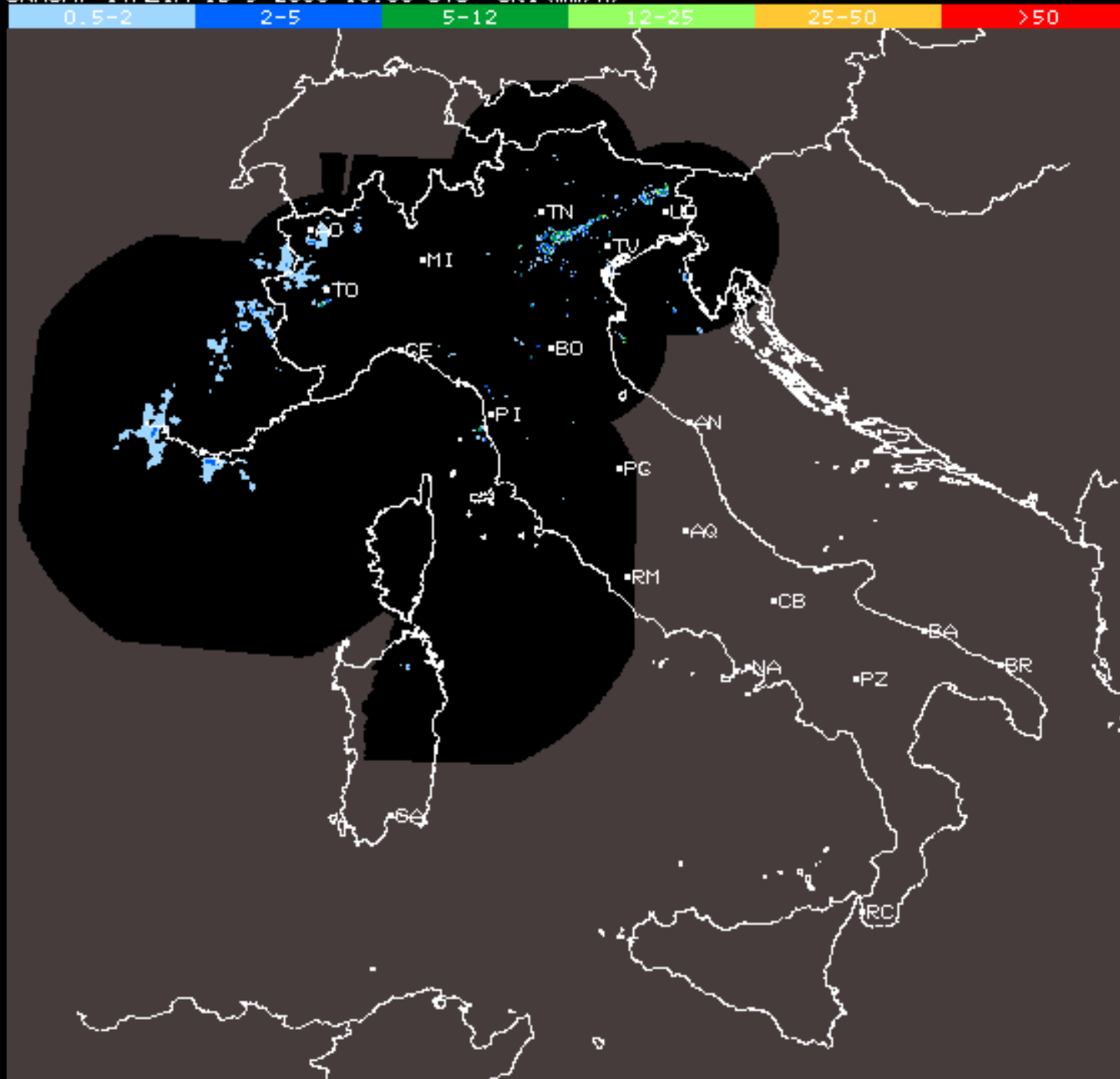
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NERO: ZONE DI OSSERVAZIONE RADAR



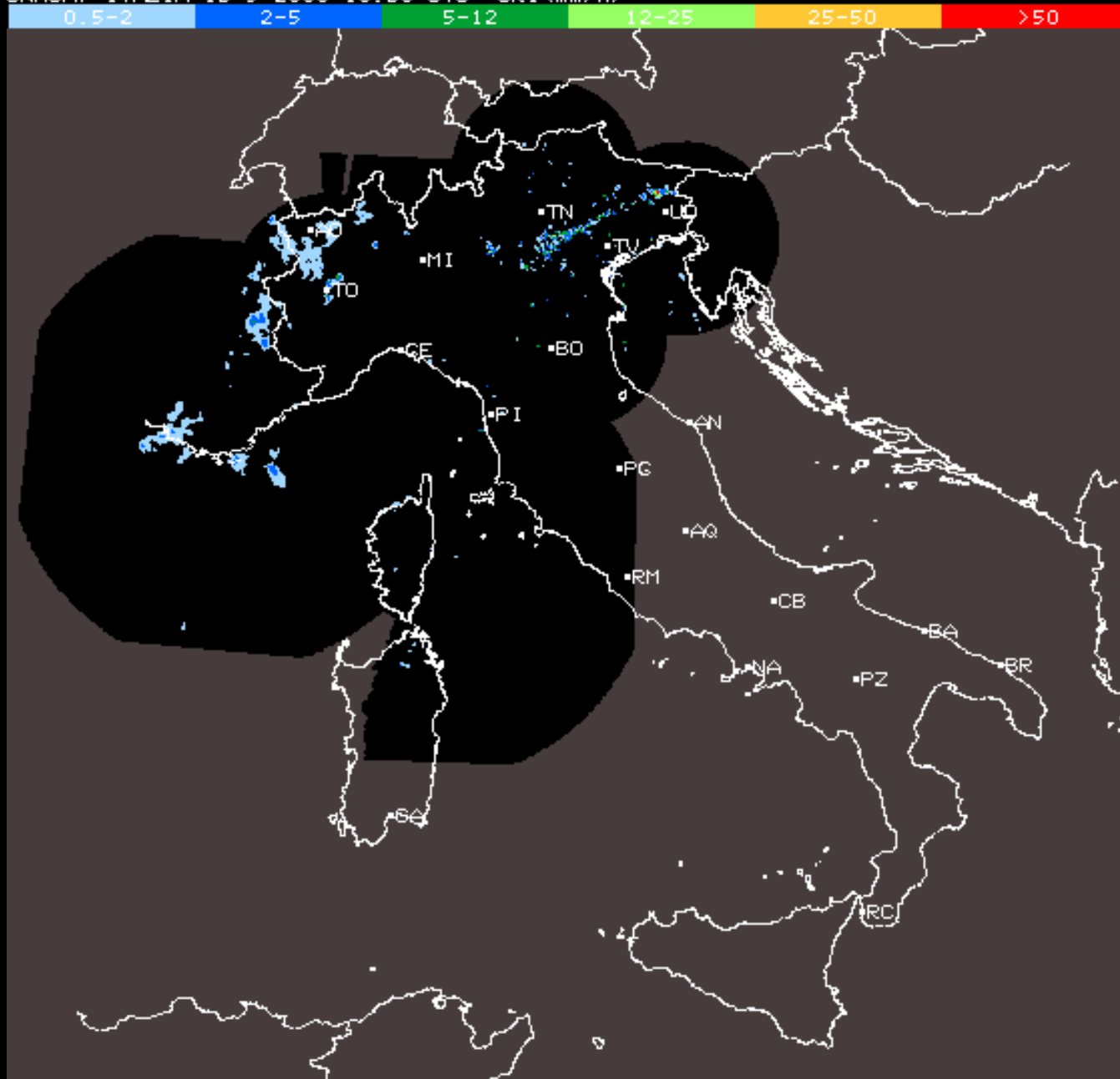
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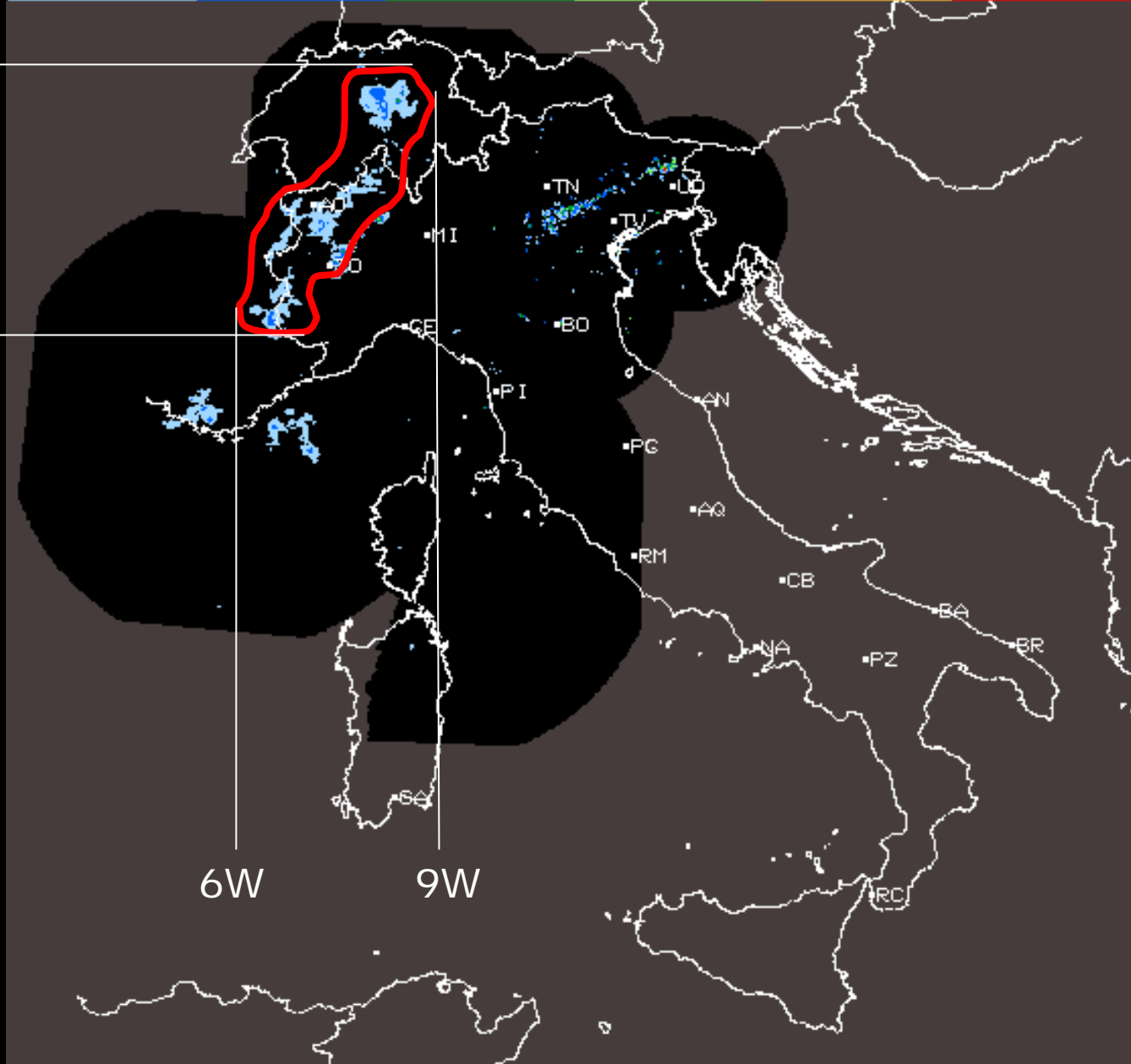


