Using IFS initial and boundary conditions in the ALADIN/HU model

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Introduction

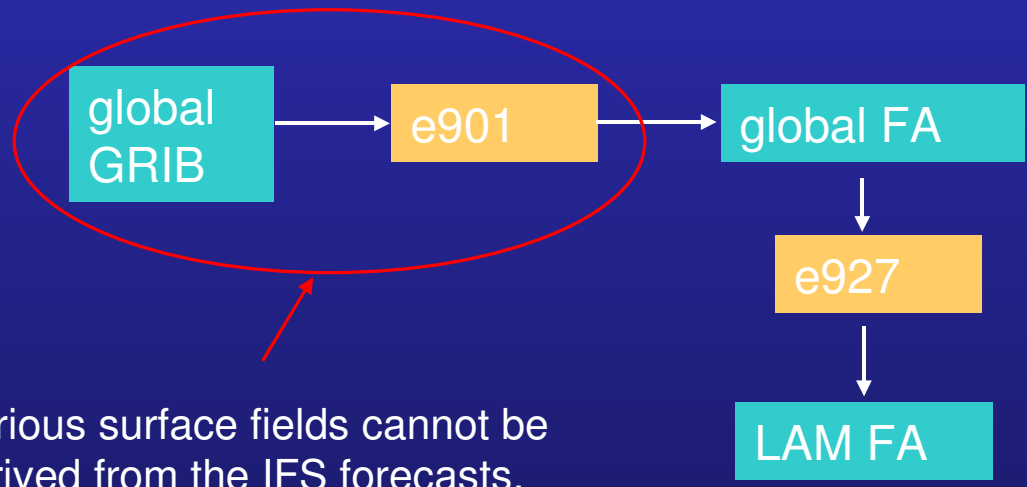
- Research carried out in the framework of the ECMWF Special Project for

  „Investigation of coupling the ALADIN and AROME models to boundary conditions from ECMWF and ERA model data”

- Part of the Data Manager’s work of RC-LACE
- The main goal of the present study: using T799 IFS forecasts as IC and BC conditions for ALADIN
- It is a continuation of the experiments Gergely Bölöni carried out last year with using T511 BCs in dynamical adaptation
- The feasibility of operational usage was investigated
- Both dynamical adaptation and 3D-VAR were tested

IC+BC generation

IC+BC generation method (running on HPCE at ECMWF):

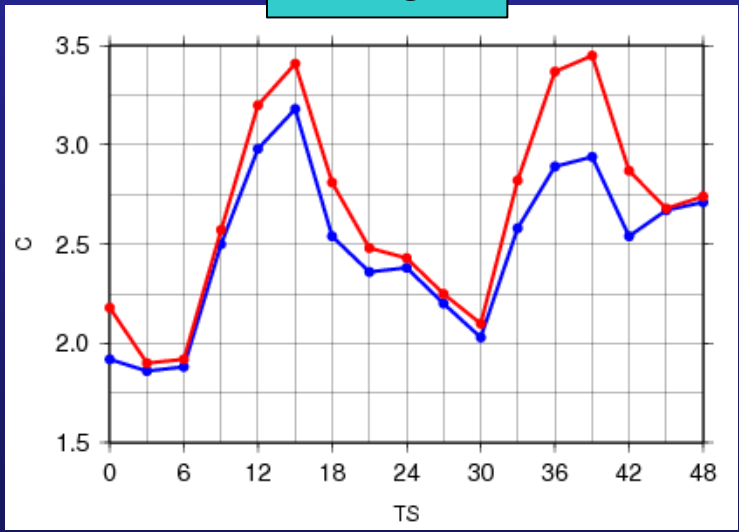


Various surface fields cannot be derived from the IFS forecasts, these are instead taken from the climate file

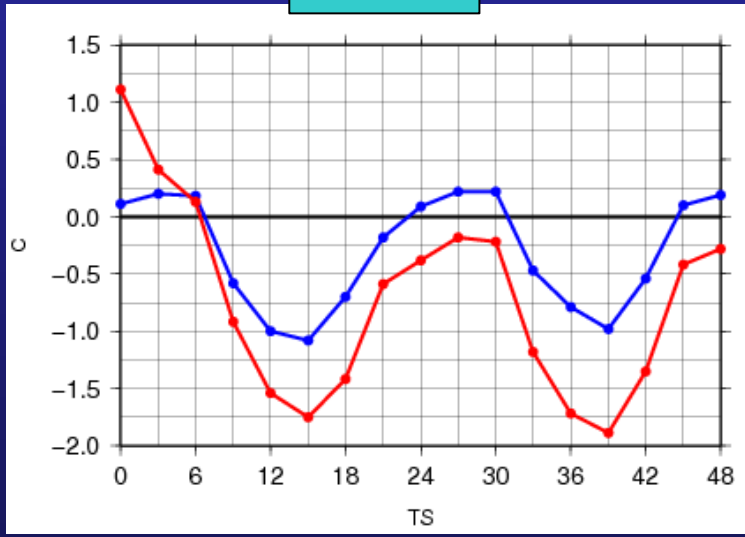
Handling of surface fields

- Simple copy of the surface fields from the ARPEGE analysis file into the initial condition file
- BC files are not modified because surface fields are not coupled from the BC files during the integration
- This solution gives better results (one 48h run with dynamical adaptation)

