COSMO-LEPS updates

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COSMO GM

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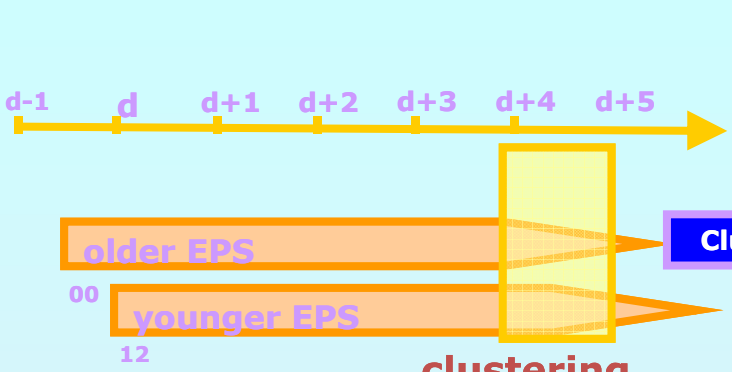
Outline

- present status and changes during the last COSMO-year
- towards COSMO-LEPS @ 5 km
- COSMO-LEPS_2_web

COSMO-LEPS suite @ ECMWF: present status



4 variables
Z U V Q

3 levels
500 700 850 hPa

Cluster Analysis and RM identification

2 time steps

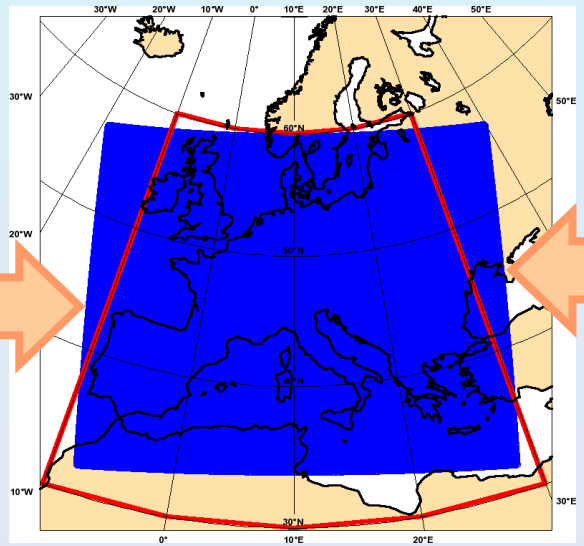
European area

Complete Linkage

20 Representative Members driving the 20 COSMO integrations (weighted according to the cluster populations)

using Tiedtke convection scheme
+
perturbations in turbulence scheme and in physical parameterisations
+
soil initial conditions from ICON-Regional

COSMO-LEPS clustering area



COSMO-LEPS integration domain

- suite runs as a "time-critical application" managed by ARPA-SIMC; runs at both 00 and 12TC;
- Δx ~ 7 km; 40 ML; fc+132h, single precision;
- COSMO v5.03 since 1 February 2016,
- computer time (57 million BUs for 2017) provided by the COSMO partners which are ECMWF member states.