47N

44N

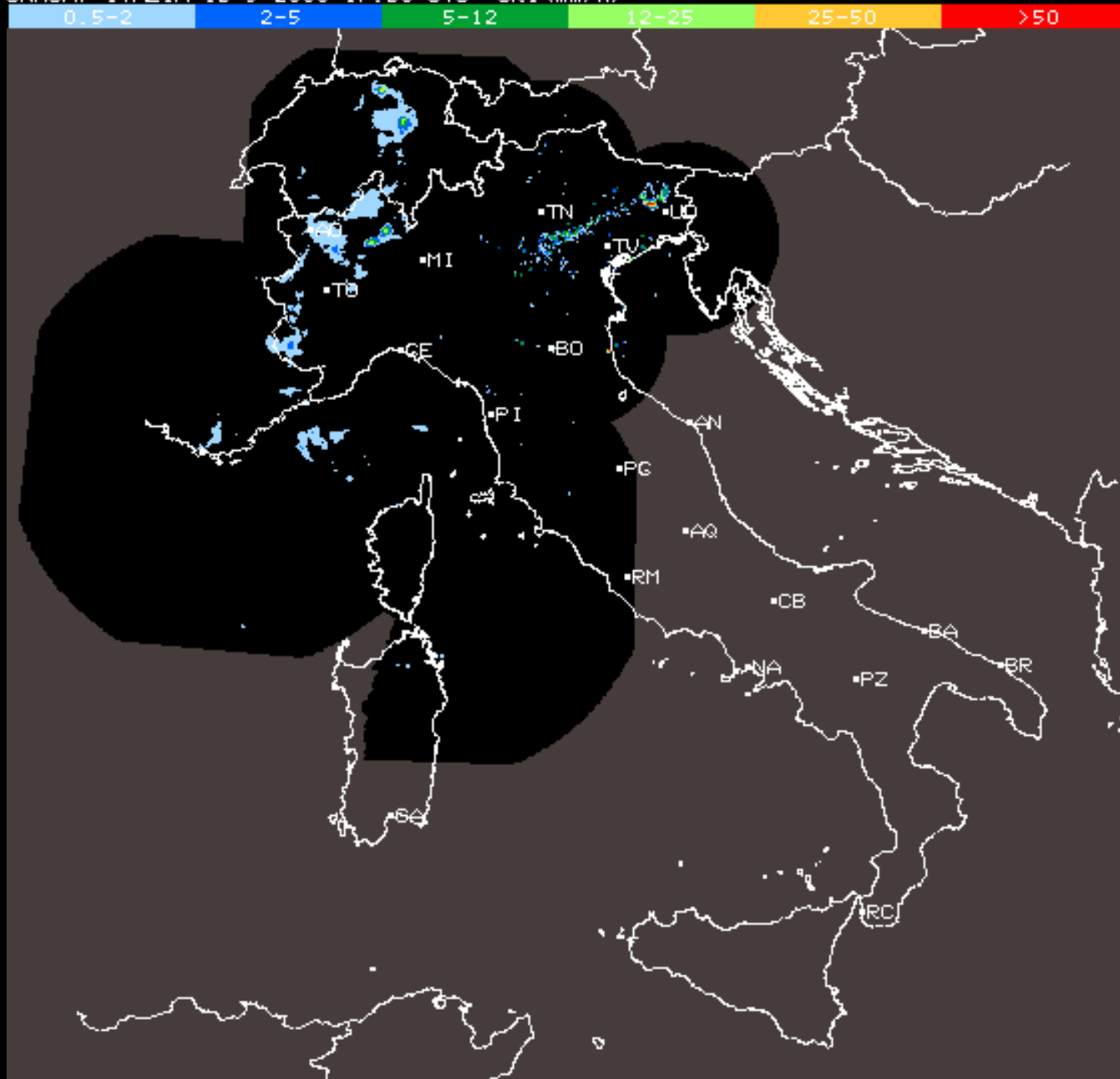
6W

9W



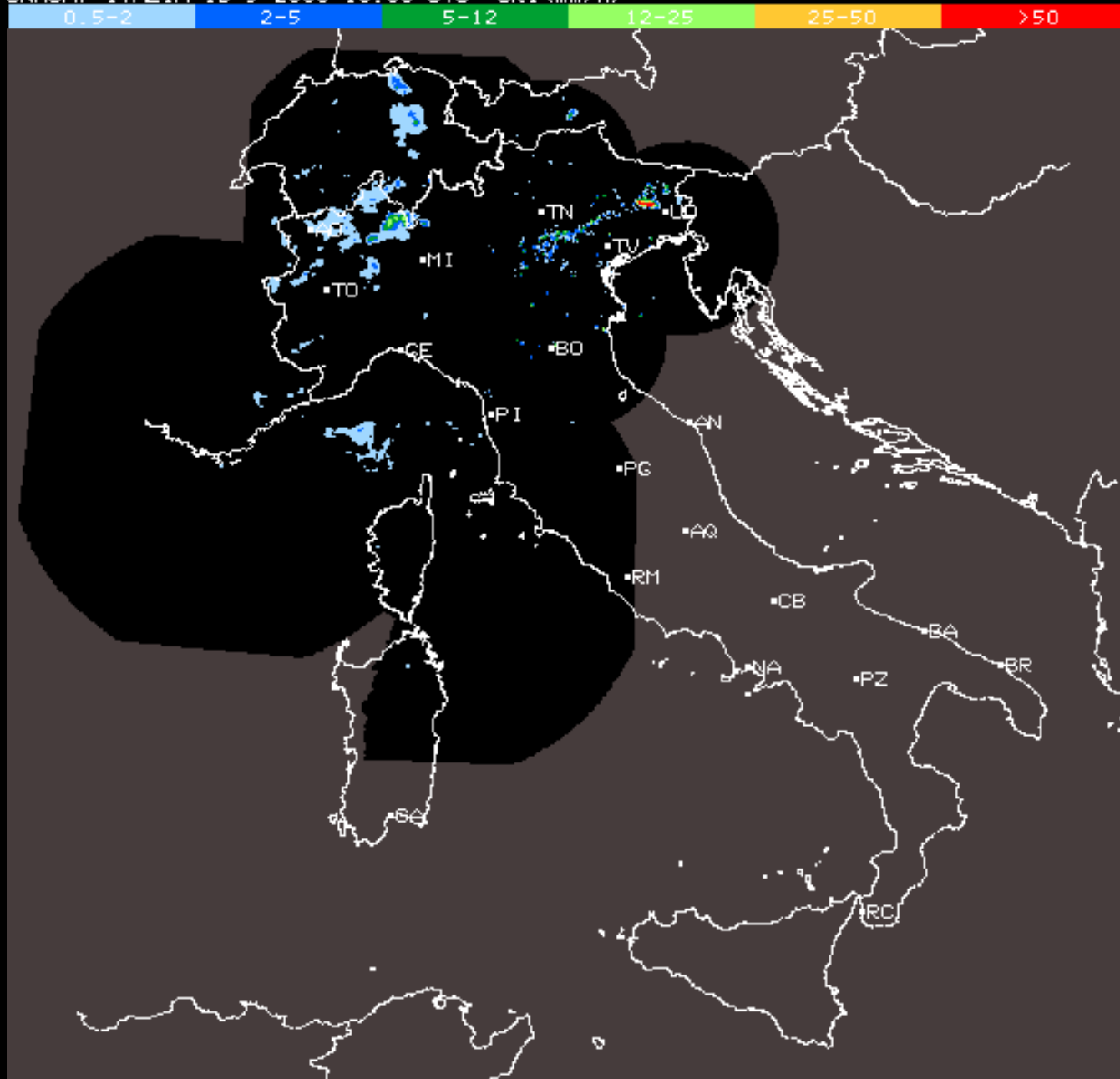
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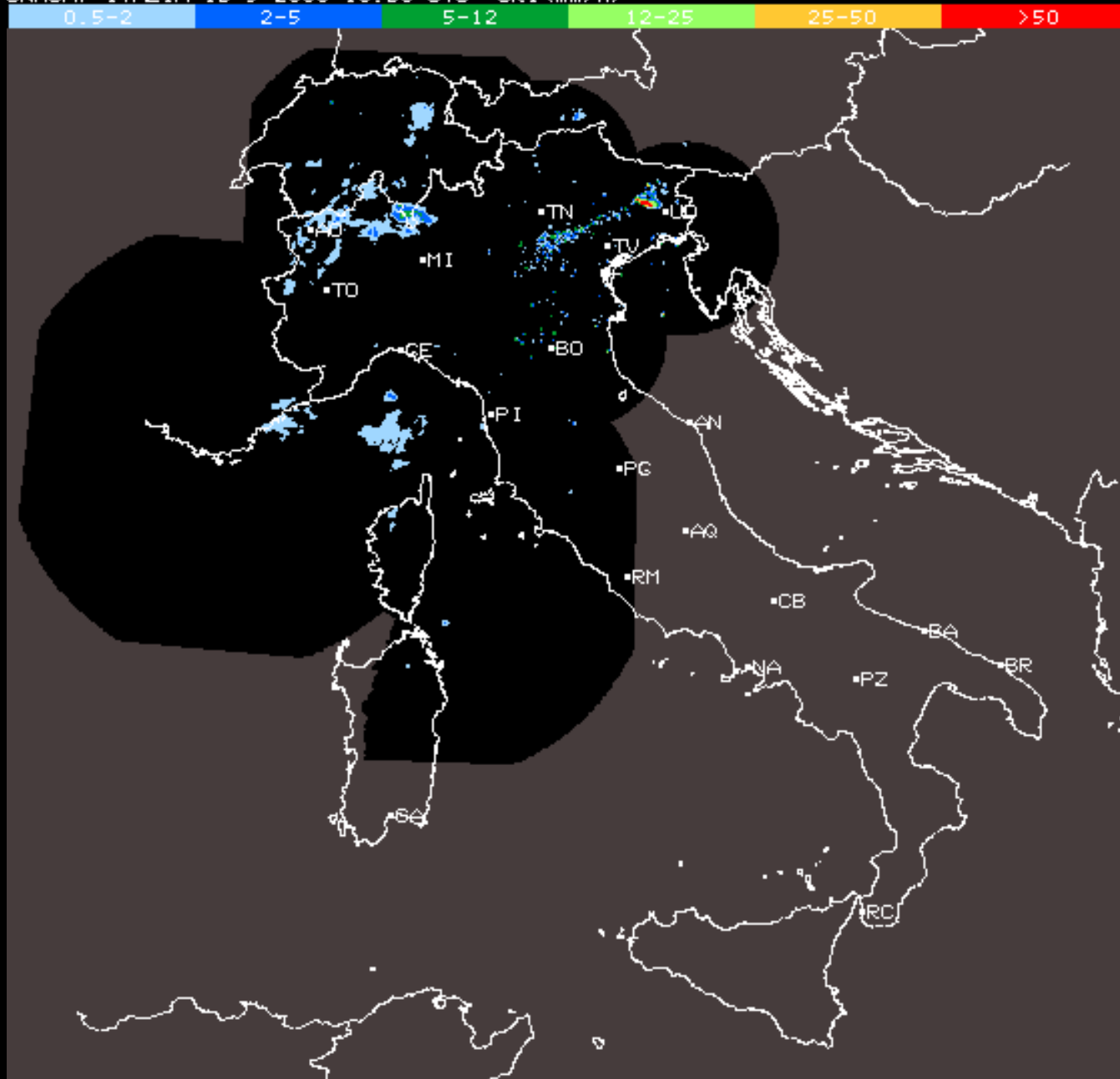
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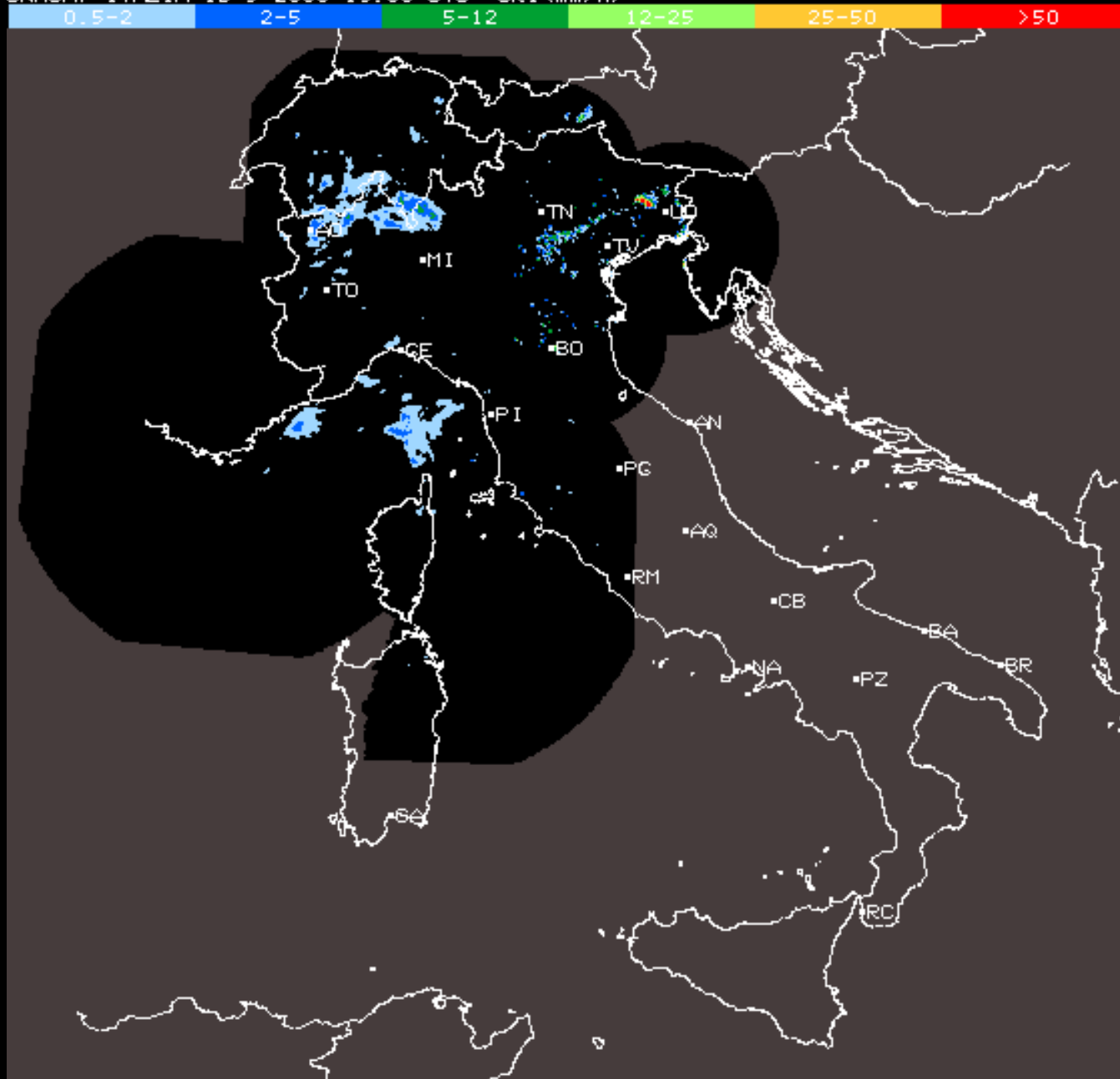
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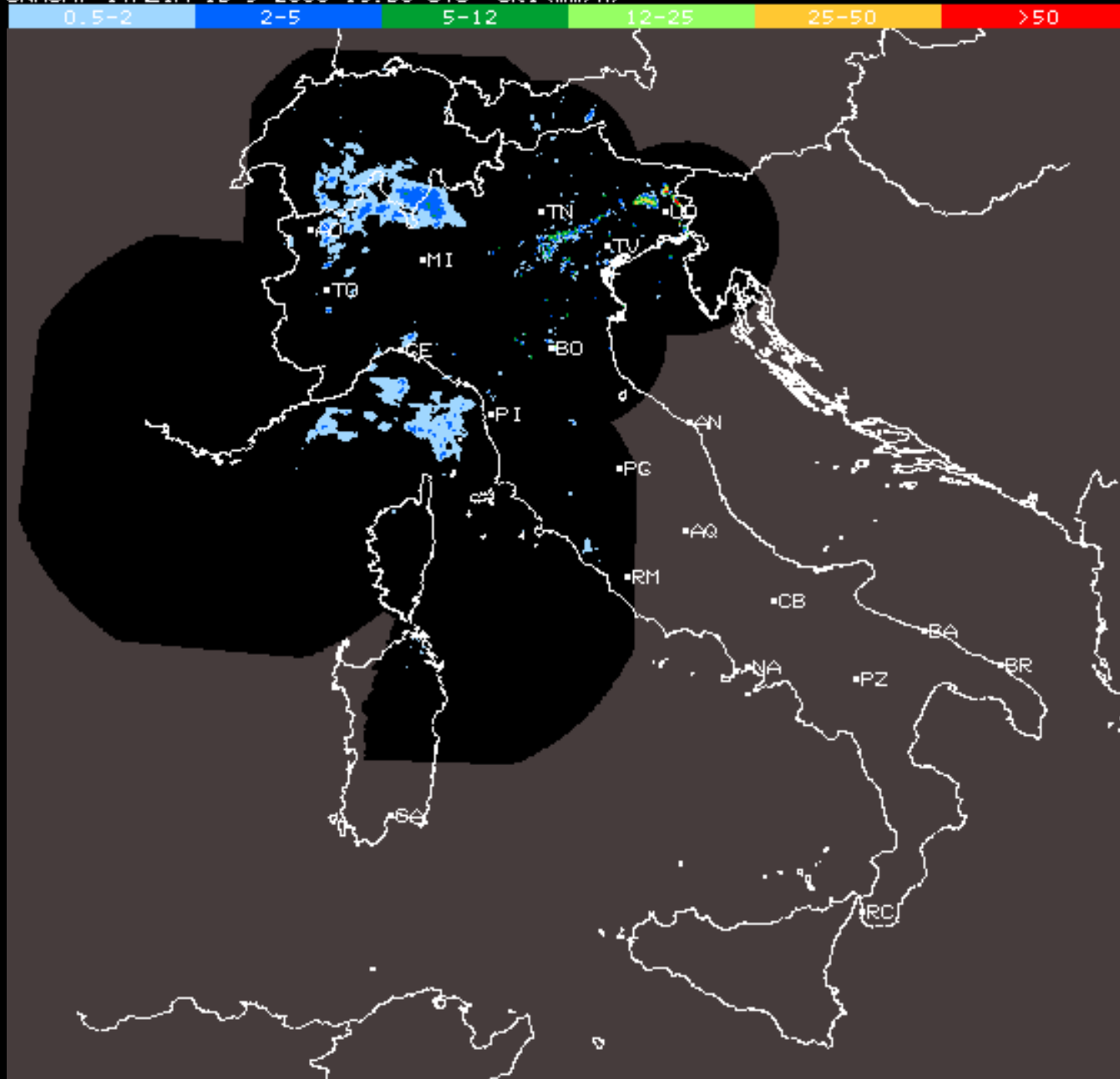
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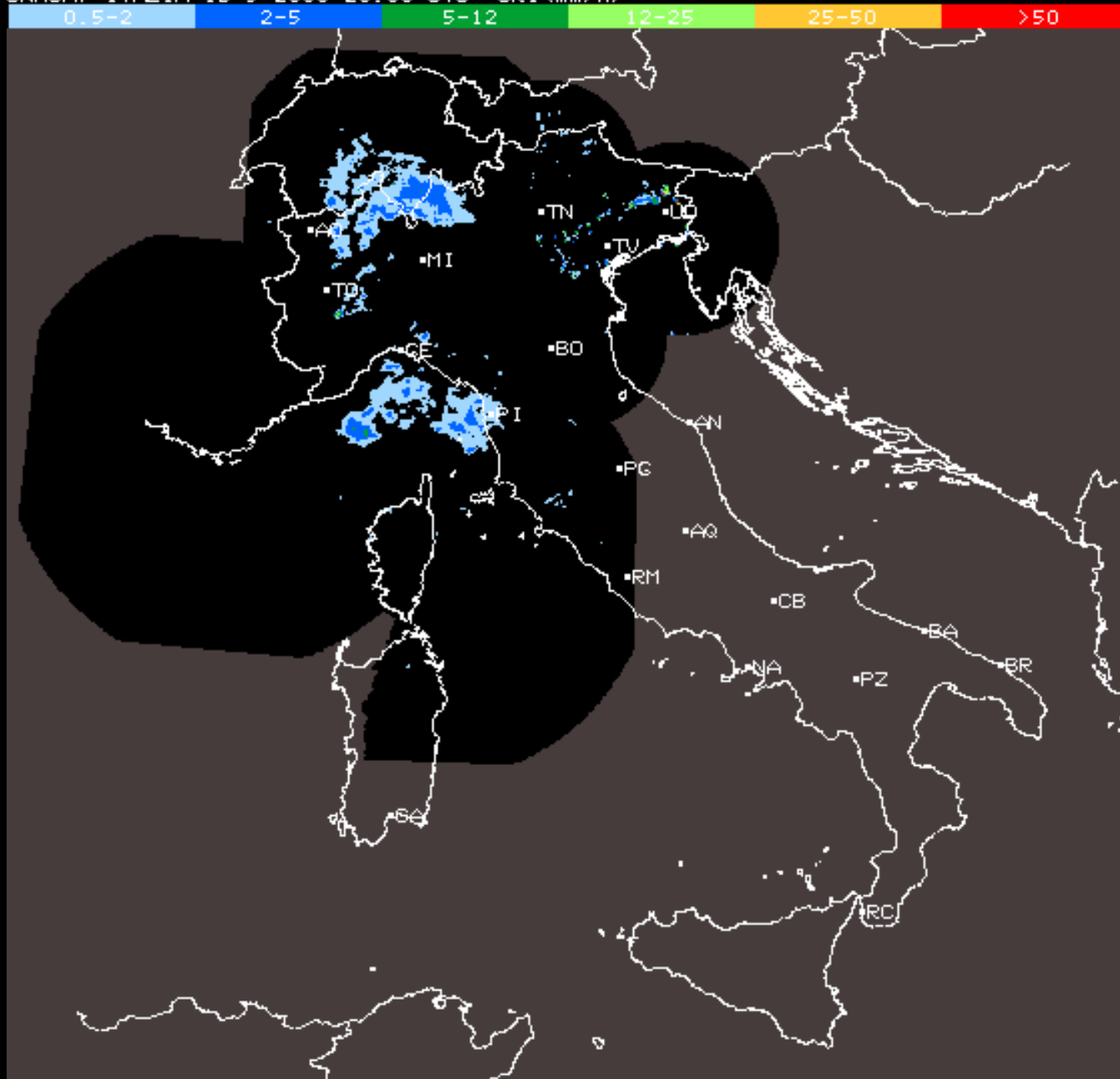
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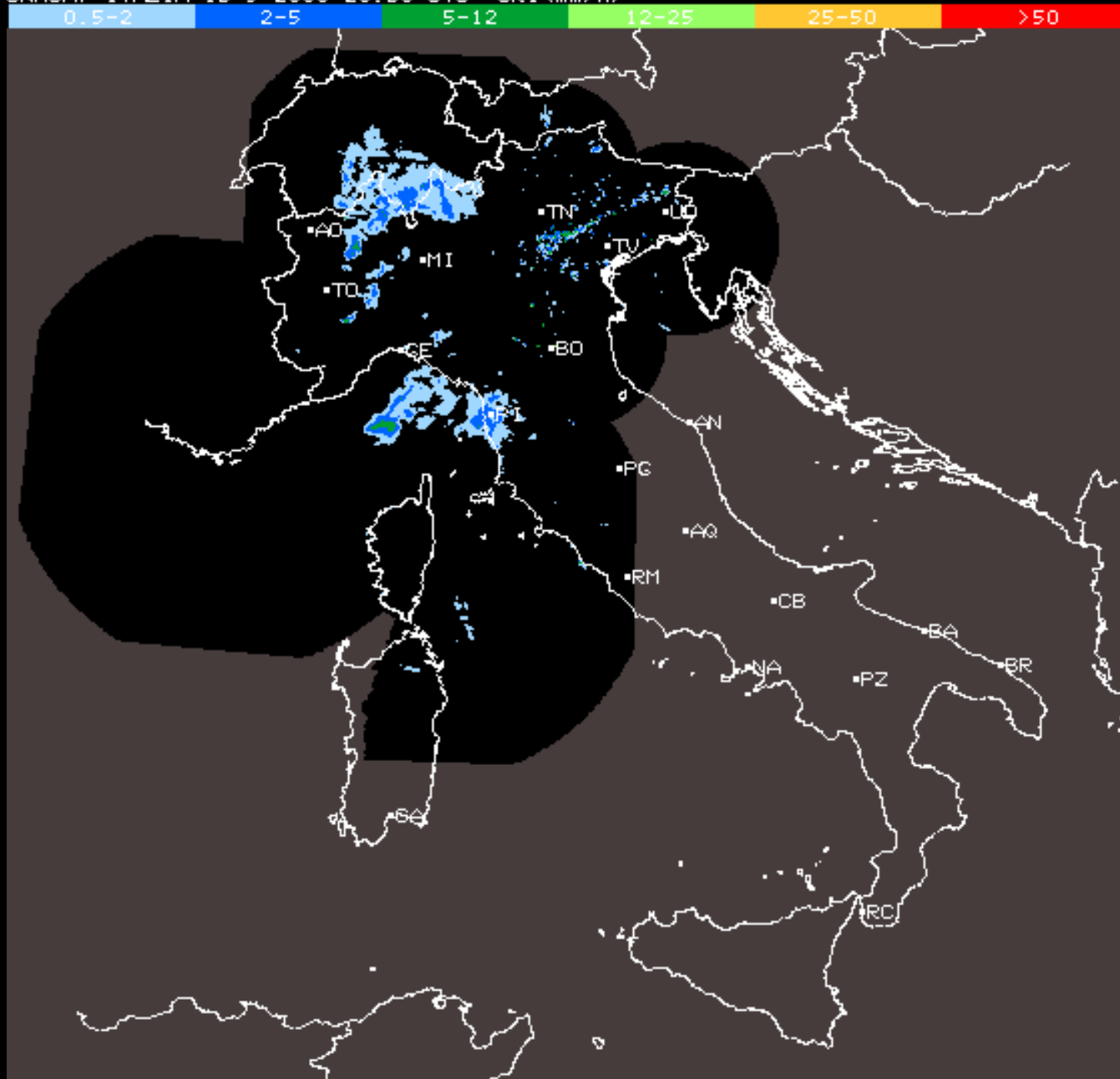
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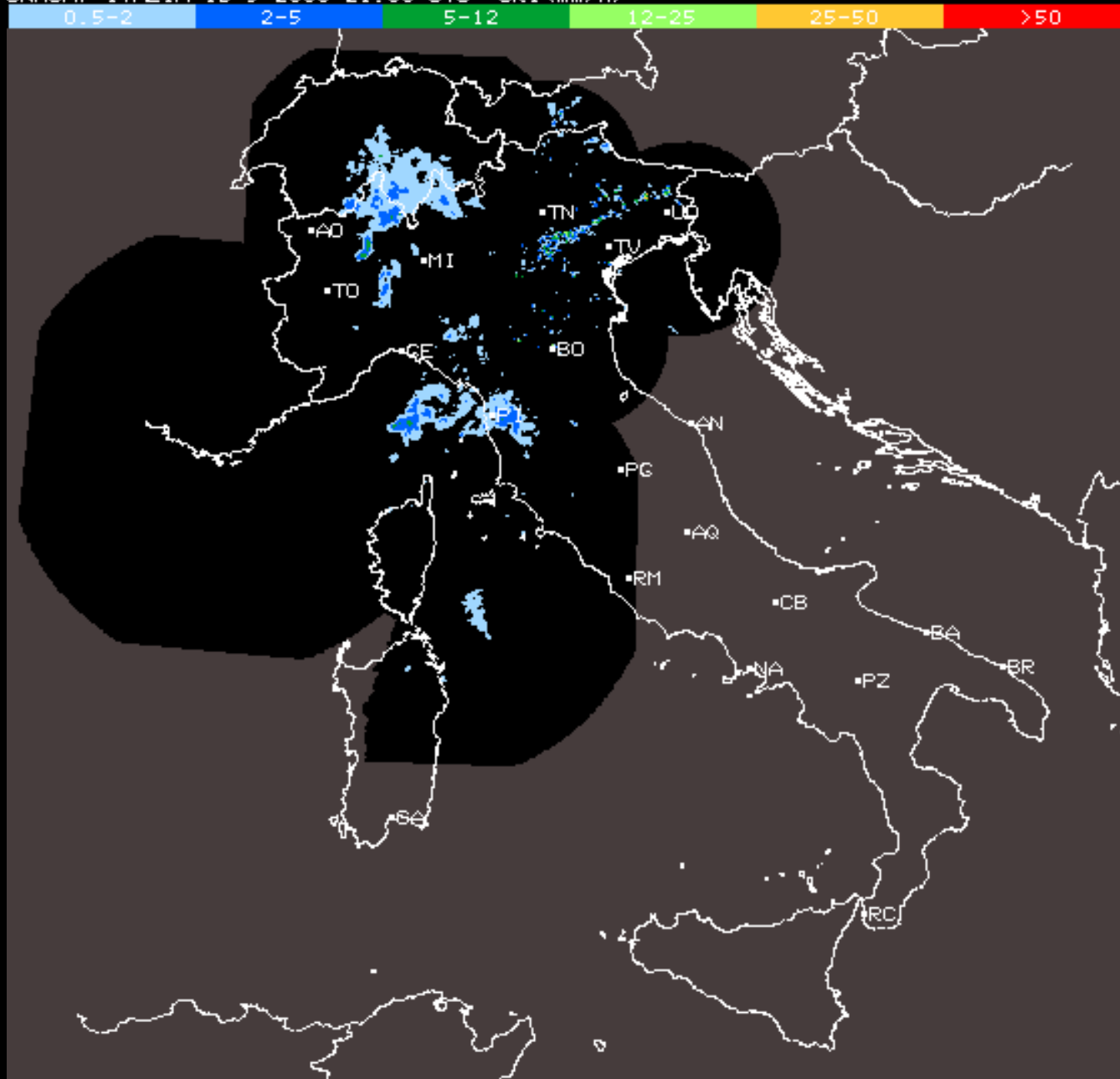
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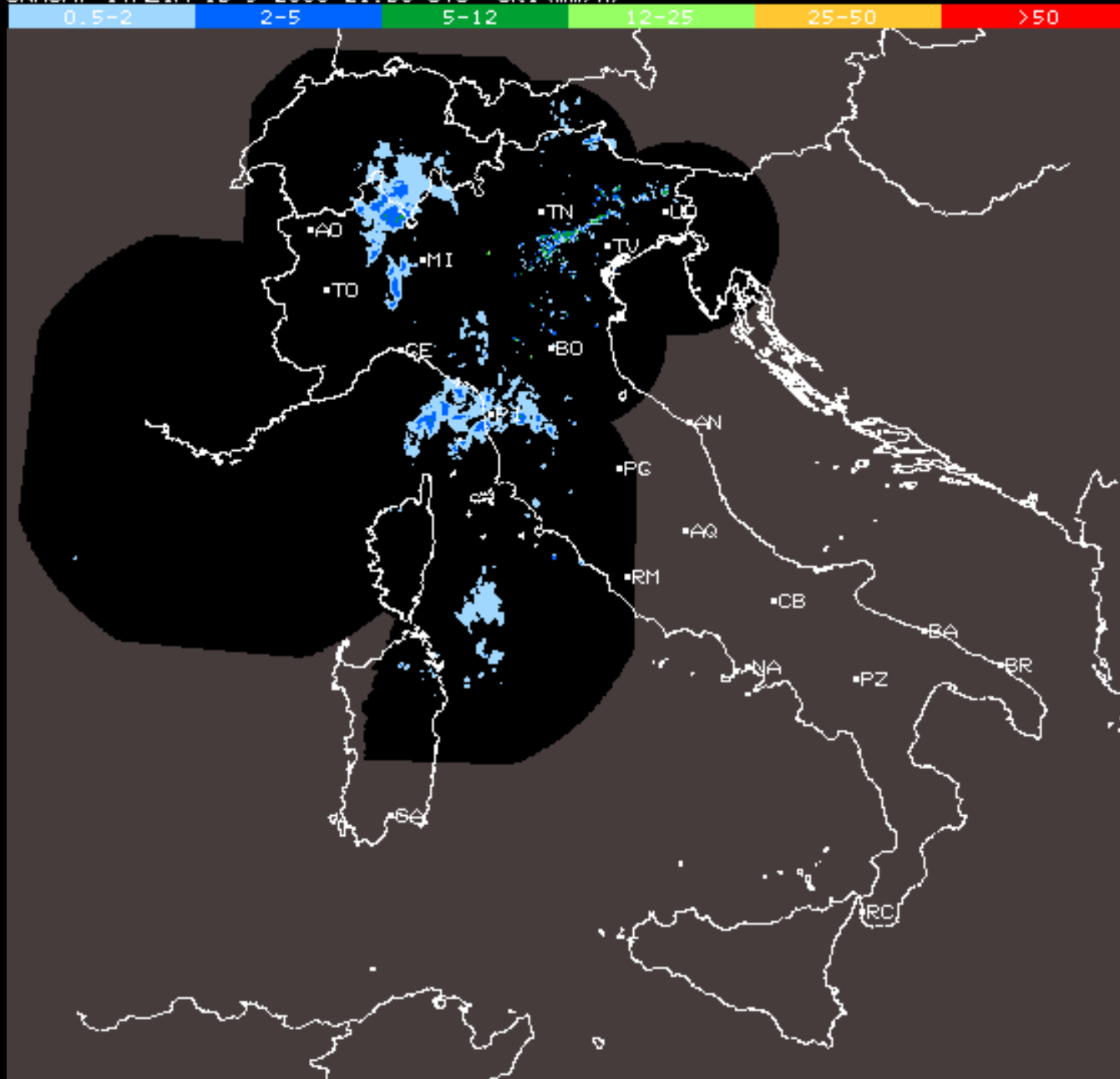
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CNMCA: ITALIA 13-5-2006 21.00 UTC SRI (mm/h)