T2 RMSE



T2 BIAS

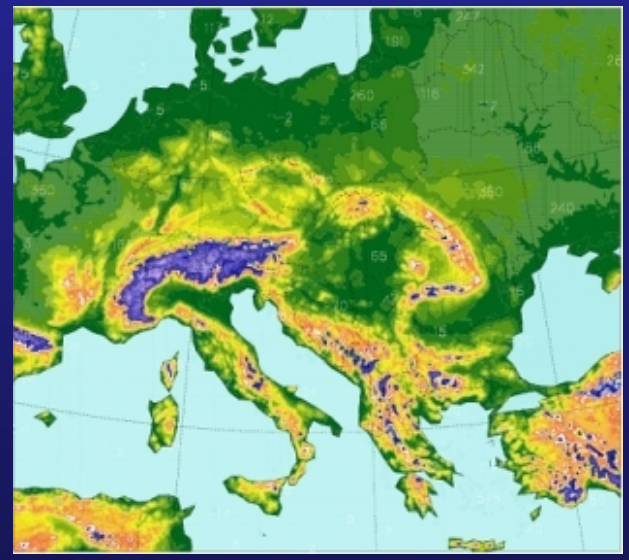


Surface fields from IFS + climate file

Surface fields from ARPEGE analysis

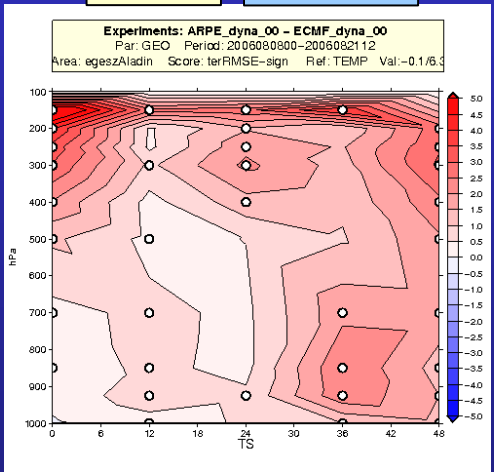
Investigation #1

- **Dynamical adaptation** runs (+48h) for 00 and 12 UTC
- Two configurations:
  - **ARPE_dyna**: IC+BC is provided by ARPEGE
  - **ECMF_dyna**: IC+BC provided by T799 IFS (stream oper).
- 14 days (08-21 August, 2006)
- The applied ALADIN configuration:
  - AL28T3
  - 8km horizontal resolution
  - 49 levels

