ECMWF STATUS REPORT 2015

Jean Noël Thépaut
Jean-noel.thepaut@ecmwf.int

and ECMWF colleagues

Outline

1. Last-year model cycle and new cycles 
2. R&D research topics (a selection)
3. New projects/programmes
4. Conclusions

Model implementations
(Nov. 2013 - to date)

Nov 2013 →

(Covered at WGNE-29)

Cycle **40r1**:

- EDA to 25 members, and flow dependent cov in 4DV
- Improved convection (daily cycle)
- Wave-ocean currents 1-way interaction, and NEMO v3.4
- ENS to L91 with TOA at 0.01hPa
- ENS coupling to NEMO from d0
- ENS land-surface initial perturbations (EDA-based)

Sept. 2014 →

Cycle **40r1C**:

- Migration to CRAY HPC

Apr. 2015 →

Cycle **41r1**:

- Microphysics upgrade
- Implementation of lake model (Flake)
- Higher-resolution 4DV inner loops and improved EDA filtering
- All-sky assimilation upgrade
- ENS reforecasts from 5 to 22 members per week

Forthcoming changes in models and systems

- April 2015 (cy41r1):
  - ENS refc suite: from 5-member once to 11-member twice weekly
  - New climate fields
  - Improvements in resolved and unresolved (stochastic phys) processes
  - Higher-resolution inner loops in HRES-4DVAR
- Q4 2015 / Q1 2016 (cy41r2):
  - Model processes
  - Increased horizontal resolution of all systems (still under discussion)
- 2016:
  - New ocean model (wave, mixed layer, dynamical ocean and sea ice)
  - Higher-resolution ocean model (ORCA025_z75)

Cy41r1: main upgrades

- Micro-physics upgrade
- Revised detrainment in convection scheme
- Lake model: Flake
- 4DV upgrade of inner loop resolutions (255L-255L-255L grid)
- EDA improved noise filtering
- ENS re-forecasts: from 5-member once to 11-member twice weekly
- Active use of wave modified stress in coupled mode
- New surface climate fields (land-sea mask, sub-grid orography)
- Improved SL-trajectory (stratospheric noise)
- All-sky assimilation upgrade
- Observation based FEC in operational monitoring

Cy41r1: clouds and precipitation

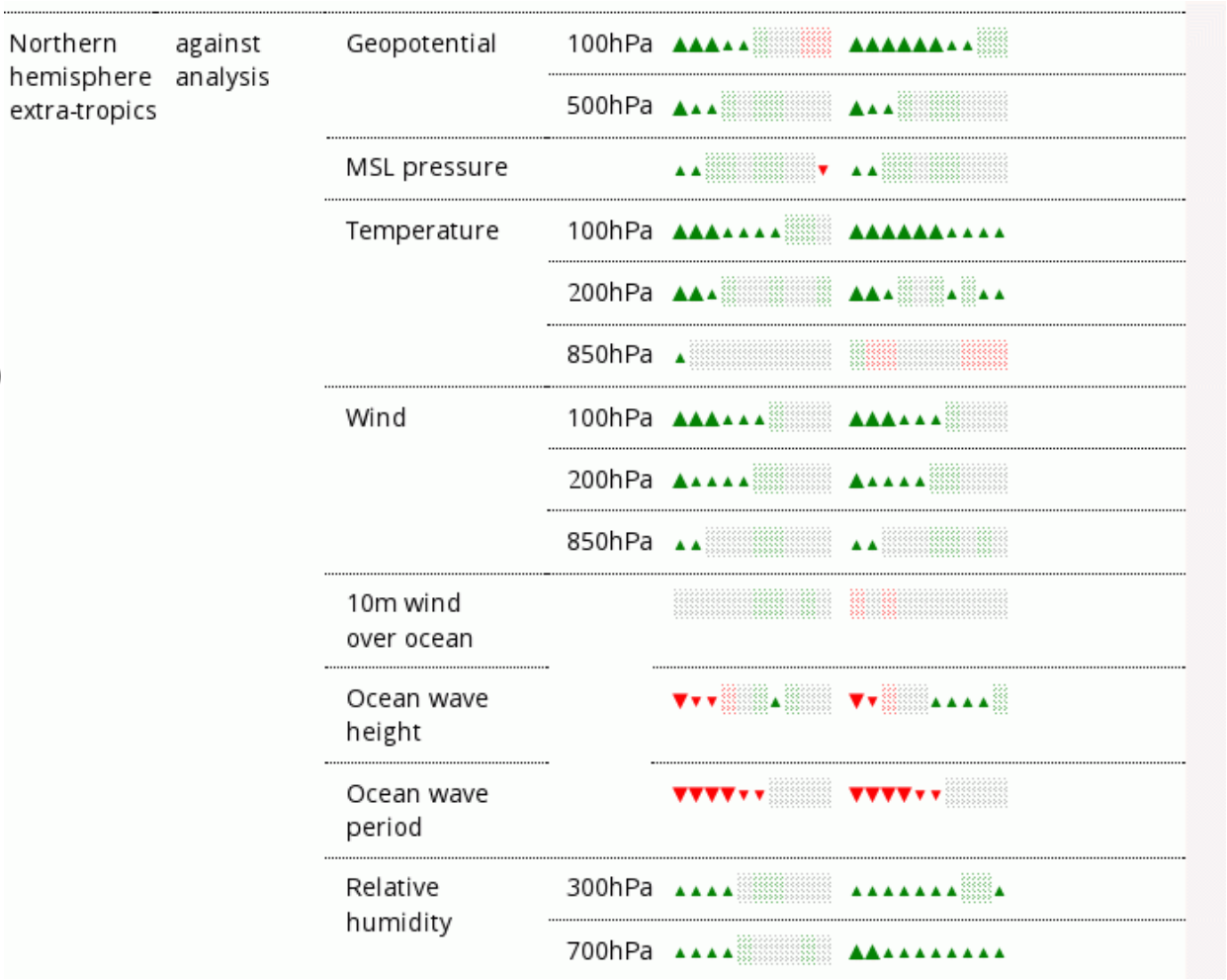
Microphysics upgrade package for 40r3 – replacing microphysics in IFS since 1995!