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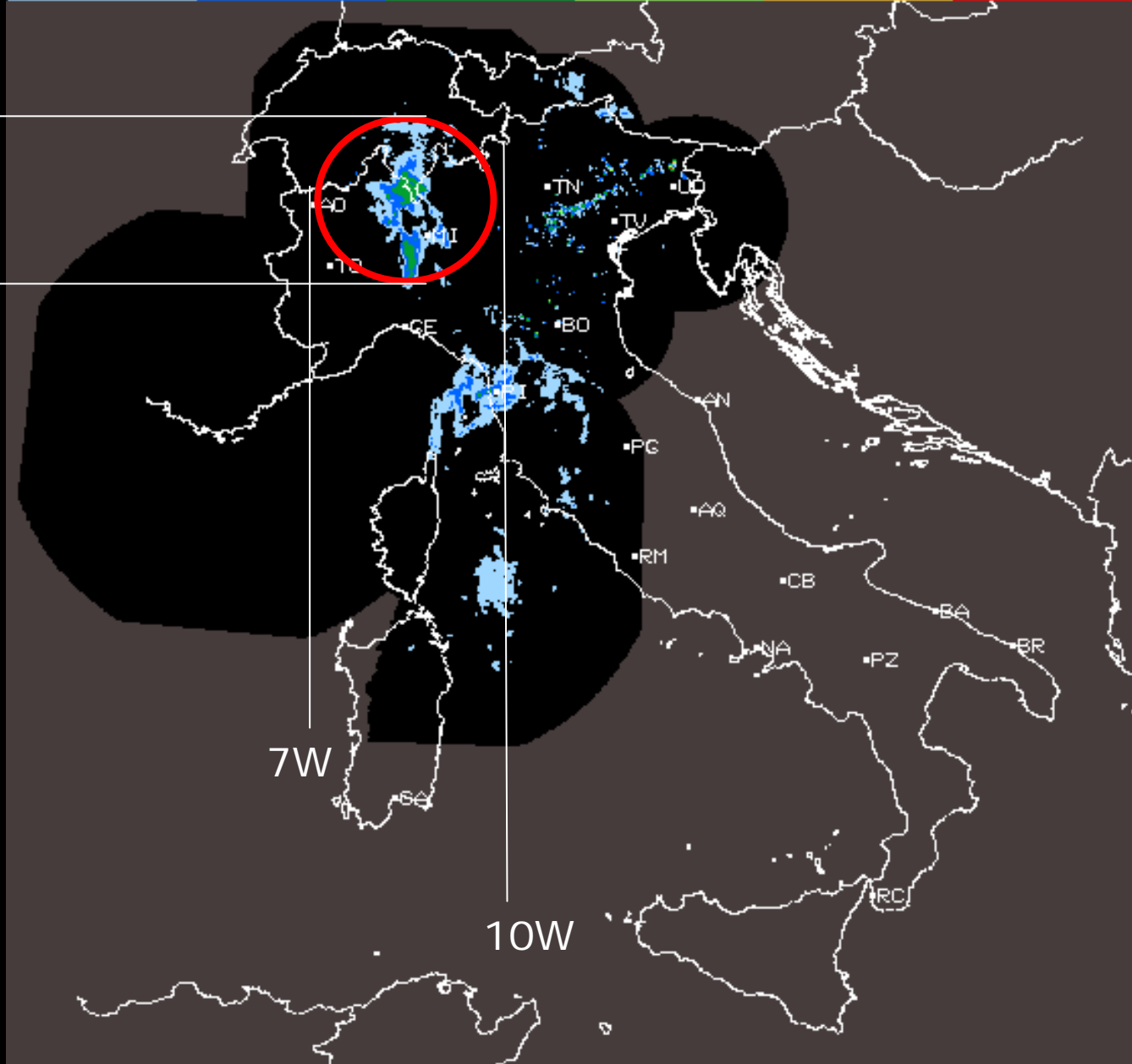
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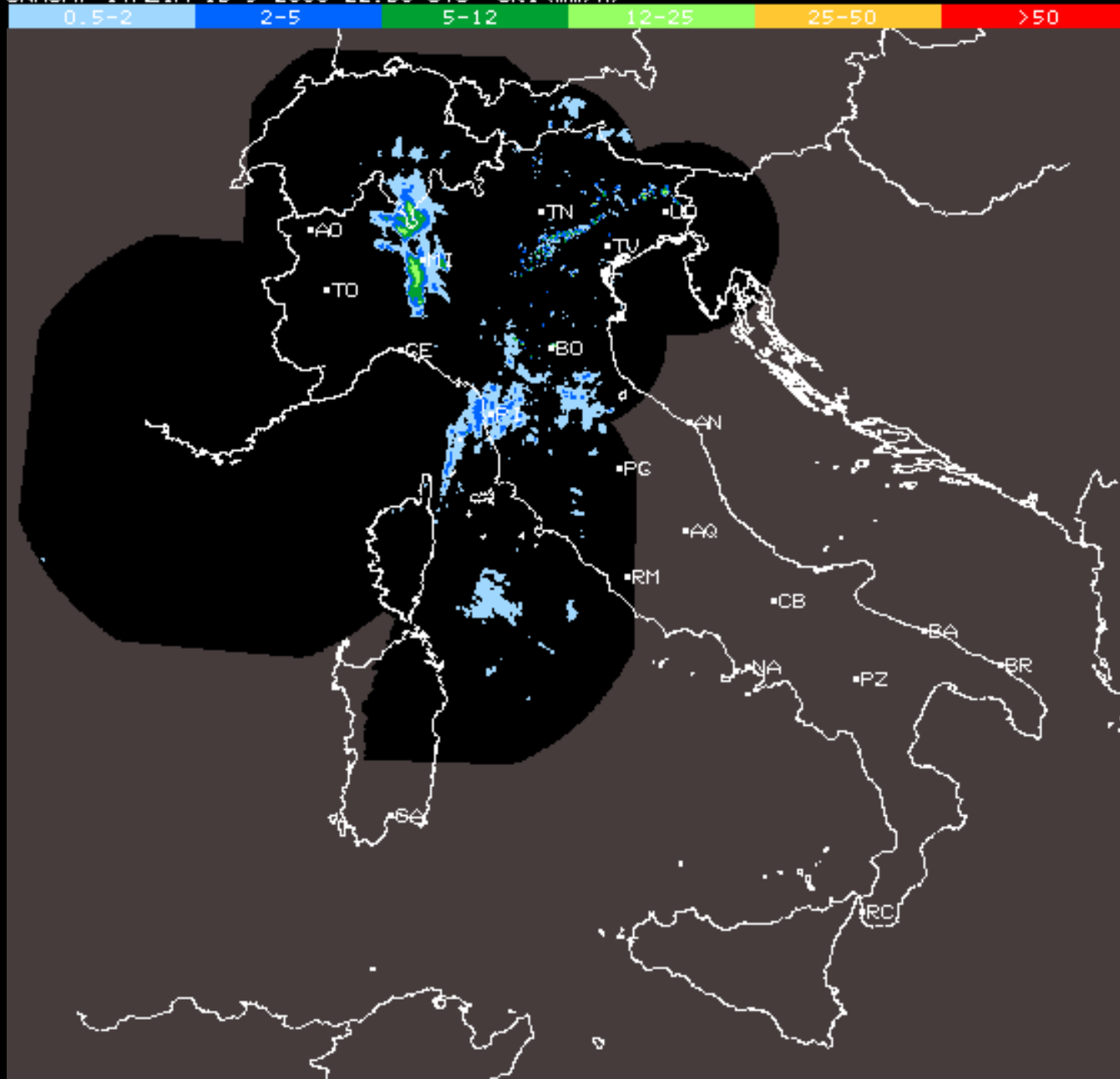
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45N