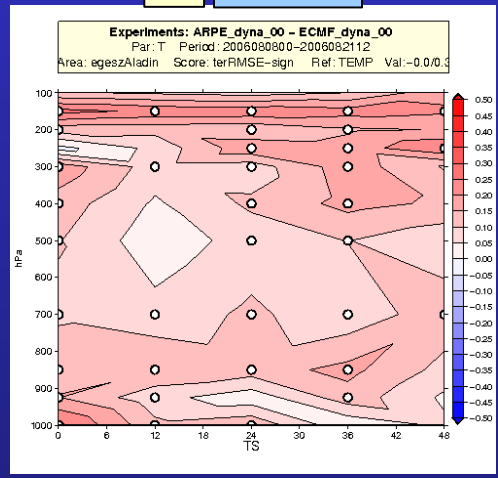


TEMP-based verification

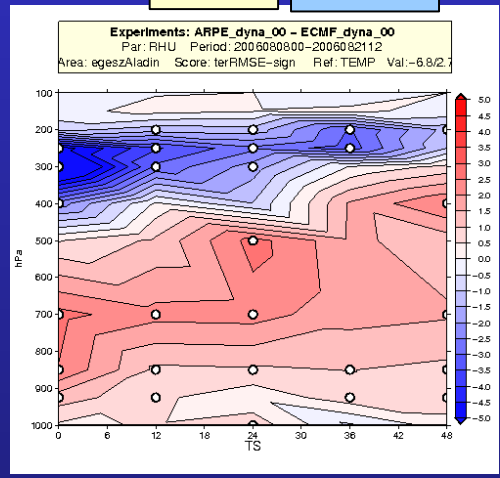
GEO -0.1/+6



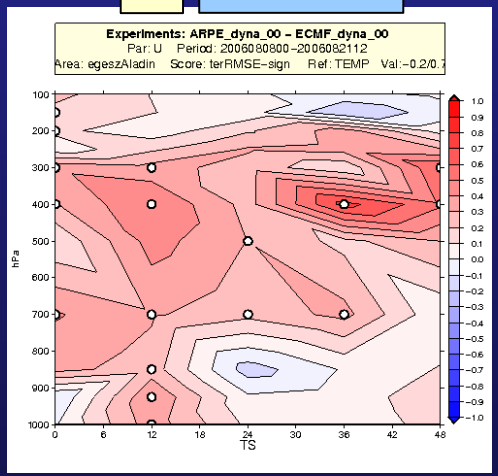
T 0/+0.3



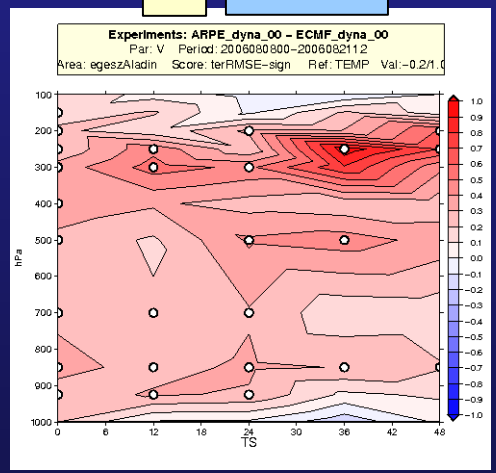
RHU -7/+3



U -0.2/+0.7



V -0.2/+1

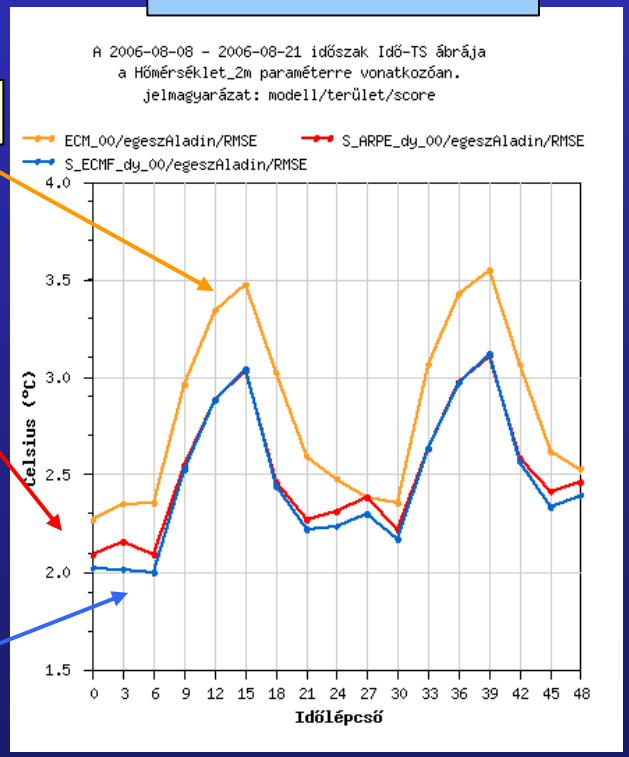


00 UTC scores:

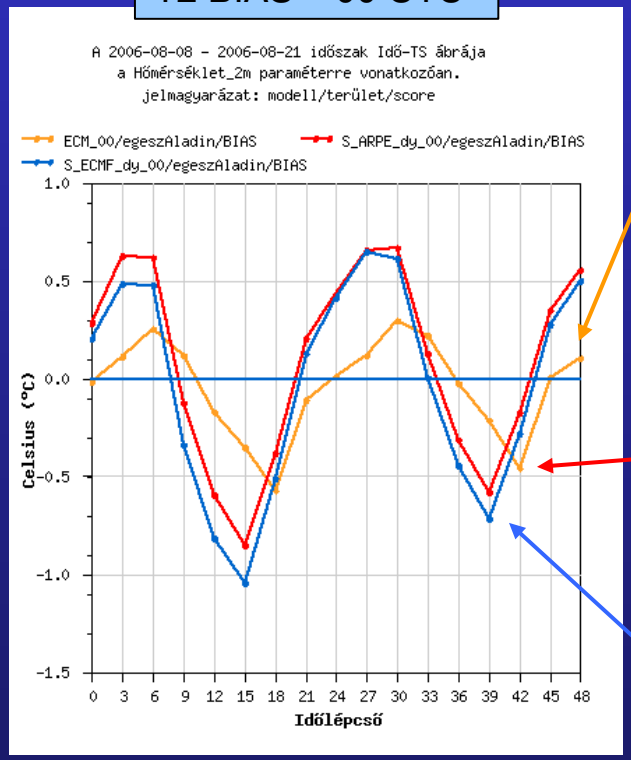
RMSE differences: **ARPE-ECMF**
Red shades indicate that ECMF is better.

SYNOP-based verification

T2 RMSE – 00 UTC



T2 BIAS – 00 UTC



ECMWF oper

ARPE_dyna

ECMF_dyna

ECMWF oper

ARPE_dyna

ECMF_dyna

On the surface ECMF_dyna performs similarly than ARPE_dyna!!

Investigation #2

- Problem with operational applications: **IFS forecasts not available at the desired time**
- For instance:
  - 00 UTC ALADIN/HU run ends at 3:30 UTC
  - 00 UTC IFS run starts only at after 5:00 UTC
- Solution: the previous IFS run should be used as IC+BC (like in HIRLAM)
  - The 18 UTC IFS run for 00 UTC
  - The 06 UTC IFS run for 12 UTC
- The 06 and 18 UTC IFS runs are available in stream SCDA, provide forecast up to 96h
- The 6h shifted BC usage was tested with dynamical adaptation and 3D-VAR