- New rain autoconversion/accretion formulation
- New snow riming term
- New rain evaporation formulation
- New freezing rain formulation
- Number of additional 2D diagnostics, including severe weather (“freezing rain”, visibility/fog, instantaneous and max/min precipitation rates...)

New cycles

41r1 impact in a nutshell

- Very good upper air scores throughout
- Particularly in the stratosphere (also SSW)
- Ocean wave deterioration explained (more active analysis)
- SH T850 deterioration explained (change of mean)



Peter Bauer

Future resolution increase: Number of gridpoints

TL1279 (linear, ~16km) ~= 2.14 Million points per level

TL2047 (linear, ~10km) ~= 5.45 Million points per level

TC511 (cubic, ~20km) ~= 1.37 Million points per level

TCo639 (cubic, ~18km) ~= 1.66 Million points per level

TC639 (cubic, ~16km) ~= 2.14 Million points per level

TC1023 (cubic, ~10km) ~= 5.45 Million points per level

TCo1279 (cubic, ~9km) ~= 6.59 Million points per level

TC1279 (cubic, ~8km) ~= 8.51 Million points per level

The TCo grid will correspondingly
save on TL/AD costs and radiation grids

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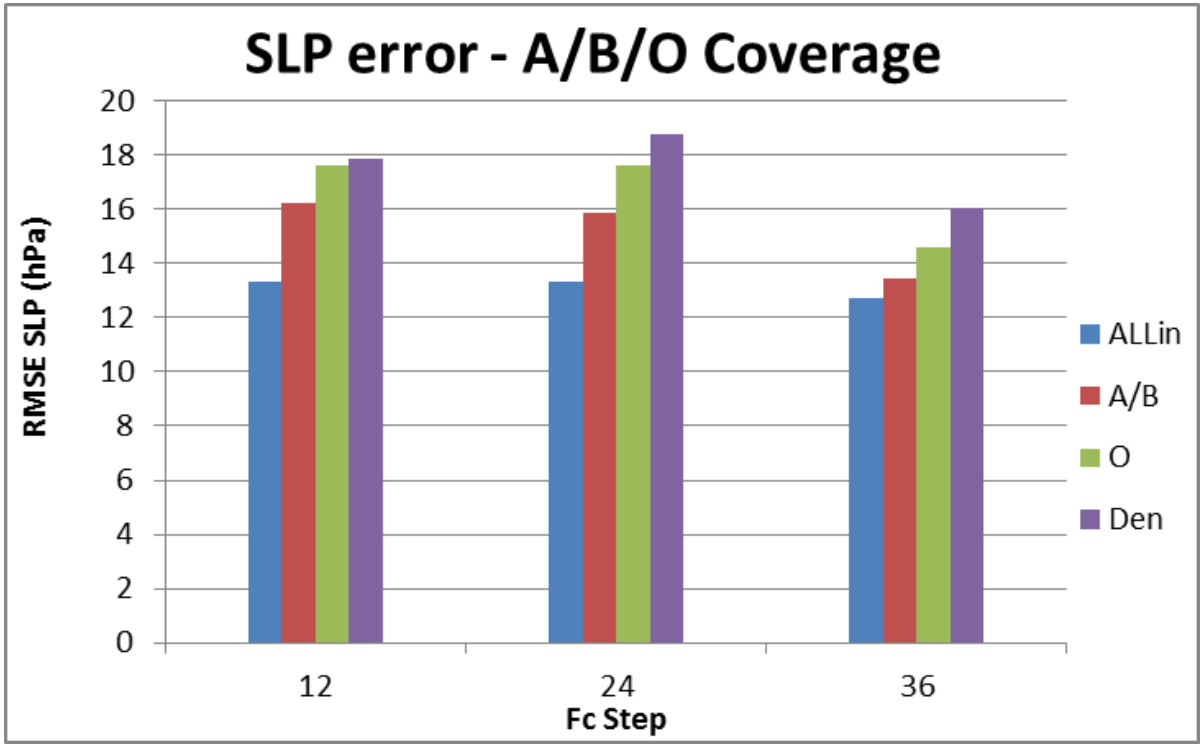
1. Last-year model cycles and new cycles
2. R&D research topics (a selection)
    1. OSEs
    2. MACC
    3. ERA
3. New projects/programmes
4. Conclusions

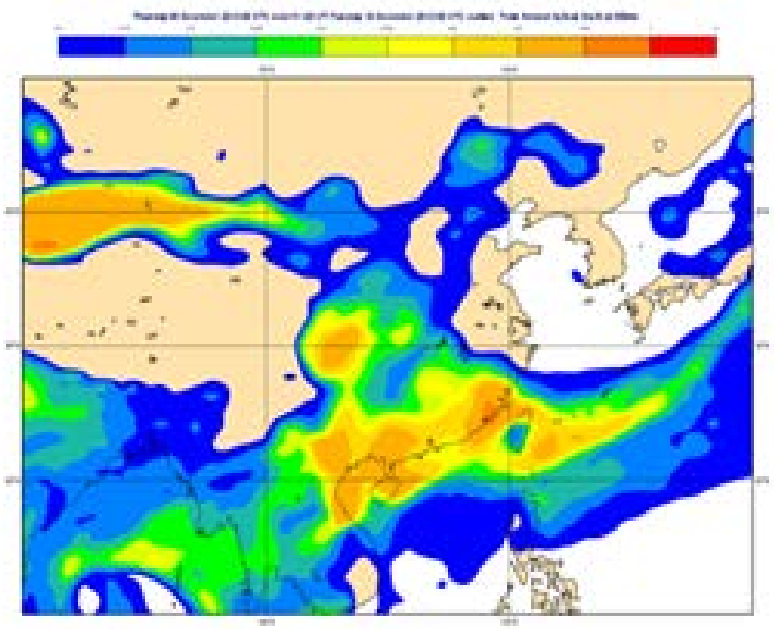
Impact of scatterometer winds on Tropical Cyclone forecasts

Tropical cyclones' positions and SLP have been compared to observation values (from NHC and JMA), with statistics based only on cases where ASCAT-A, ASCAT-B and OSCAT passes were available.

