CONSORTIUM FOR SMALL SCALE MODELING

COSMO

COSMO-LEPS: status

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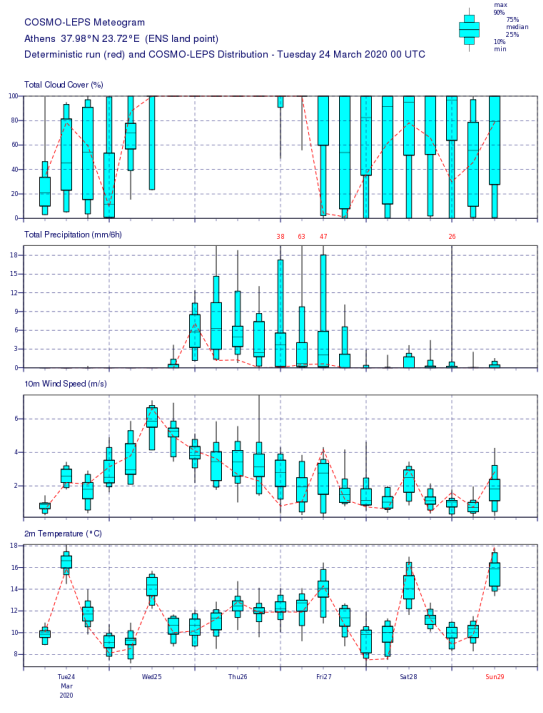
COSMO-LEPS: overview

COSMO-LEPS is meant to provide probabilistic forecast over the European area for the short-medium range weather forecast at a higher resolution than global models for COSMO Members and other users

- Reliable operational production and product delivery
- User-tailored probabilistic products
- Higher performance compared to ECMWF EPS in any season for precipitation and for all the surface variables verified
- Time range of 5 days is not covered by higher-resolution models EPS
- Ensemble members are used to drive downstream models e.g. hydrological models, phytosanitary models



Operational suite: status

The operational suite runs at ECMWF HPC as time critical application managed by Arpae-SIMC (Ines and help by Andrea)

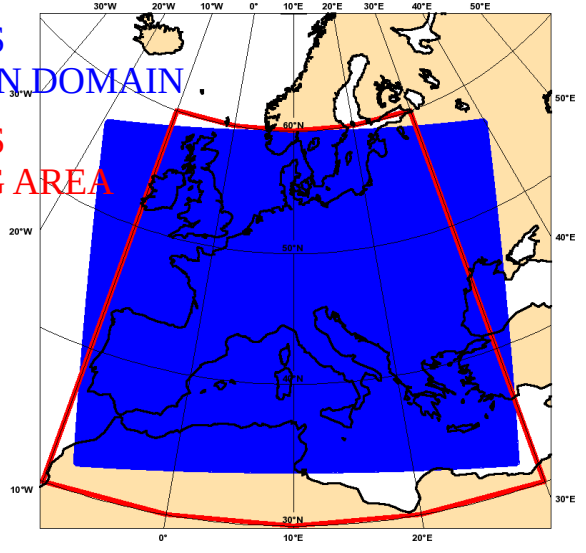
The computer time is provided by the COSMO partners which are ECMWF member states (CH, D, GR, I, Is)

Configuration:

- ensemble size: 20 members
- IC/BCs from ECMWF ENS members (only 00 and 12UTC ENS runs are considered) using cluster analysis and soil IC from ICON-EU
- horizontal / vertical resolution: 7 km / 40 ML
- forecast range: +132h
- starting times: 00 and 12UTC
- COSMO model version: 5.03 in single-precision
- convection scheme: Tiedtke
- perturbations in turbulence scheme and in physical parameterisations (PP), but no SPPT
- ecflow suite

