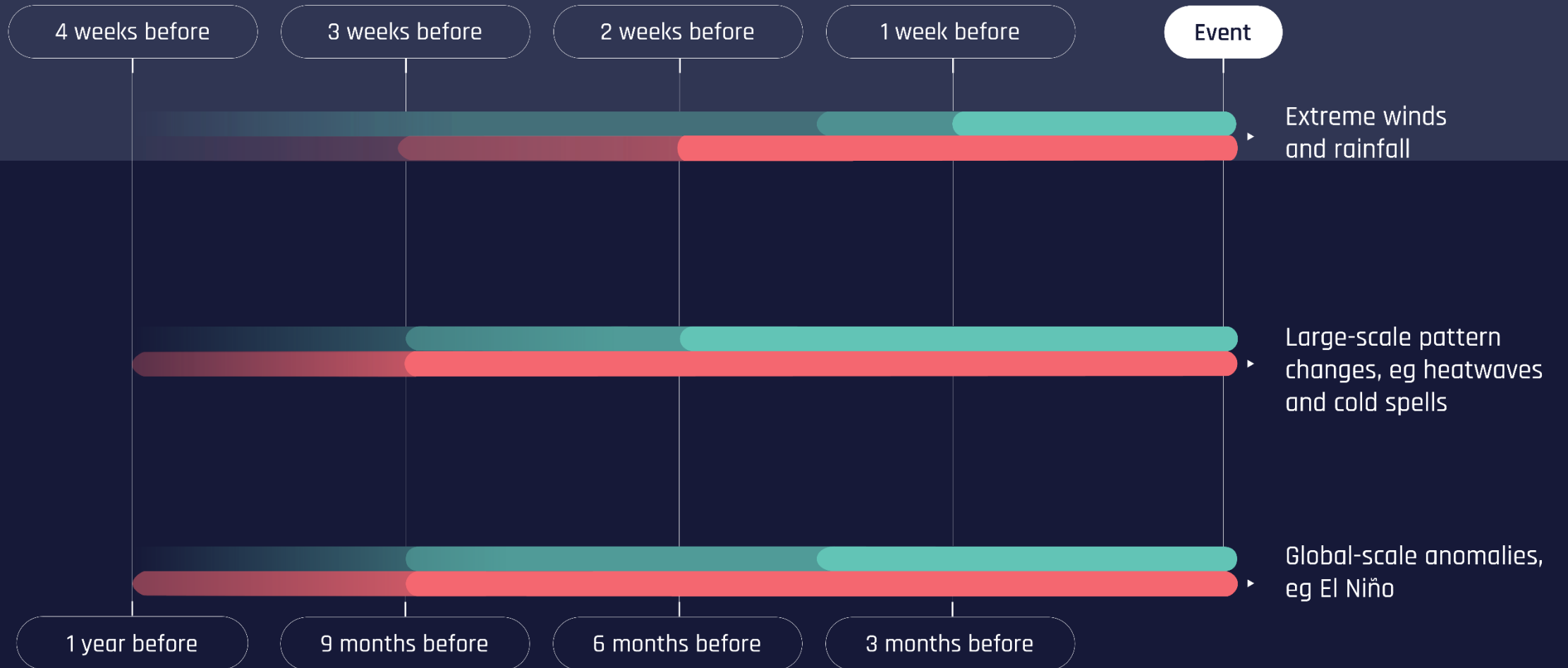
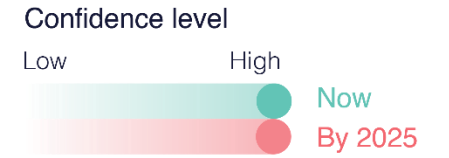




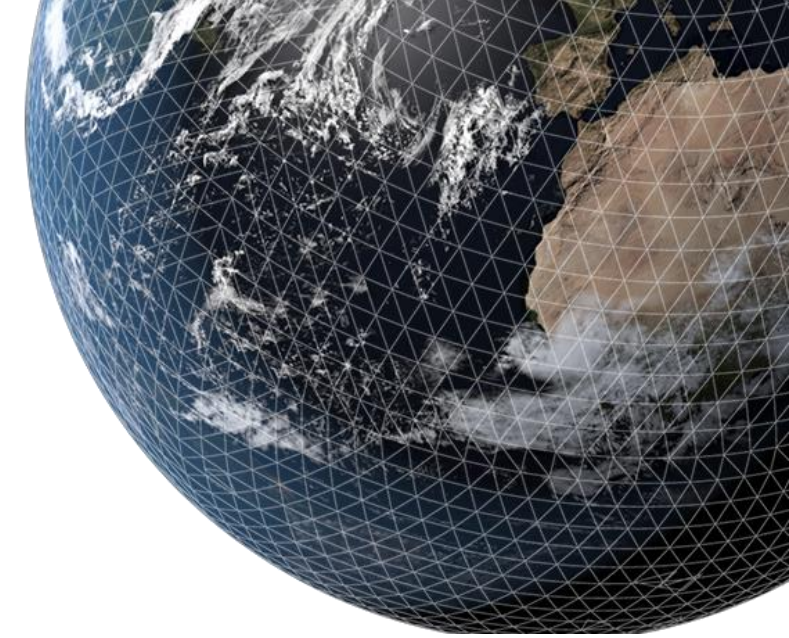
THINKING AHEAD

How far in advance can we predict extreme weather events, now and in the future?



The strength of a common goal:

Strategic Objectives to 2025



Three pillars:

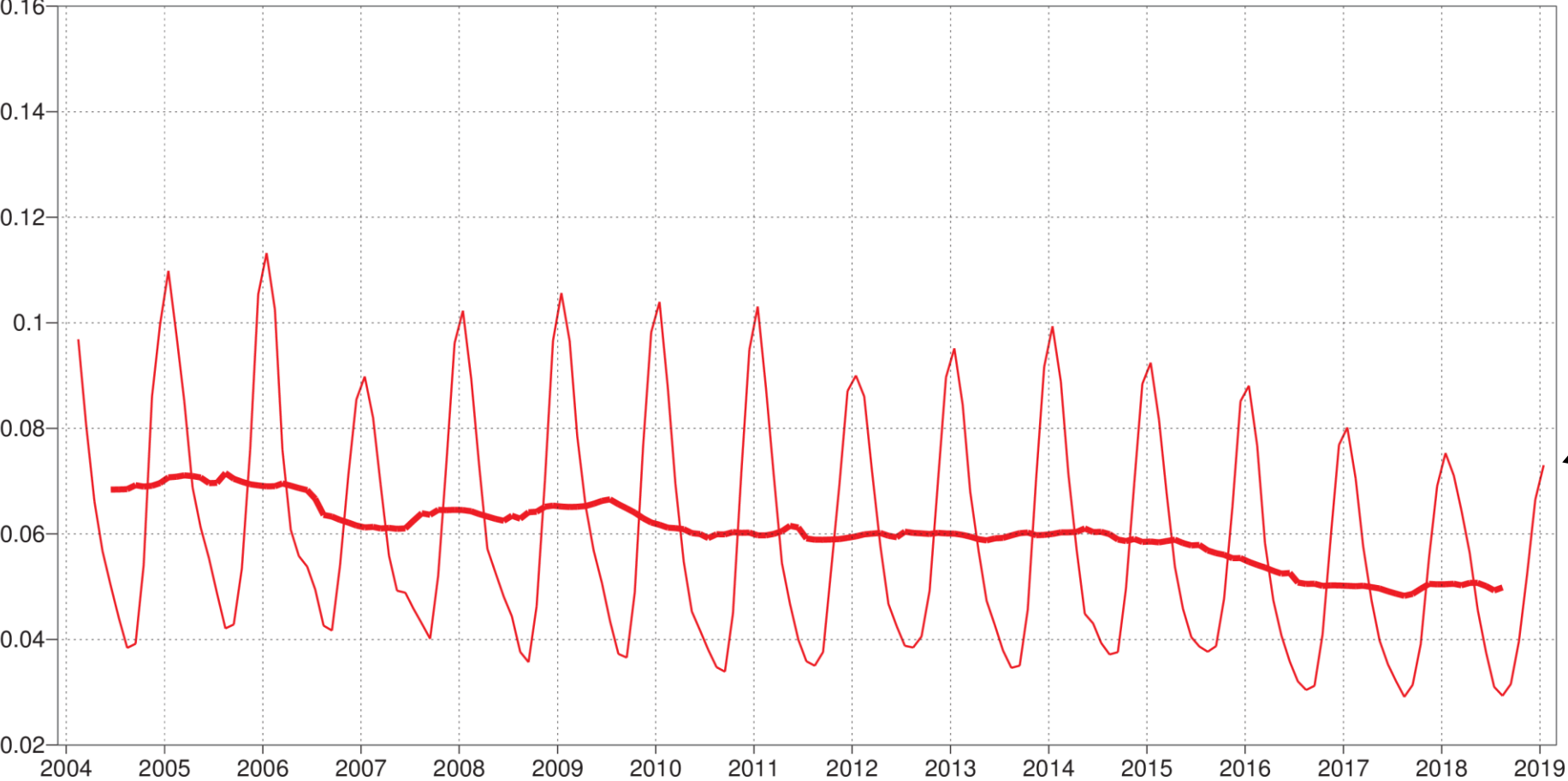
- Seamless earth system approach to modelling and analysing
- Ensemble prediction at 5km
- Scalability across the NWP chain

