ALADIN-LAEF (Limited Area Ensemble Forecasting) at ZAMG: Status and Plan

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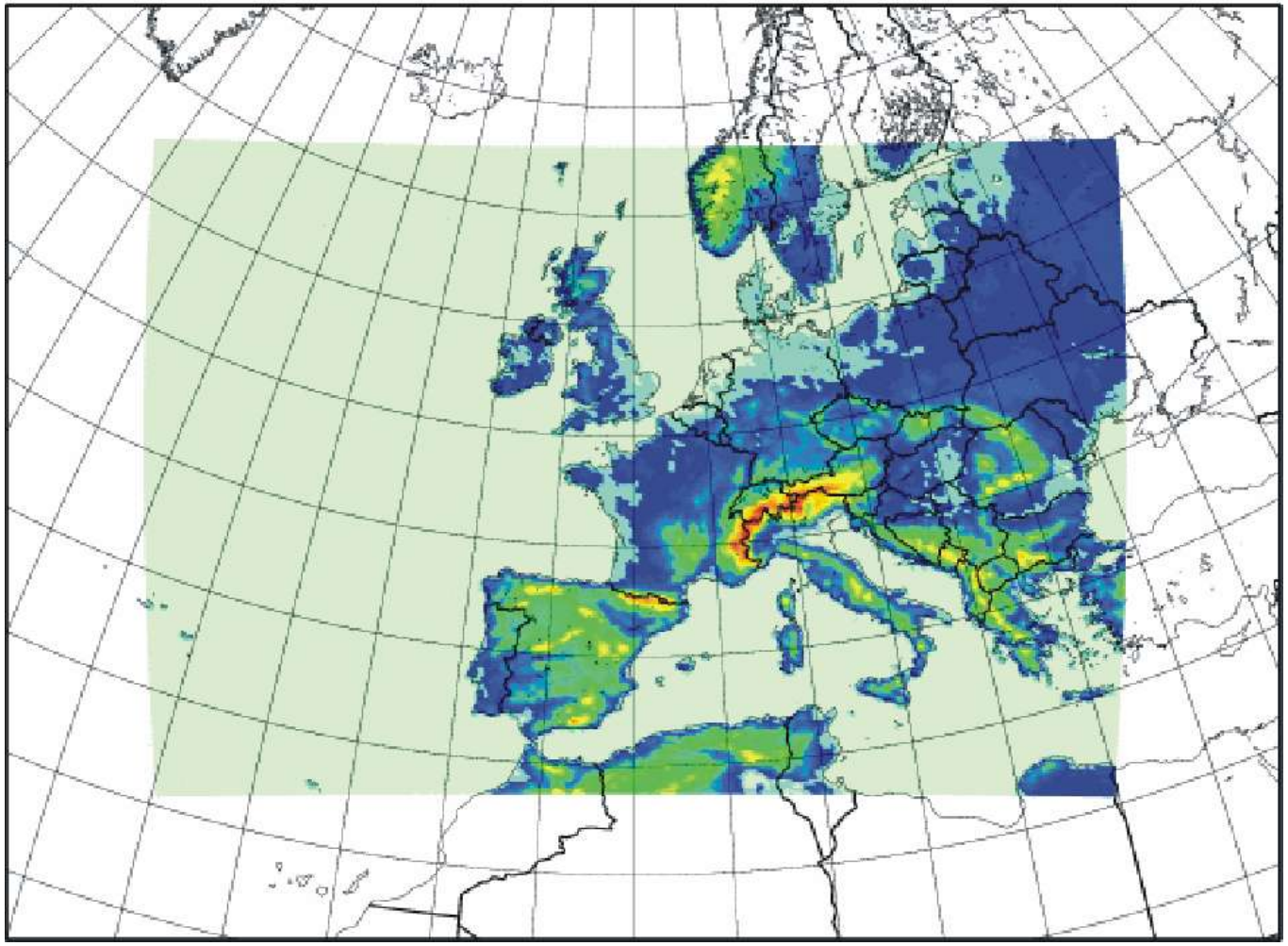
15th ALADIN Workshop

LAEF Domain & Topography



ALADIN-LAEF Configuration

- 16km in horizontal, 31 levels in vertical
- domian with 320x225 gridpoints
- time step 600s
- ALADIN cycle 25t2
- IC perturbation with Breeding
- no LBC perturbation (ARPEGE control)

LAEF: Breeding

- lukewarm start
- 24 hour breeding cycle
- u, v, T, q and Ps at each gridpoint/level
- centering around the control
- constant rescaling

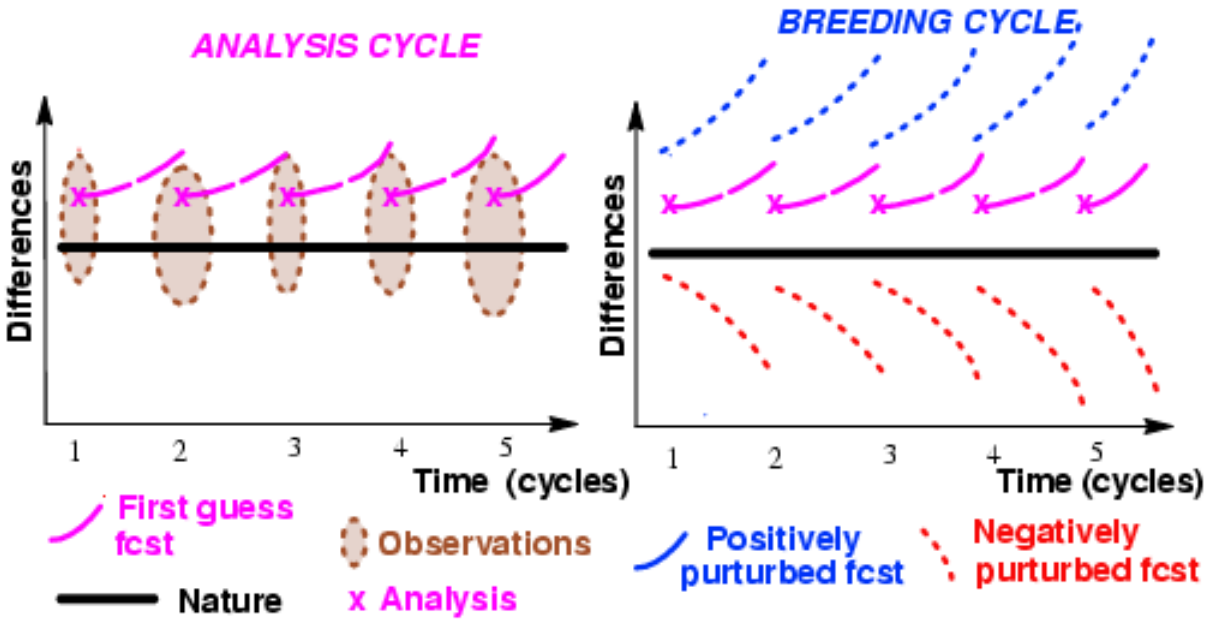
Breeding

Simulate effect of obs by rescaling nonlinear perturbations

Sample subspace of most rapidly growing analysis errors:

*Extension of linear concept of Lyapunov Vectors into nonlinear environment;

*fastest growing nonlinear perturbations, *not optimized for future growth



Toth, et.al 2004

Breeding: rescaling

Scaling factor = $C / \Delta P$

Where: ΔP is standard deviation of 850hPa temperature, C is a tuning constant around 1.