Investigation #2

- IFS BCs were tested with the 6h shift
  - ARPE_dyna: dynamical adaptation with ARPEGE
  - ARPE_3d: 3D-VAR with ARPEGE
  - ECM6_dyn: dynamical adaptation with IFS SCDA
  - ECM6_3d: 3D-VAR with SCDA (to simulate the operational environment OPER is used in the cycling)
- 14 days (08-21 August, 2006), 48 h forecasts at 00 and 12 UTC
- 3D-VAR cycling started 4 days earlier from the same background in both cases

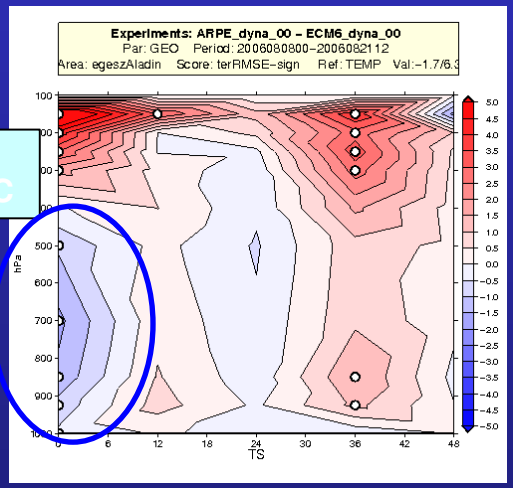
Geopotential

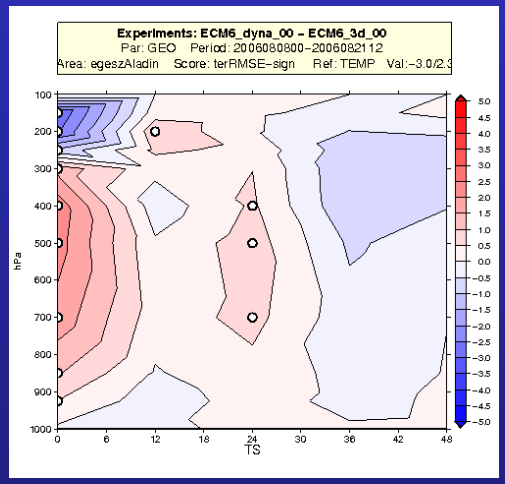