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CONSORTIUM FOR SMALL SCALE MODELING COSMO

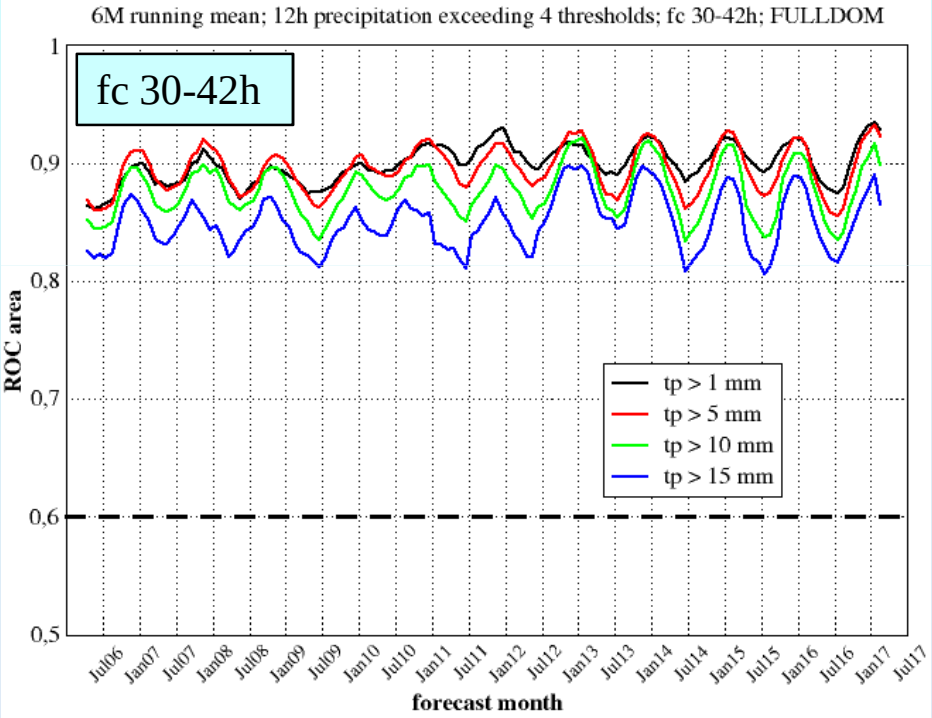
Changes during the last COSMO year

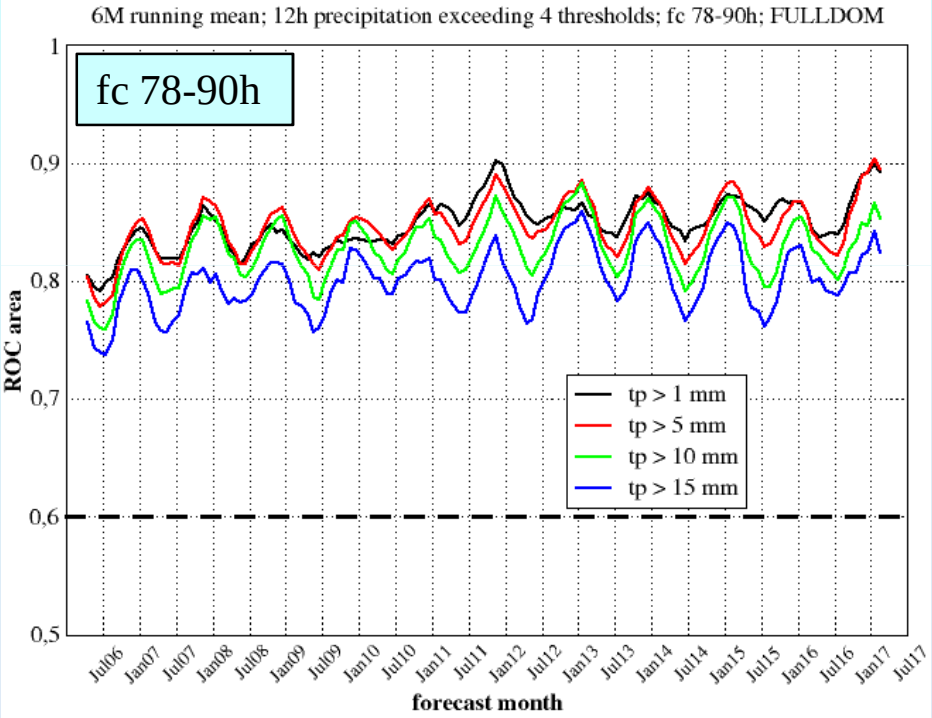
- **5 October 2016: fieldextra upgrade.**
  - Migration to fieldextra 12.3.1 (and I'm still there….).
- **1 December 2016: suite upgrade.**
  - The ensemble size is increased from 16 to 20 members.
  - COSMO integrations are performed in single-precision mode.
  - The suite is about 30% cheaper than last year.
- **10 May 2017: dissemination to DWD.**
  - Test dissemination of COSMO-LEPS fields in GRIB2 format.
- **20 July 2017: implementation of visibility products.**
  - COSMO-LEPS provides forecasts of visibility using 3 different methods (modifications to fieldextra dictionary were needed).
  - Clustering code migrated from GRIB_API to ecCodes.