Case studies

1. MAP IOP2B case: 12 Sept. 1999 to 20 Sept. 1999

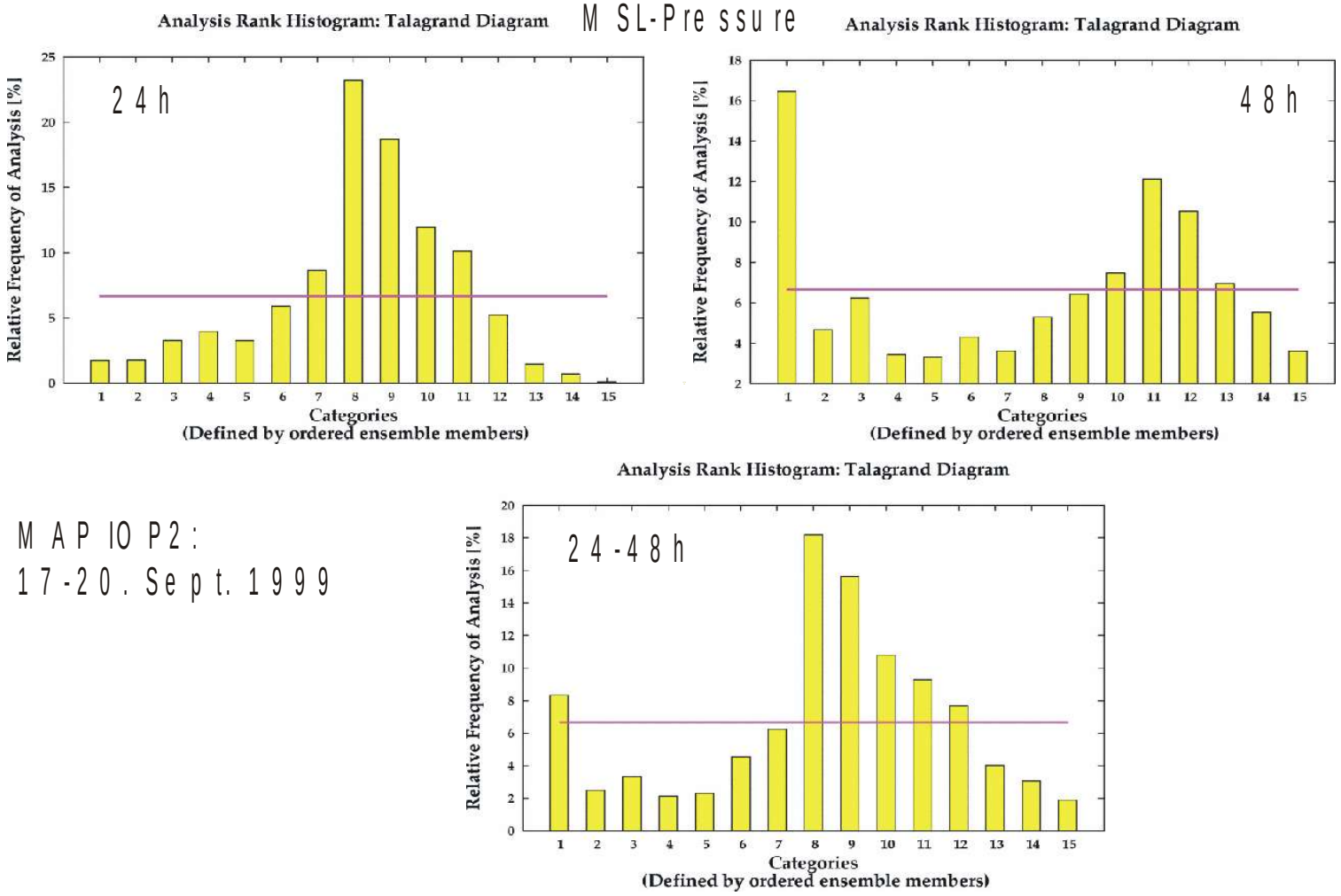
15 members, integration up to 60 hours,

37 vertical levels, recsaling C = 1.2

2. Lothar storm case: 14 Dec. 1999 to 28 Dec. 1999

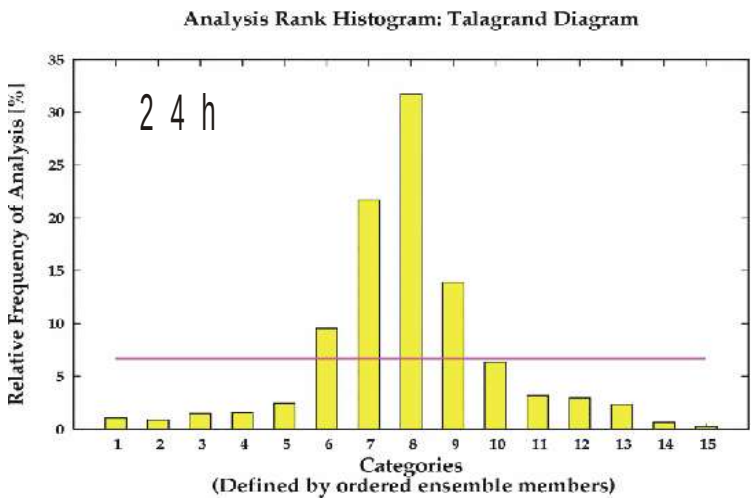
11 members, integration up to 48 hours, 31 vertical levels, recaling C = 1.0