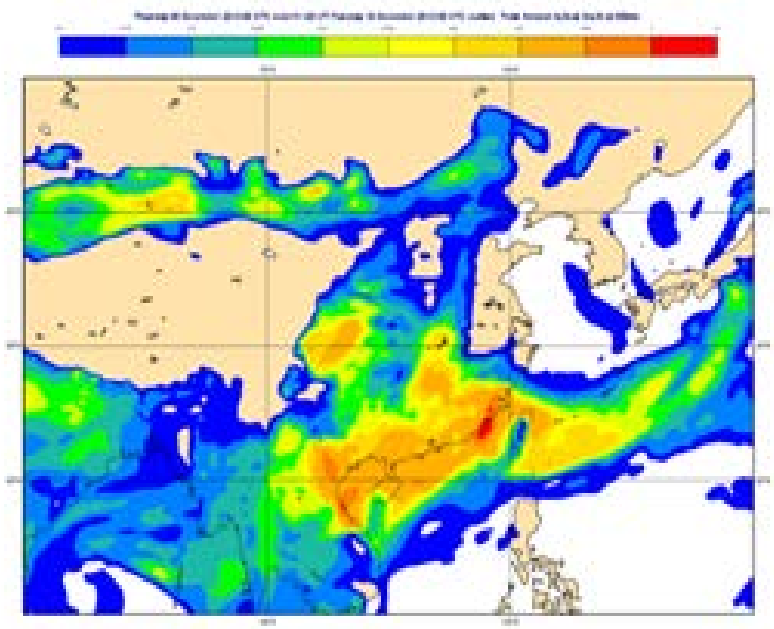


MACC: higher-resolution suite

T255L60 – t+120h



T511L60 – t+120h



Reanalyses: ERA5 (replacement of ERA-interim)

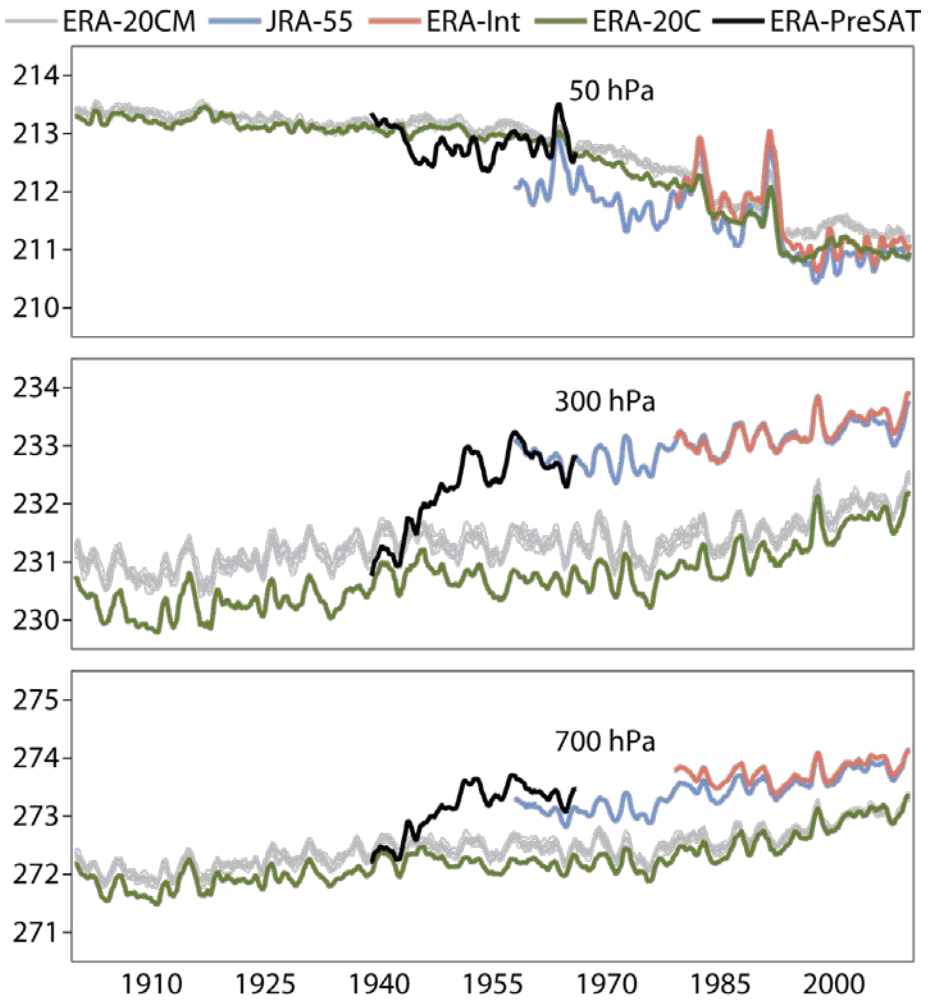
	ERA-Interim	ERA5
Start of production	August 2006 IFS Cy31r2	mid 2015 IFS Cy41R1
Model input	As in operations *(inconsistent SST)*	Appropriate for climate (CMIP5, HadISST.2, OSTIA)
Spatial resolution	79 km global 60 levels to 10 Pa	39 km global (or 31 km) 91 levels to 1 Pa (or 137 levels)
Output frequency	6-hourly Analyses	Hourly
Time period	1979 - present	1979 - present (extension to ~1950)
Dissemination	Monthly	Monthly for ERA5; daily for ERA5T
Observations	Mostly ERA-40, GTS	Various reprocessed CDRs
Radiative transfer	RTTOV7	RTTOV11
Analysis method	4D-Var 1D+4DVar rain	10-member ensemble 4D-Var (EDA) All-sky MW
Variational bias corrections	Satellite radiances	Also ozone, aircraft, surface pressure, radiosondes
Operated by	Reanalysis team	Forecast Department