Trends in forecast scores: ROC area

Monthly-based verification performed over the full integration domain (~1400 synop reports; NGP)

- Area under the curve in the HIT rate vs FAR diagram; the higher, the better …
- Valuable forecast systems have ROC area values > 0.6.
- Consider four events (12-hour precipitation exceeding 1 , 5, 10, 15 mm) and two forecast ranges (30-42h, 78-90h).



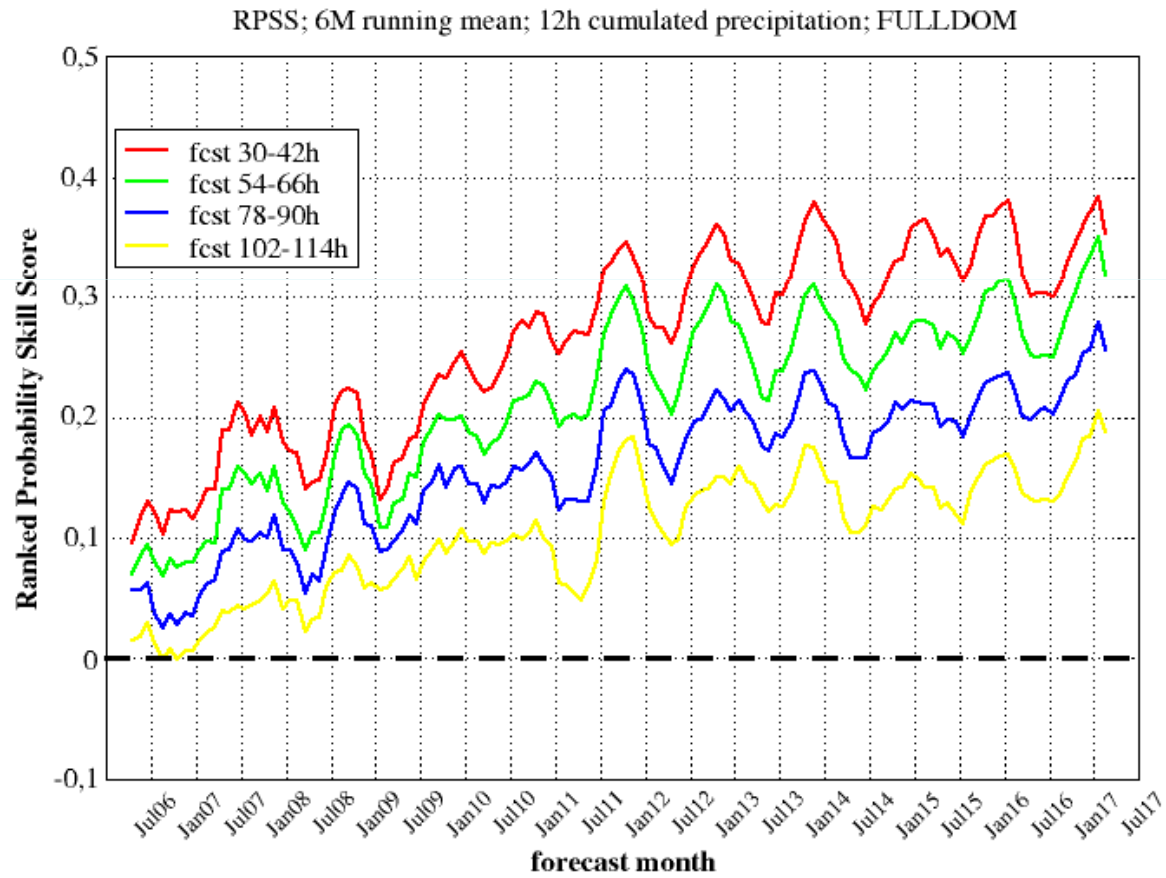


Positive trend of the score in the last months, more evident for longer forecast ranges .