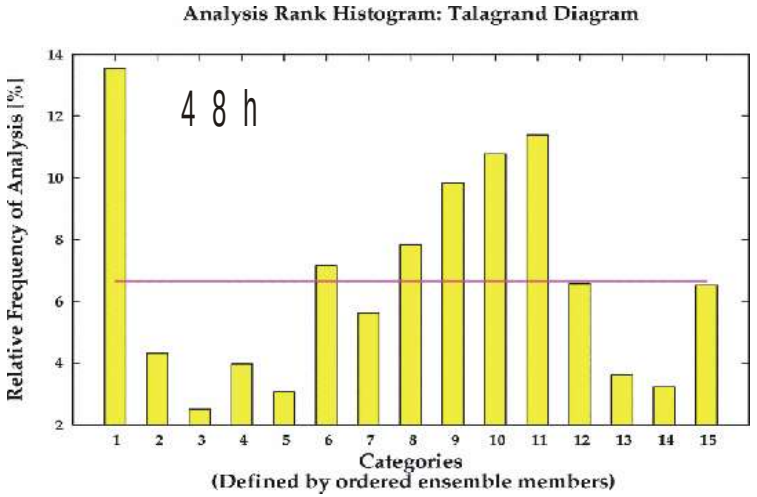
Results: MAP-IOP2 case

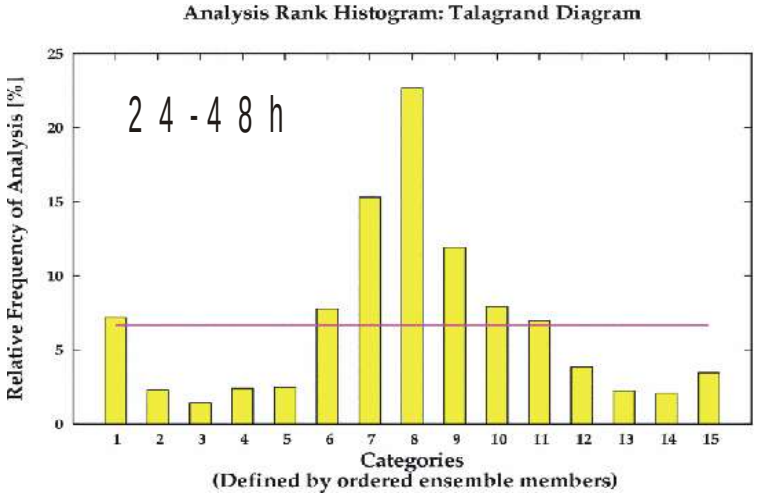


Results: MAP-IOP2 case

MAP-IOP2: 500hPa geopotential

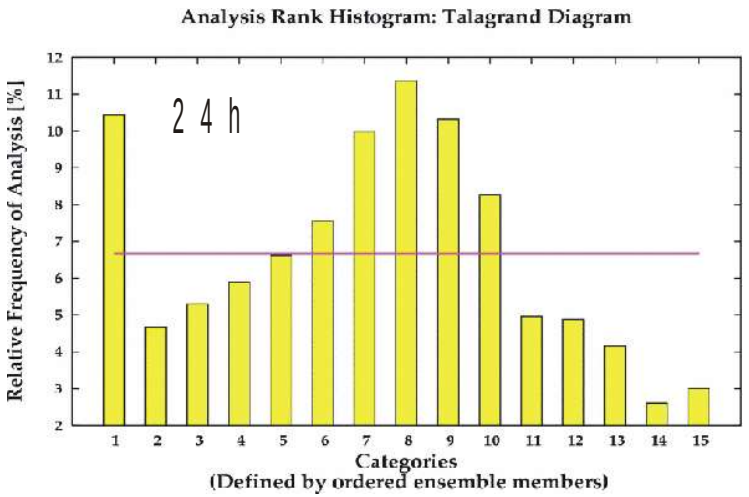


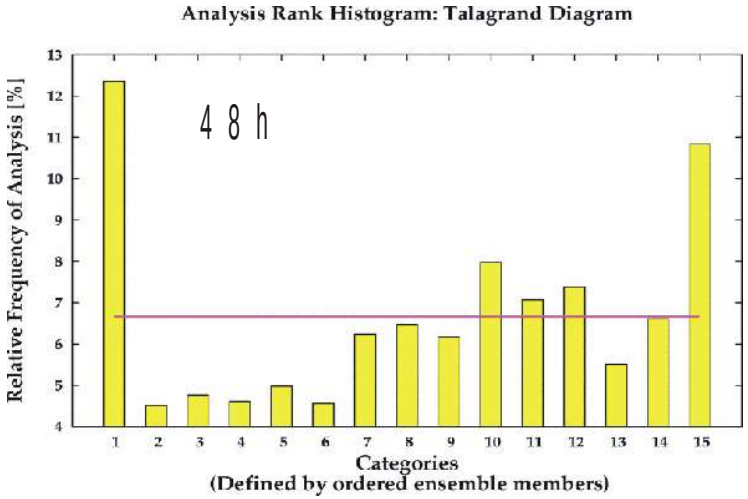


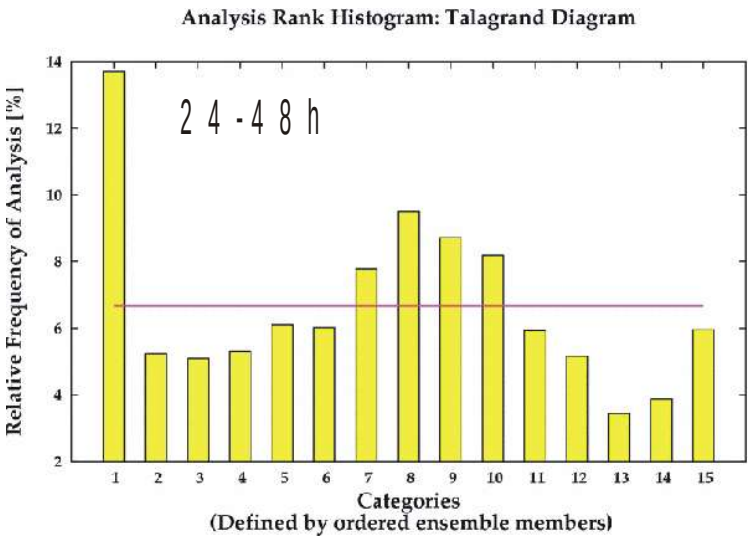


Results: MAP-IOP2 case

850hPa Temperature

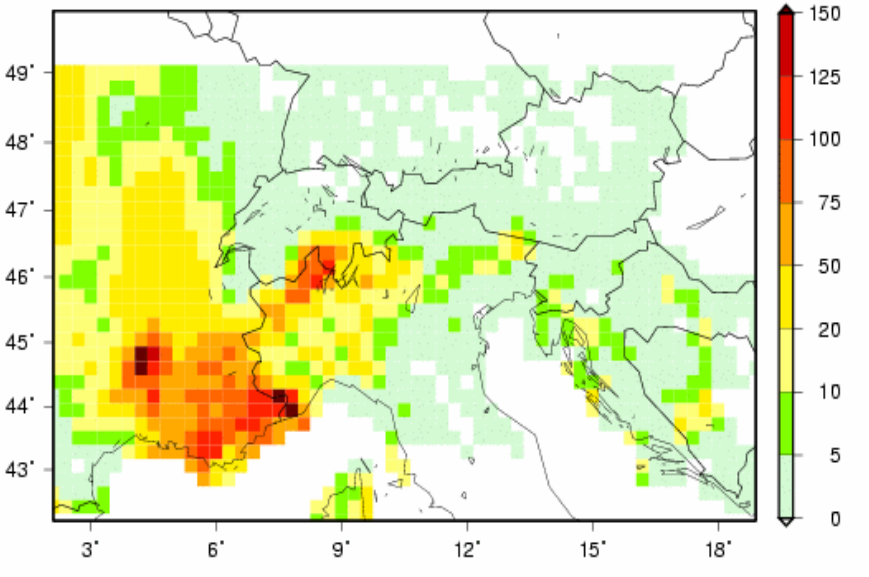




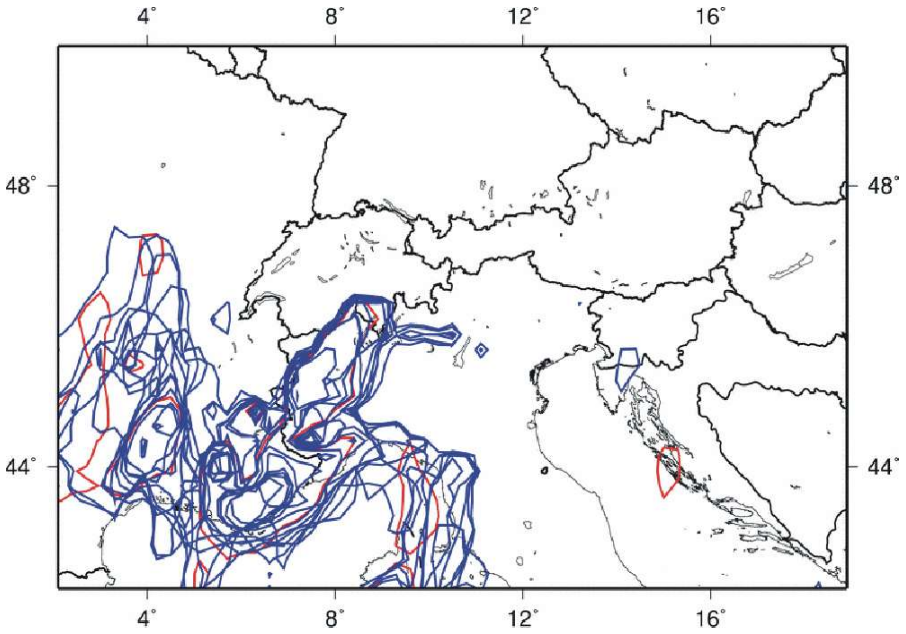