Reanalyses

Comparisons of different reanalyses datasets:

ERA-20CM
JRA-55
ERA-Int
ERA-20C
ERA-PreSAT

12m running-mean average global mean temperature



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Copernicus
Atmosphere Monitoring Service

Copernicus
Climate Change Service

Funded by the European Union

Implemente
d by ECMWF

Copernicus Atmosphere Monitoring Service

MISSION

Supporting the European strategy "Living well within the boundaries of our planet" by combining models and observations to monitor and forecast atmospheric pollution.

Contributing to Europe's green economy by providing timely and accurate information on aerosols, chemical pollutants and greenhouse gases.

Funded by the European Union

Implemented by ECMWF

Copernicus Climate Change Service

MISSION

An authoritative source of climate information for Europe covering past climate and trends, current state of the climate and projections of possible scenarios of future climate.

Building upon national and international existing efforts

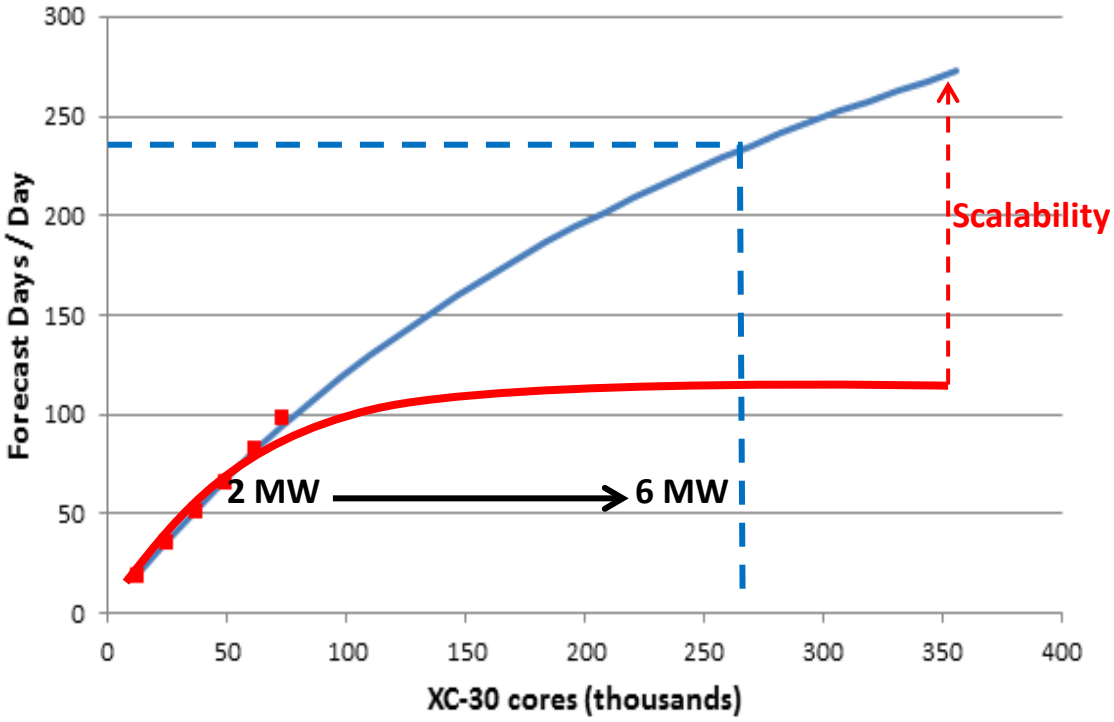
Supporting the market for climate services in Europe

Funded by the European Union

Implemented by ECMWF

ECMWF Scalability Programme

Scalability is the ability of a system, network, or process to handle a growing amount of work in a capable manner or its ability to be enlarged to accommodate that growth