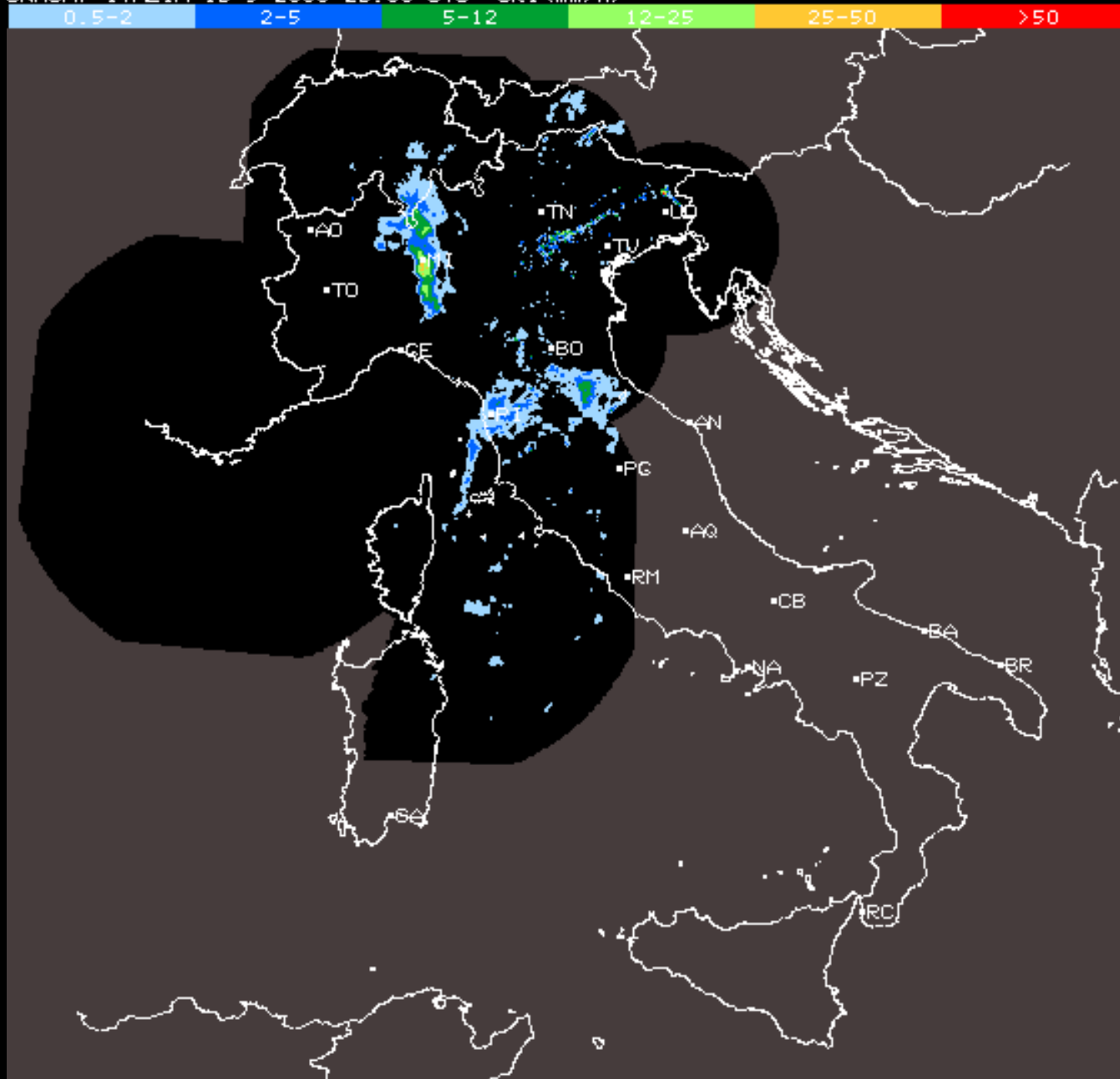
7W

10W



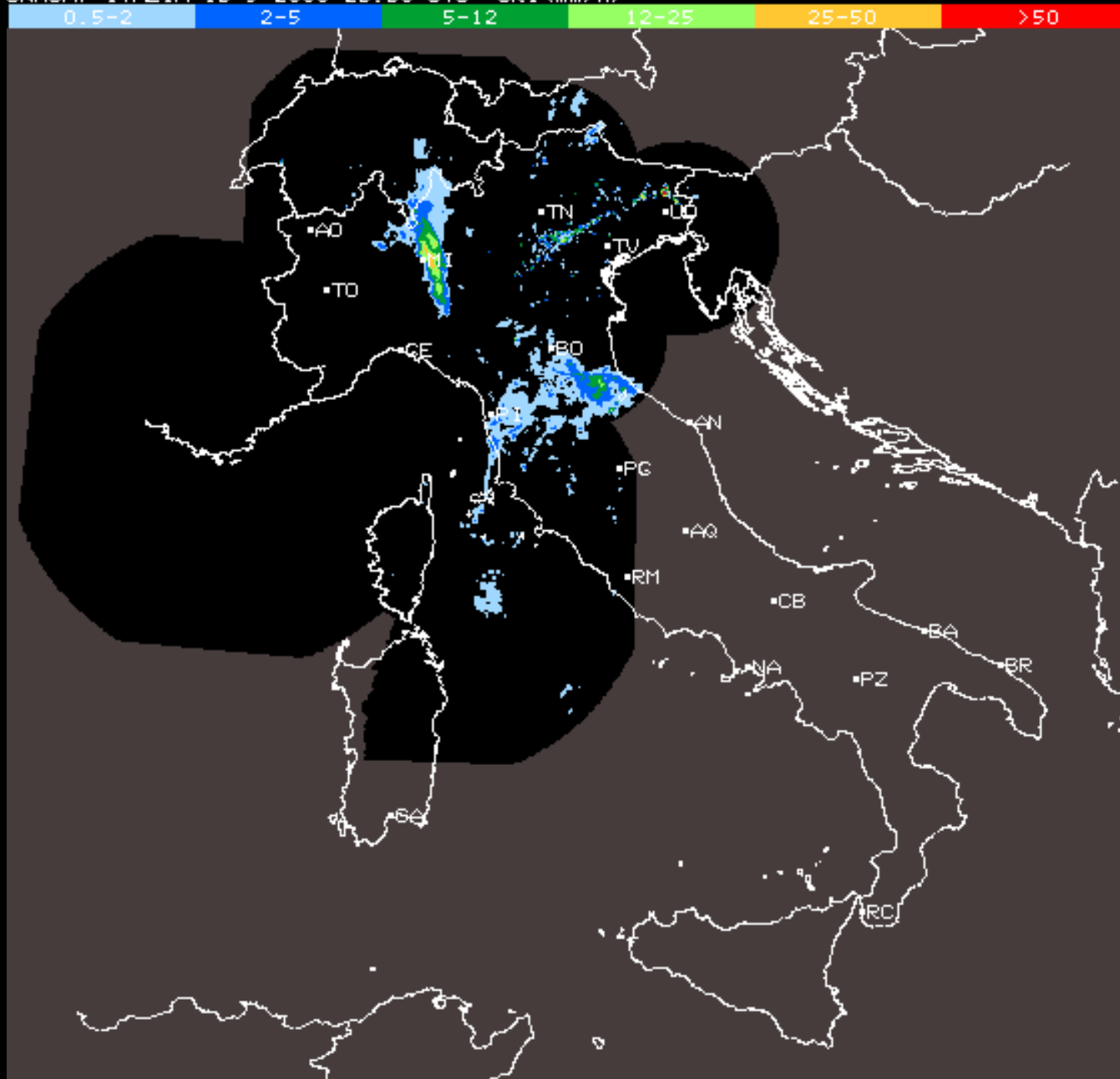
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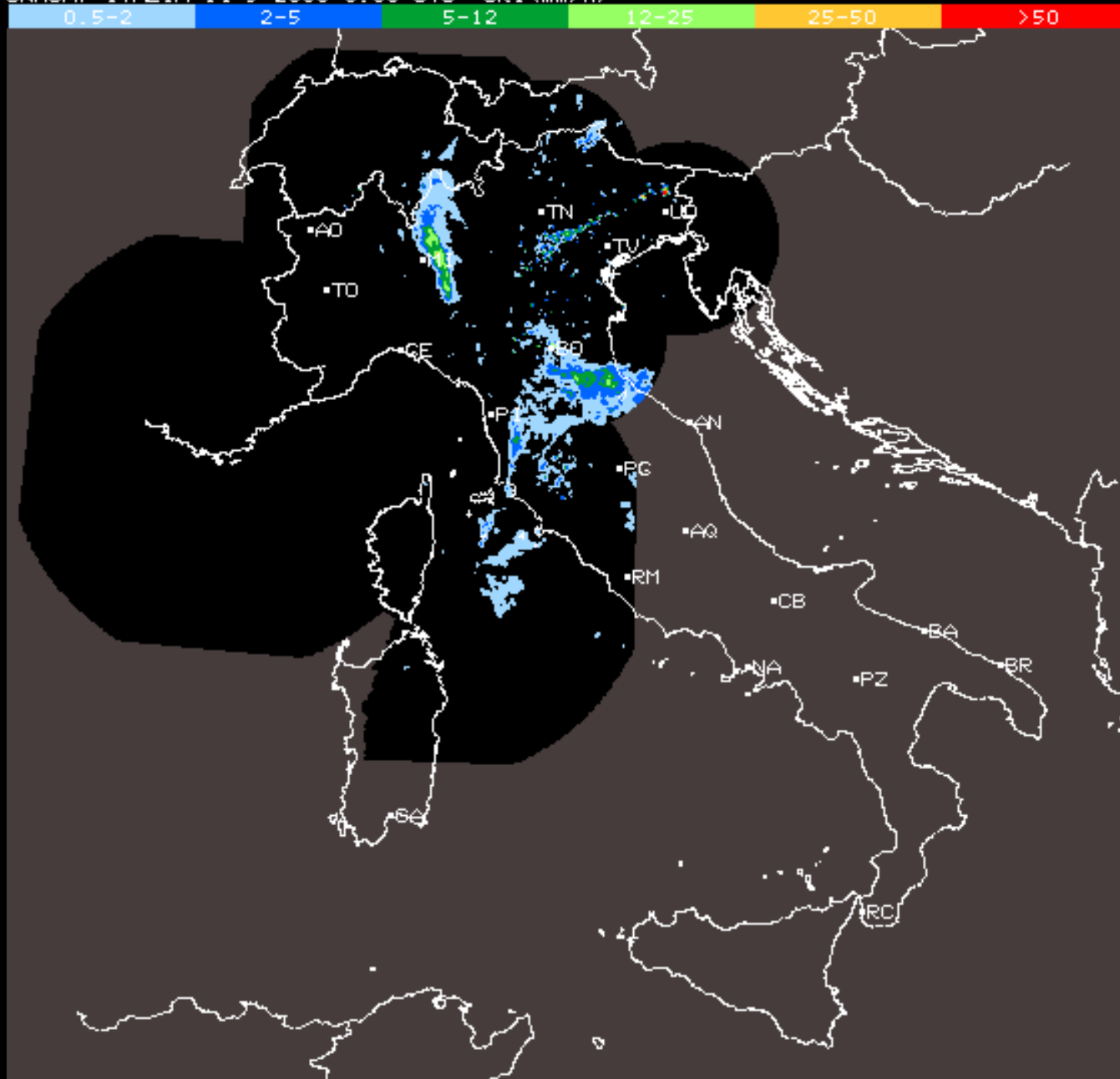
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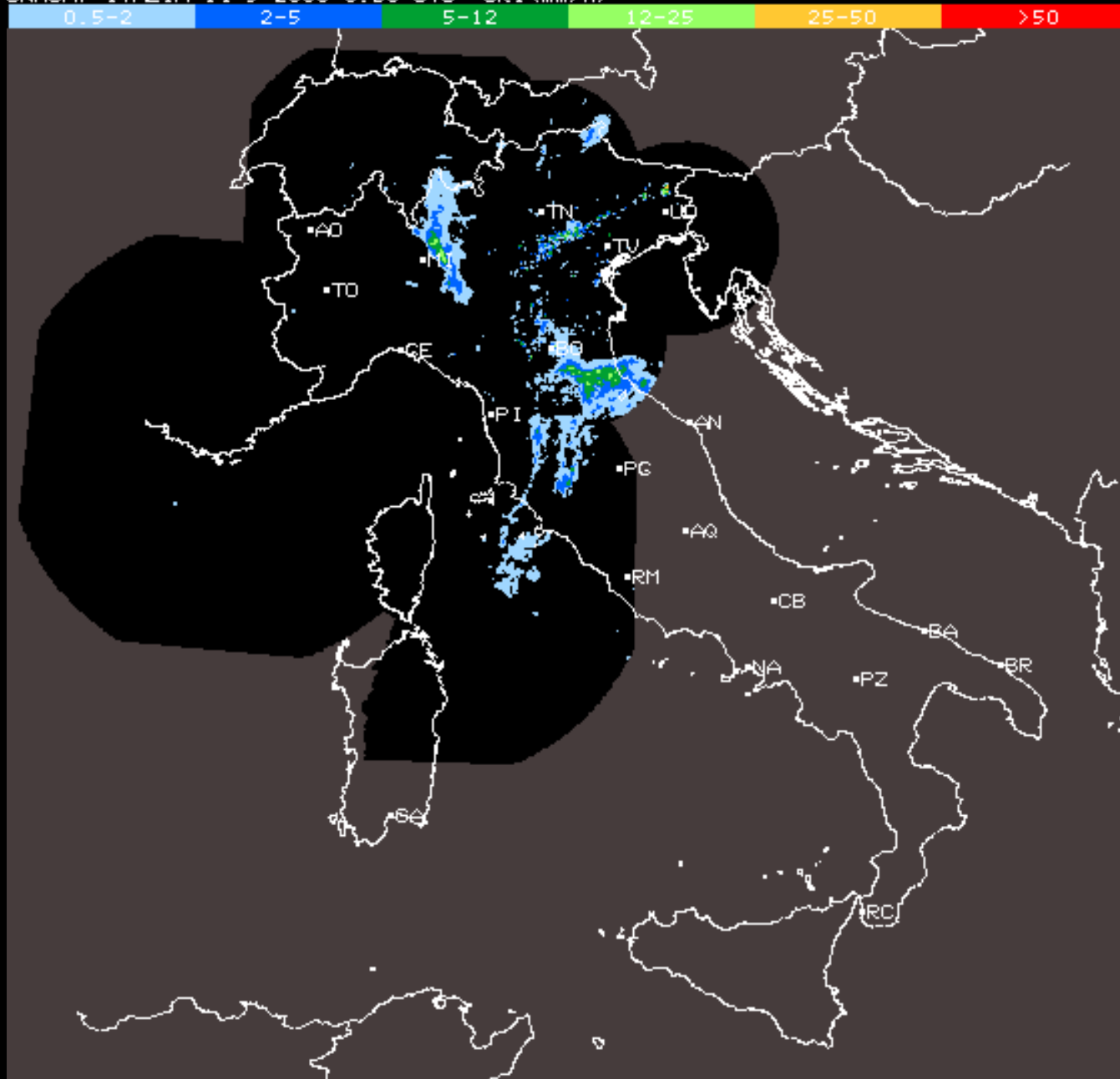
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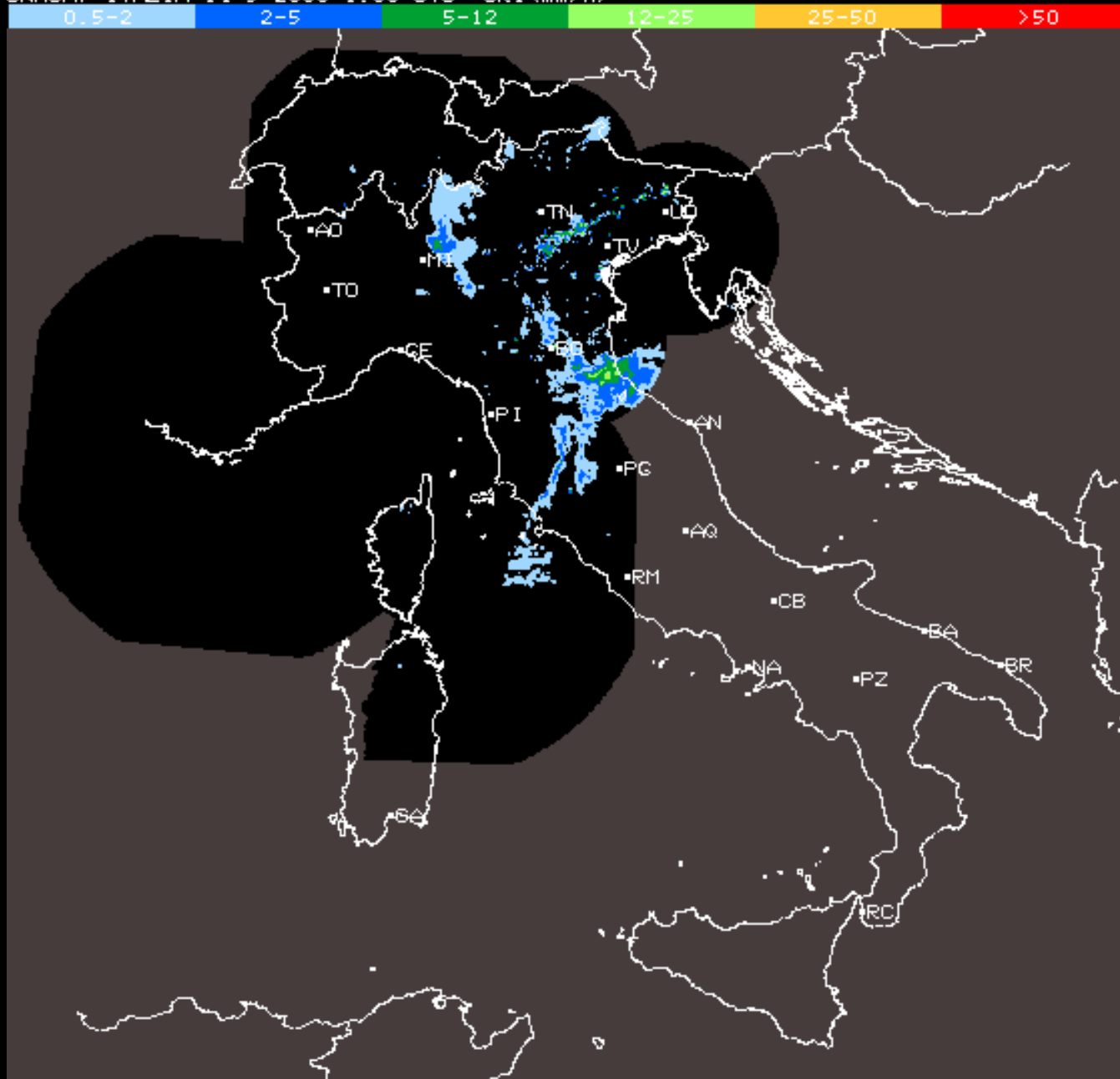
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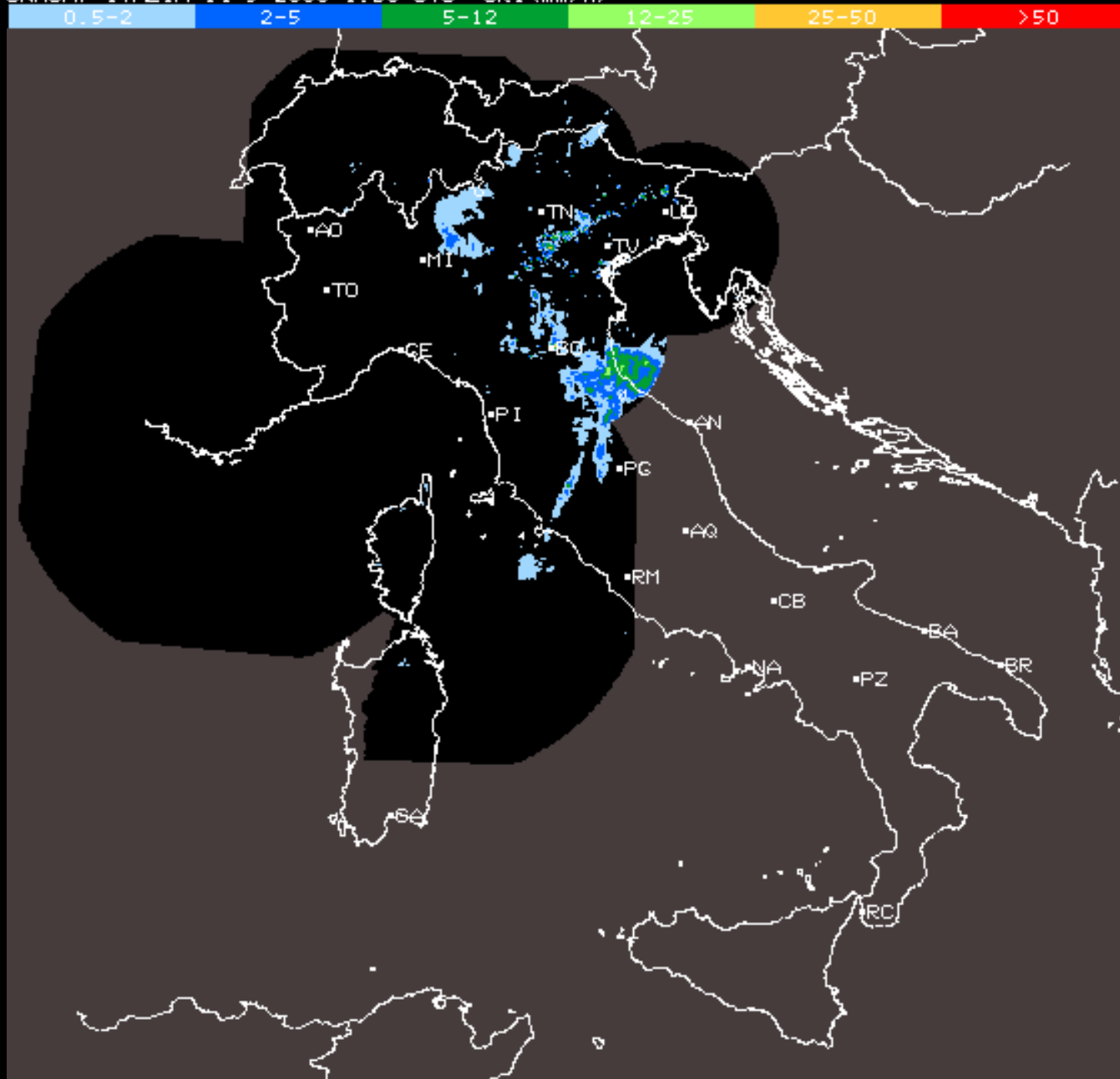
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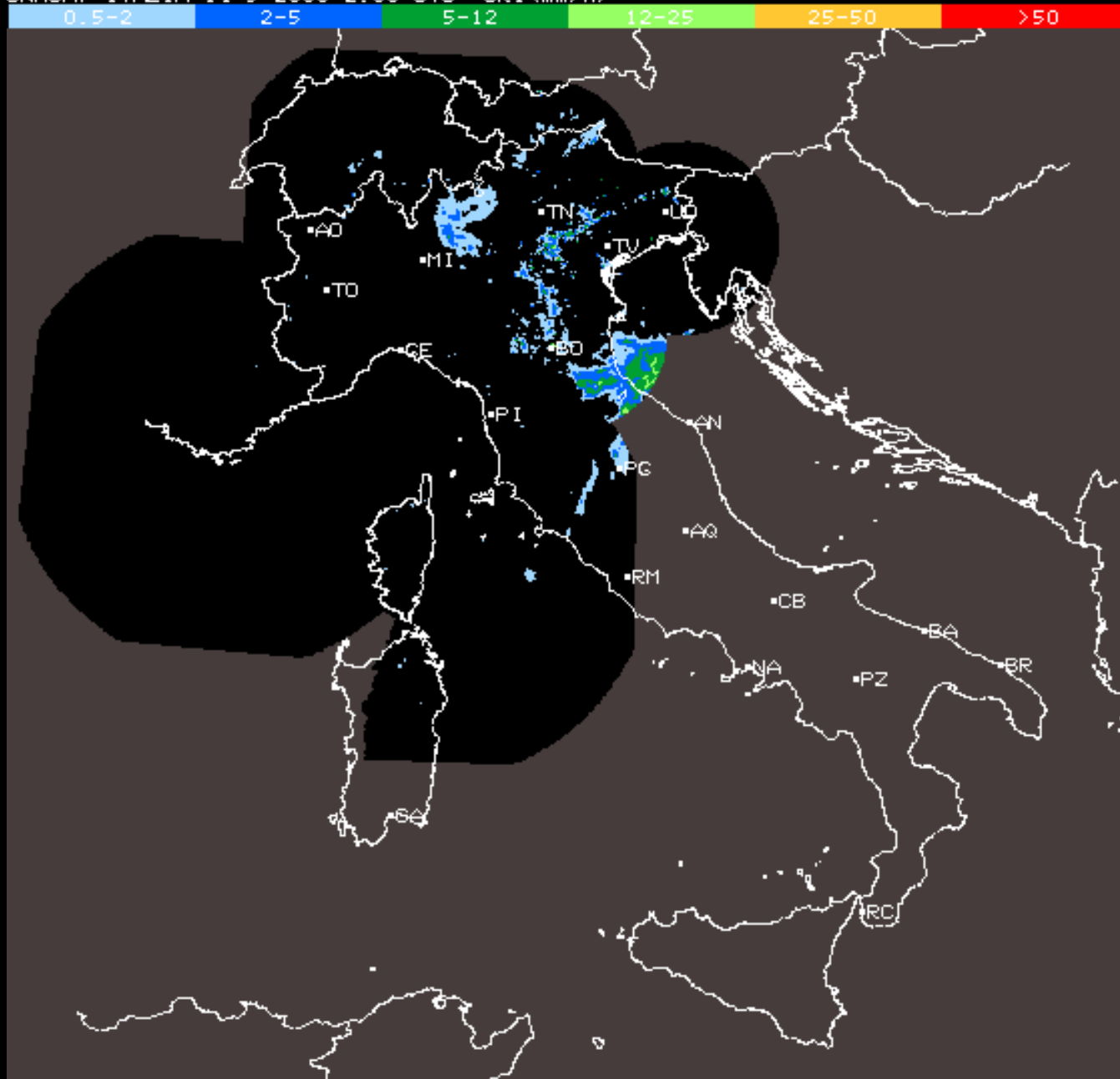
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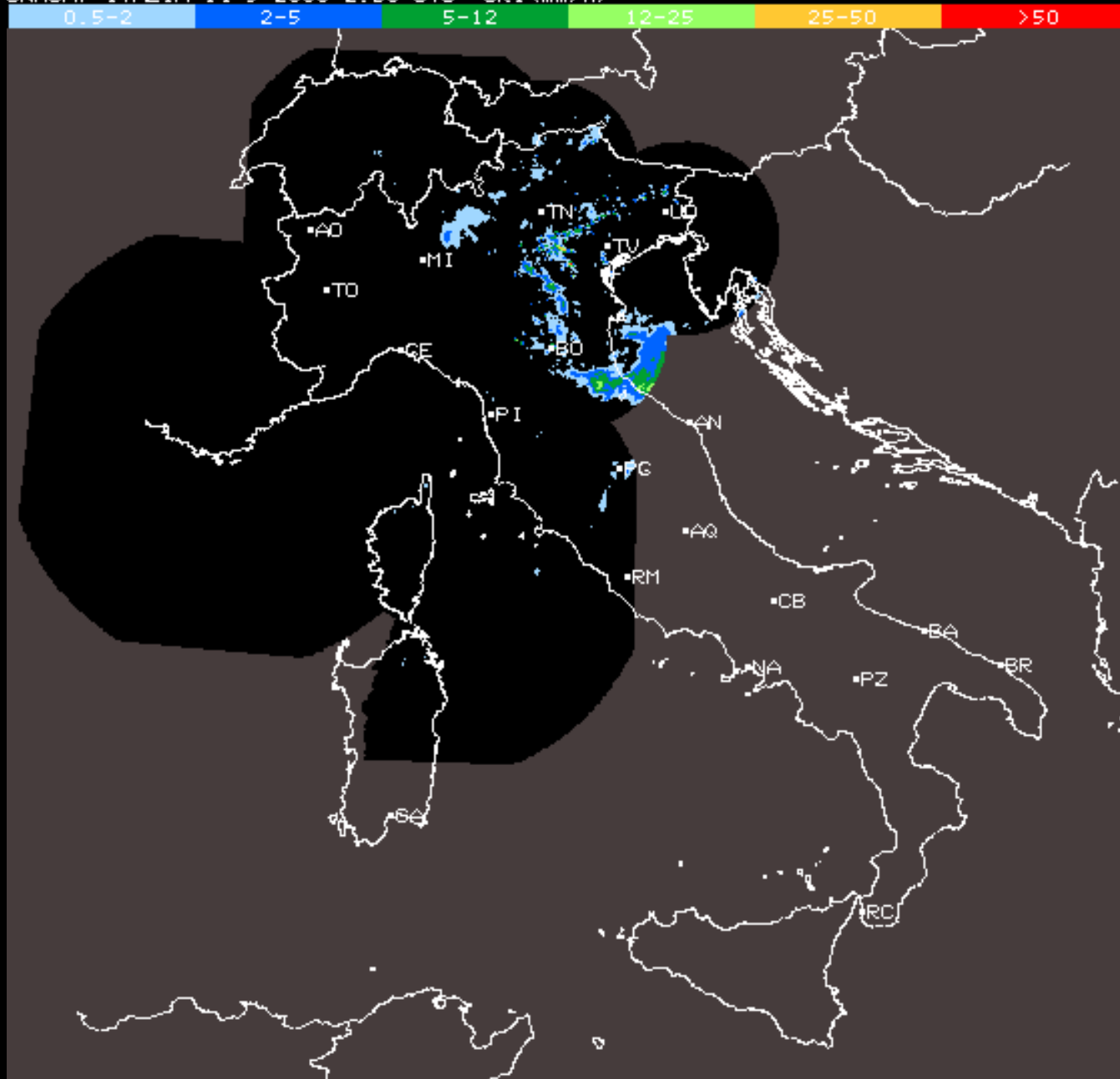