MAP: 17-20 Sept. 1999

Results: MAP-IOP2 case

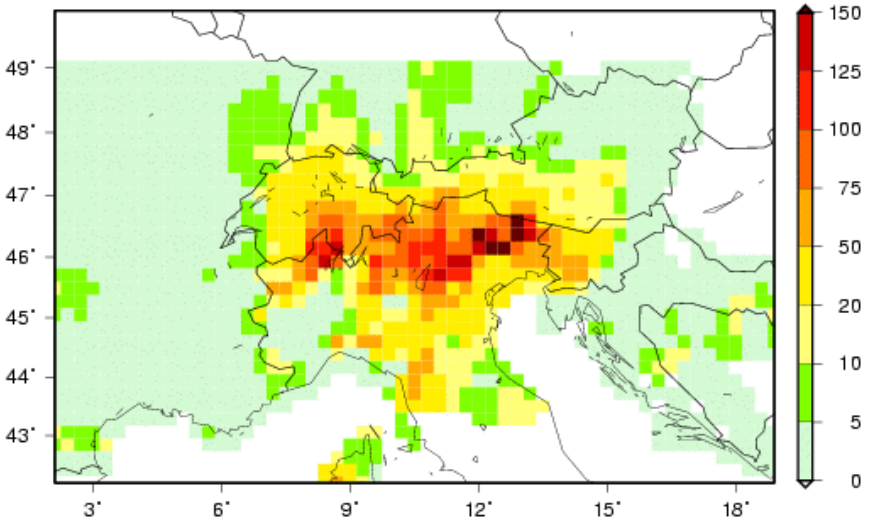


24h Prec. Observation, 19-20 Sept.1999

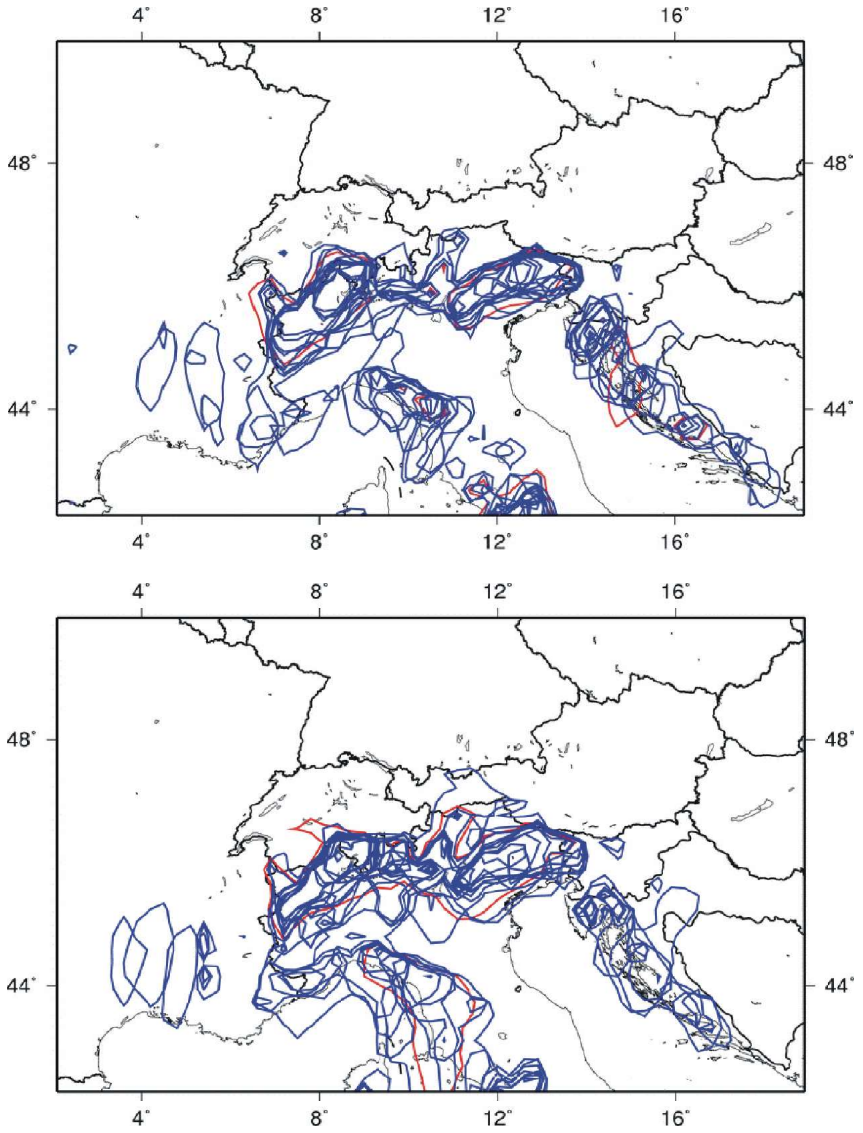


Forecasts: 06-30h, above 50 mm/24h

Results: MAP-IOP2 case

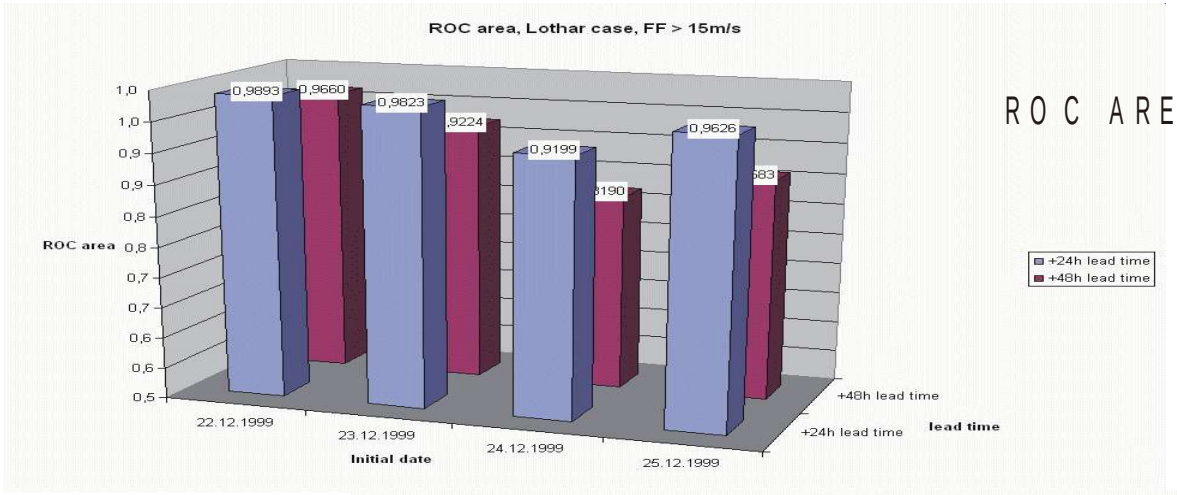


24h Prec. Observation, 20-21 Sept.1999

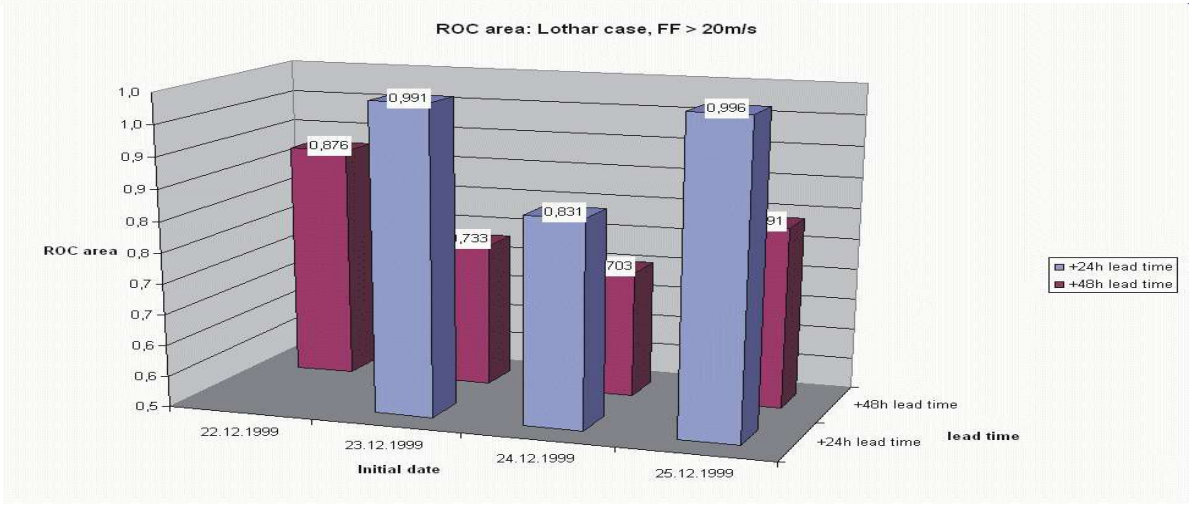


Forecasts: 06-30h, and 30-54h,
above 50mm/24h

