Met Office progress report

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WGNE, Toulouse, November 2012

Primary NWP Models in Operational Suite: Sep 2012

Global

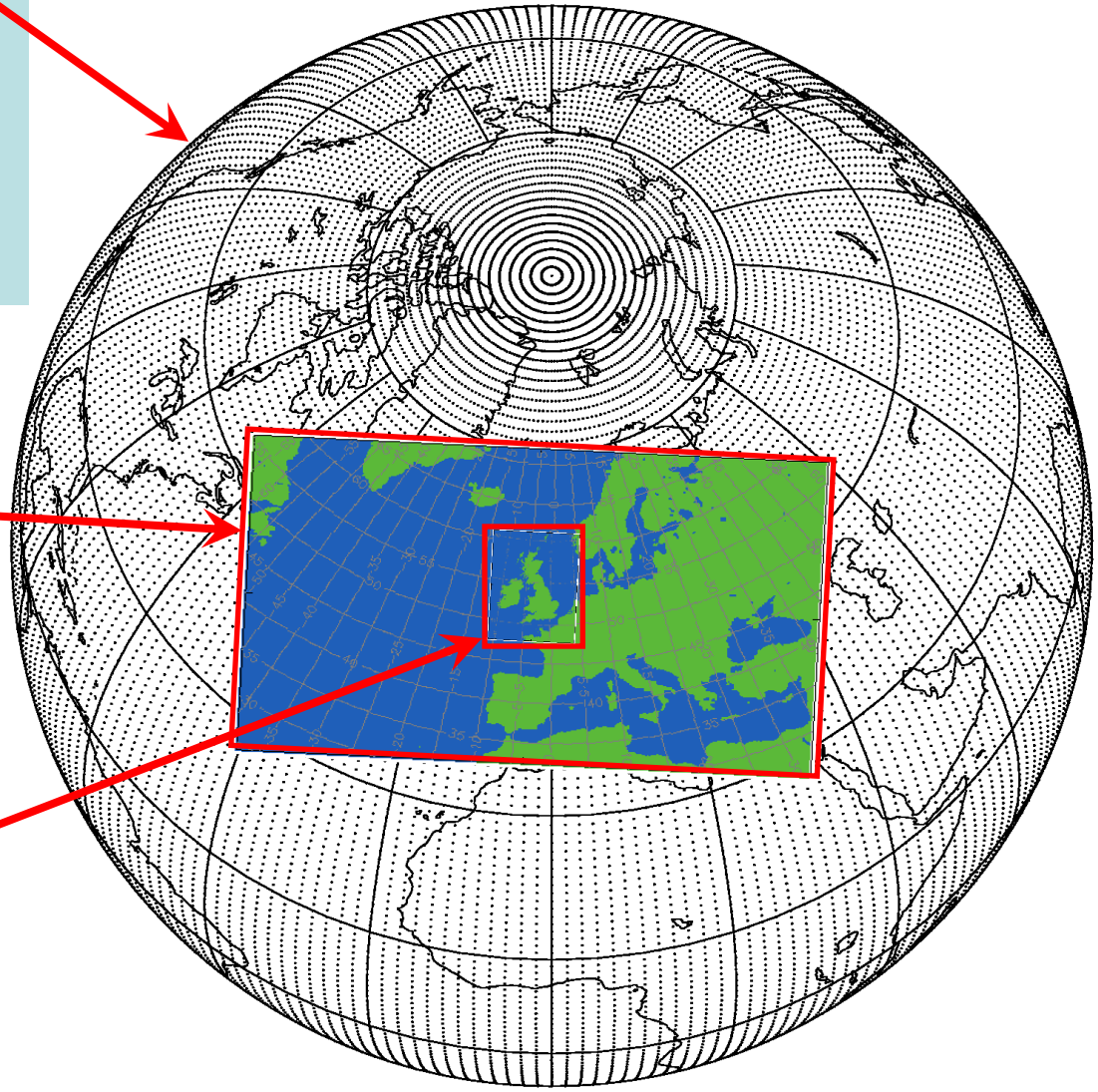
- 25km 70L + *UK4 as dynamic downscaler*
- with Hybrid 4DVAR at 60km
- 66hr forecast twice/day
- 144hr forecast twice/day
- *+12 member EPS - 60km 4x/day 72hr*
- *& 24 member EPS 2x/day to 15days*