Trends in forecast scores: RPSS

Monthly-based verification performed over the full integration domain (~1400 synop reports; NGP)

- BSS "cumulated" over all thresholds. RPSS is written as 1-RPS/RPS_{ref}. **Sample climate** is the reference system. RPS is the extension of the Brier Score to the multi-event situation.
- RPSS: the higher the better.
- Useful forecast systems for RPSS > 0



Positive trend for all forecast ranges in the last years, especially for the longer ones (— and ---).

Outline

- towards COSMO-LEPS @ 5 km

State-of-the-art

• COSMO-LEPS: 20 members, single precision, 7 km, 40 ML, fc+132h, twice a day.

• The production of the 00UTC-based COSMO-LEPS starts at 8.10UTC and dissemination begins at about 8.45UTC (+12 hours for 12UTC products).

• Products (grib files and/or png images) are operationally disseminated to the COSMO countries which made requests, plus to JRC for EFAS-related issues.

• In other consortia, there is on-going activity on the upgrade of convection-parameterised ensemble systems (e.g. LAEF, 11 → 5 km).

Upgrade COSMO-LEPS (7 → 5 km) to stay abreast of the other systems?

Is it worth it?

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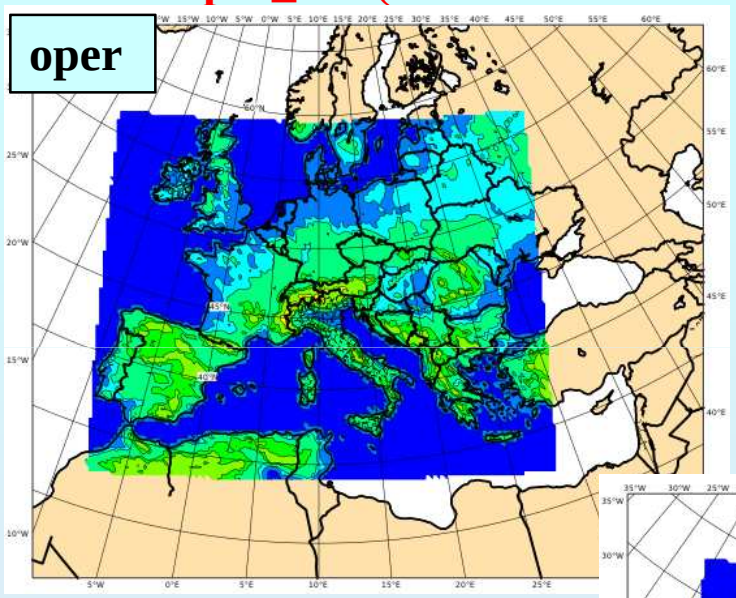
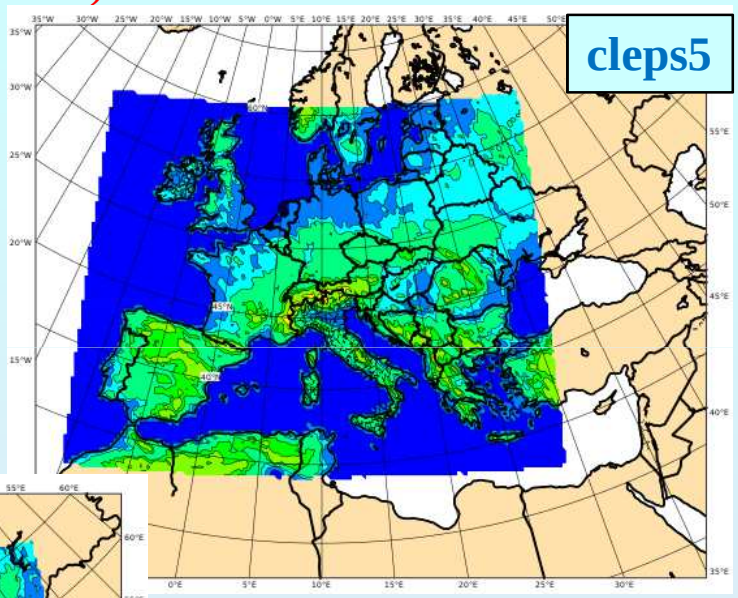
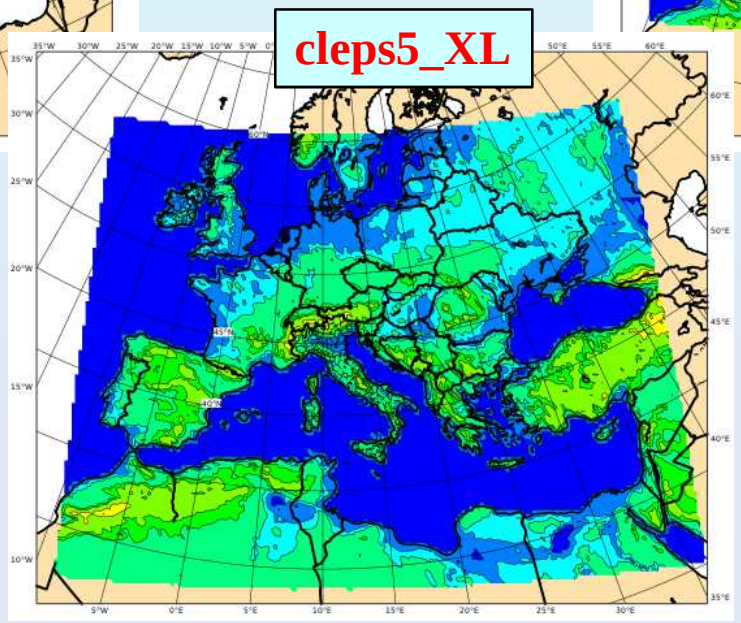
Towards COSMO-LEPS @ 5 km