Results: Lothar storm case

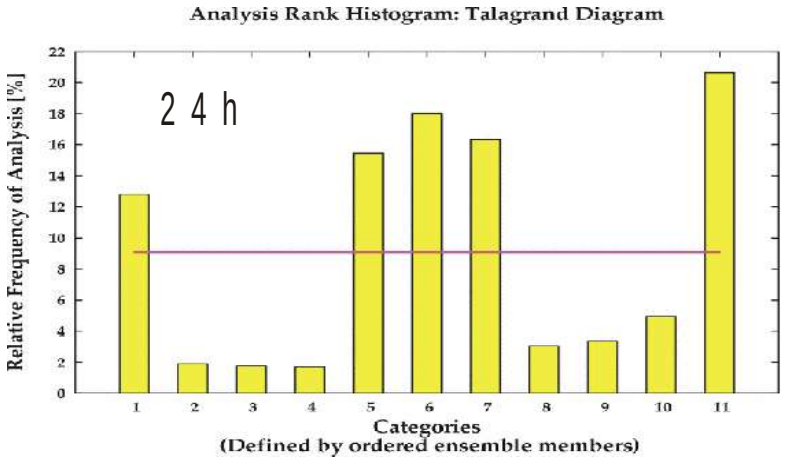


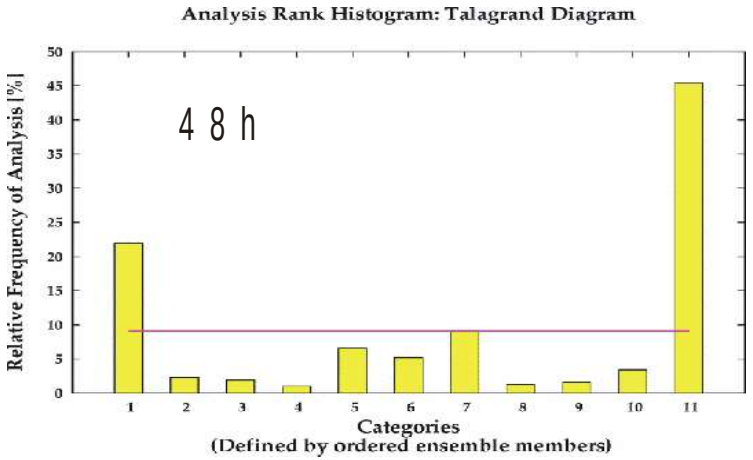
ROC AREA wind

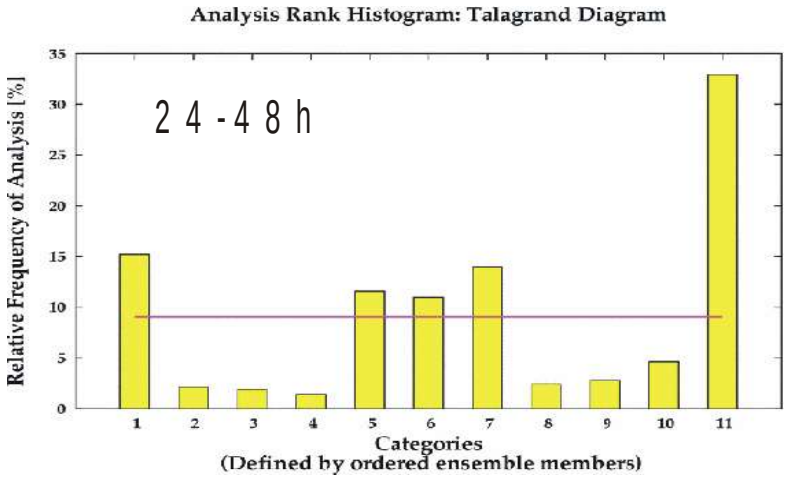


Results: Lothar storm case

MSL-Pressure, Lothar



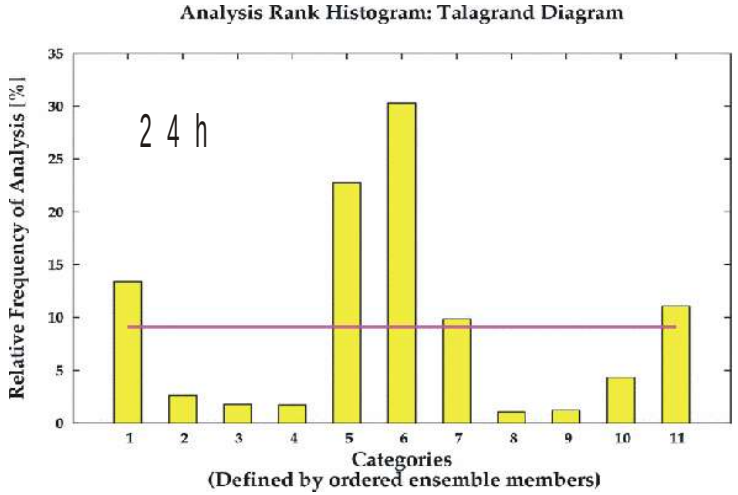


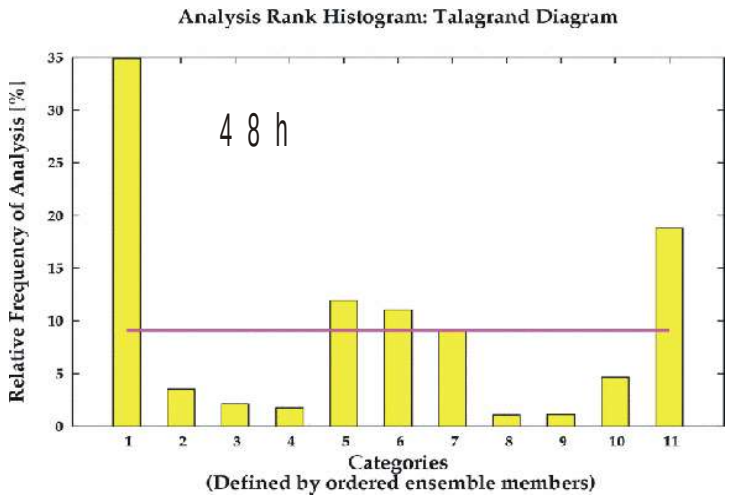


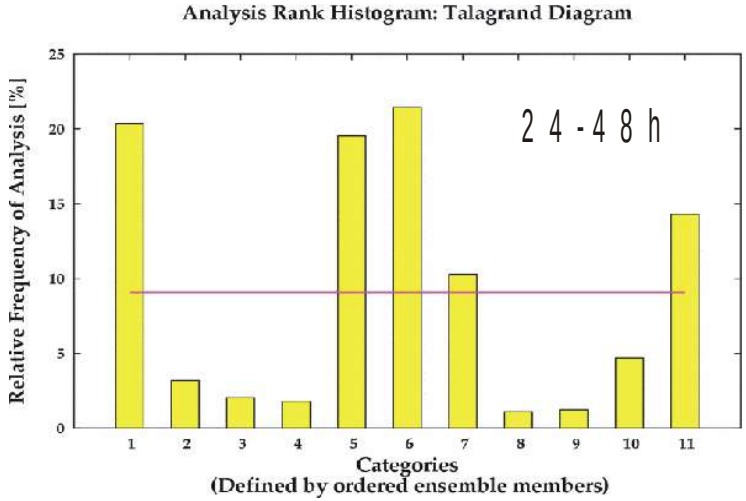
Lothar: 20-28 Dec. 1999

Results: Lothar storm case