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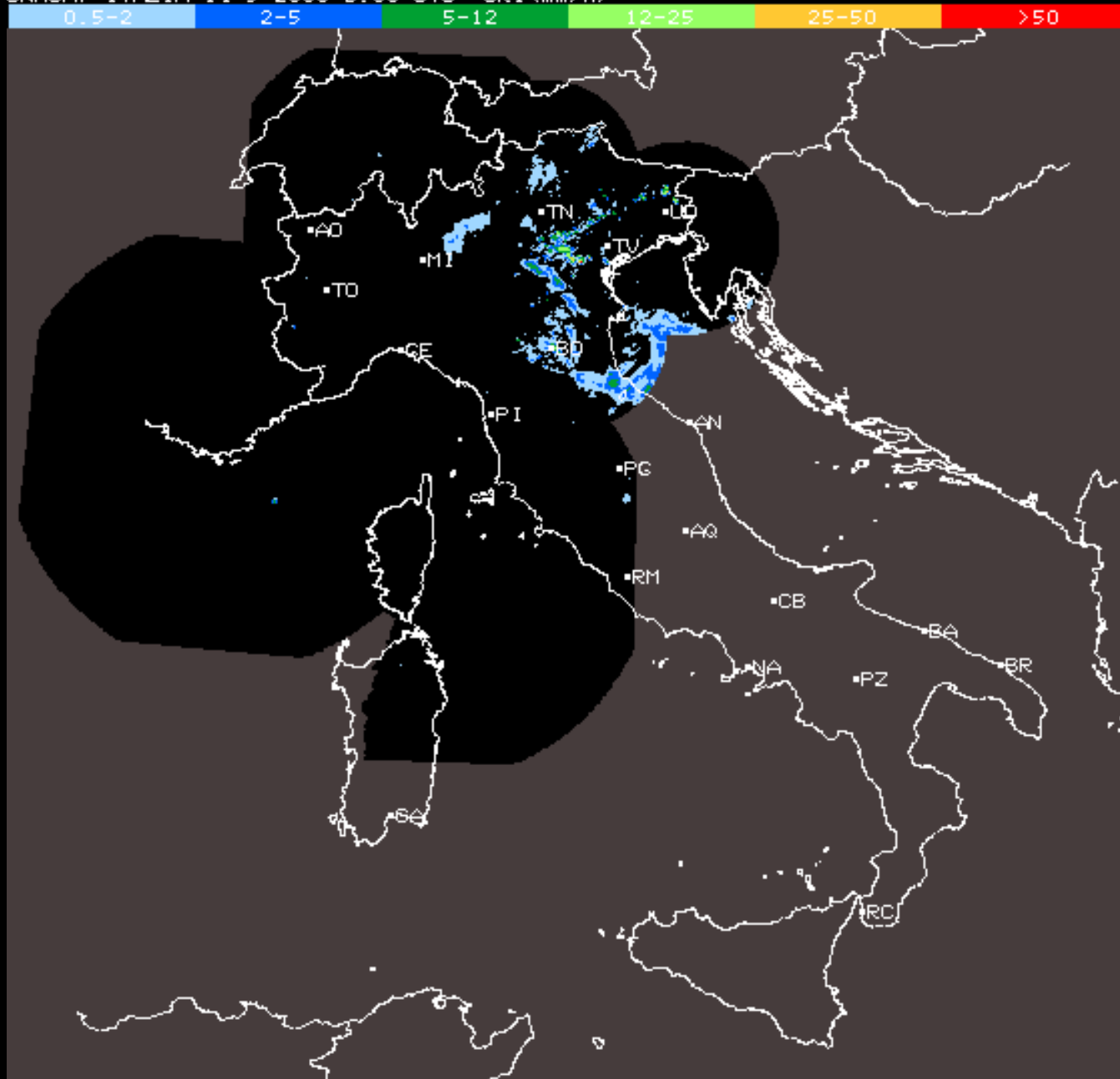
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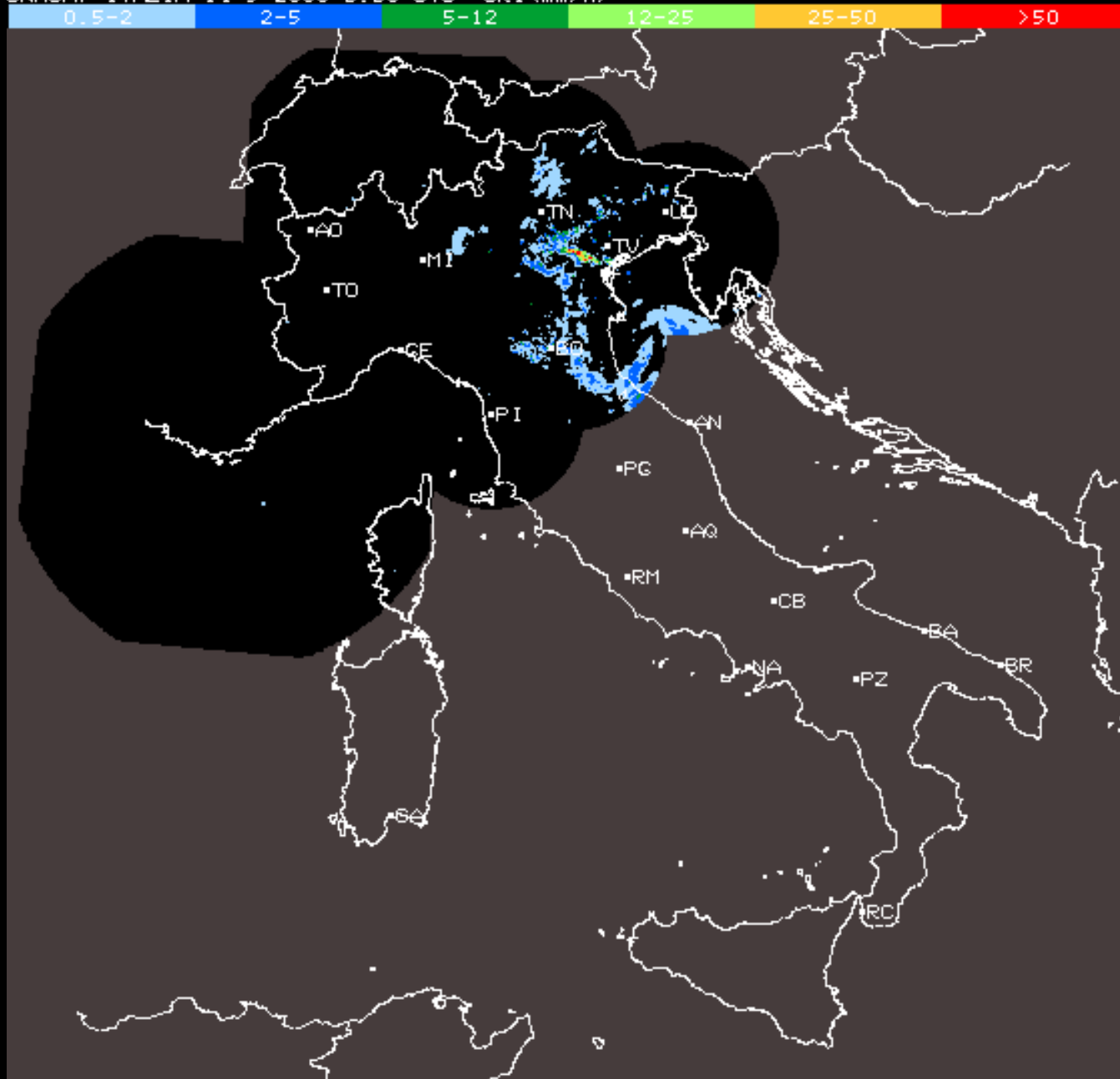
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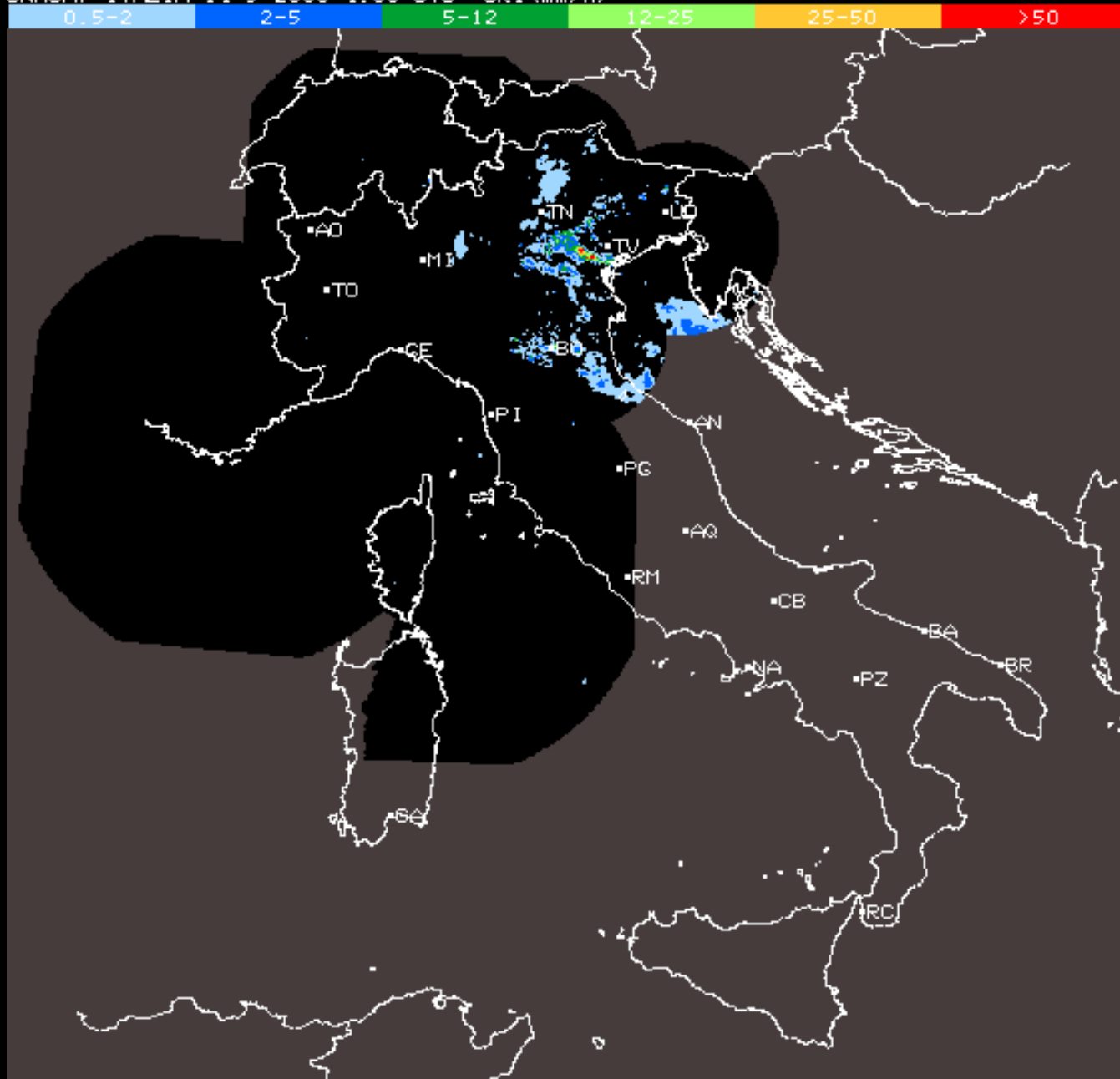
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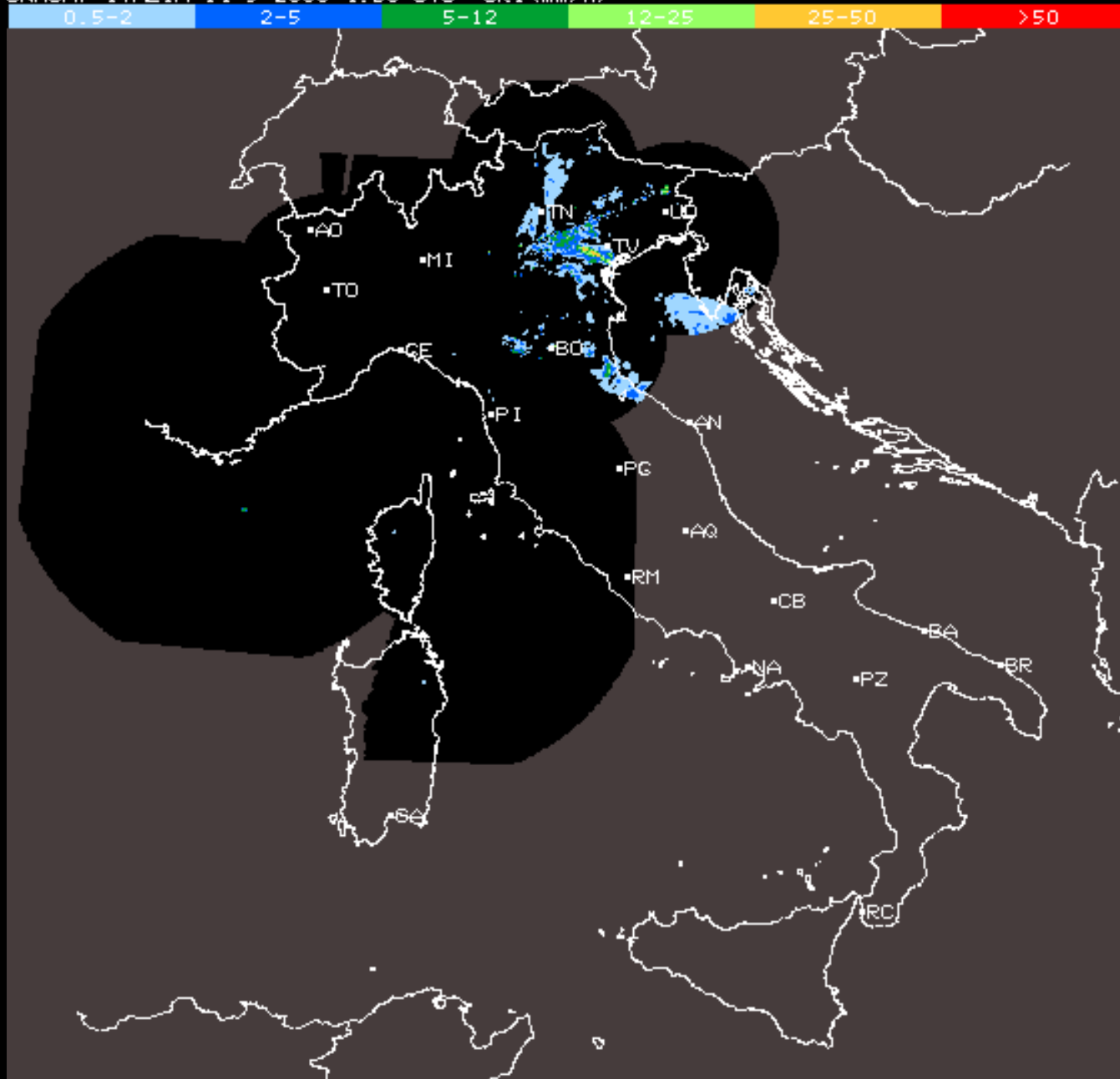
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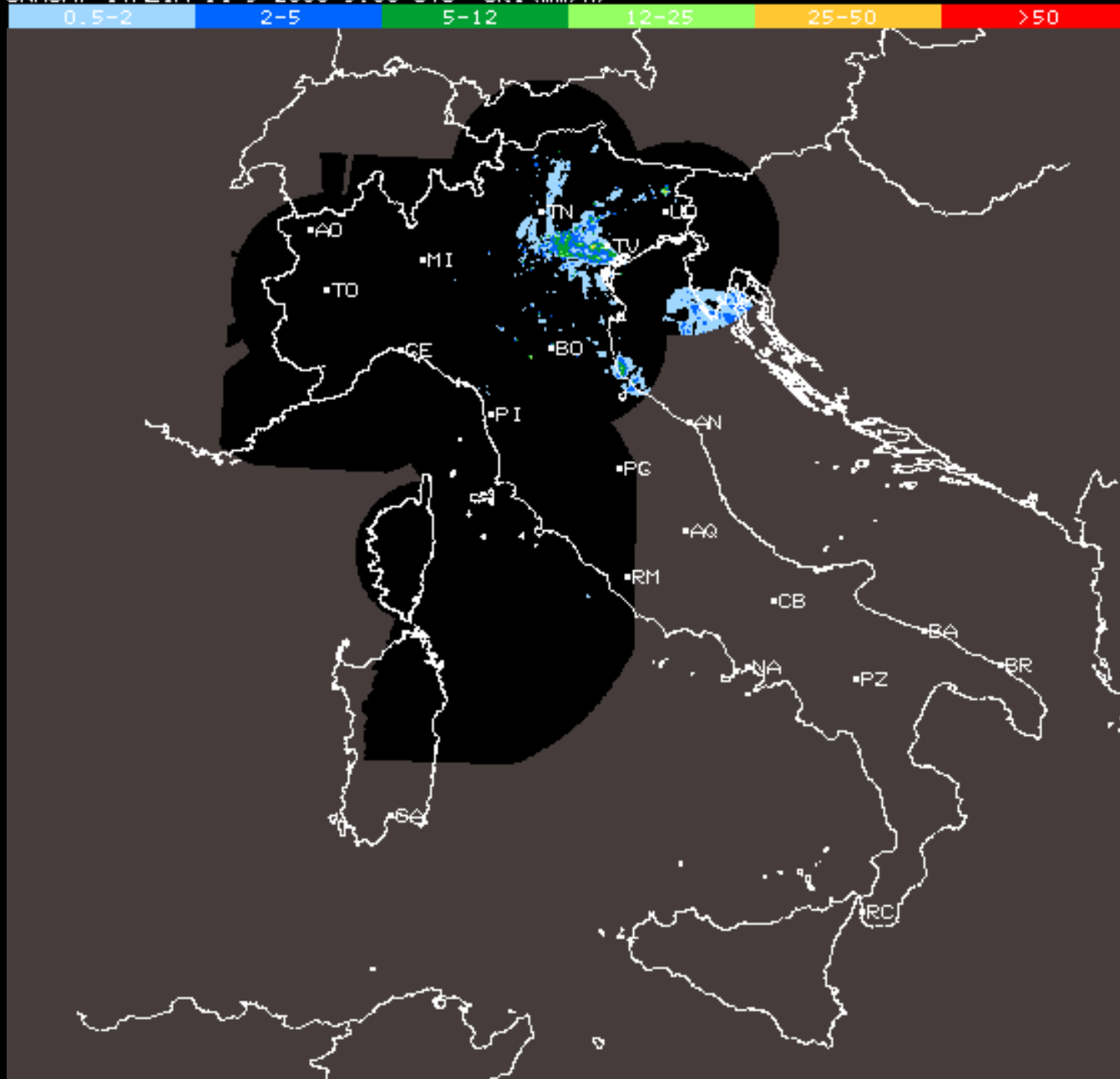
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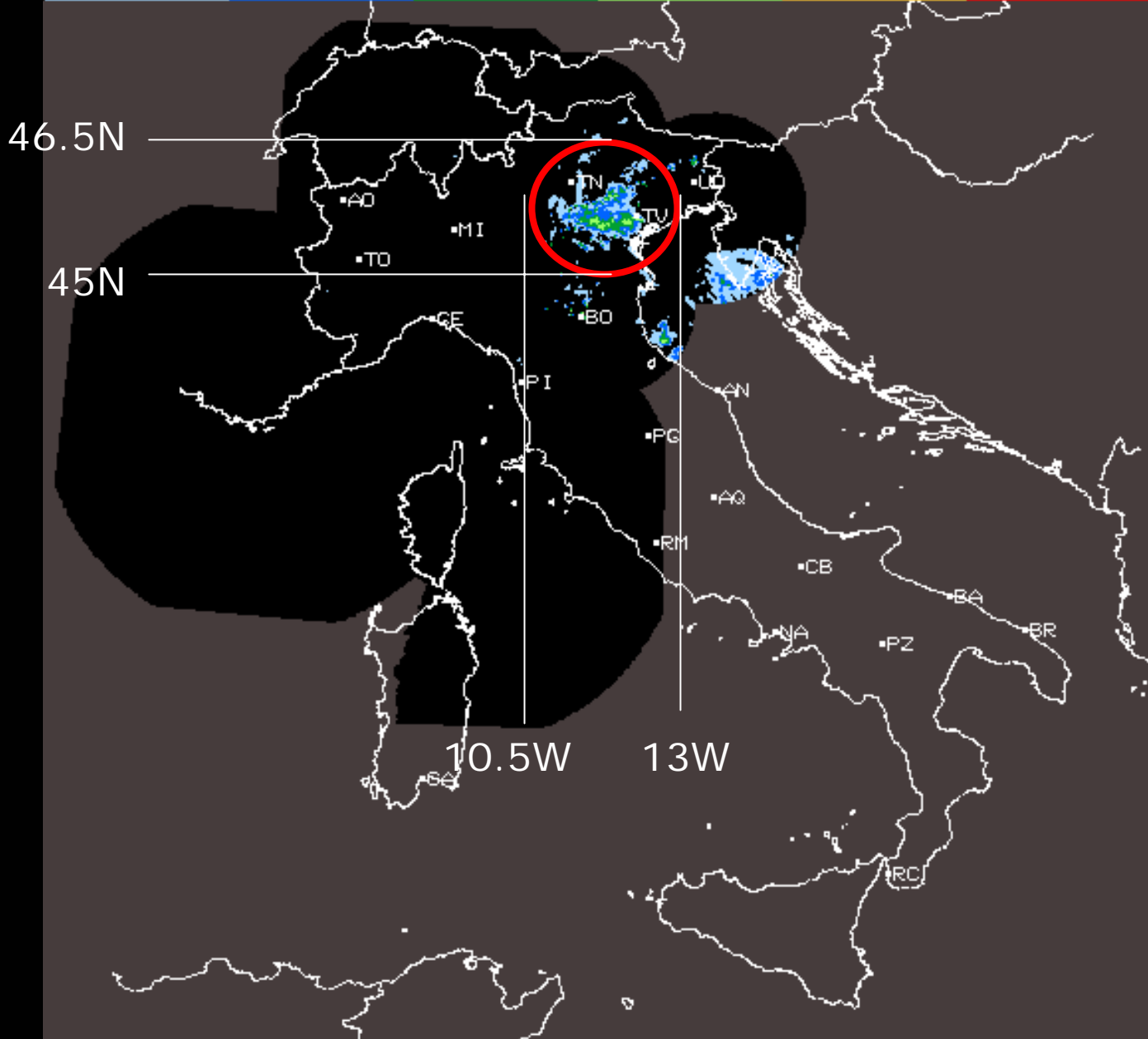
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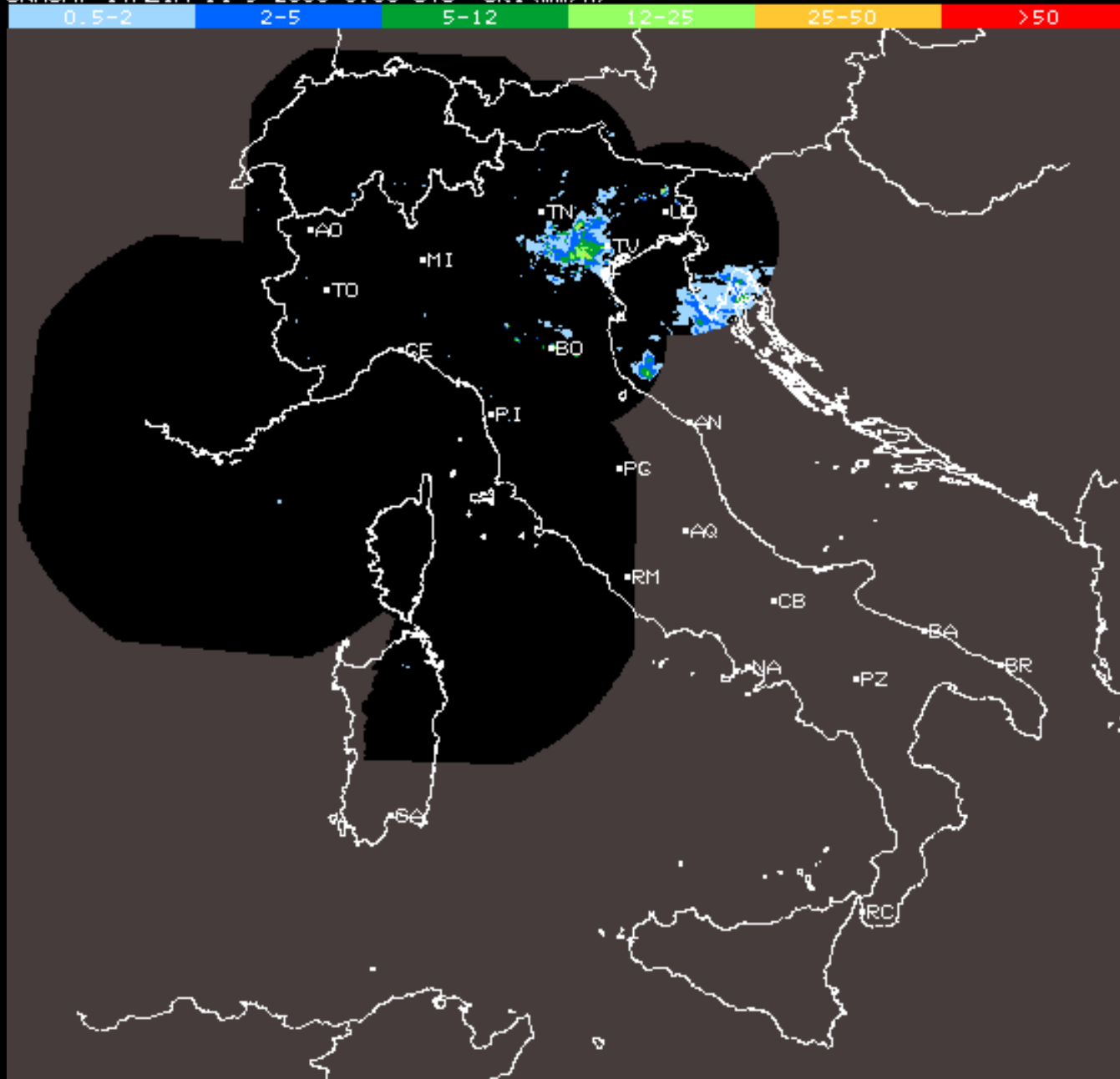