- Following the discussion at CUS2017, a few preliminary tests were performed.
- In addition to **oper** (COSMO-LEPS @ 7 km), two new configurations were tried:
  - **cleps5** (the same domain as **oper**, but at 5 km),
  - **cleps5_XL** (5 km domain covering the full Mediterranean).







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CONSORTIUM FOR SMALL SCALE MODELING COSMO

COSMO-LEPS @ 5 km: some preliminary figures

- nodes = 24
- totalTasks = 864 (geometry: 27x32)
- test for 1 COSMO-LEPS run

Configuration	Grid points	Delta t (s)	BU (1 run, fc+132h, 40 ML)	ElapsedTime (min)	Impact on ECMWF National allocations (CH+DE+GR+IT)
oper	**511x415x40 = 8.482.600**	**66**	**2044**	**9**	**2.4%**
cleps5	**739x599x40 = 17.706.440 (oper x 2.1)**	**45**	**8632**	**29**	**10%**
cleps5_XL	**919x719x40 = 26.430.440 (oper x 3.1)**	**45**	**11772**	**50**	**14%**

- Try to optimise the configuration - more aggressive approach → use more nodes!

Outline

- COSMO-LEPS_2_web

State-of-the-art

- Little visibility of COSMO-LEPS on COSMO web-site (no maps, not updated configuration, not updated namelists, ...).

Aims

- Increase the visibility and the use of ensemble-based products both inside and outside the Consortium.
- Attract more users for COSMO model.
- ...

COSMO-LEPS on the web:
what planned after CUS2017

• Disseminate from ECMWF to COSMO web-site some static maps (jpg/png files) with very few "basic" products:

- meteograms of COSMO-LEPS over some fixed locations,
- ensemble mean of mean-sea-level-pressure overlapped with probability of total precipitation to exceed some threshold (e.g.10 mm in 24h).
- .....

• Create a test web-page and start loading the files (need to coordinate with Theodore).

Few maps, but public?

Thanks for your attention

Resolution upgrade: some numbers

- As for 2017, COSMO-LEPS costs 59.000.000 (**59 million**) BUs, including both operations and some tests with the IFS-Bechtold convection scheme.
- the computing availability for CH+DE+GR+IT amounts to 2.257.243.000 (**2.2 billion**) BUs.
- **COSMO-LEPS @ 7 km (cleps7) weights on the national allocations for about 2.6%.**
- 7 km: one grid-box covers ~ 49 km^2.
- 5 km: one grid-box covers ~ 25 km^2.