500hPa Geopotential

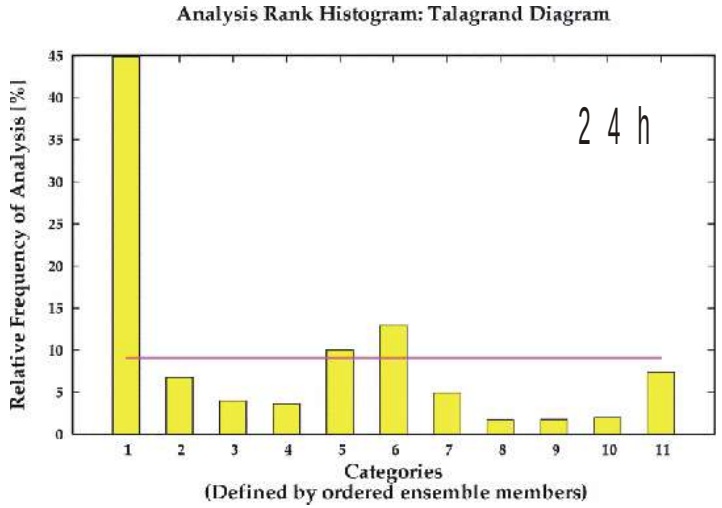


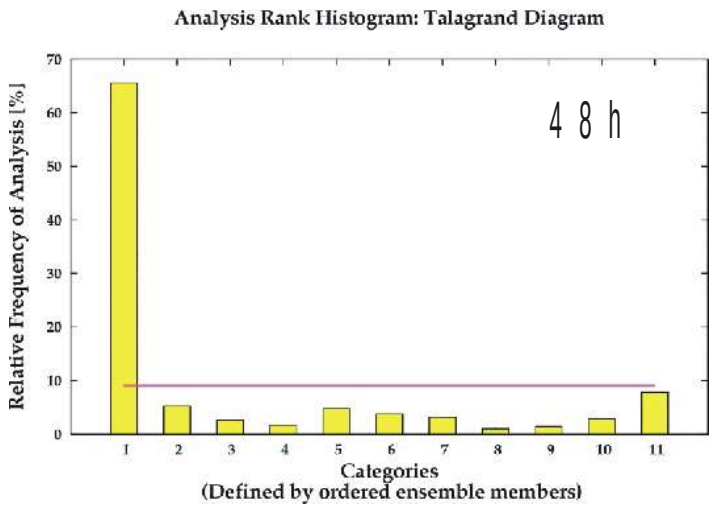


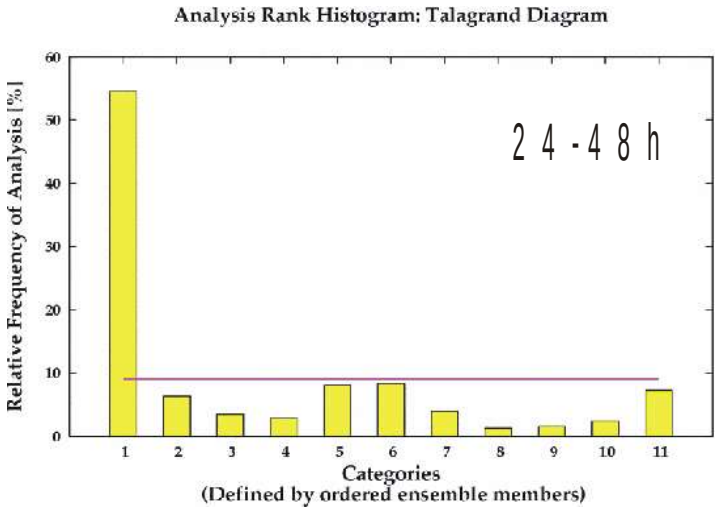


Results: Lothar storm case

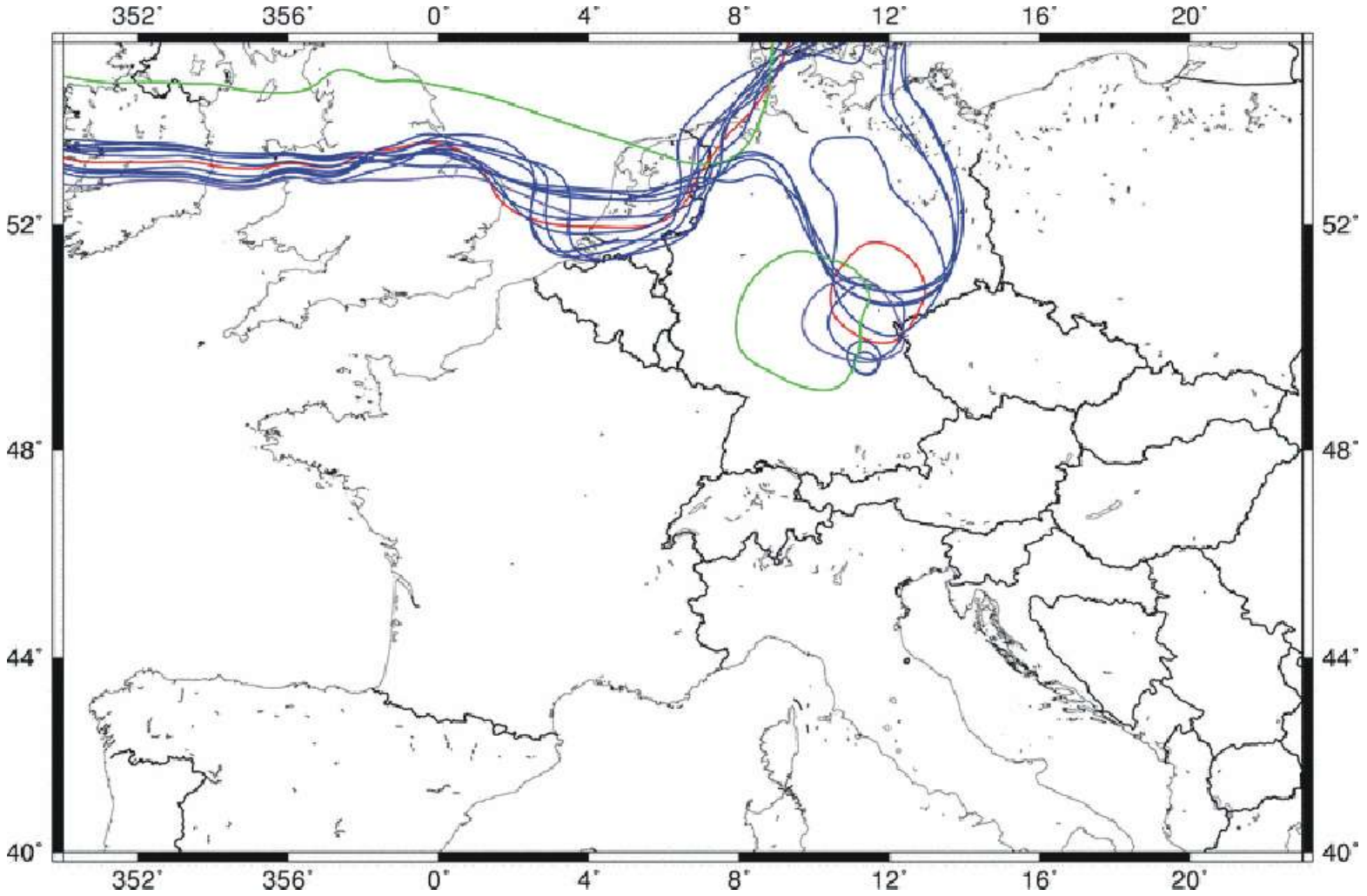
850hPa Temperature





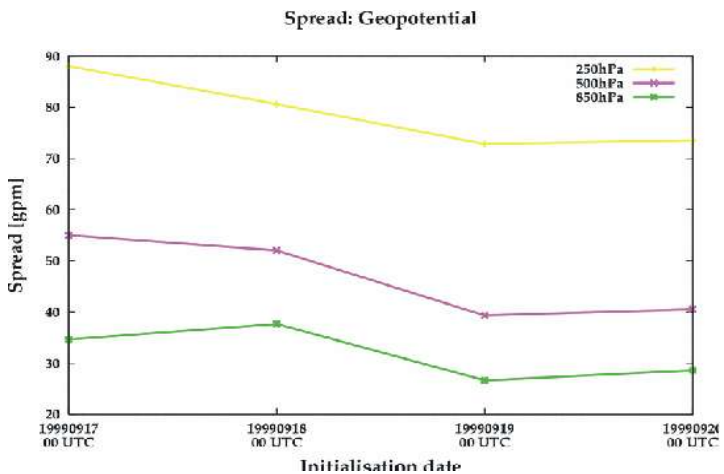


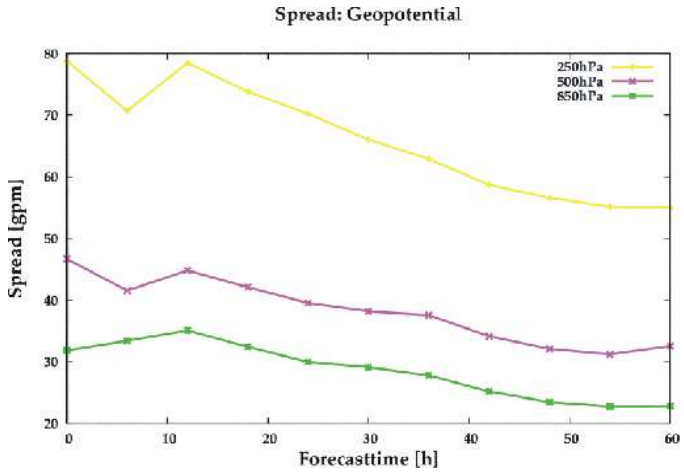
Lothar storm, observation, ARPEGE, and LAEF, 1000 hPa, H, 12 UTC, 26 Dec 1999, 36 h forecasts