Fraction of large T2M errors – ENS

2 meter temperature
Fraction of large CRPS value >5.0
Extratropics (lat -90 to -30.0 and 30.0 to 90, lon -180.0 to 180.0)

T+120

oper_ob od enfo 0001

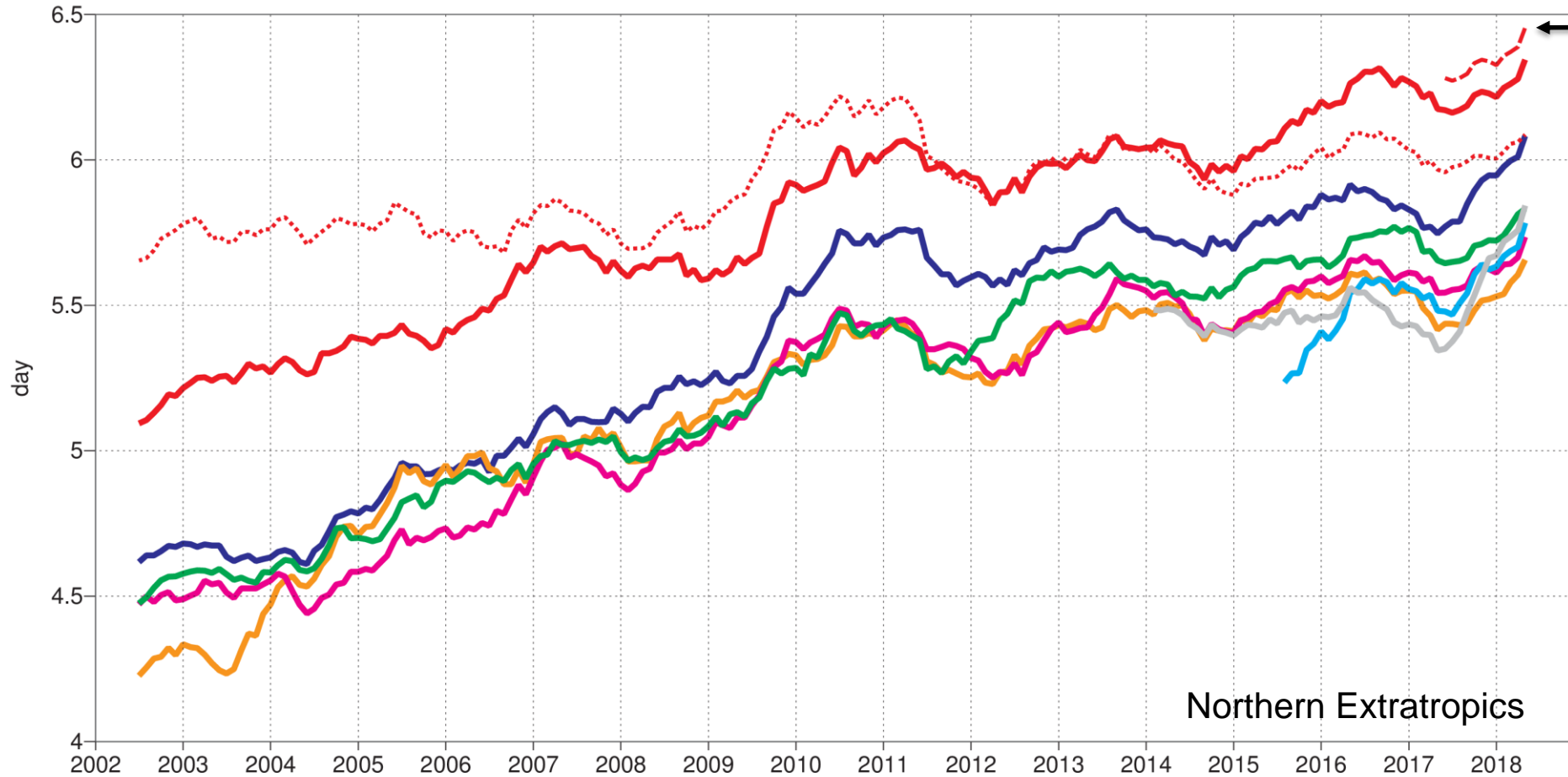
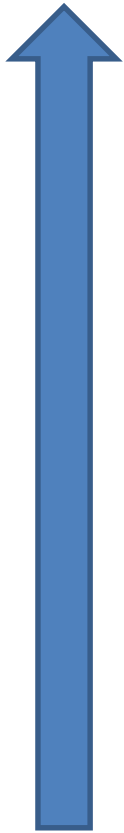


Forecast Performance

500hPa geopotential
Anomaly correlation
NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)



Better

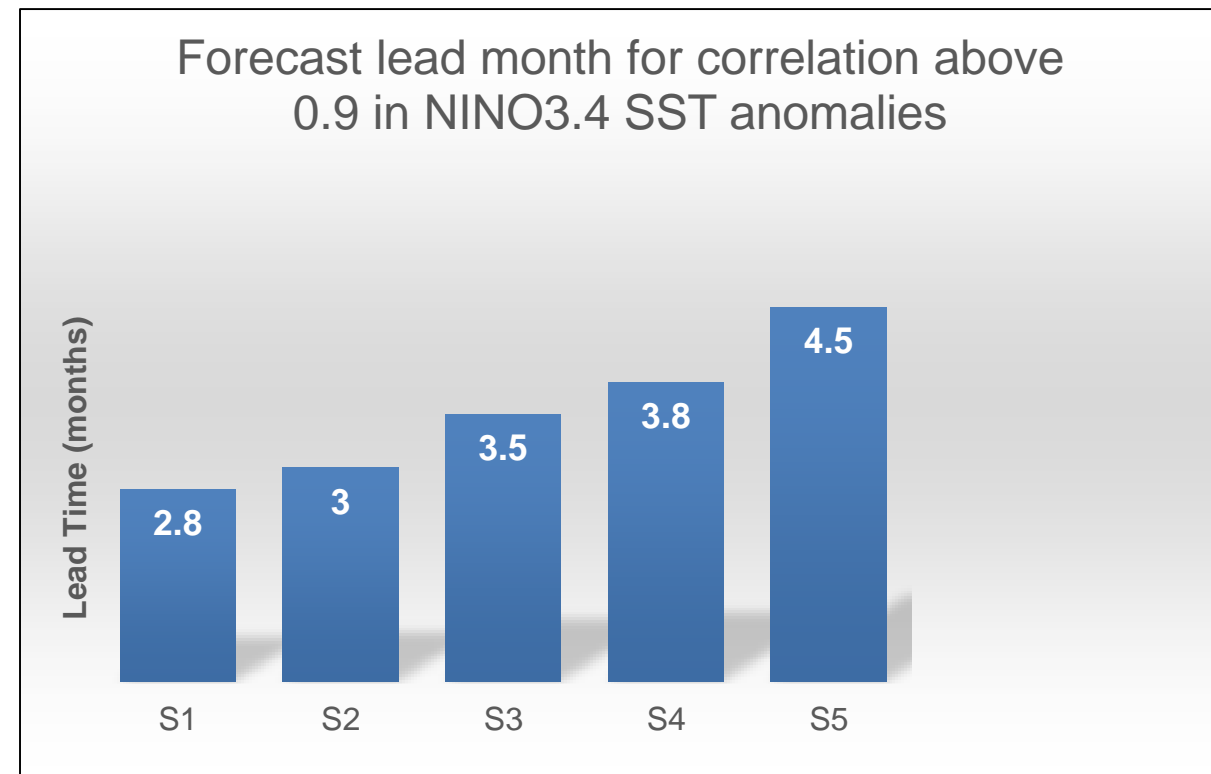


New System
(Last week)