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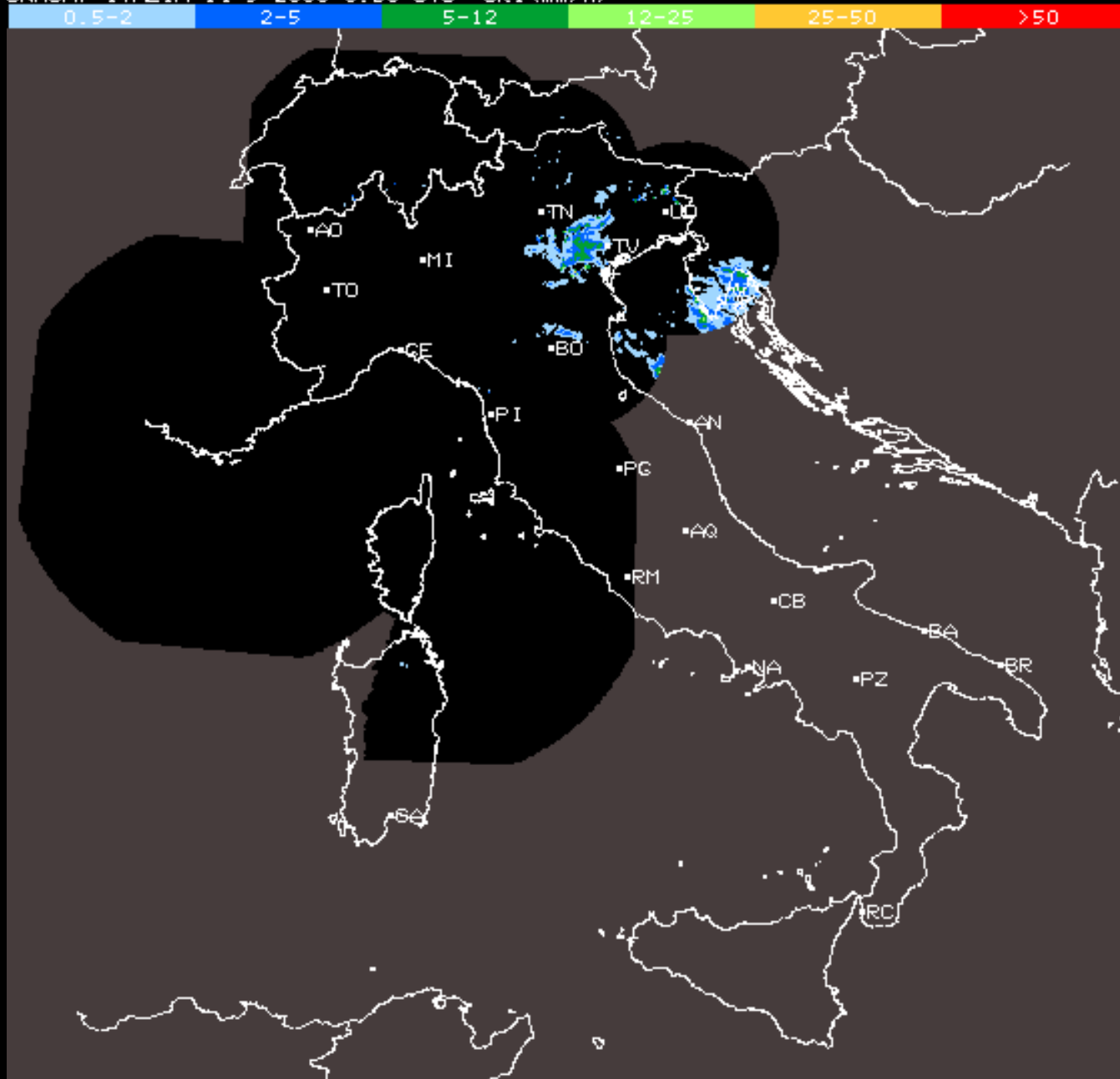


CNMCA: ITALIA 14-5-2006 6.00 UTC SRI (mm/h)



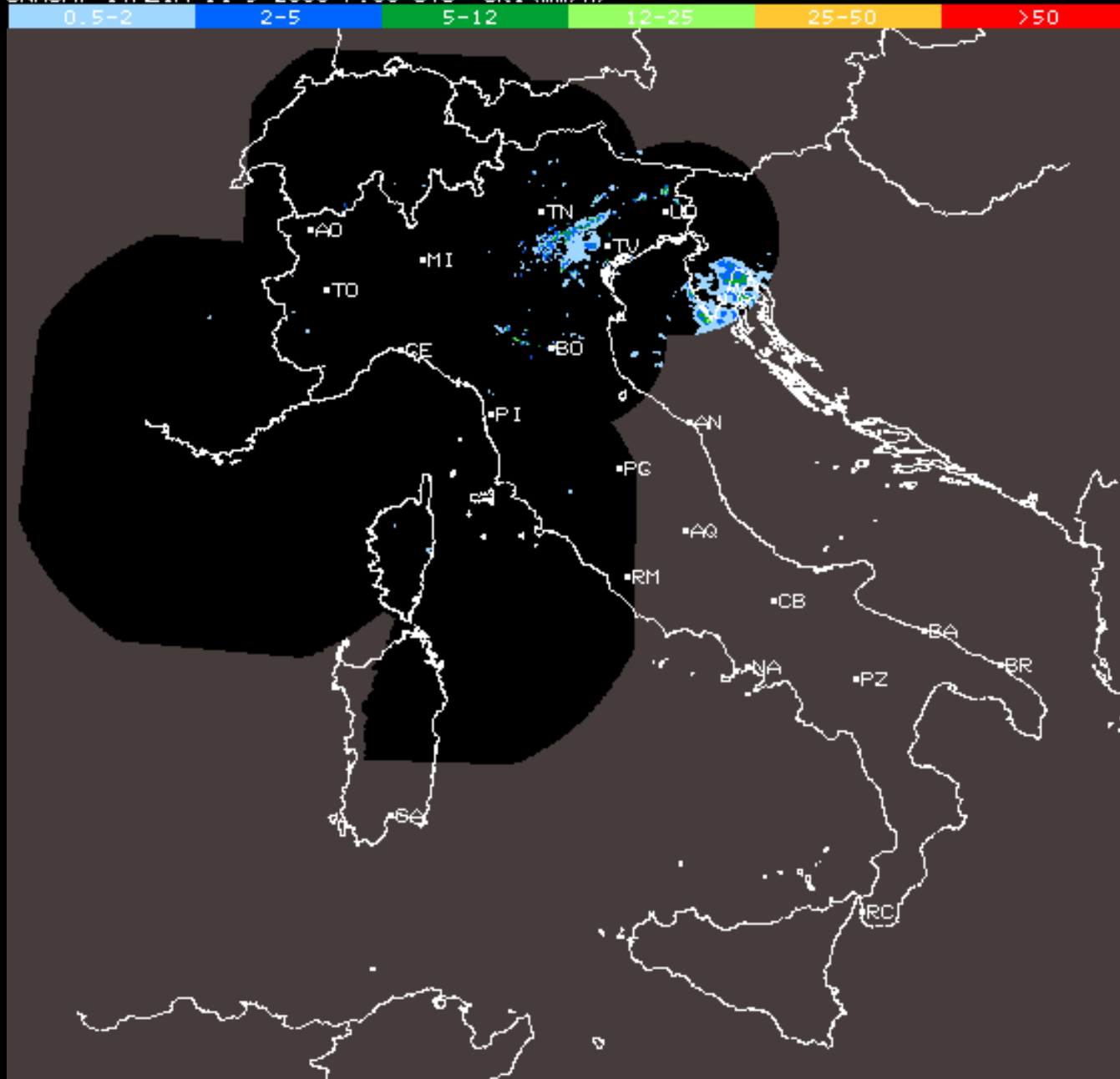
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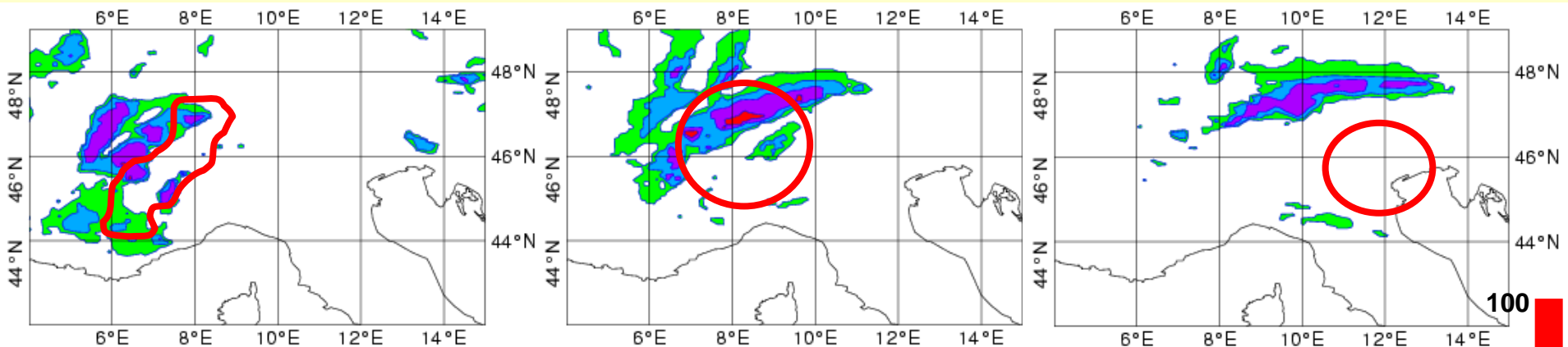
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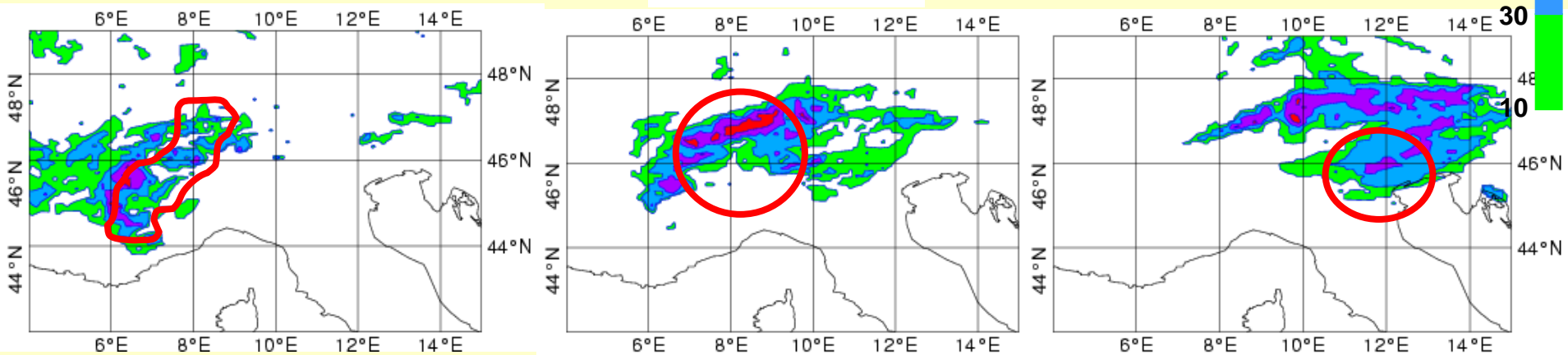
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COSMO-LEPS PROB. MAPS fc. range 0-6h