ARPE dyn - ECM6 dyn

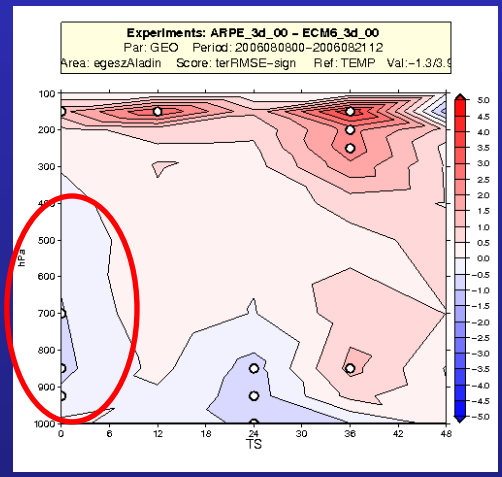
ECM6 dyn - ECM6 3d

ARPE 3d - ECM6 3d

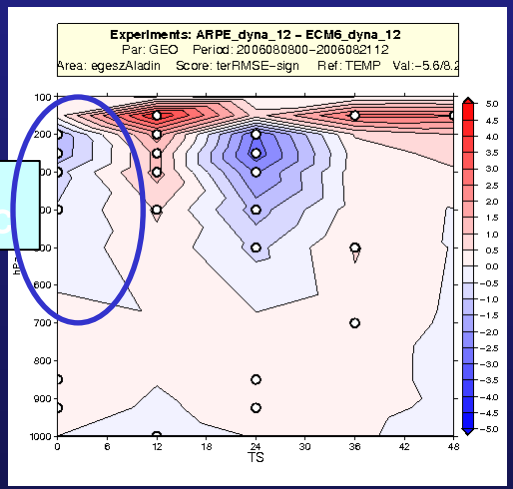
00 UTC

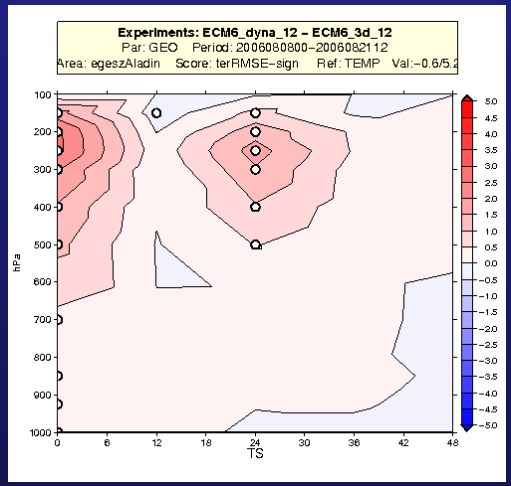


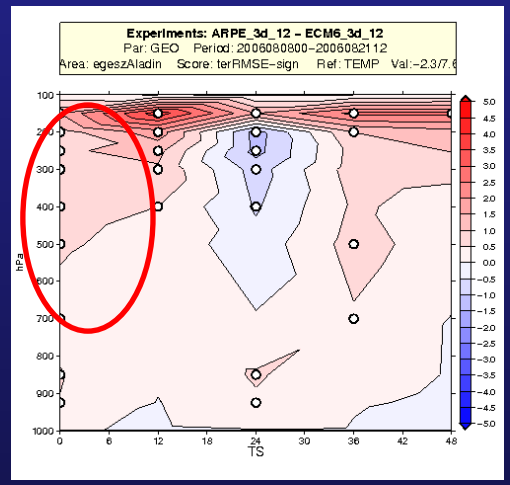




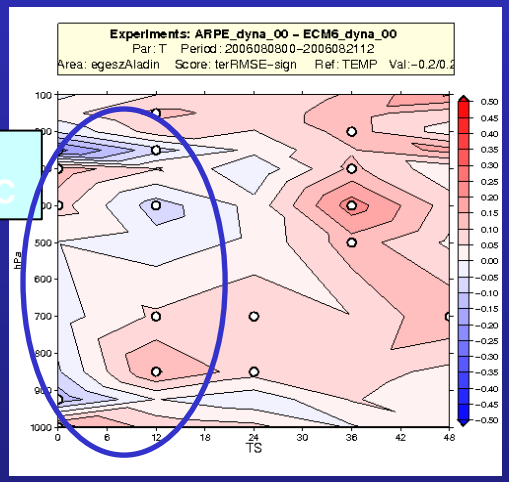
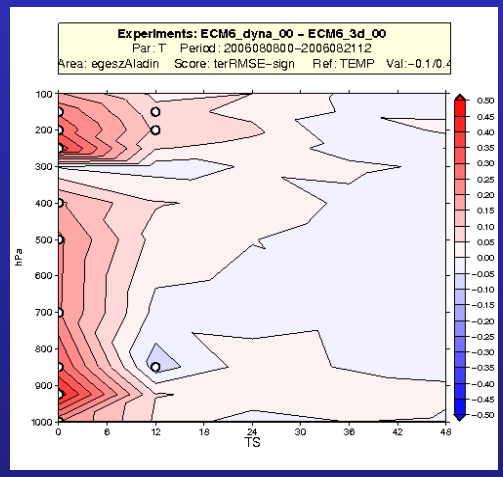
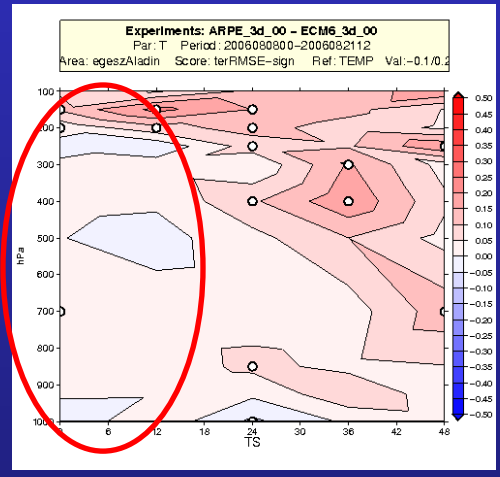
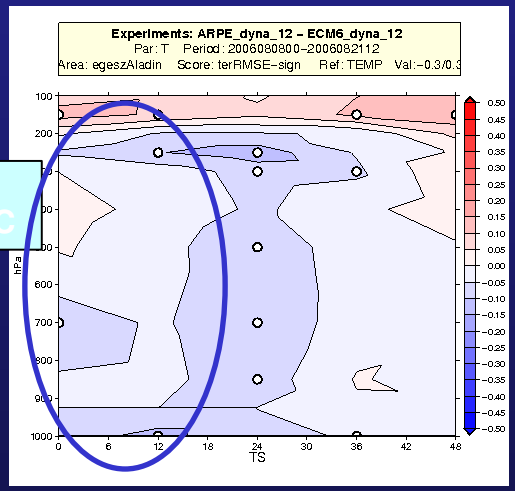
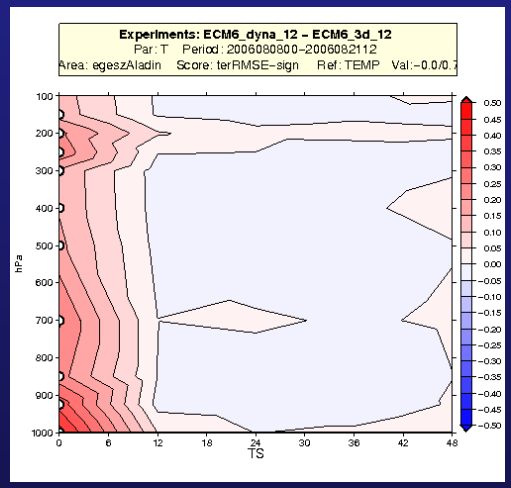
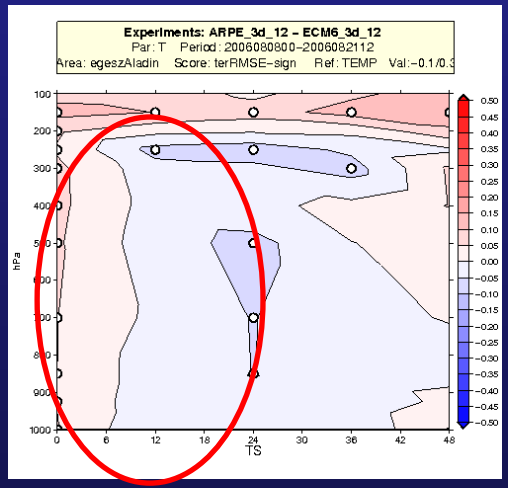
12 UTC