Seamless modelling: SEAS5 seasonal system

Seasonal system science almost identical to medium and extended range

- Better results
- More efficient use of resources



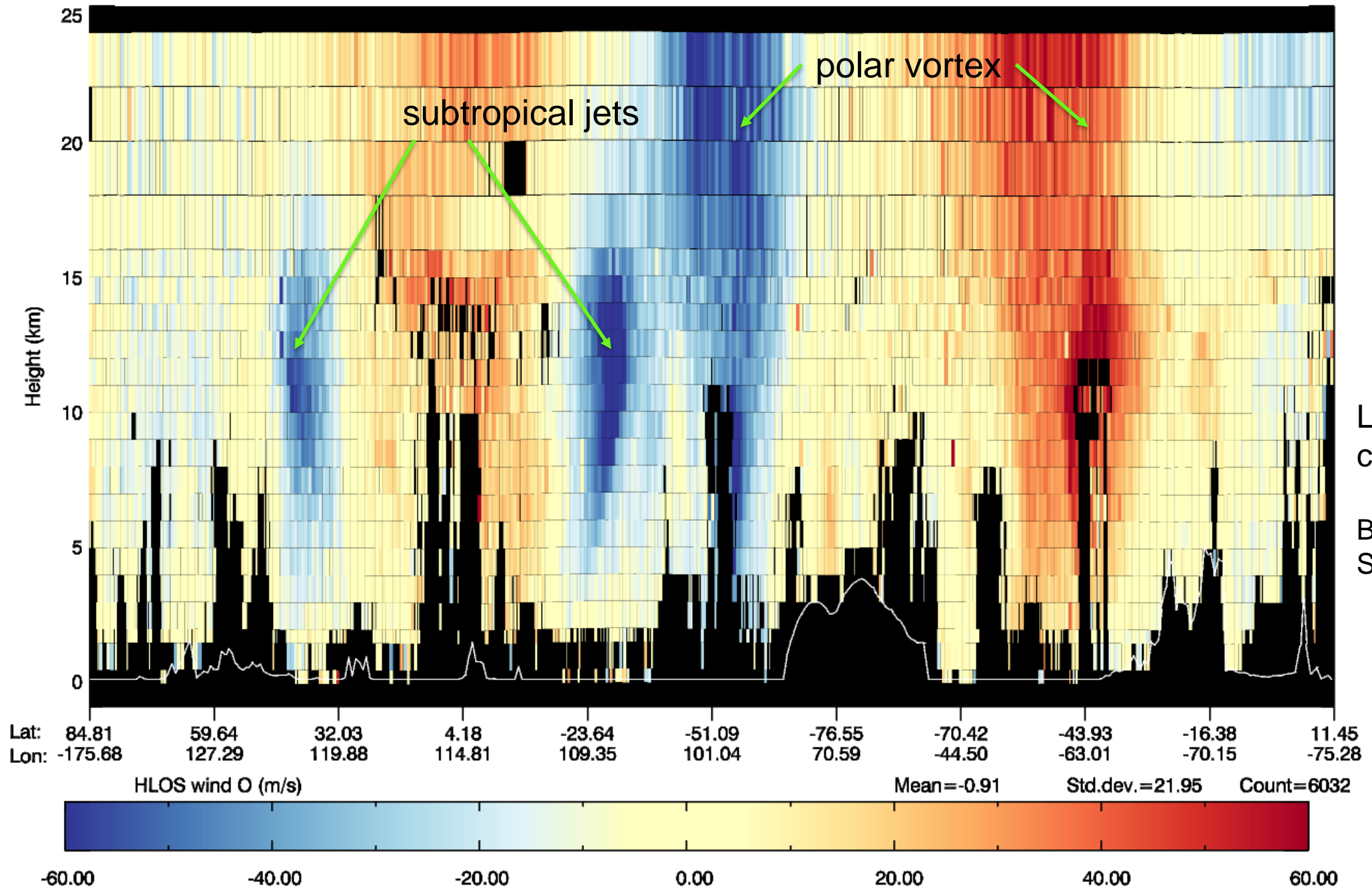
THE STRENGTH OF A COMMON GOAL

How do we achieve these goals?