Keeping the same integration domain, the reduction of grid spacing (Δx, 7 → 5 km; TSTEP, 66 → 48 sec) implies an increase of computing costs by approximately a factor of 3.

The impact of COSMO-LEPS @ 5 km (cleps5) on the national allocations would remain anyway limited (below 8%).

Proposed road-map:

perform 2-3 weeks of experimentation with “cleps5” to assess potential benefit and added value with respect to cleps7.

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cleps @ 5 km: costs

• nodes = 24; totalTasks = 864 (36 tasksPerNode; geometry: 27x32)

oper (delta t = 66s)

5 km(larger)	5 km(smaller)	7 km
919x719x40	739x599x40	511x415x40
26.430.440	17.706.440	8.482.600
int2lm		
1 node - total_tasks=36 (6x6)		
115 BU	86 BU	45 BU
714 sec	534 sec	276 sec
~12m	~9m	~4.5m
cosmo		
24 nodes - totalTasks=864 (27x32)		
delta_t=45s	delta_t=45s	delta_t=66s
11772 BU	8632 BU	2044 BU

5 km(larger)	
919x719x40	7
26.430.440	17
int2lm	
1 node - total_tasks=36 (	
115 BU	86 B
714 sec	534
~12m	~9m
cosmo	
24 nodes - totalTasks=8(	
delta_t=45s	de
11772 BU	86
3041 sec	17
~50m	2

COSMO-LEPS @ 5 km: some figures

- nodes = 24;
- totalTasks = 864 (geometry: 27x32)
- tasks PerNode = 36
- test for 1 COSMO-LEPS run (fc +132h, 40 ML)

Config	grid-points	delta t (s)	BU	Elapsed (min)
oper	**511x415x40 = 8.482.600**	**66**	**2044**	**9**
cleps5	739x599x40 = 17.706.440 (oper x 2.1)	45	8632	29
cleps5_XL	919x719x40 = 26.430.440 (oper x 3.1)	45	11772	50

•Try to optimise the configuration - more aggressive approach → use more modes!

COSMO-LEPS on the web: about usability

ECMWF approach:

- some products are accessible by everybody (e.g. ensemble mean and ensemble spread of mslp, WSPEED850, Z500);
- other products are password-protected (e.g. meteograms, ...). A few years ago, meteograms were the “clickiest” among ECMWF products.

If the aim is to increase the visibility and the use of ensemble-based products, some products should be public.

but how to achieve this?

COSMO-LEPS on the web:

Preliminary question for COSMO STC:

Does the STC agree on putting real-time products (e.g. maps) on COSMO public web page?

AIMS:

- Increase the visibility and the use of ensemble-based products both inside and outside the Consortium.
- Attract more users.
- ...

If the aim is to increase the visibility and the use of ensemble-based products, some products need to be public.

but how to achieve this?

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CONSORTIUM FOR SMALL SCALE MODELING COSMO

COSMO-LEPS on the web

Here are some options:

a) Disseminate from ECMWF to COSMO web-site some static maps (png files) with some "basic" products:
   - meteograms of COSMO-LEPS over some fixed locations,
   - ensemble mean of mean-sea-level-pressure overlapped with probability of total precipitation to exceed some threshold (e.g.10 mm in 24h).

b) Disseminate the COSMO-LEPS grib files directly to COSMO web-site where to construct the products.

c) .....

a) is simpler to implement and maintain → Priority Task may be (not) needed.

b) is much more demanding, but enables more flexibility and quantity in the generation of products → Priority Task definitely needed, maybe a Priority Project.

Project structure

COSMO-T: COSMO run performed with Tiedtke convection scheme

COSMO-B: COSMO run performed with Bechtold convection scheme

SubTask1: benchmark of COSMO-B

SubTask2: tests of COSMO-B in deterministic mode

SubTask3: test of COSMO-B in ensemble mode

SubTask4: COSMO-B and COSMO-T in ensemble mode

SubTask1: benchmark of COSMO-B

Perform a benchmark of the COSMO integrations in deterministic mode to assess and refine the technical details of COSMO-B....