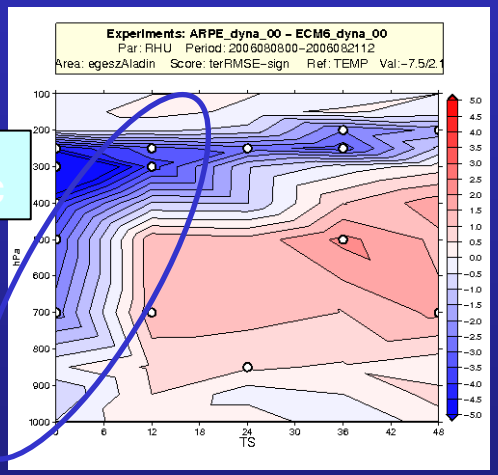
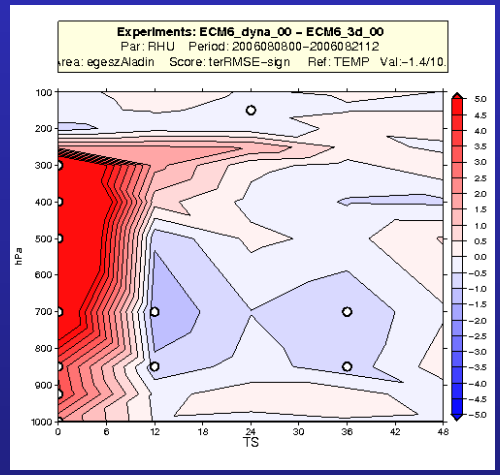
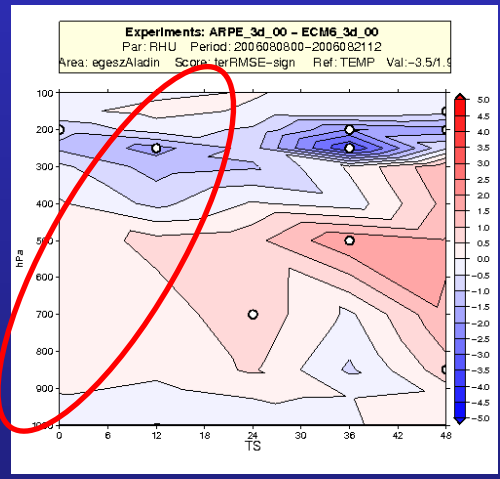
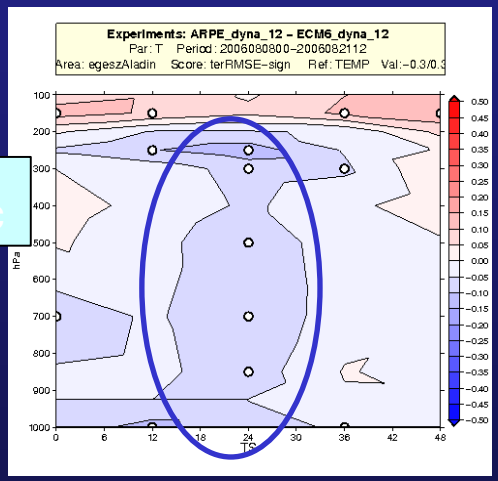
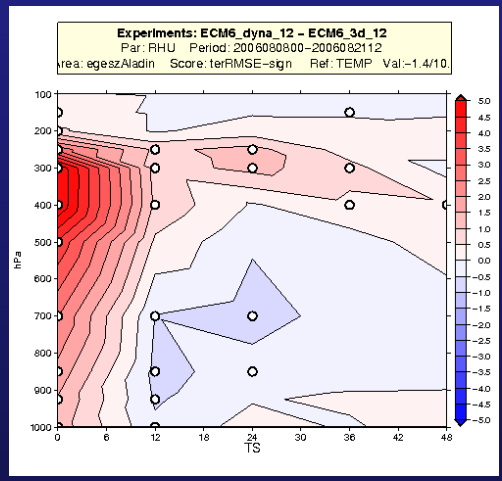
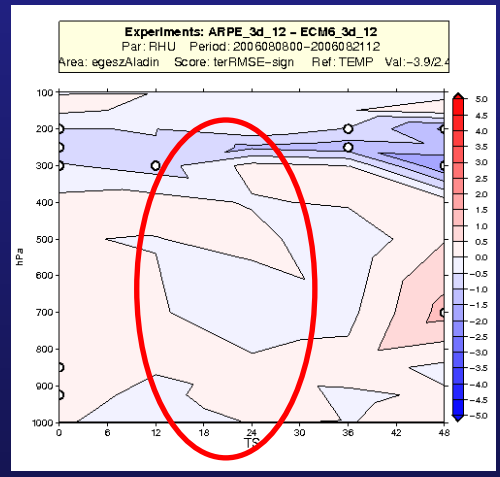