- Observations
- Earth-system models
- Supercomputers
- People
- Collaborations



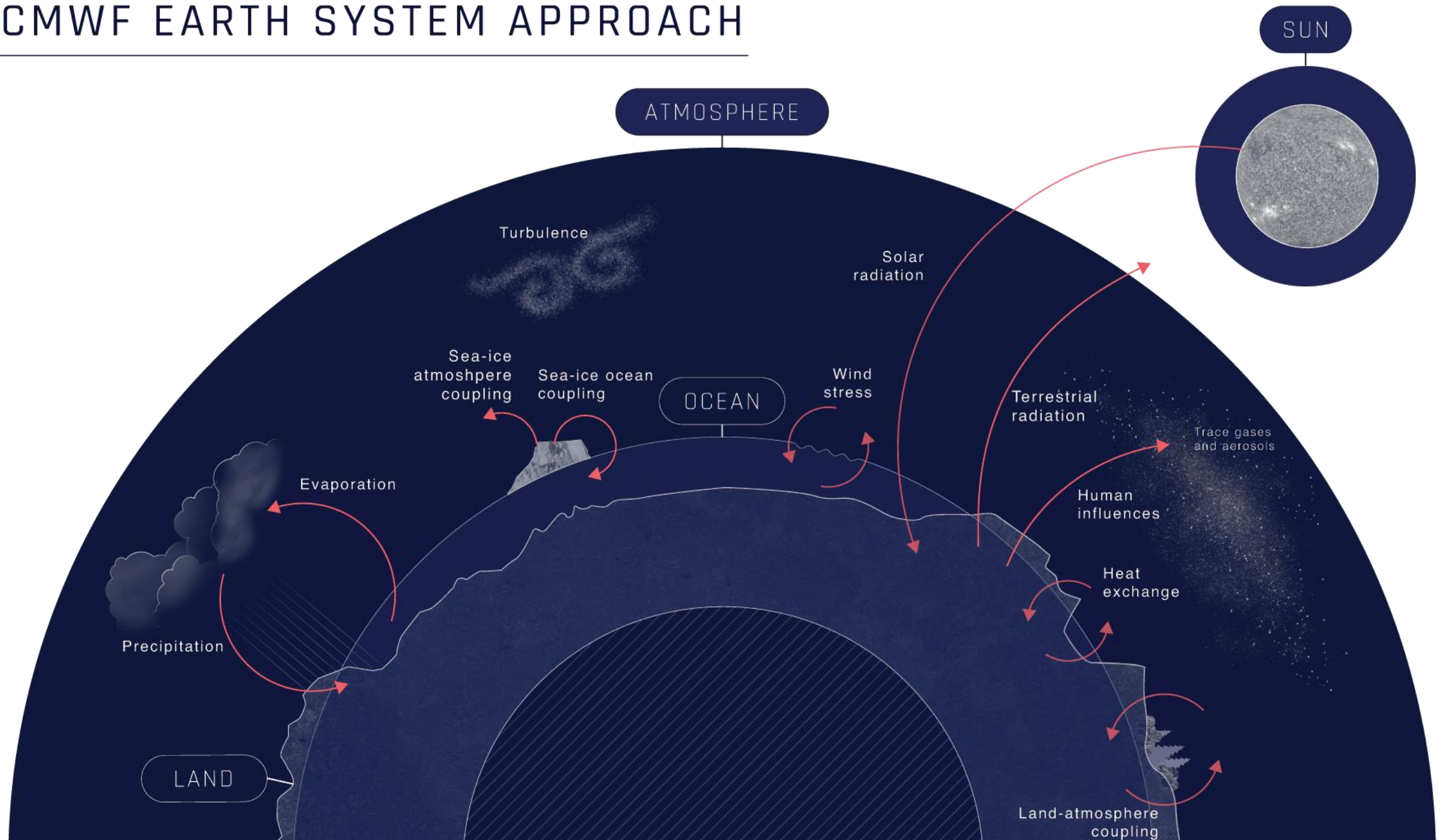
AEOLUS: wind observations from space



Level-2B Rayleigh-clear HLOS wind

Bias vs model ~ 4m/s
Stdev ~ 4.5m/s

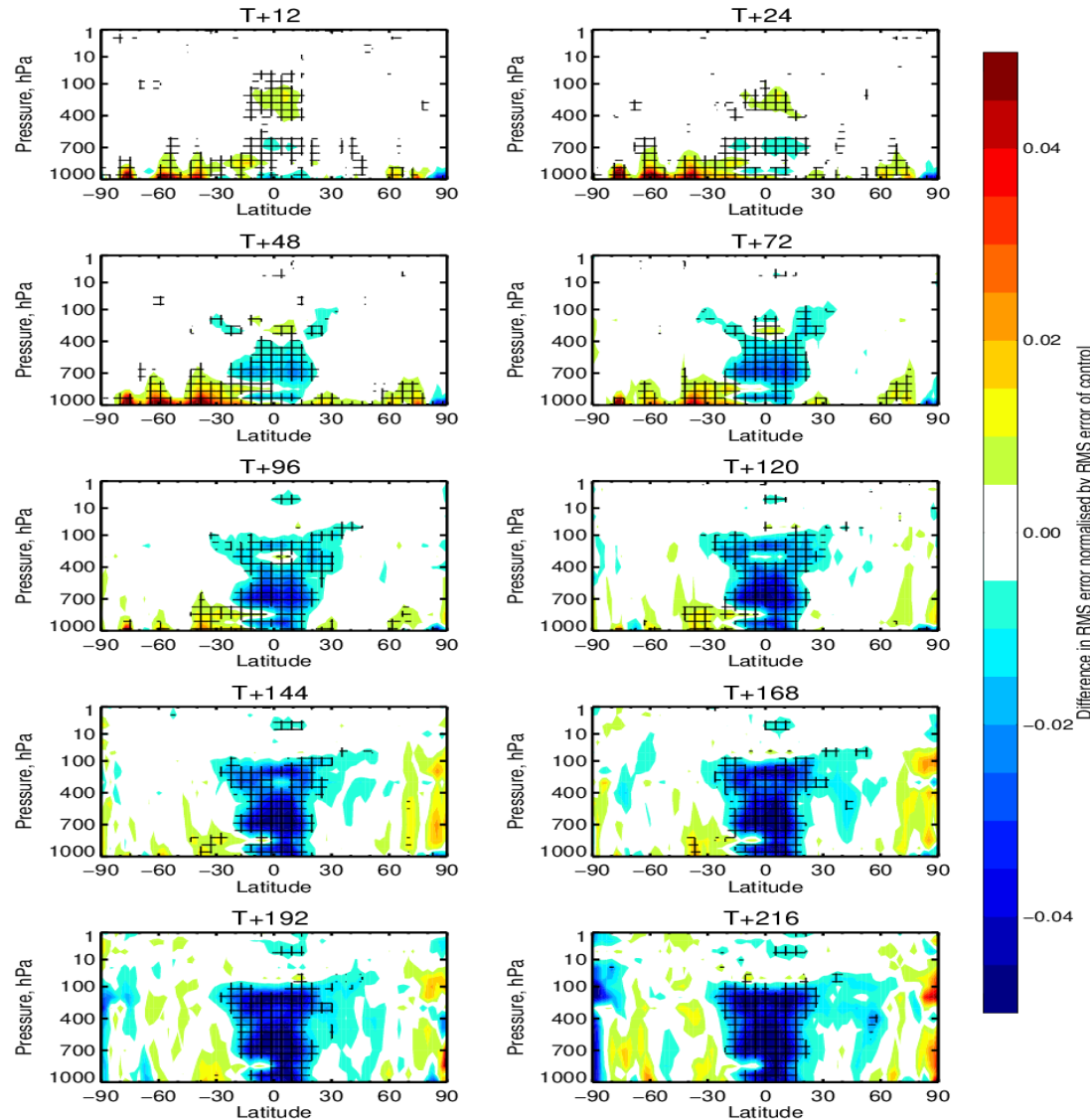
ECMWF EARTH SYSTEM APPROACH



45r1 Coupled HRES NWP

Change in error in T (Fully coupled–Oper SST)

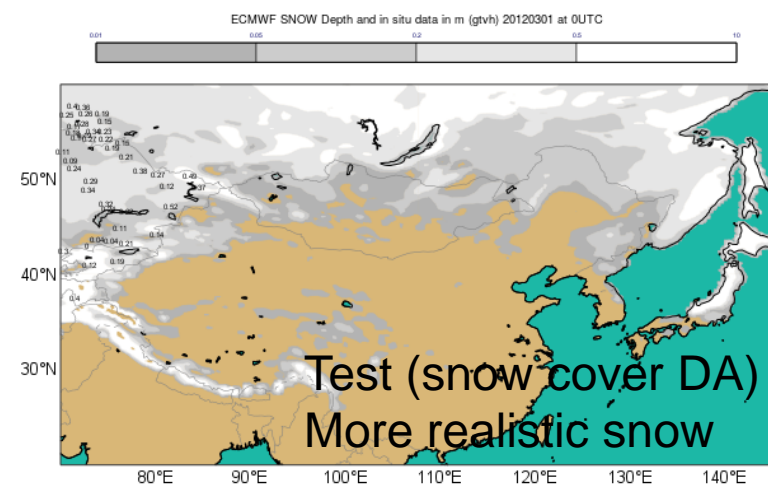
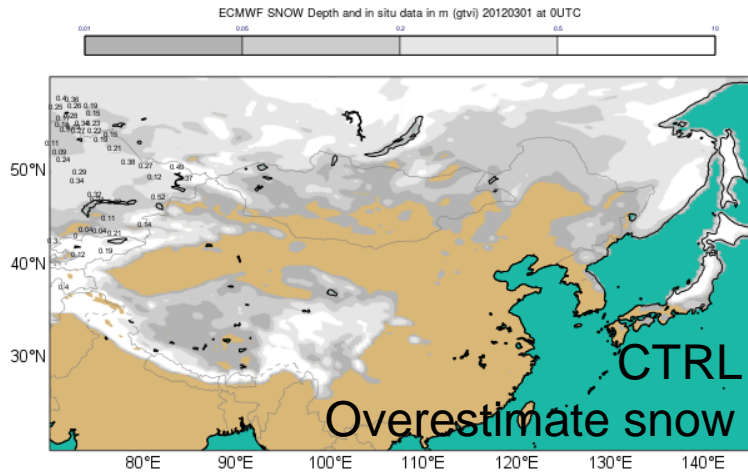
1–Dec–2014 to 30–Nov–2015 from 356 to 365 samples. Cross-hatching indicates 95% confidence. Verified against 0001.