> 10mm/6h

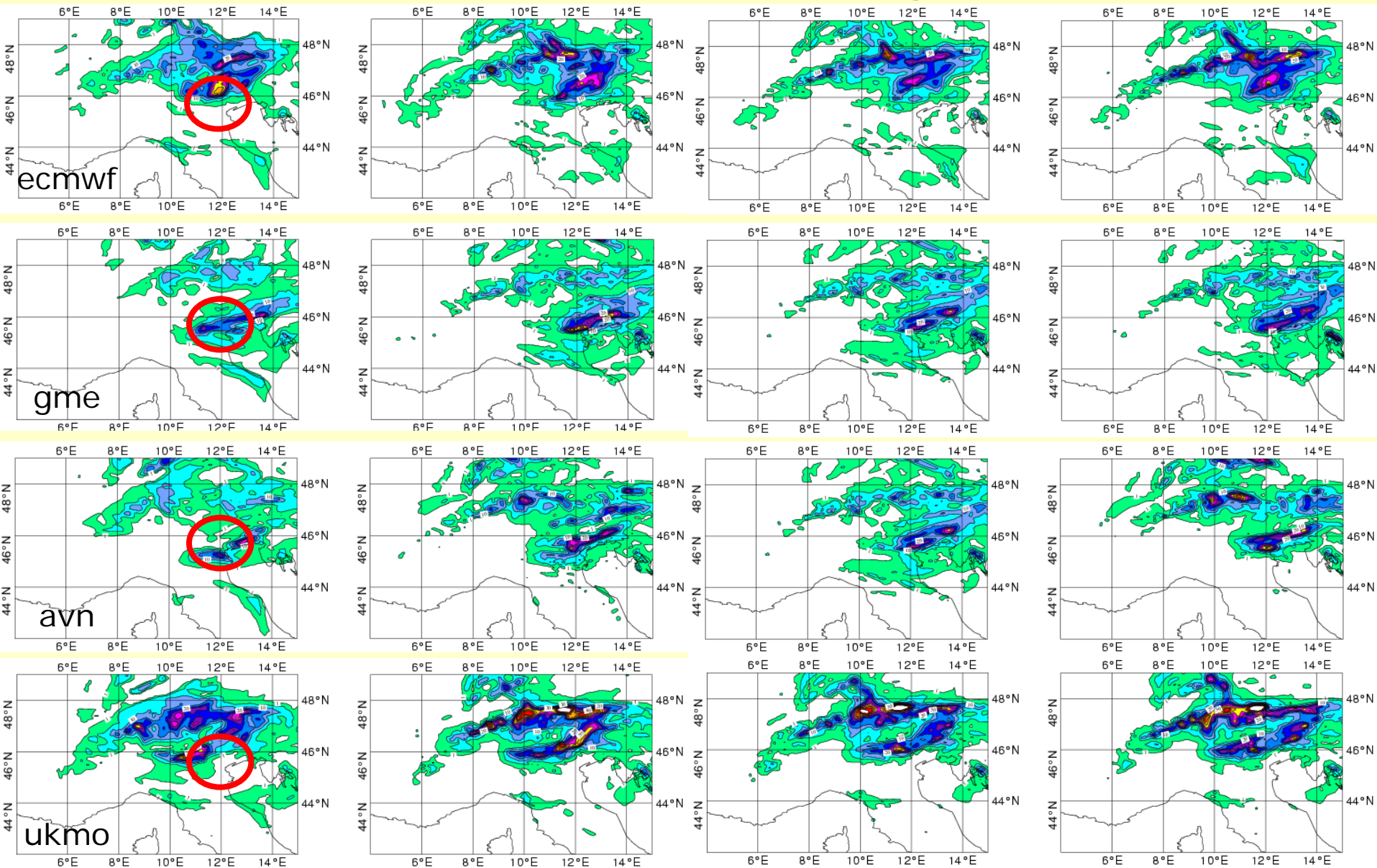
COSMO-SREPS PROB. MAPS fc. range 12-18h



> 10mm/6h

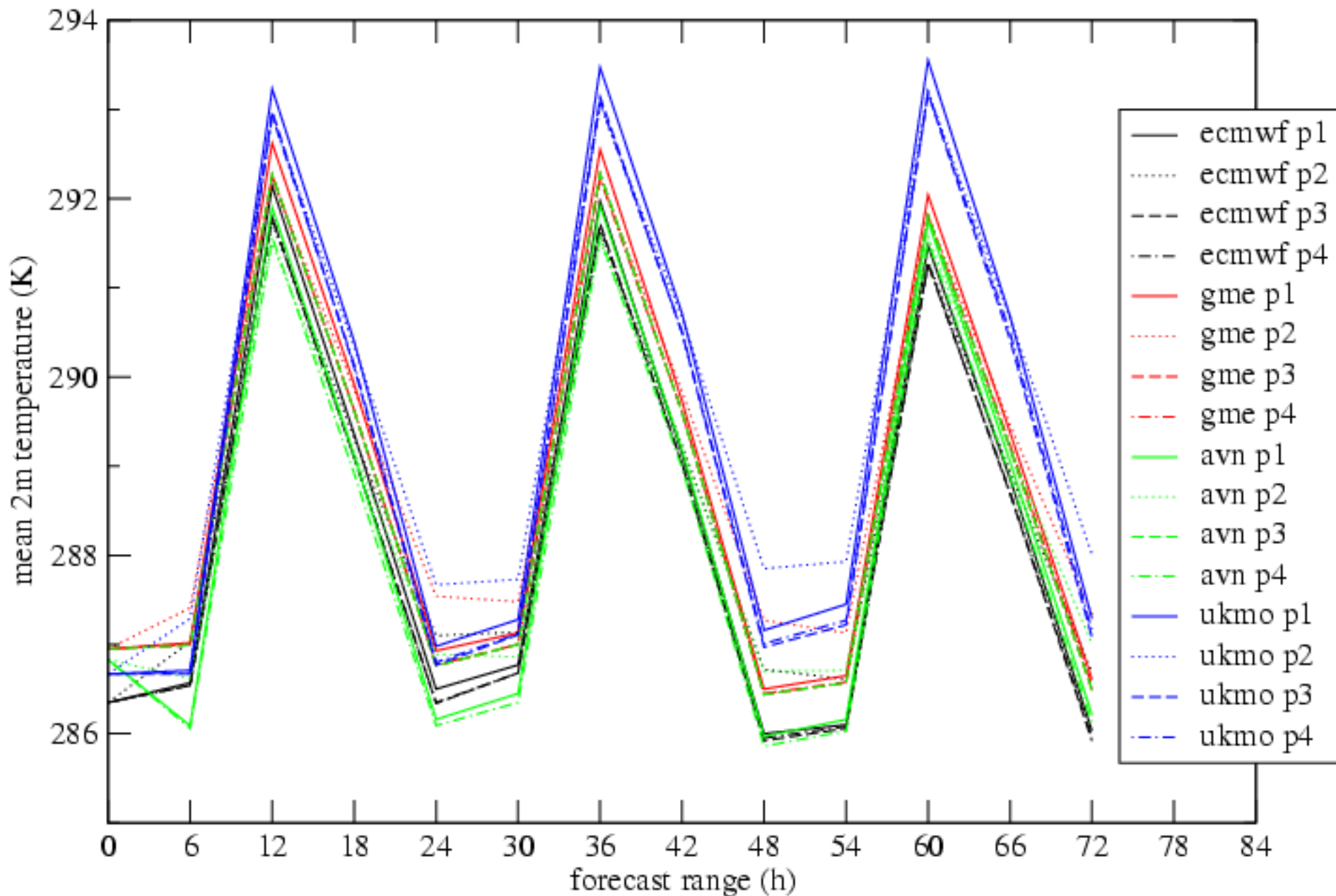
13 May 12-18 UTC

COSMO-SREPS fc. range 24-30

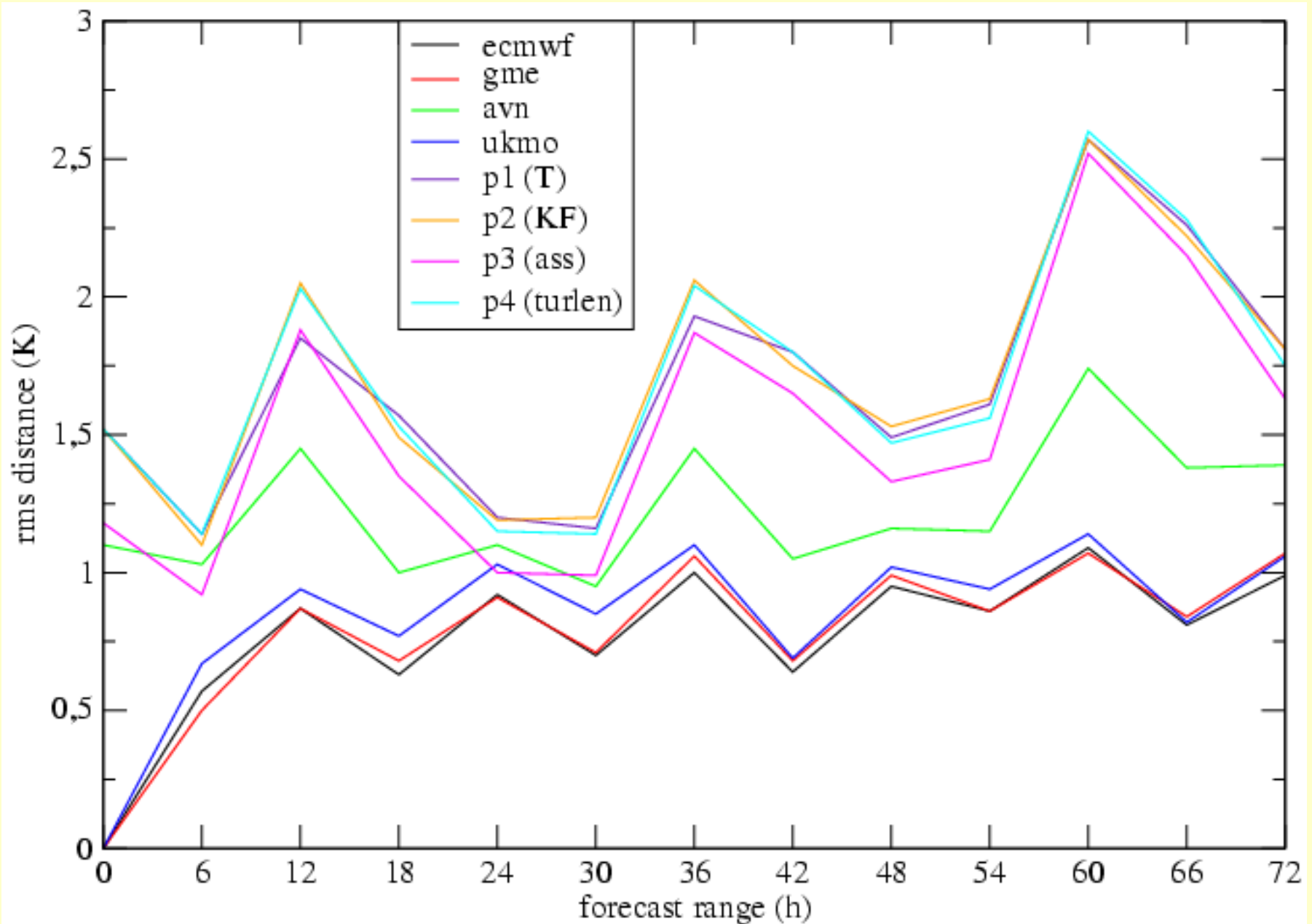


14 May 0-6 UTC

member behaviour ("father")



intra-group distance

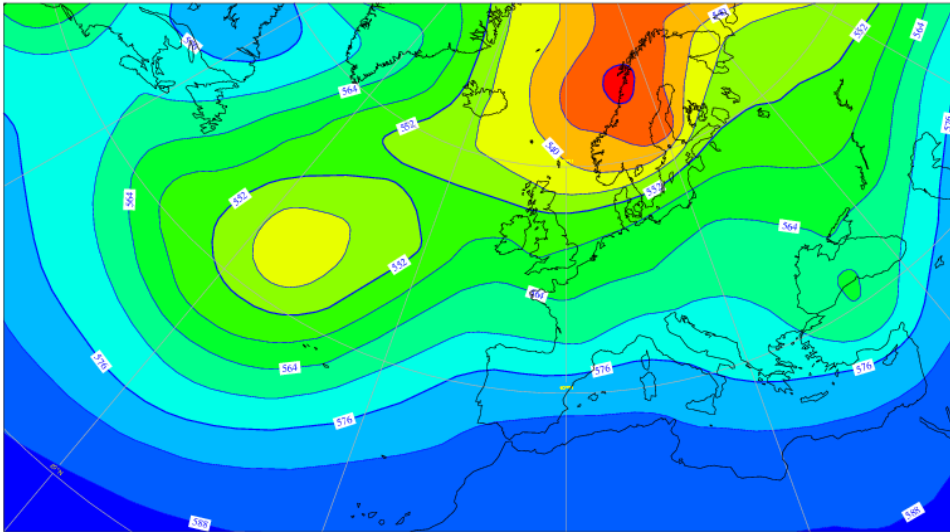


Future work

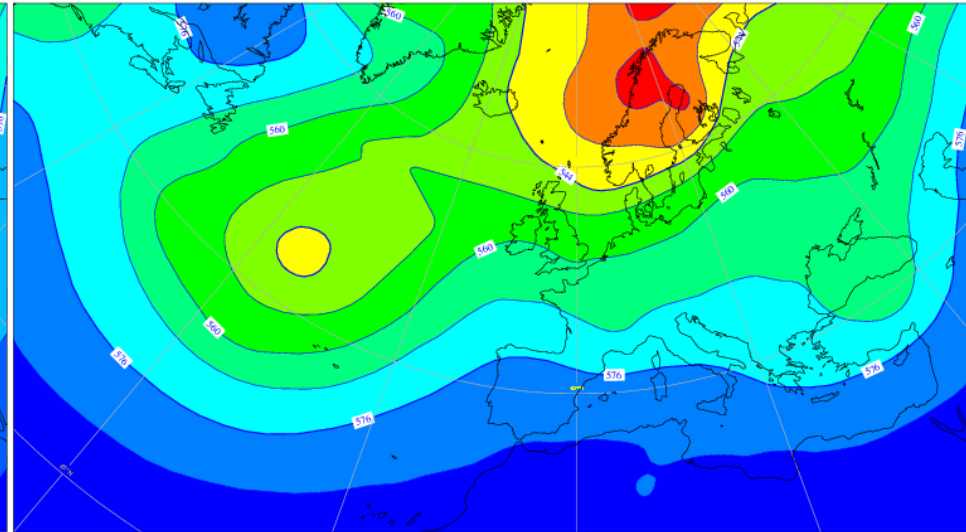
- ❖ choice of the parameters to be perturbed based on a statistical analysis of the different runs behaviour (avoid biases)
- ❖ statistical evaluation of the system over a period (month-season)
- ❖ application of the model perturbation technique also to COSMO-LEPS