NAE

- 12km 70L
- 4DVAR – 24km
- 60hr forecast
- 4 times per day
- *+12member EPS at 18km 4x/day*

UK-V *(& UK-4)*

- 1.5km 70L
- 3DVAR (3 hourly)
- 36hr forecast
- 4 times per day
- *+12member EPS at 2.2km 4x/day (near-op)*



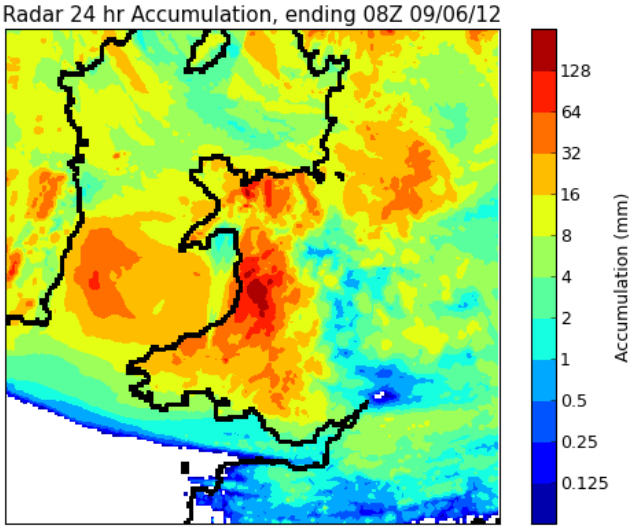
Operations on the IBM P7

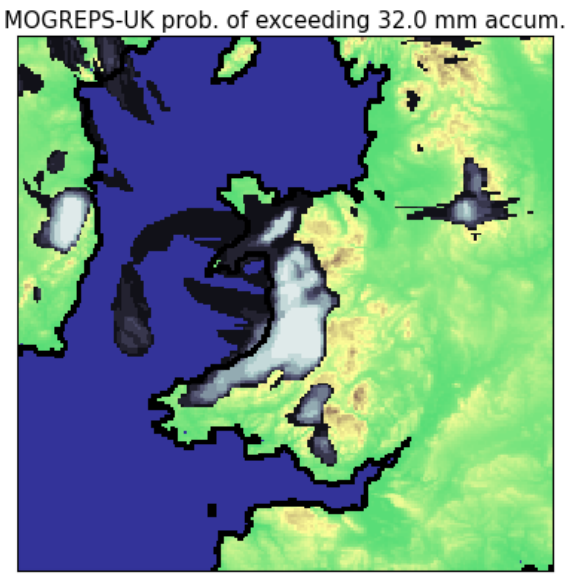
- **System Size**
  - *38912 cores = 0.9PFlop max (Linpack)*
  - *5*P6 capacity as measured by node count (4* for NWP)*
- ***System Performance***
  - *For given application using same node count.*
    - *On 1 node we get ~10% performance improvement*
    - *On (say) 24 nodes we get up to 40% performance improvement*
  - *For larger applications the ability to scale out to higher node count*
- **System Usage**
  - *~40% Weather : ~60% Climate (according to Customer Funding)*