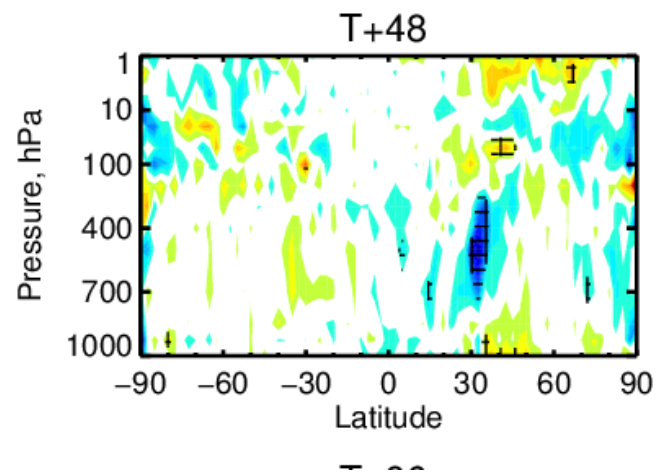
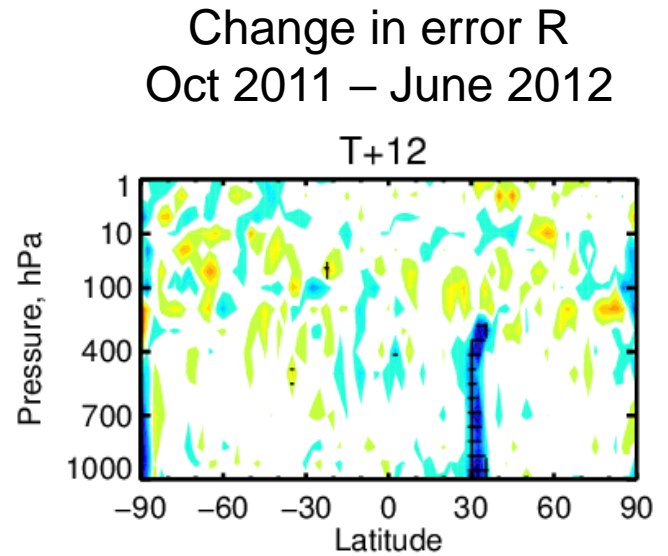
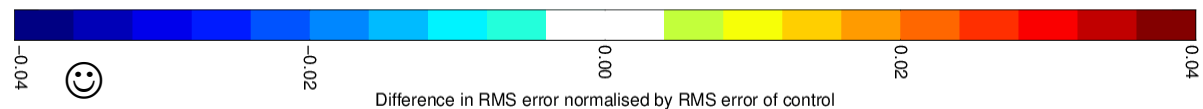
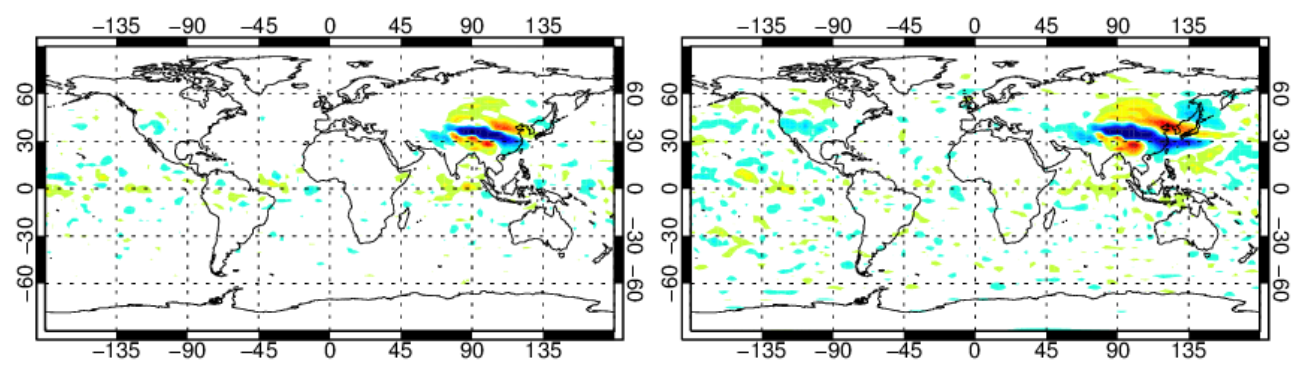
Plan to develop a NEMO V4 based configuration with ORCA1, ORCA025 and ORCA12 (all 75 levels)

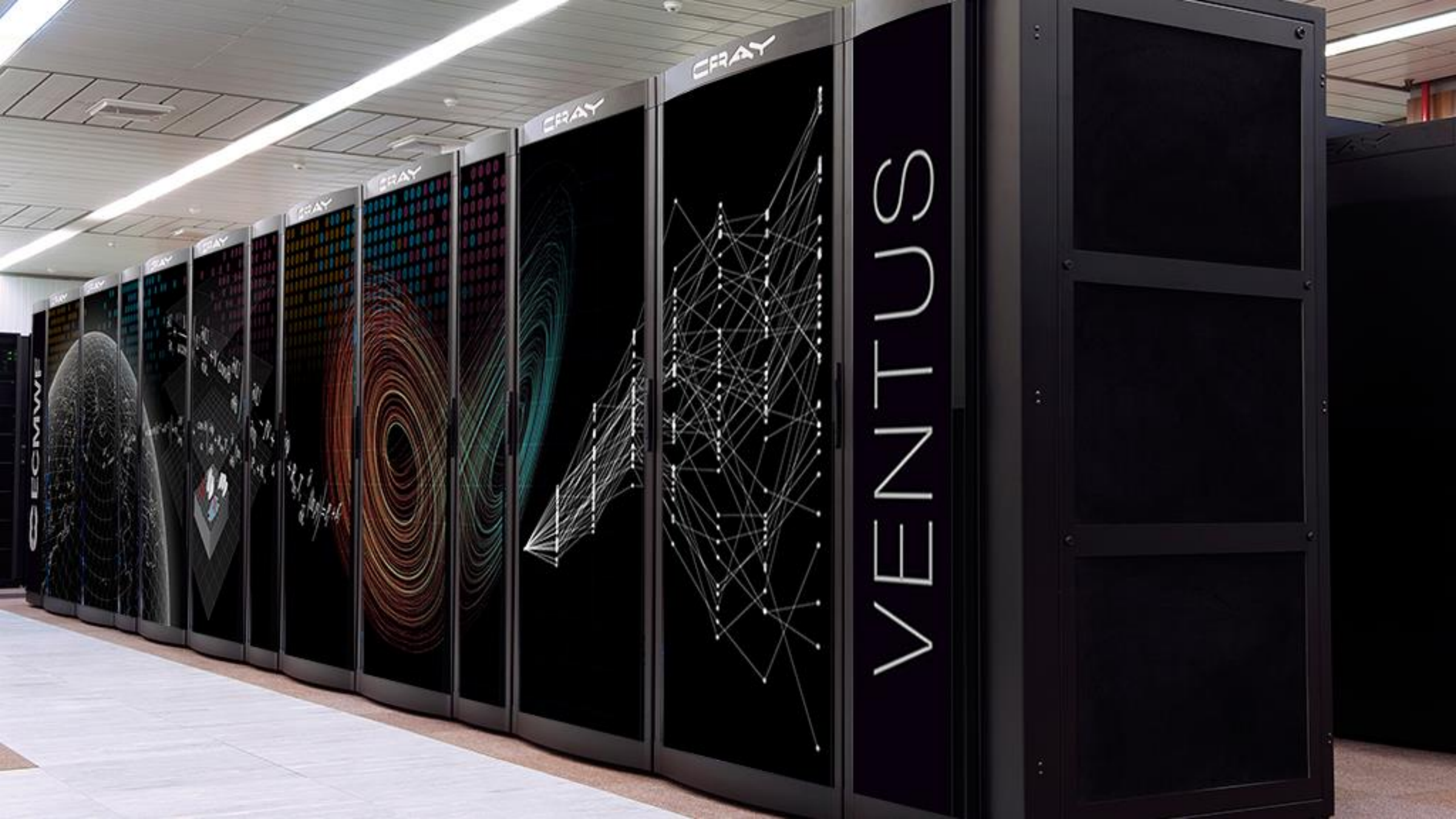
Snow cover data assimilation over the HTP