• **Deliverables**: Identification of the optimal configuration of COSMO-B runs for the different set-ups.

• Start: 04/17 - End: 06/17 **completed!!!**

Bechtold scheme available since version 5.04b (at ECMWF, experiments performed with v5.04e-beta-corrected).

COSMO-B as expensive as COSMO-T.

About namelists (and docu)

&PHYCTL

.....

itype_conv=2, ← with "2" the Bechtold scheme is chosen

icpl_aero_conv=1,

icapdcycl=3,

…….

New namelist switches:

Name	Description	Default:
icpl_aero_conv	: type of coupling between aerosols and convection scheme	0
=0:		
=1:		
icapdcycl	:	0

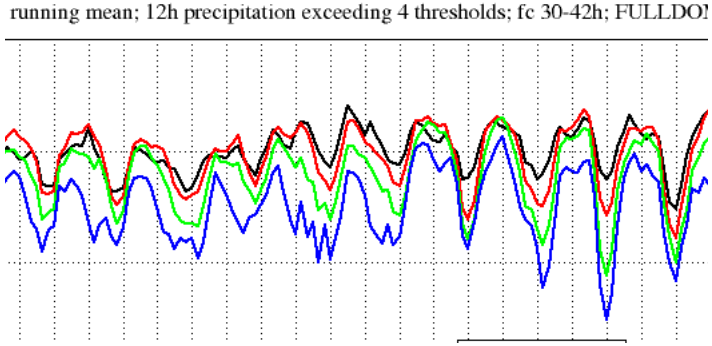
=0 no CAPE diurnal cycle correction (IFS default prior to cy40r1, i.e. 2013-11-19)

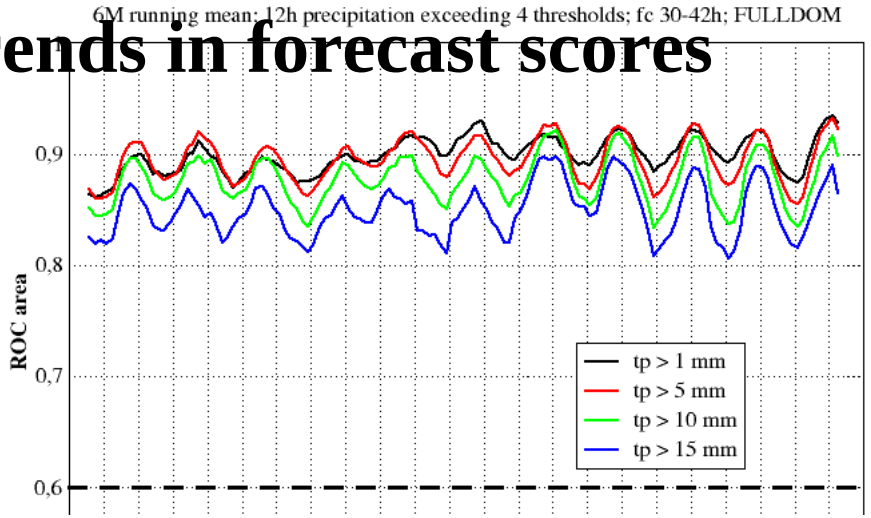
=1 CAPE - surface buoyancy flux (intermediate testing option)