Z500 ana

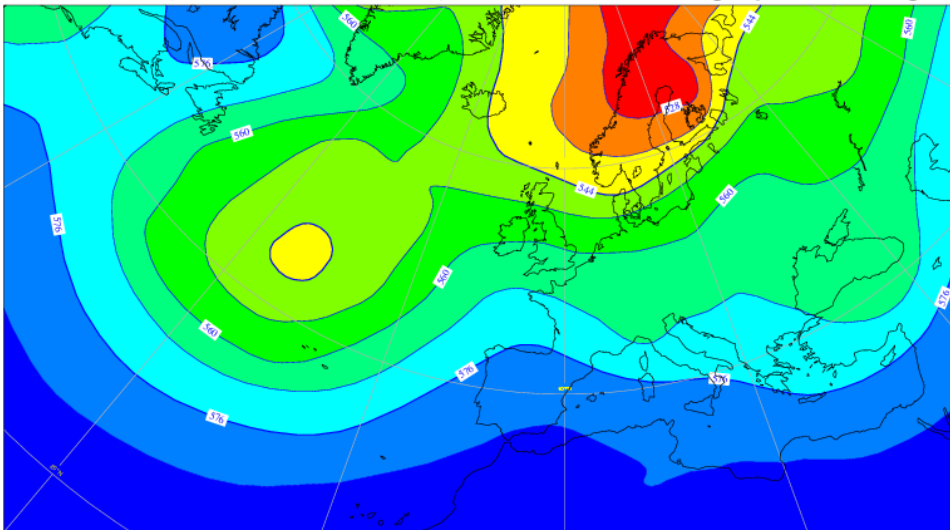
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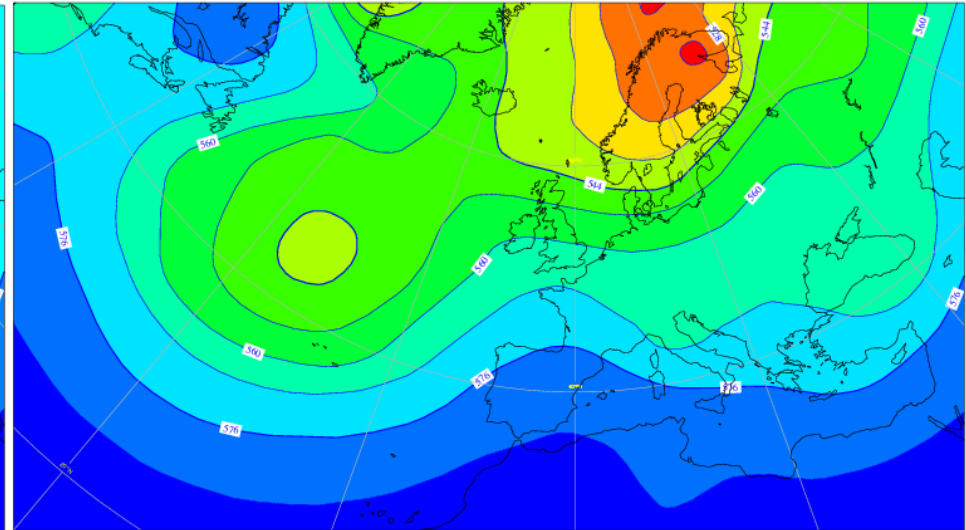
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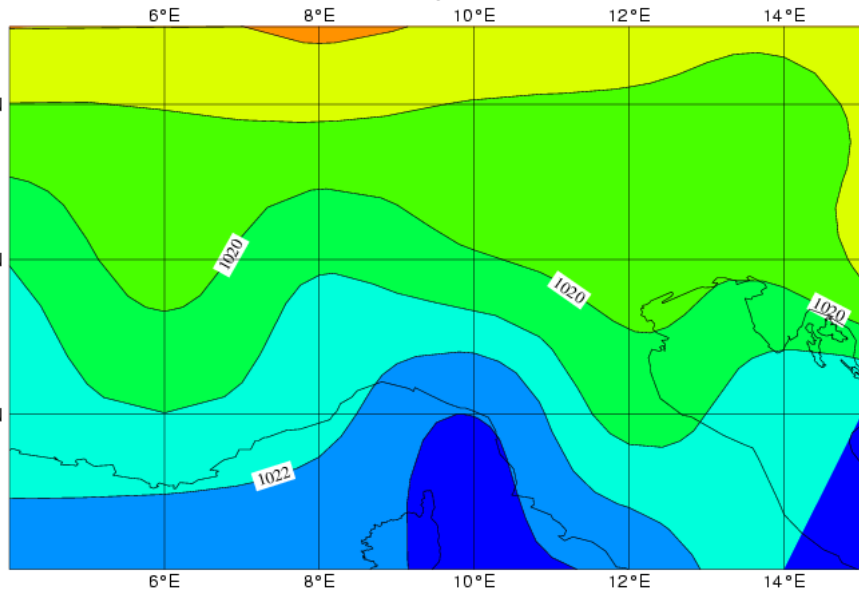
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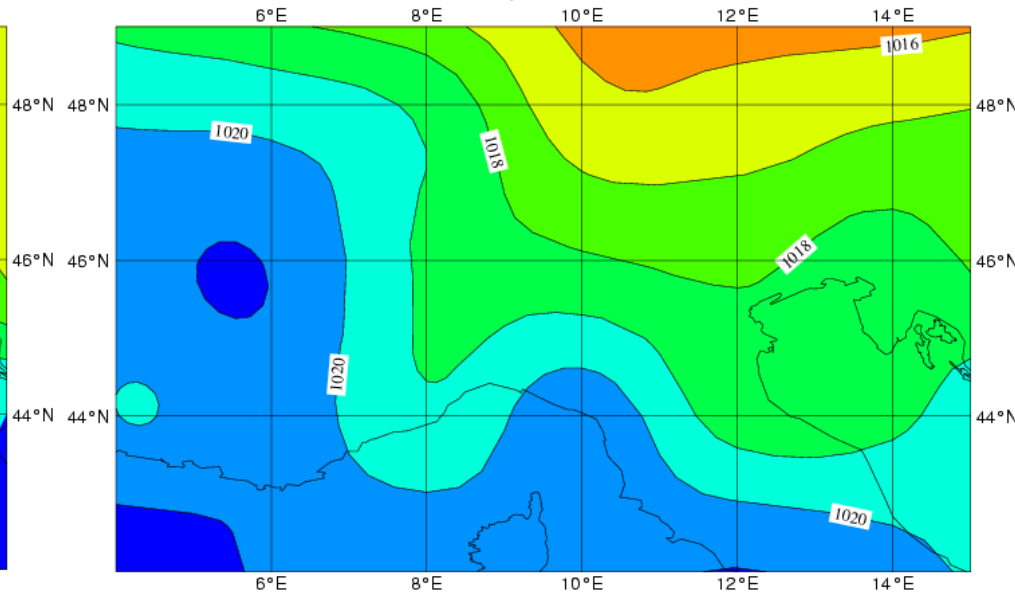
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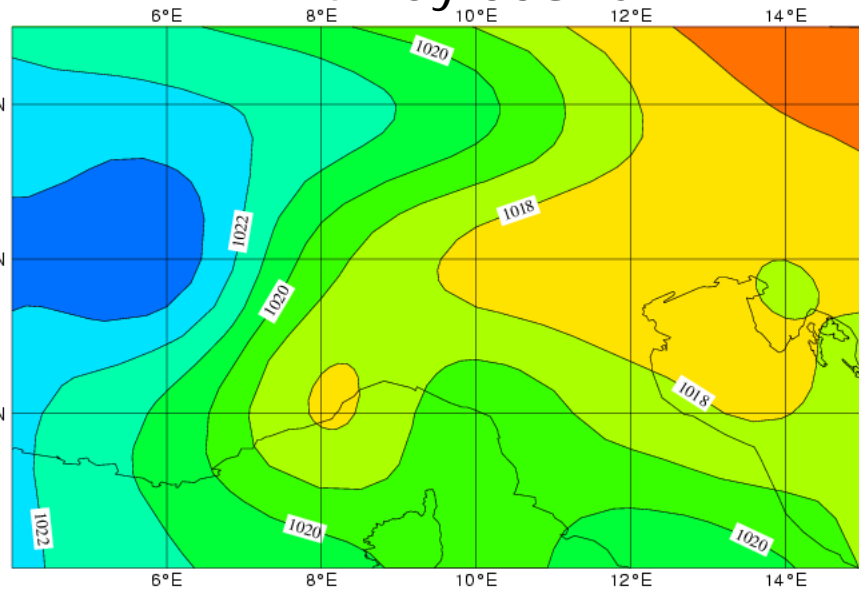
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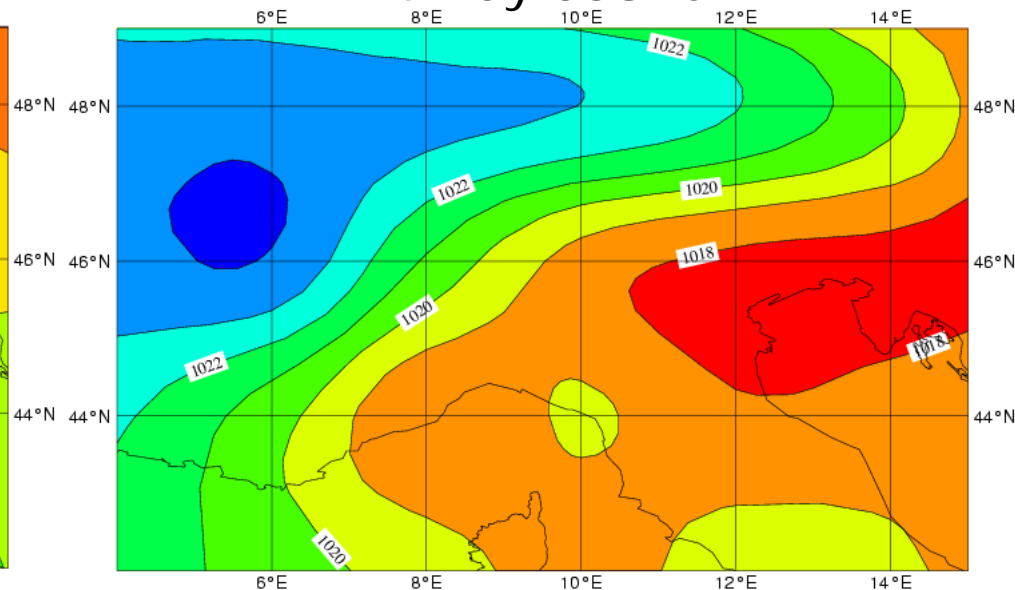
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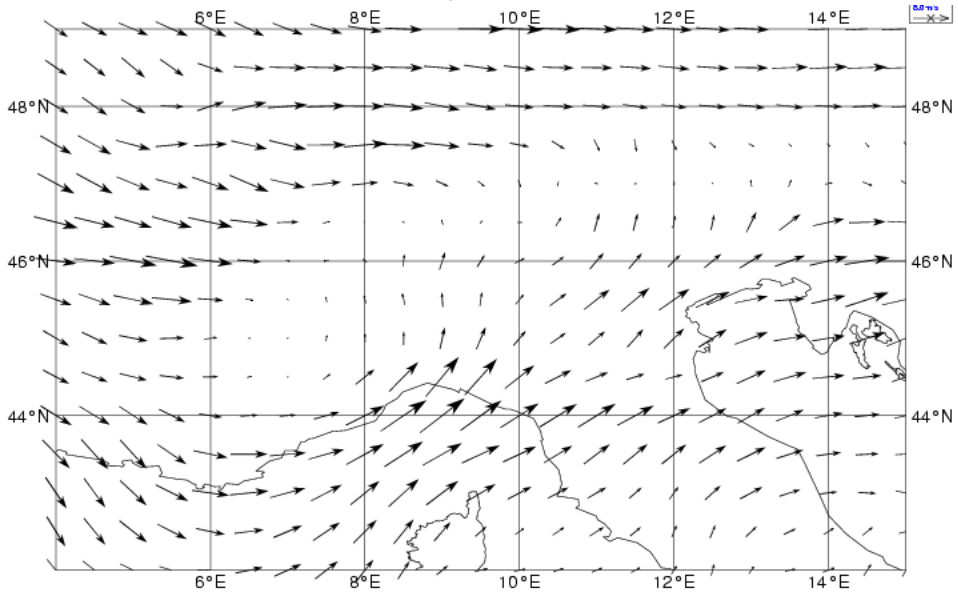
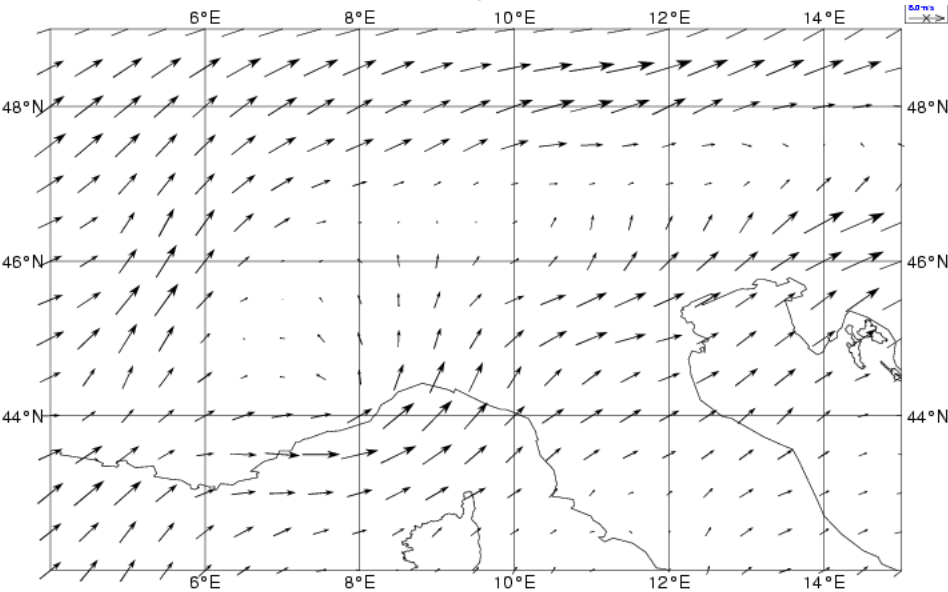
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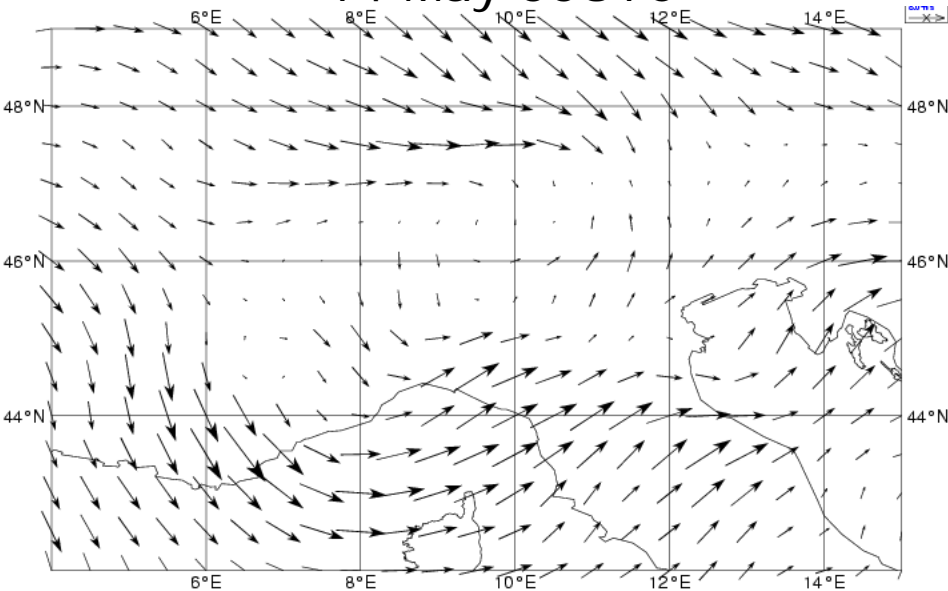
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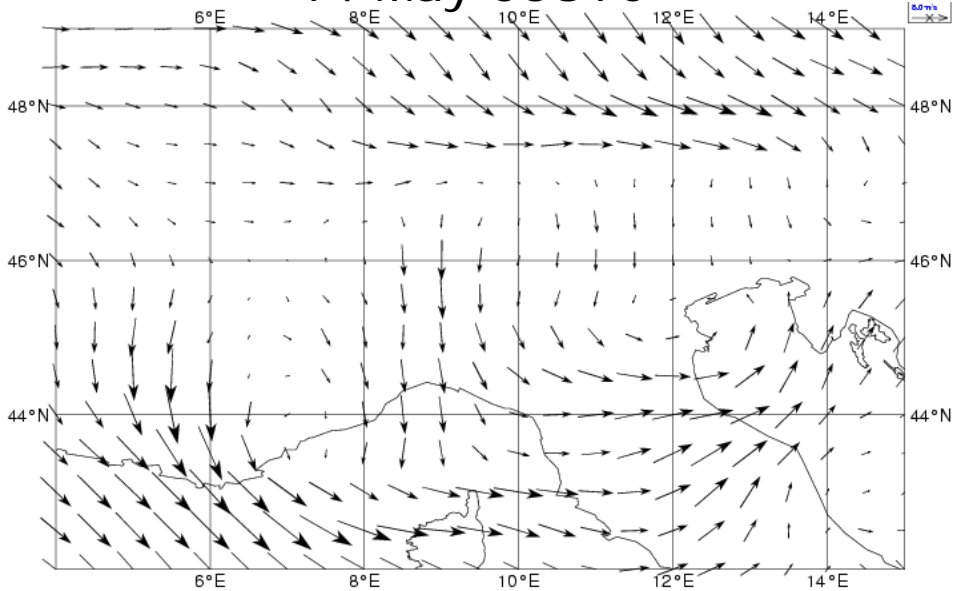
13 May 12UTC V850 ANA 13 May 18UTC



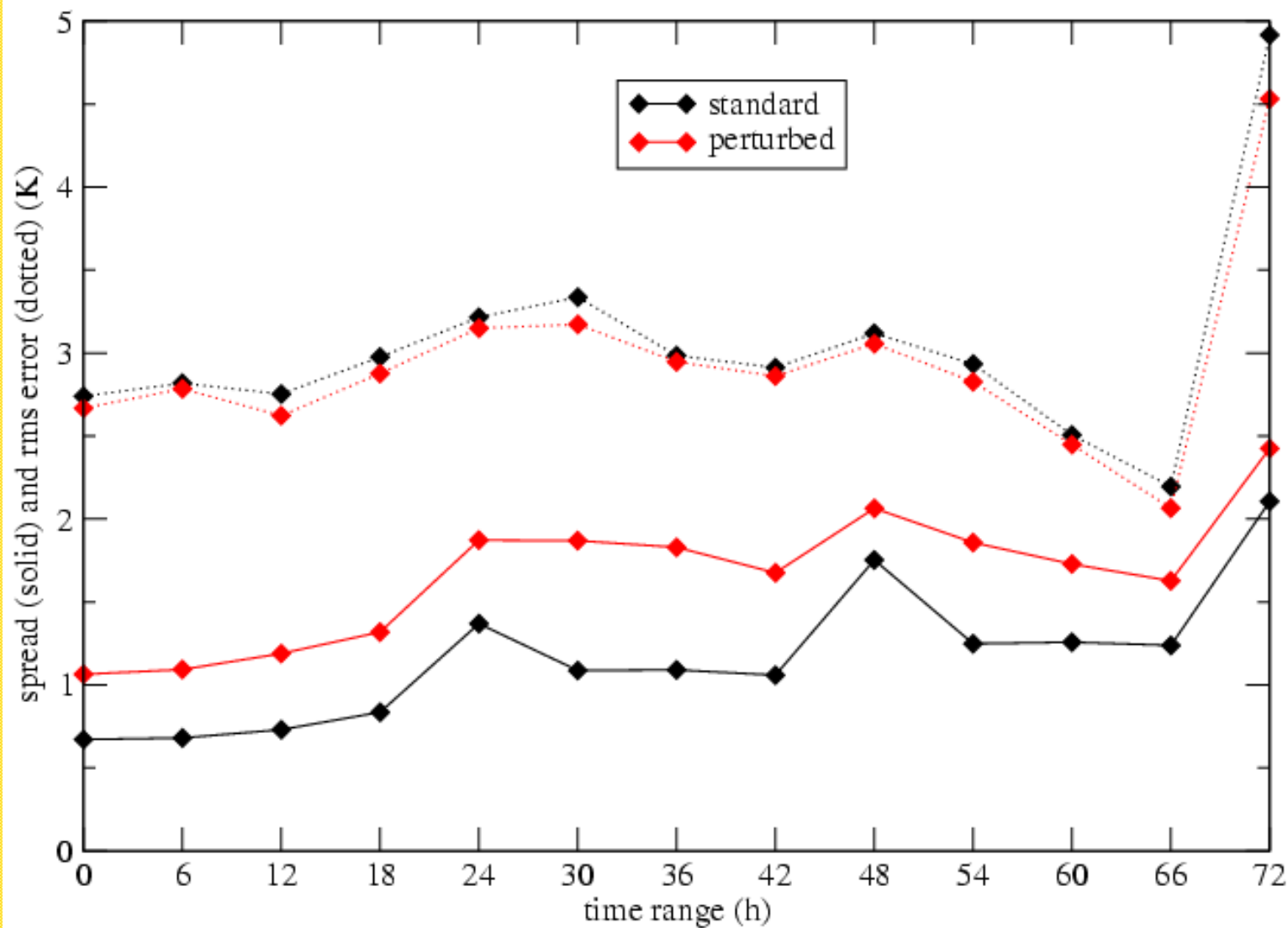
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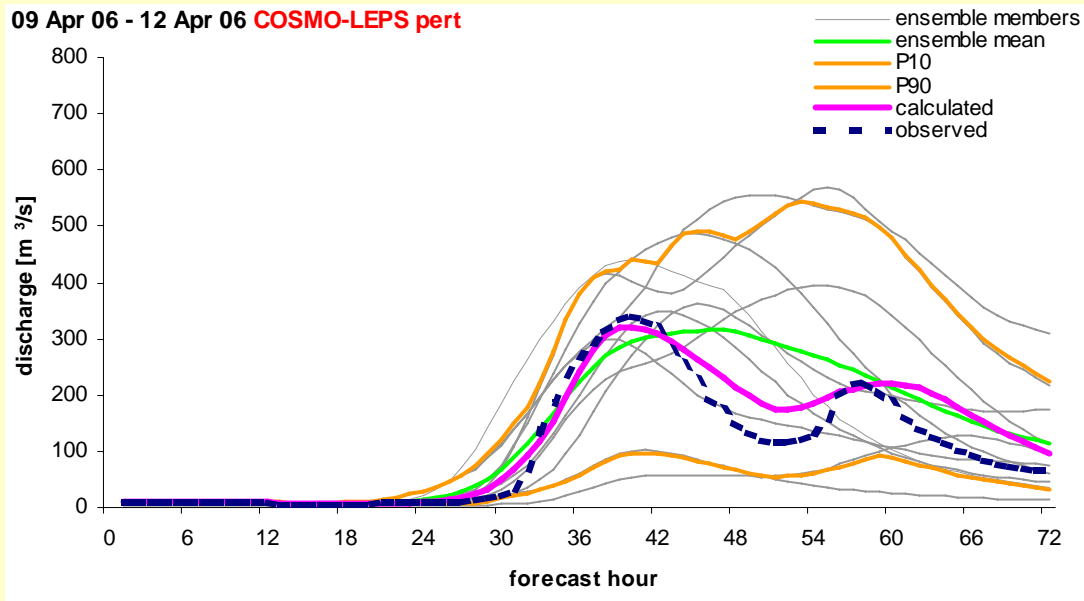
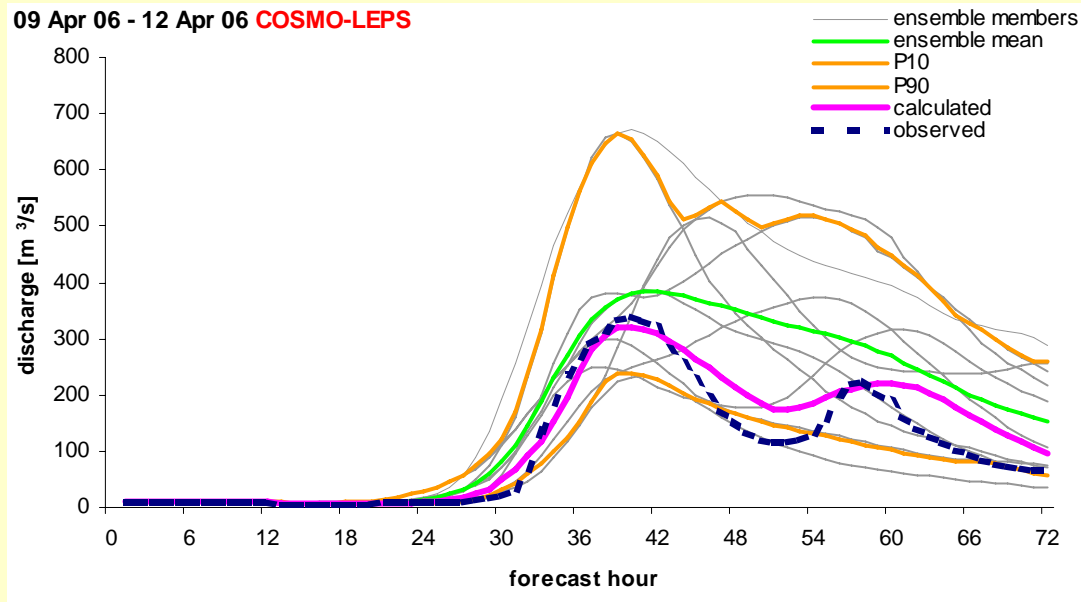
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2m temperature spread and error



Addition of model perturbations



ensemble spread