Impact on albedo and momentum
 → Modifies the jet circulation



Change in error T
 Oct 2011 – June 2012





CEMWE

CRAY

CRAY

CRAY

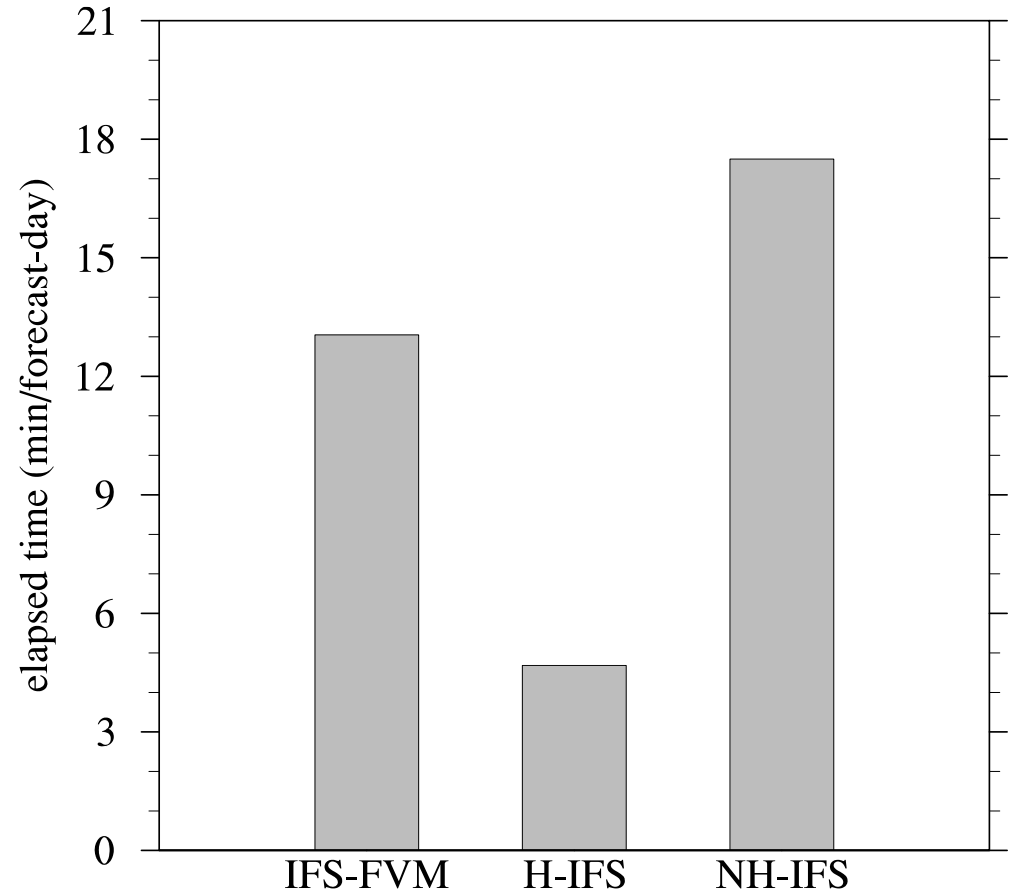
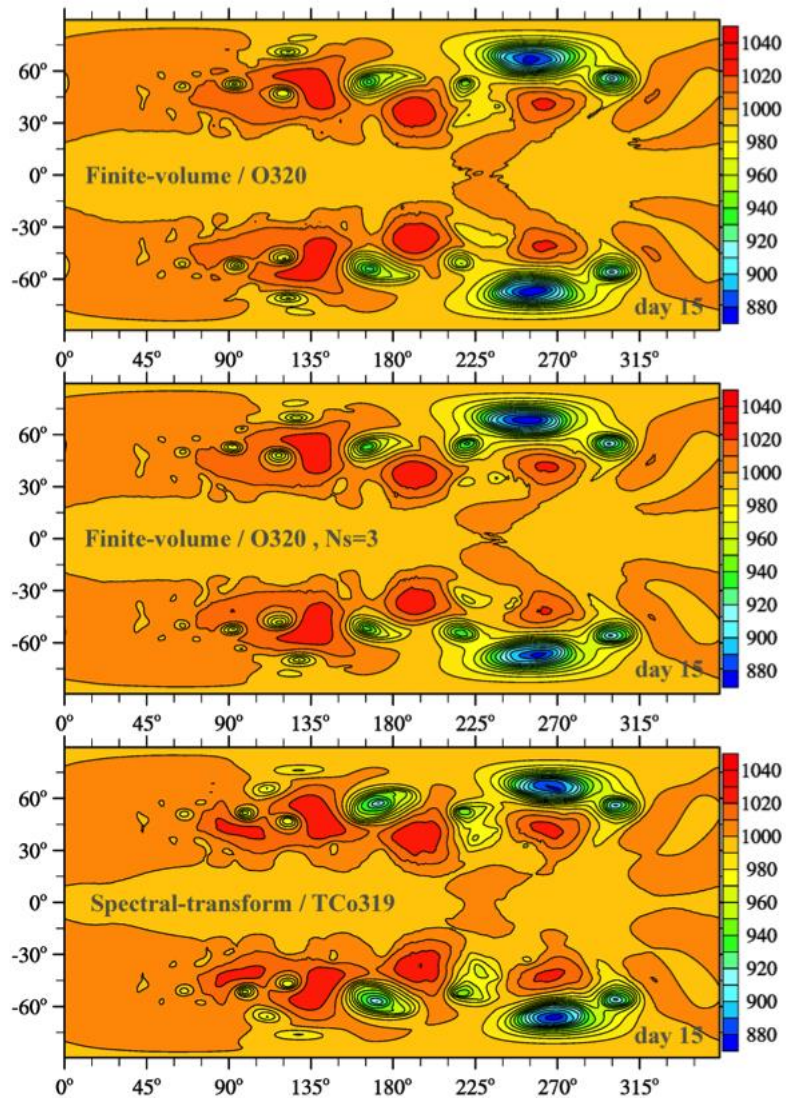
CRAY