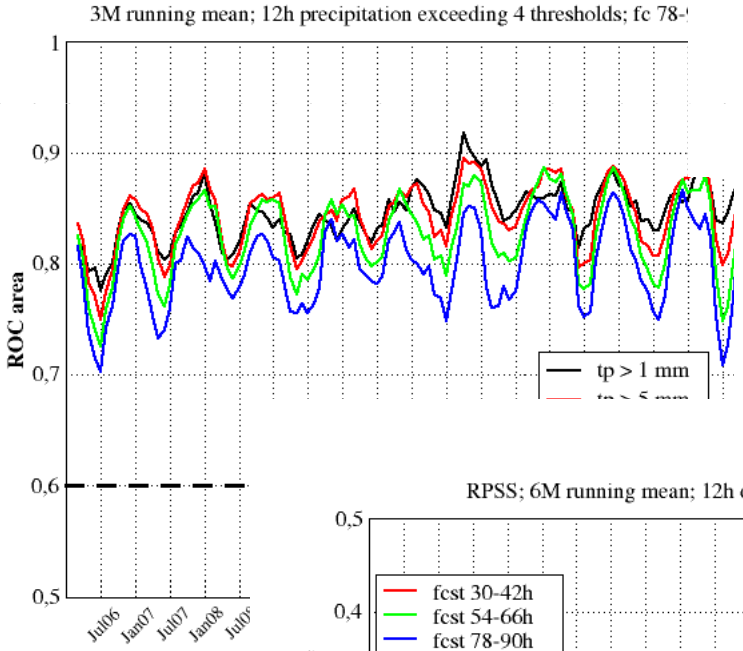
=2 CAPE - subcloud CAPE (IFS default starting with cy40r1)

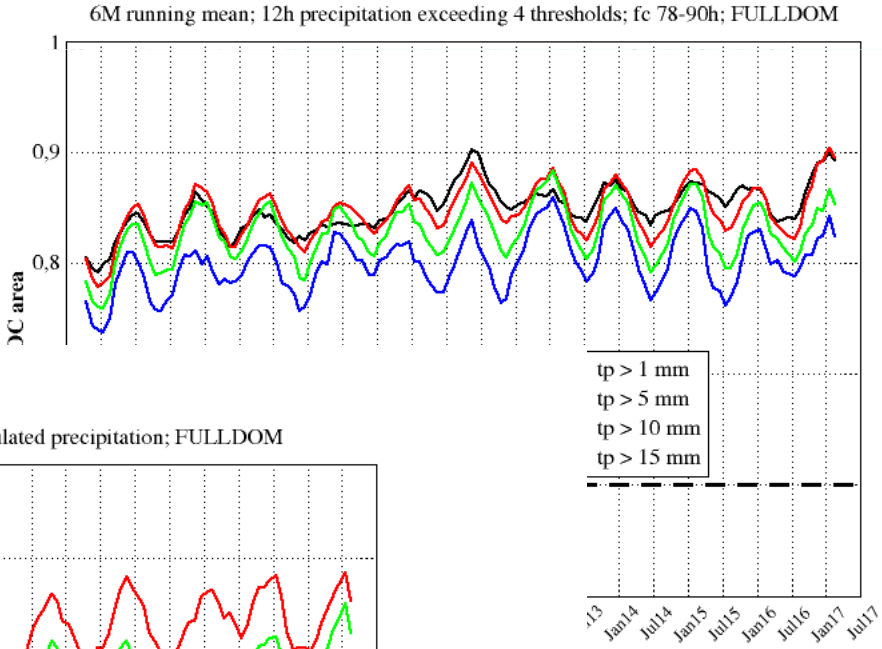
=3 Apply CAPE modification of (2) over land only, with additional restriction to the tropics

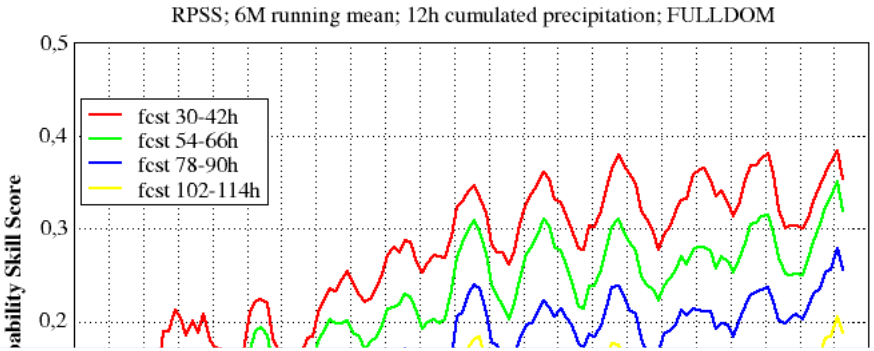
Some trends in forecast scores











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COSMO