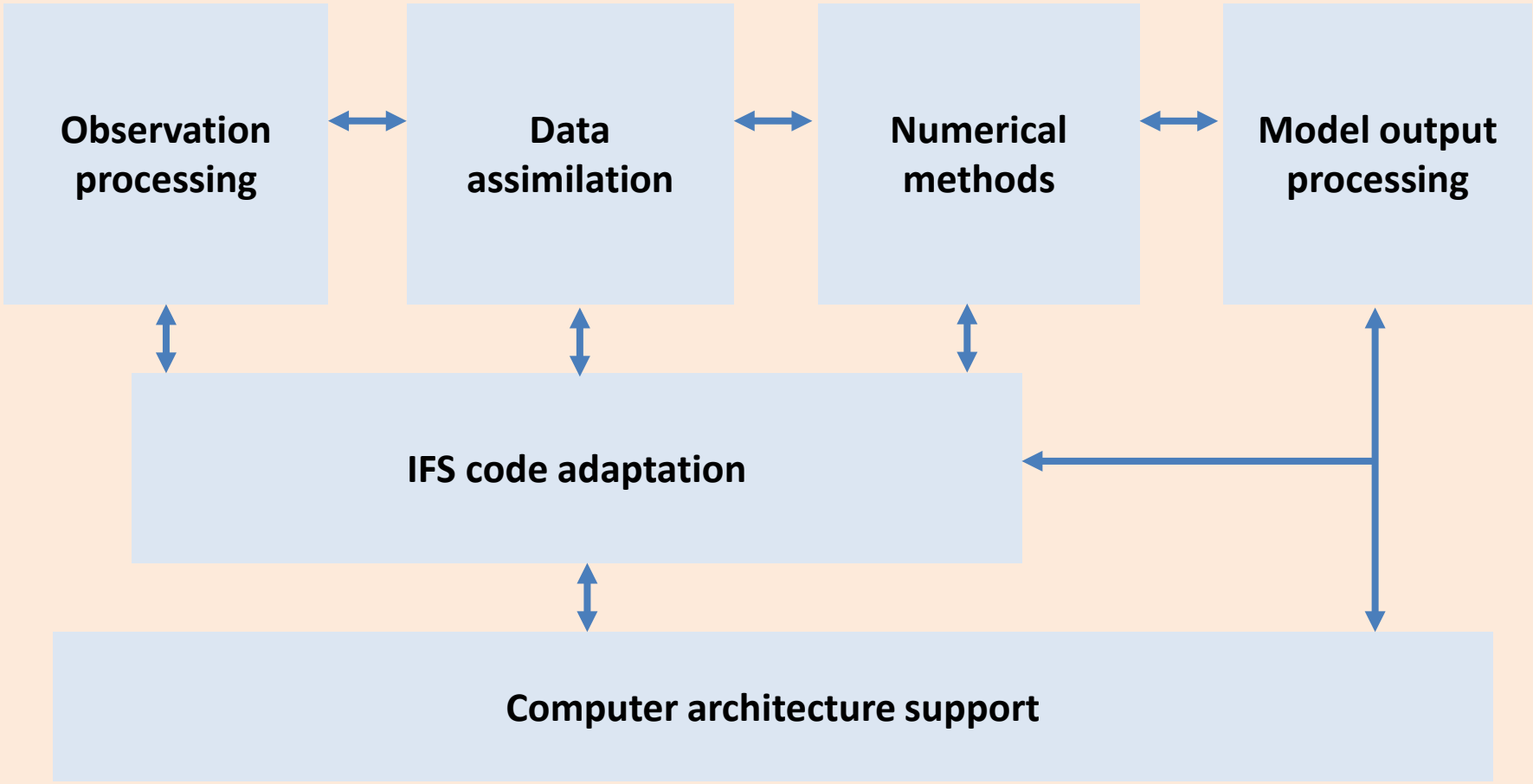
2.5 km ECMWF model run on current Cray XC-30

ECMWF Scalability Programme

Board:

ECMWF, NMS's, regional consortia

Projects:



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Conclusions: Forthcoming challenges and opportunities

- Scalability
- Dynamical core
- Coupling (land/ocean/atmospheric composition/meteorology)
- Predictability and seamless ensembles (EDA/ENS/monthly/seasonal)
- DA science (mainstream/reanalysis; maximize use of observations, algorithms)
- Physical processes (resolved and unresolved)
- Climate monitoring
- Feedback: core <-> applications
- Infrastructure and compute support to enable pioneering science
- Adaptability
- Transfer of dev/prod activities into Copernicus