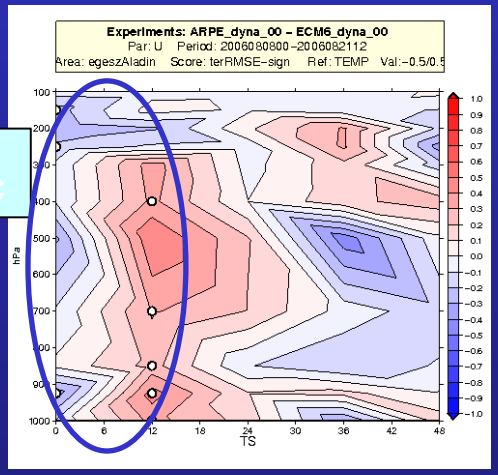
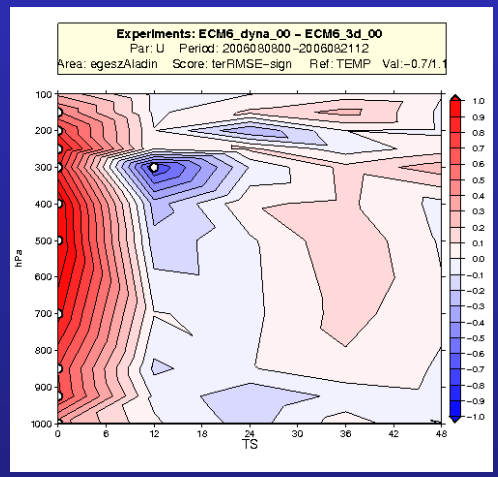
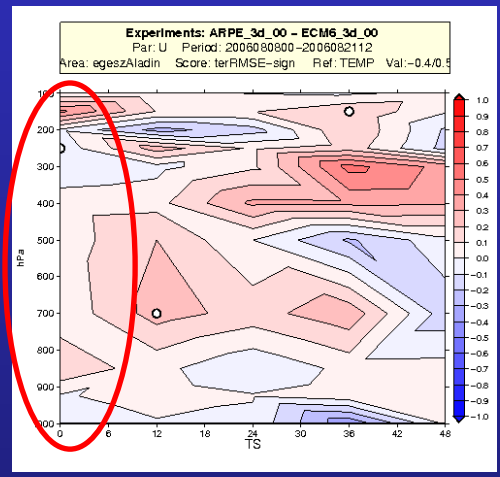
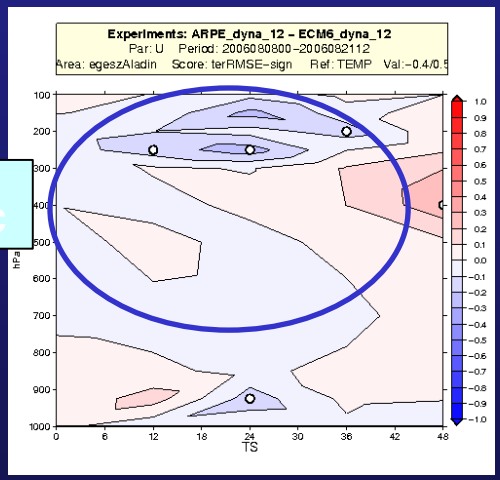
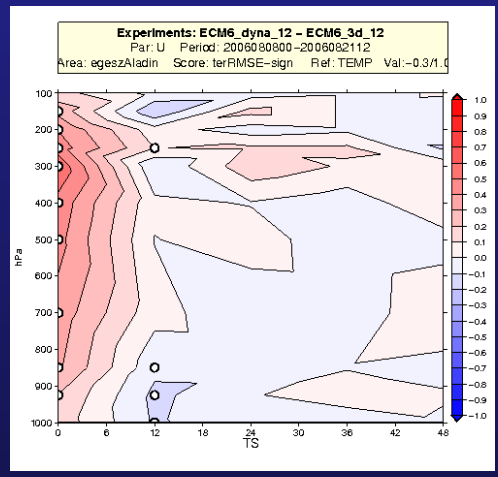
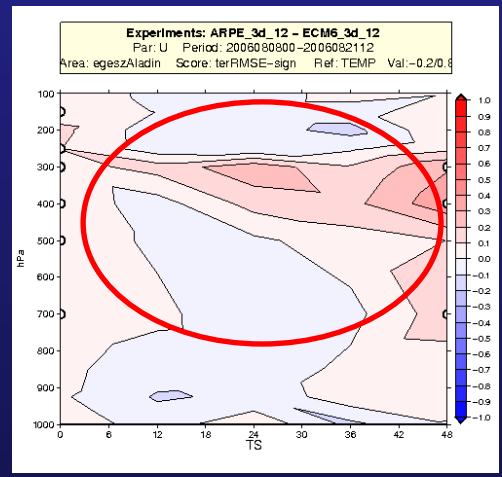
Temperature