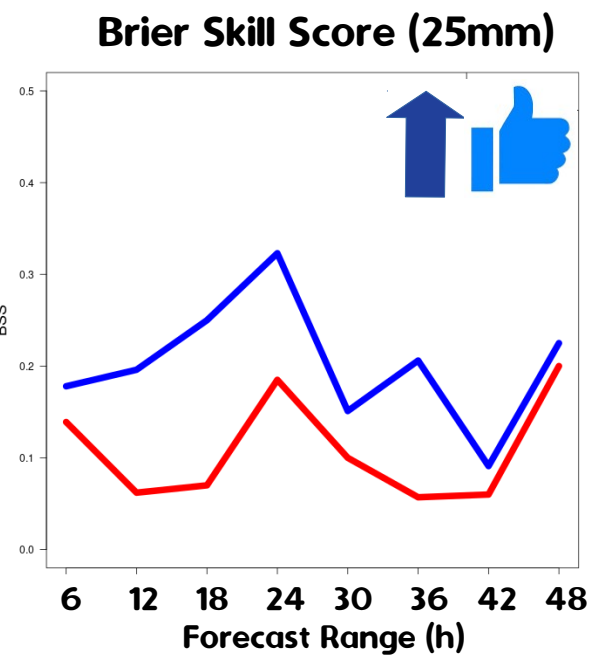
COSMO-LEPS INTEGRATION DOMAIN

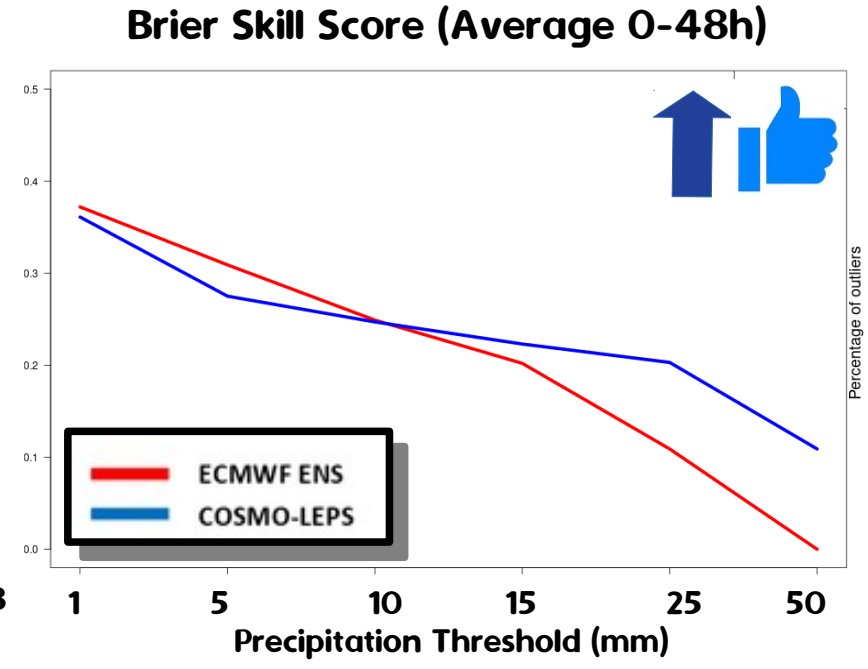
COSMO-LEPS CLUSTERING AREA

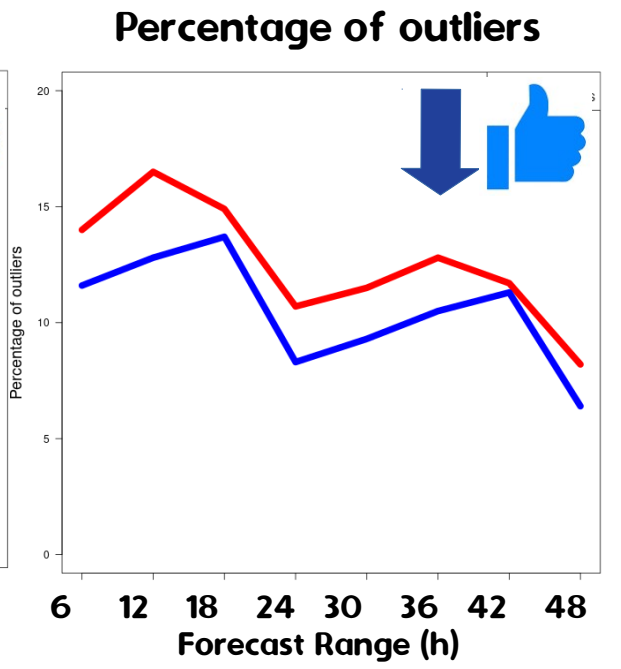


Operational suite: performance

JFMA2020, Total precipitation accumulated in 6h, ~1500 stations, boxes of 0.25°







Brier Skill Score: indicates the degree of improvement of the Brier Score (BS) of a forecast compared to the BS of a climatological forecast. BS is the mean square error of the probability forecast