CRAY

CRAY

VENTTUS

Finite-Volume Module of IFS

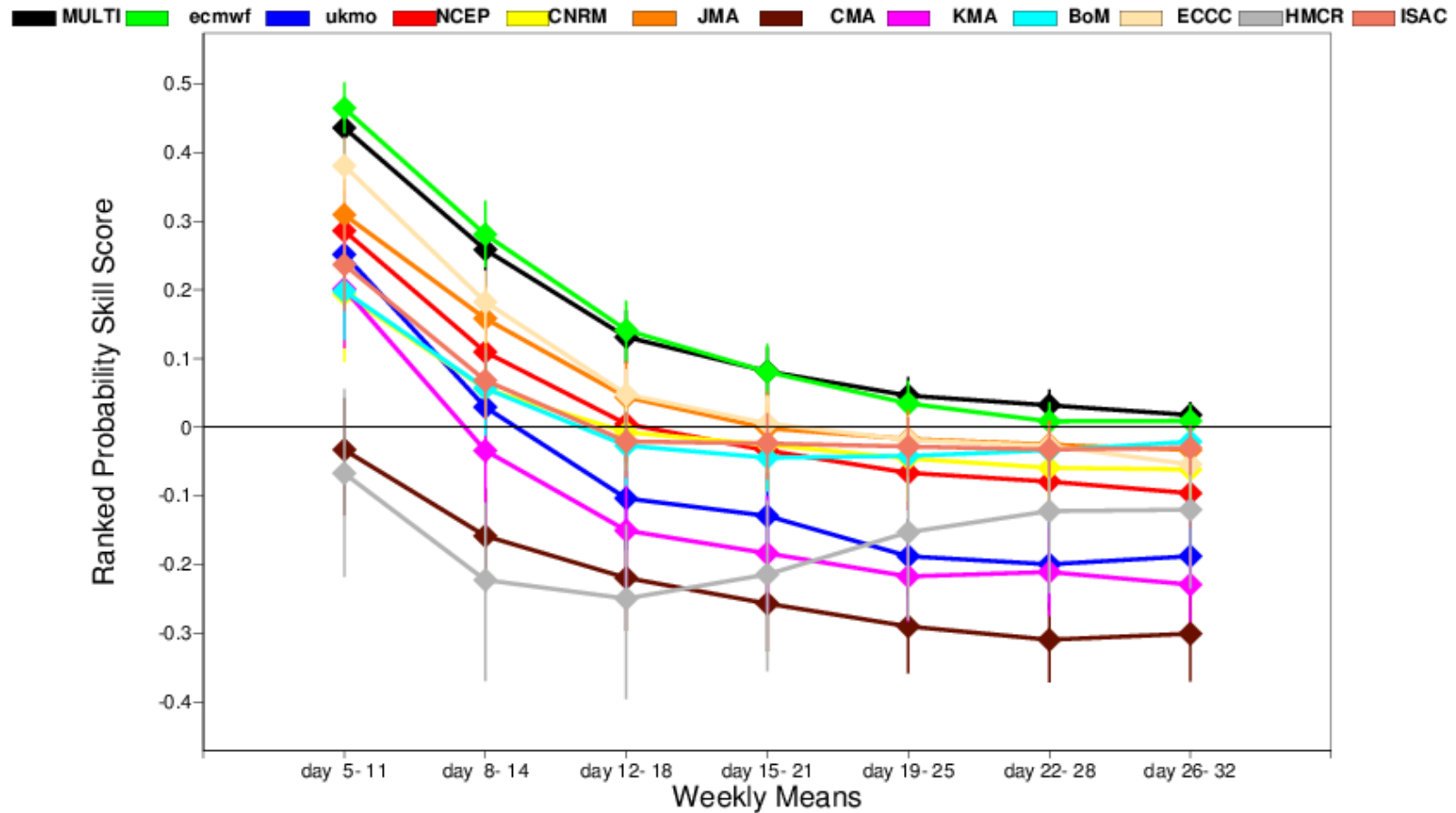


O1280/TCo1279 and L137 using dry dycore on 350 nodes of ECMWF's Cray XC40

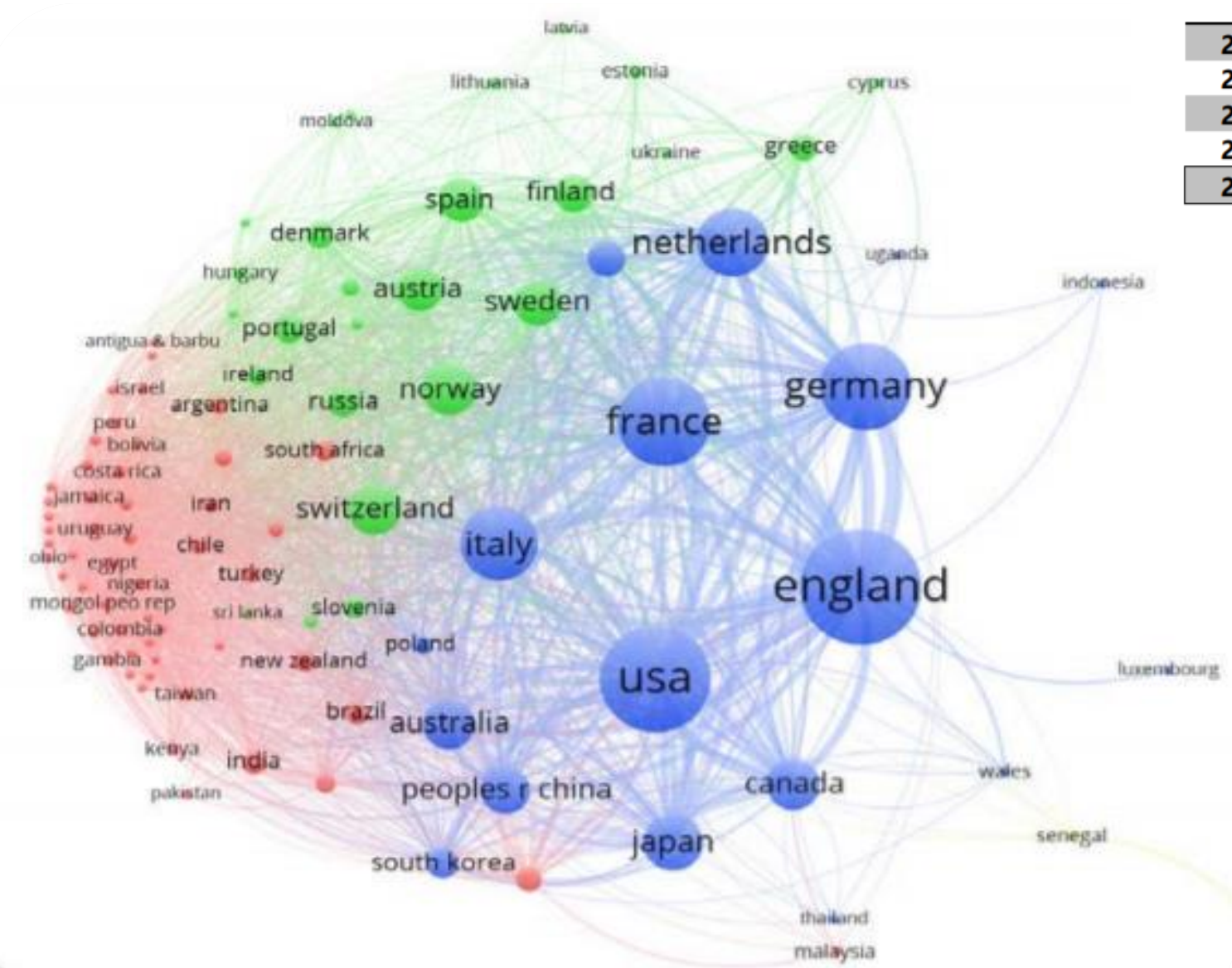
Collaborations and serving community: S2S project

Ranked Probability Skill Score
MULTI
Geopotential height at 500 hpa

Weekly Means
Northern Extratropics
87.5:30.0:-180.0:180.0



Collaborations: publications



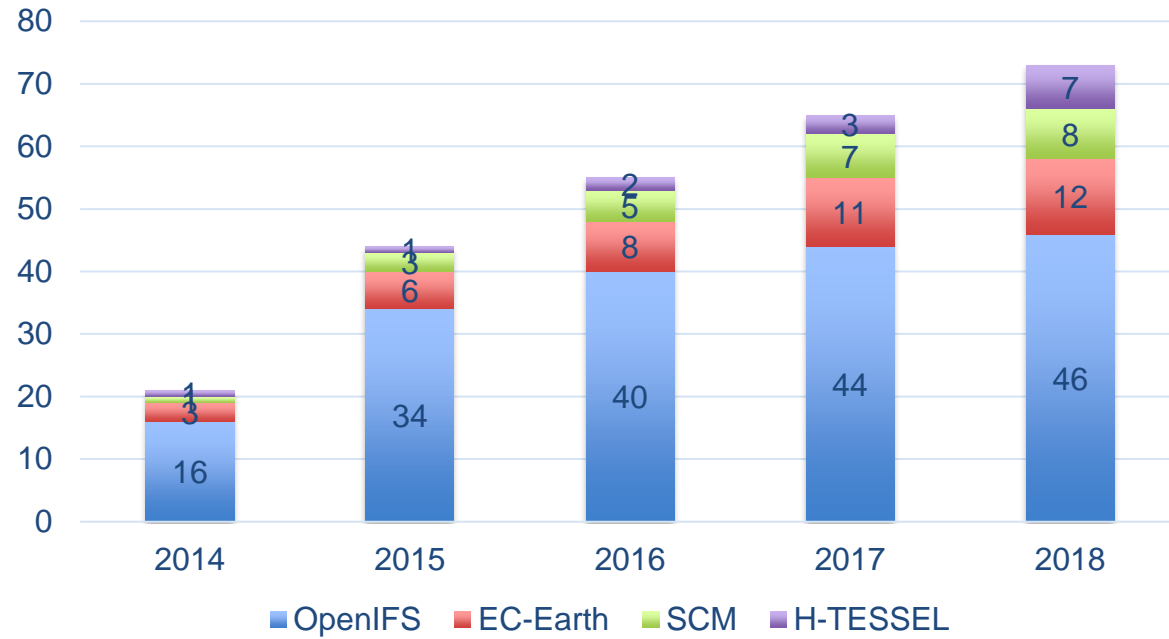
	# of international collaboration papers	% of international collaboration Papers
2013	89	78.76%
2014	90	69.23%
2015	115	78.23%
2016	111	82.84%
2017	114	78.62%

Collaborations and serving community: WORKSHOPS

- Workshop on shedding light on the greyzone
- Workshop on developing Python frameworks for earth system sciences
- ECMWF/ESA workshop on using low frequency passive microwave measurements in research and operational applications
- Workshop on observations and analysis of sea-surface temperature and sea ice for NWP and climate applications
- Workshop: Hydrological services for business
- Workshop: Radiation in the next generation of weather forecast models
- Workshop on Member and Co-operating State requirements for ECMWF outputs in support of multi-hazard Early Warning Systems
- Using ECMWF's forecasts (UEF2018)
- Hackathon: "Innovate with Open Climate Data"
- Workshop on physics-dynamics coupling 2018 (PDC18)
- Radio-Frequency Interference (RFI) workshop
- Annual Seminar: Earth system assimilation
- 18th Workshop on high performance computing in meteorology



Collaborations and serving community: OpenIFS licensed sites



- Total number of licensed sites with breakdown of main model used.
- Some sites use multiple models.
- Number of licensed sites does not match active users.