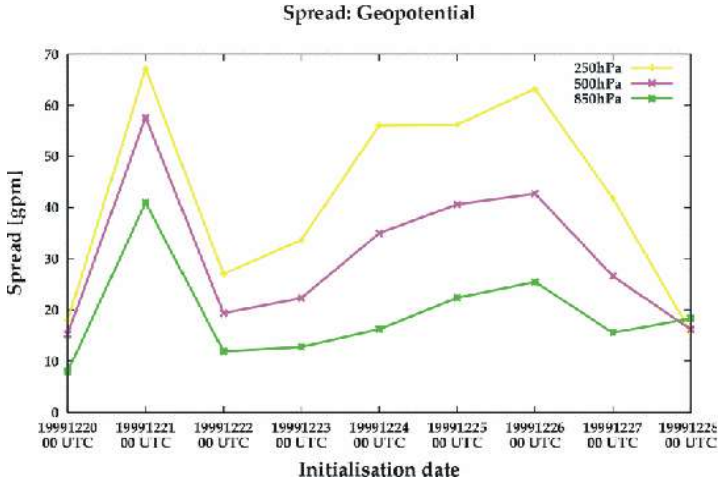
MAP:

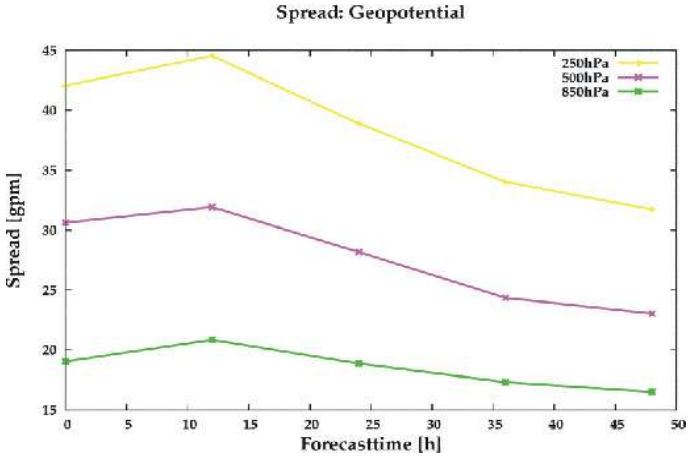
Geopotential





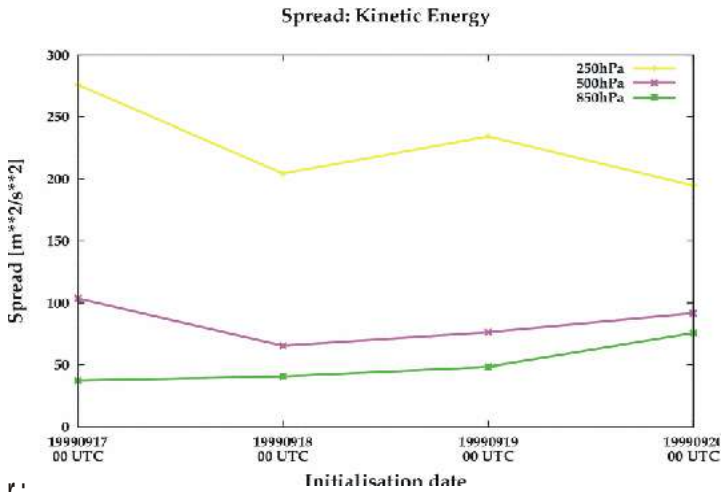
Lothar:

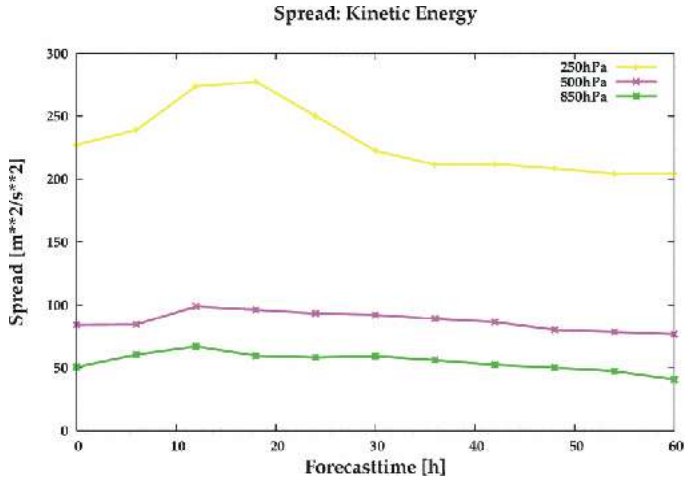




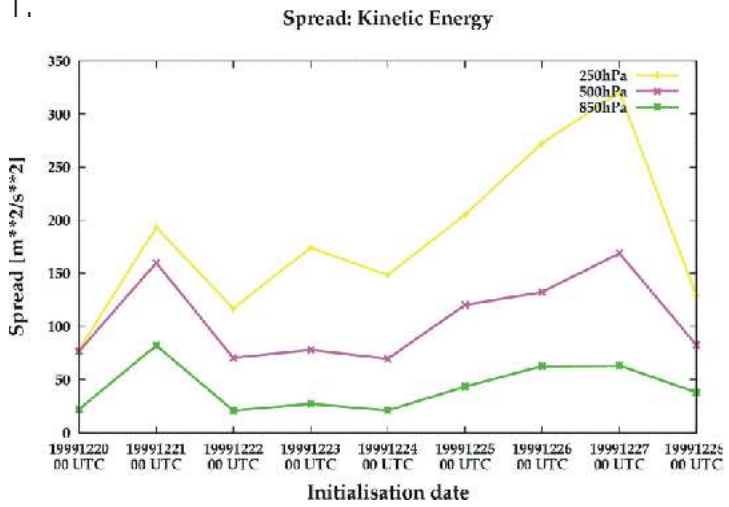
Kinetic energy

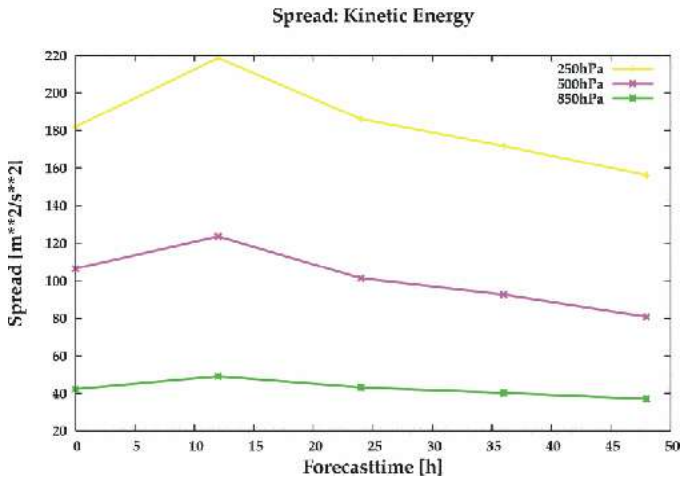
MAP:





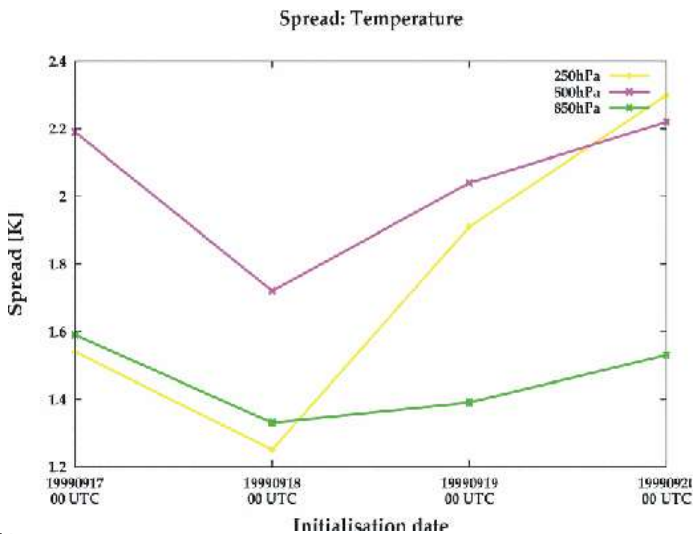
Lothar:

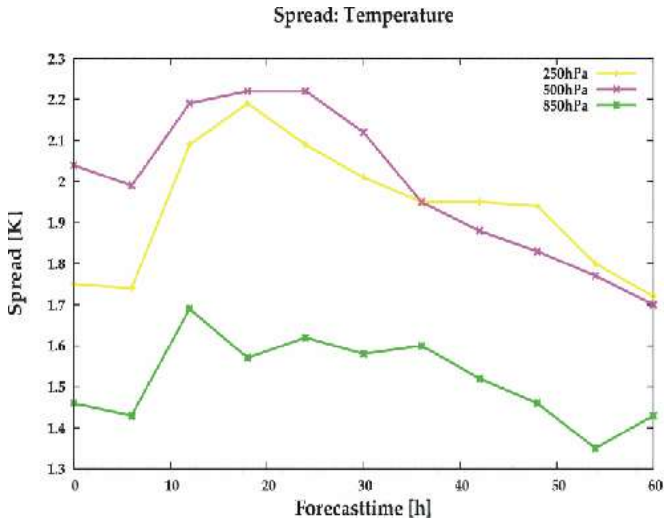




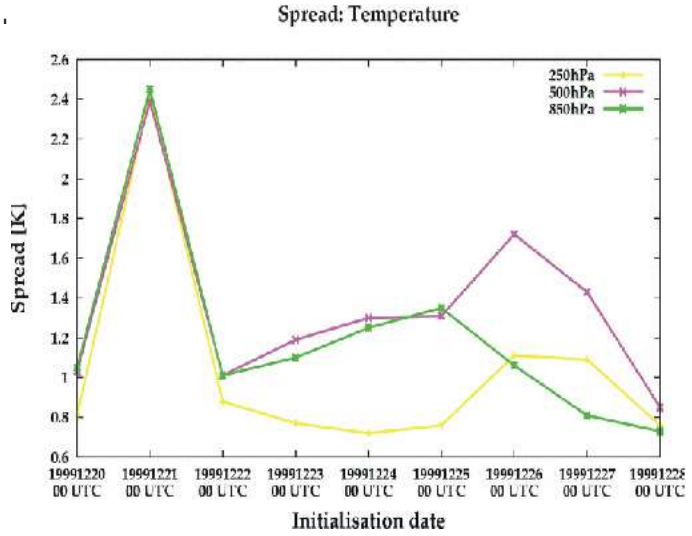
Temperature

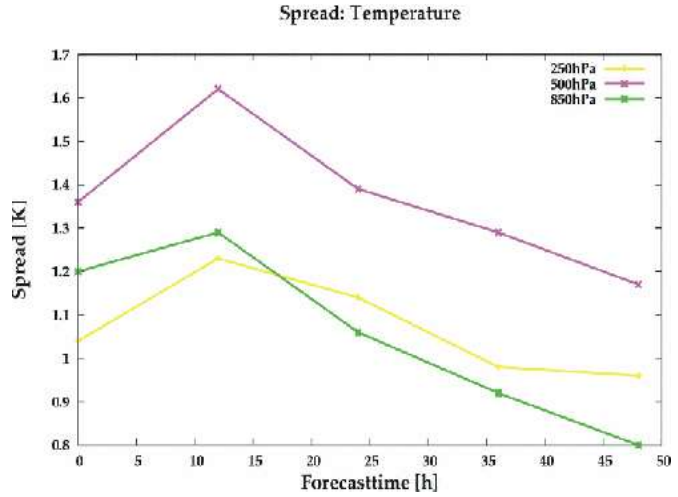
MAP:



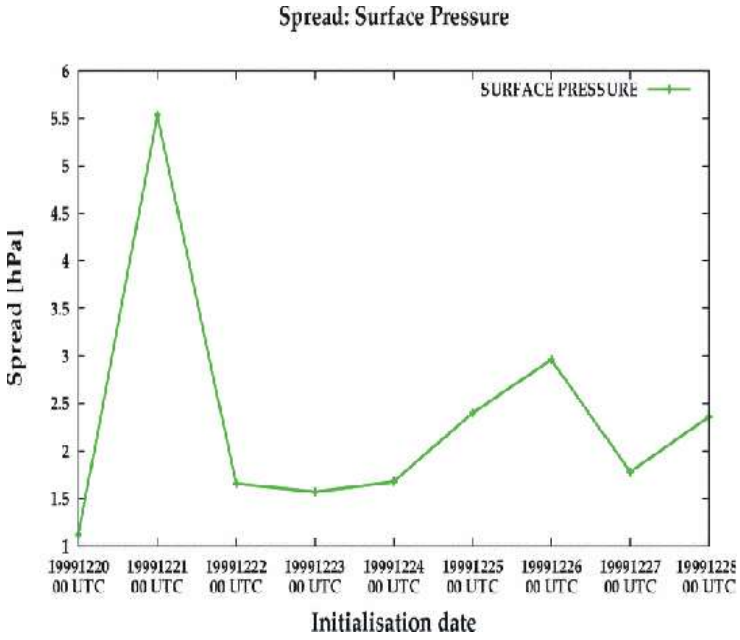


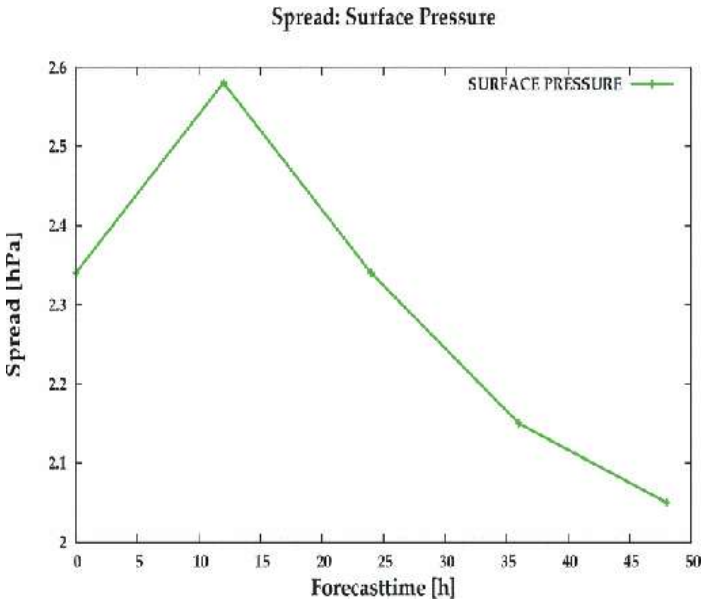
Lothar:





Surface Pressure, Lothar





Conclusion/Problems

Case studies show some potential/skill, BUT:

2. Too strong initial perturbation (50-70% should be reduced)
3. Perturbation doesn‘t grow after 12-24h integration,

   LBC problem? Breeding?

3. Strong bias

Ongoing activities and plan

1. Tuning the rescaling factor
2. 12h Breeding cycle + LBC provided by ARPEGE-PEARP + ALADIN multi-physics (KF, PB, LOPEZ etc.)
4. Downscaling ARPEGE-PEARP + ALADIN multi-physics
5. Downscaling ECMWF EPS + ALADIN multi-physics
6. Orthogonalization of Bred vector: ET (Ensemble Transform) plus rescaling
7. Study on ETKF (Ensemble Transform Kalman Filter)
8. Investigation on the impact of the inconsistent IC/LBCs
9. Post-processing (bias correction)

A lot of work need to be done!!!