Percentage of Outliers: Indication of number of observations falling outside the ensemble spread

Technical Updates

Technical upgrades in the last COSMO year

- Complete migration from grib_api to eccodes, including the version upgrade of several modules (Magics, Metview, libsim, fieldextra) and the migration from python to python3 (January 2020)
- Transition to ecflow version 5 (July 2020)

Technical upgrades foreseen in the next months

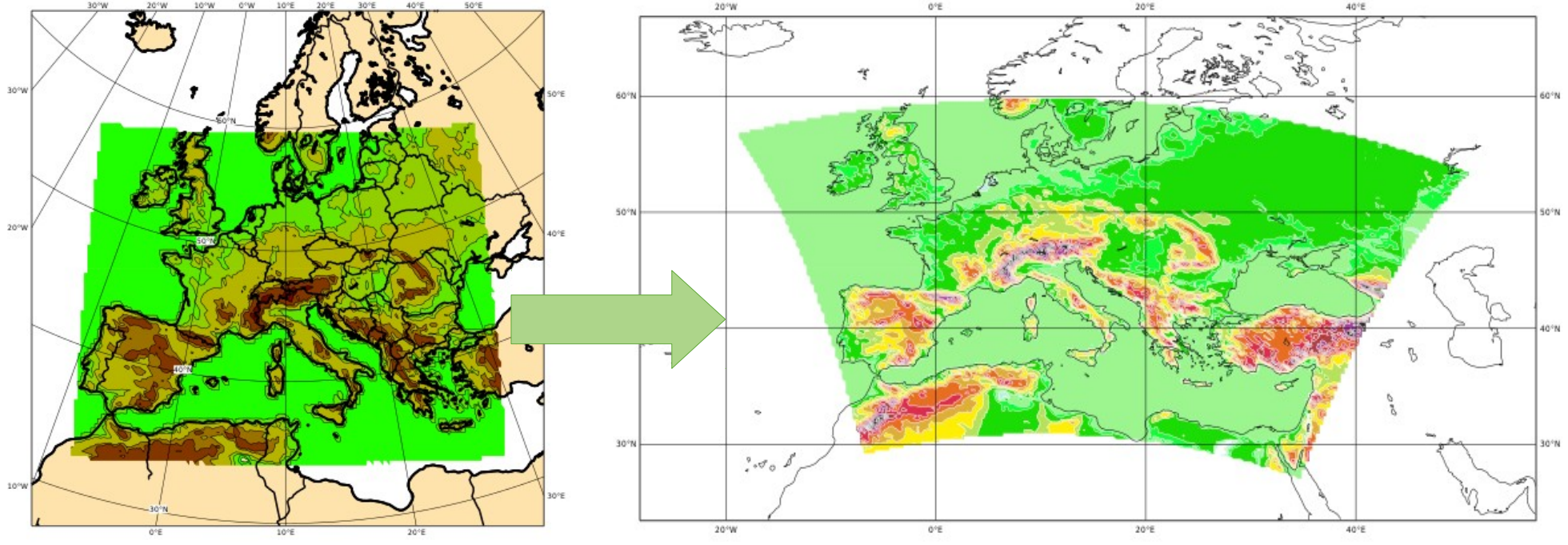
- Update of COSMO code to version 5.06 Single Precision
- Include in the lagged ensemble the ENS runs starting at 18UTC and 06UTC
- Test new grib definition to include COSMO-LEPS specific metadata (developed by Doerte Liermann)

All these upgrades are user transparent

Strategy for COSMO-LEPS

Main points on the table:

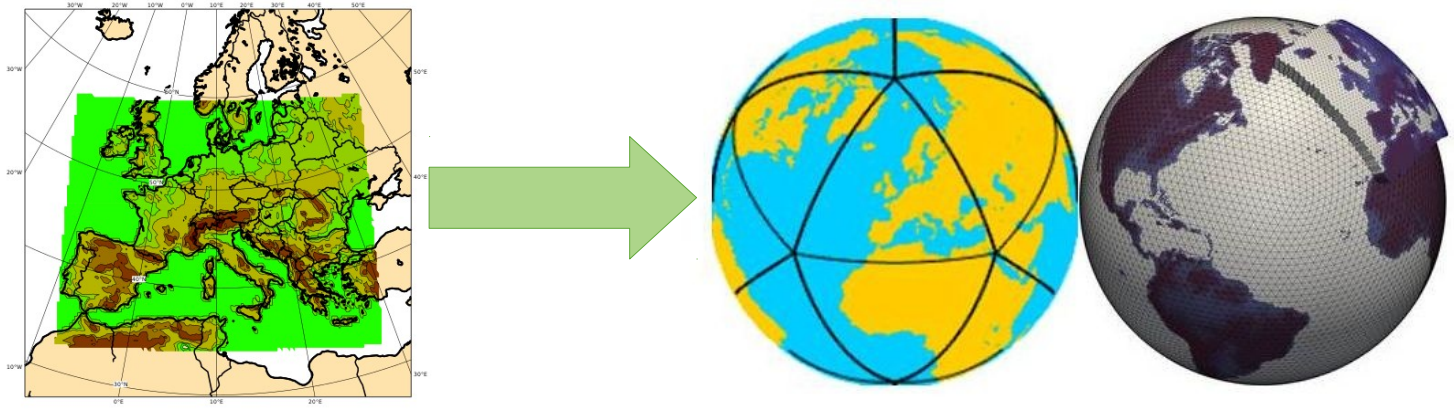
1. **Extension of COSMO-LEPS domain to include the Mediterrenean Sea:**
   - **PRO:** full coverage of Greece and Israel, might be useful for ocean applications,
   - **CONS**: small but non-transparent changes in the output fields e.g. rotation pole
   - **COST:** computational cost ~ +37%, the suite would require several modifications ~ 0.1FTE



Strategy for COSMO-LEPS

Main points on the table:

1. **Extension of COSMO-LEPS domain to include the Mediterrenean Sea:**
   - **PRO:** full coverage of Greece and Israel, might be useful for ocean applications,
   - **CONTRO**: small but non-transparent changes in the output fields e.g. rotation pole
   - **COST:** computational cost ~ +40%, the suite would require several modifications ~ 0.1FTE
2. **Migration to ICON-LEPS:**
   - **PRO:** useful to facilitate adaptation to the new model, domain extension and horizontal resolution increment can be easily included
   - **CONS**: non-transparent changes in the output fields e.g. migration to grib2
   - **COST:** computational cost ~ =, the suite would require several modifications ~0.3-0.4FTE, parallel production, verification and dissemination should be done for ~ 6months



Strategy for COSMO-LEPS

Computational costs compared to COSMO-LEPS

Model	Similar domain and resolution as COSMO-LEPS	Domain extension
COSMO (Single-Precision)	(this is COSMO-LEPS)	+37%
ICON (Mixed-Precision)	~0%	~+30%

→ Option 1

→ Option 2

At the moment the COSMO-LEPS operational production consumes about 50% of the resources allocated → increments up to 100% can be effordable

Strategy for COSMO-LEPS

Development proposals for 2020-2022

1. **STAY WITH COSMO:**
   a) **Extension of COSMO-LEPS domain to include the Mediterrenean Sea**
   b) **Improvement perturbation of IC/BC and of model perturbation (enhance lagged ensemble and introduce SPPT)**