New licensees (09/2017 – 09/2018):

U. Bari, Italy : HTESEL coupled to CaMa-Flood

Charles U., Prague : CHTESEL (CAMS-81 project)

GEOMAR, Helmholtz Centre for Ocean Research : replacing ECHAM with OpenIFS in Kiel Climate Model.

UFZ, Helmholtz Centre for Environmental Research : HTESEL of Noah-MP.

INPE, Brazil : Using SCM for tropical convection.

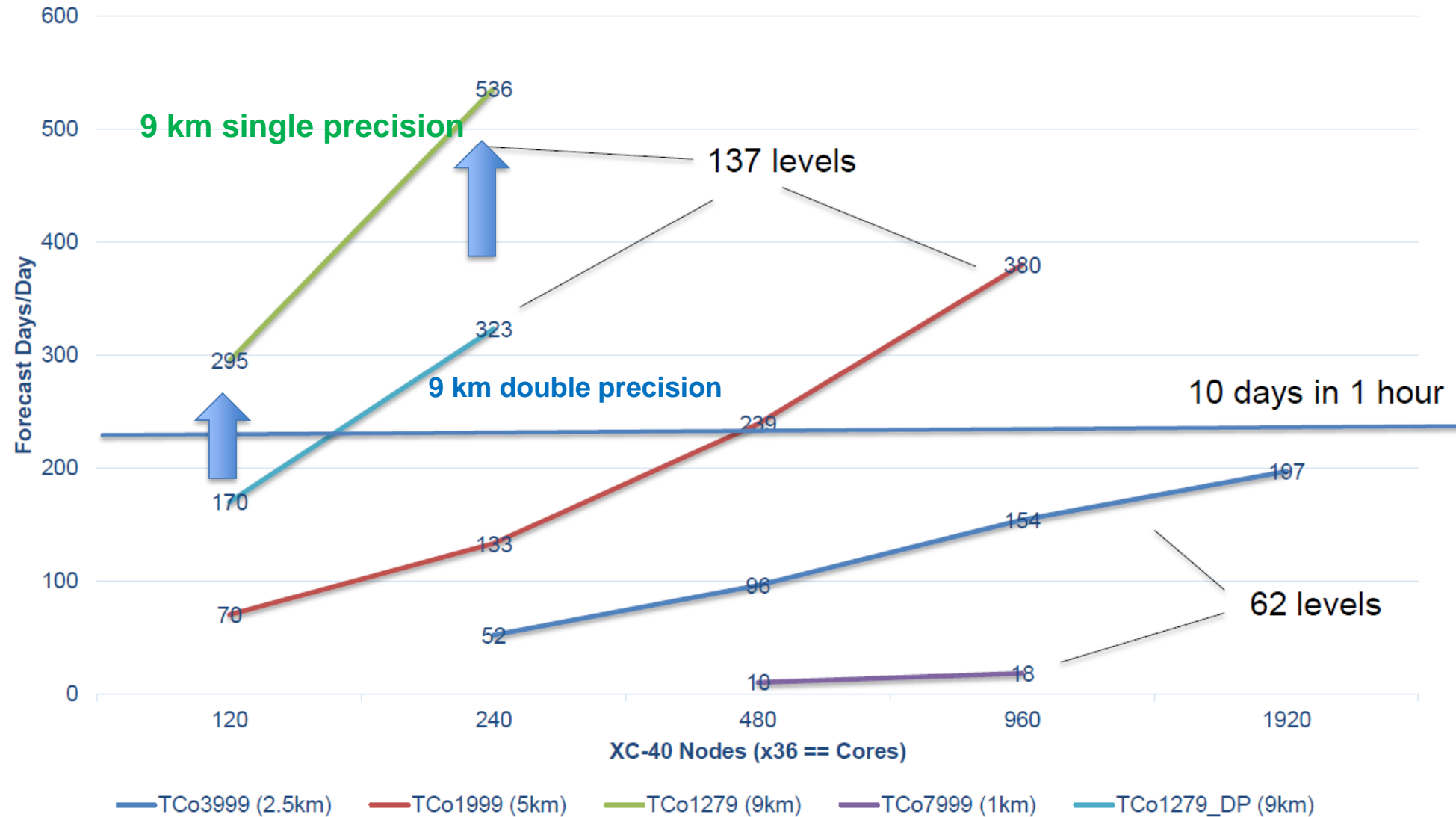
JRC-ISPRA : HTESEL

KTH Royal Institute of Technology, Stockholm : detection/visualization of flow features

U.Lisbon (E.Dutra) : HTESEL & EC-Earth

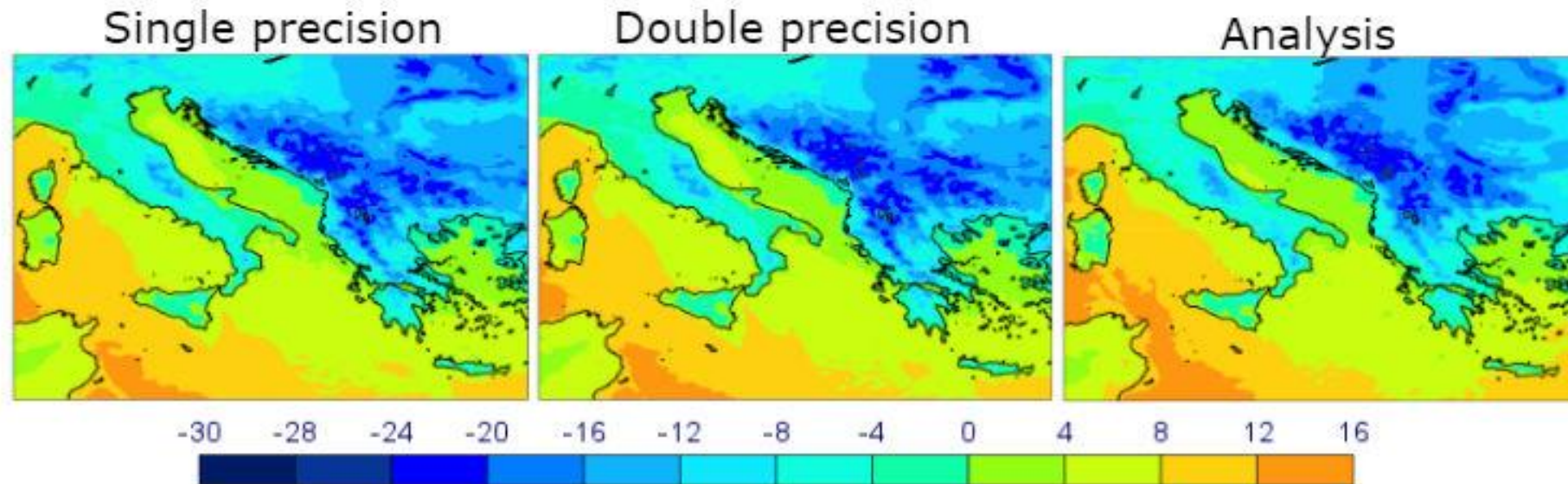


ESiWACE: Single precision IFS



Scalability across the NWP chain:

Single precision to deliver efficiency gains



Surface temperature in degree Celsius for five day forecasts for 8th January 2017 0:00 UTC. This date is during the European cold wave that caused very low temperature in Eastern and Central Europe. Results are shown for single precision and double precision simulations at 9km (TCO1279) resolution (left and middle) and the analysis as a reference (right). Differences between single and double precision are very small.