	ARPE dyn - ECM6 dyn	ECM6 dyn - ECM6 3d	ARPE 3d - ECM6 3d
00 UTC			
12 UTC			

Relative humidity

	ARPE dyn - ECM6 dyn	ECM6 dyn - ECM6 3d	ARPE 3d - ECM6 3d
00 UTC			
12 UTC			

U wind component

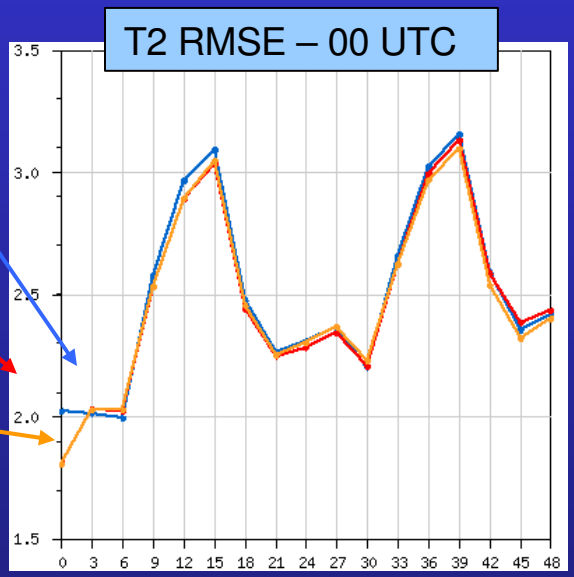
	ARPE dyn - ECM6 dyn	ECM6 dyn - ECM6 3d	ARPE 3d - ECM6 3d
00 UTC			
12 UTC			

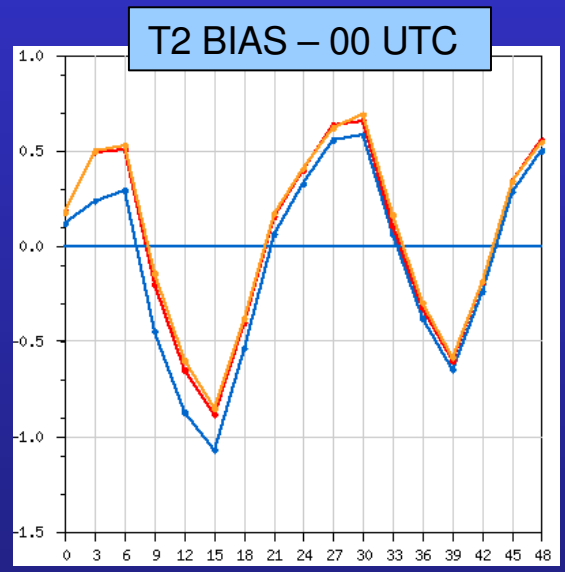
SYNOP-based verification

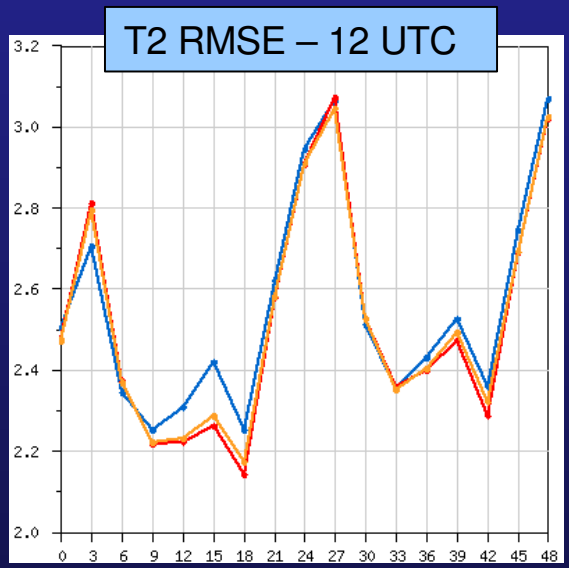
ECM6_dyna

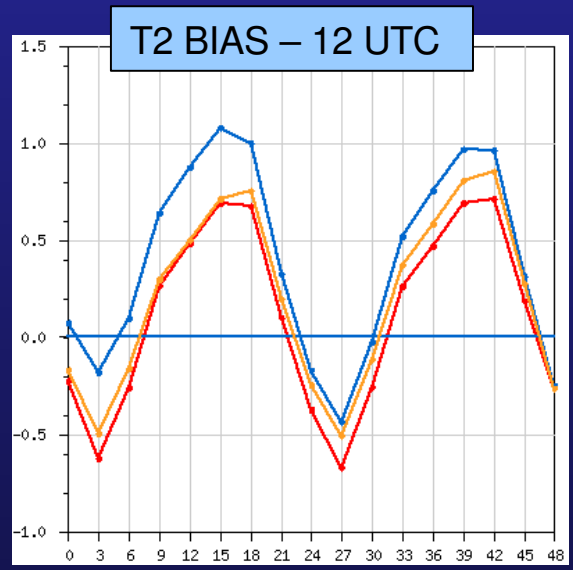
ARPE_3d

ECM6_3d









- The two 3D-VAR conf. performs similarly
- 3D-VAR in general improved the T2 forecast of ECM6
- For RHU2 and windspeed the differences are smaller

Conclusions

- Using IFS IC+BC in ALADIN/HU improved the upper air forecasts significantly
- For an operational applications only the previous (6h earlier) IFS forecasts can be used as IC+BC → ECM6
- With dynamical adaptation ECM6 is worse than using ARPEGE IC+BC
- With 3D-VAR ECM6 improved significantly and the forecast quality is as good as with ARPEGE BCs on the surface and slightly better for the upper air parameters
- An optimal usage of IFS surface fields should be further investigated (improvement of e901)