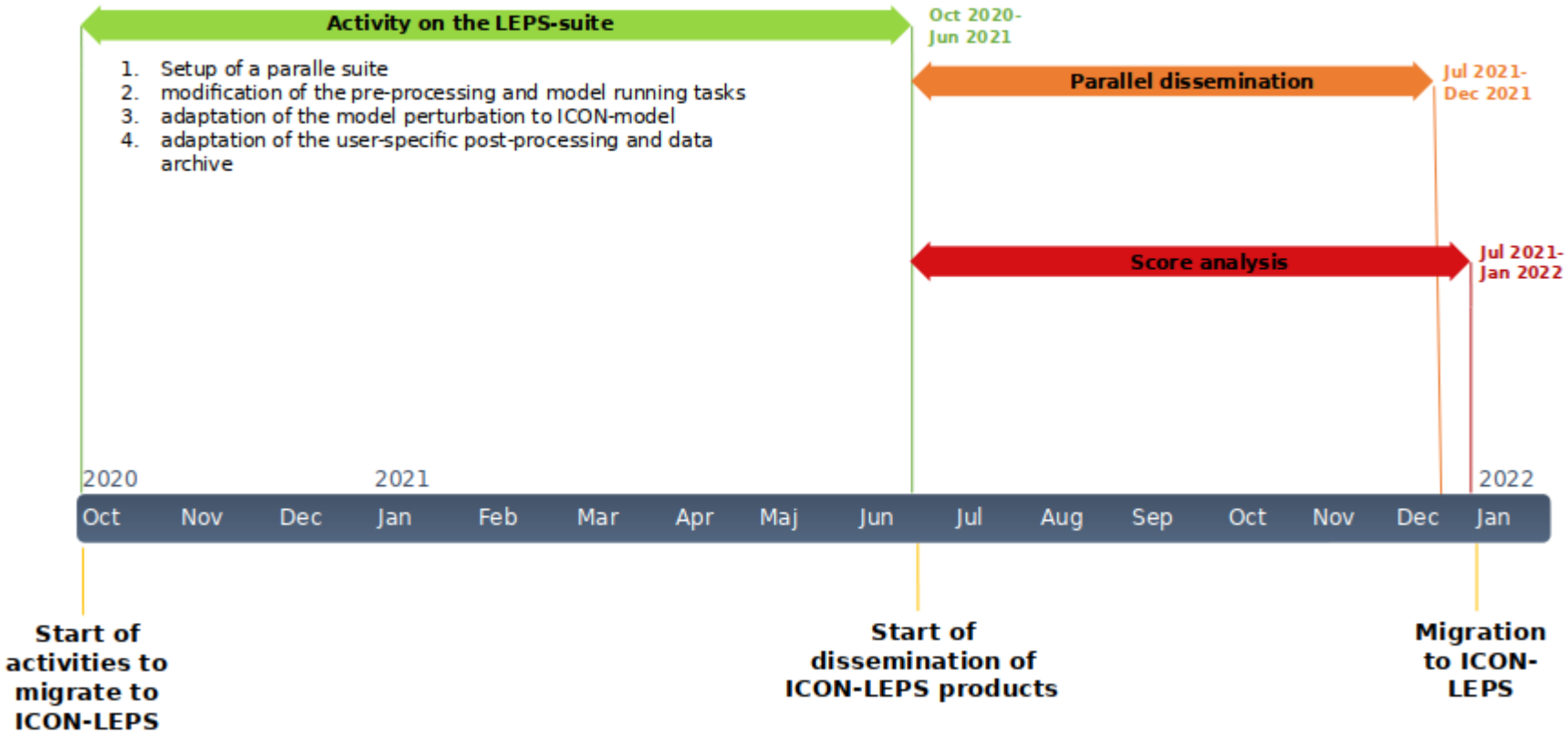
2. **MIGRATE TO ICON-LEPS:**
   a) **Extension of COSMO-LEPS domain to include the Mediterrenean Sea**
   b) **Improvement/revision perturbation of IC/BC and of model perturbation (enhance lagged ensemble, revise parameter perturbation)**
   c) **Increment of the horizontal resolution might be considered in future**
   d) **Keep similar architecture to COSMO-LEPS** (ensemble size, forecast range,..)

SMC supports this proposal

- Similar computational cost
- Part of the Consortium migration to ICON model

Strategy for COSMO-LEPS

Migration to ICON-LEPS:



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Thank you for your attention!

Strategy for COSMO-LEPS

MIGRATE TO ICON-LEPS:

- **Keep similar architecture to COSMO-LEPS**
  - ensemble size: 20 members
  - IC/BCs from ECMWF ENS members using cluster analysis and soil IC from ICON-EU
  - Model perturbation: revise PP (perhaps in line with ICON-D2-EPS + something for convection)
  - horizontal / vertical resolution: 7 km / 40 ML
  - forecast range: +132h
  - starting times: 00 and 12UTC
  - Extension of COSMO-LEPS domain to include the Mediterrenean Sea