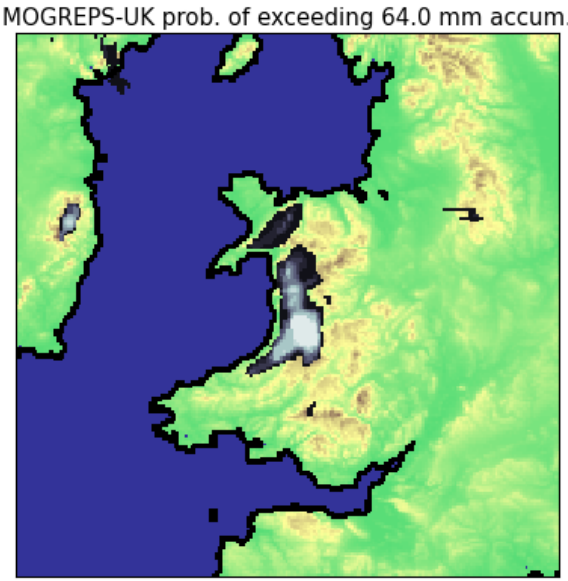
Olympics demonstrators

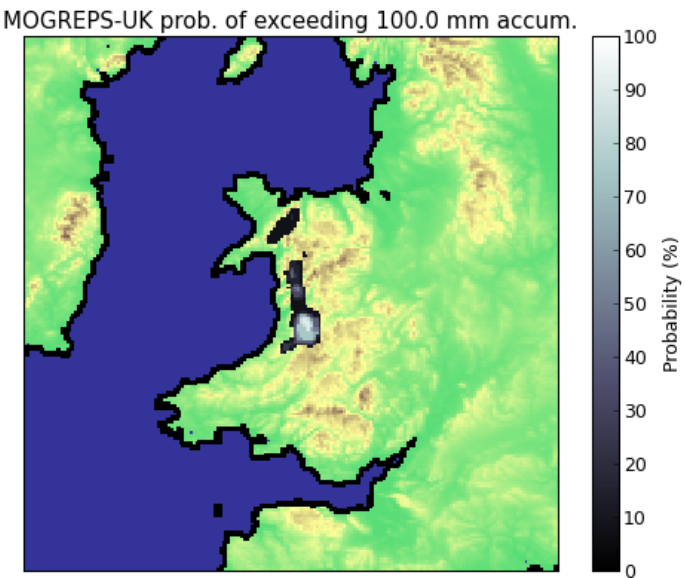
UK Ensemble

- 12 member 2.2km ensemble
- Running 4 times per day
- Currently nested in regional (18km) ensemble
- From this autumn will switch to direct nesting in enhanced resolution (33km) global ensemble



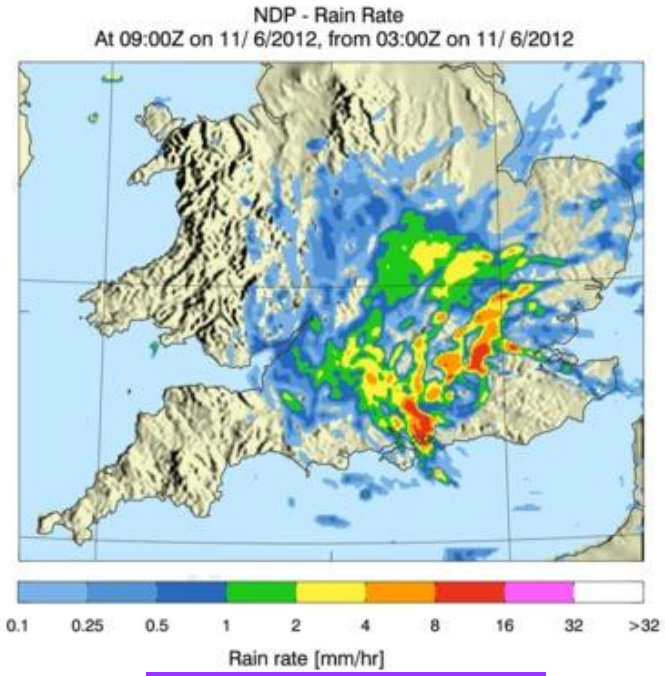




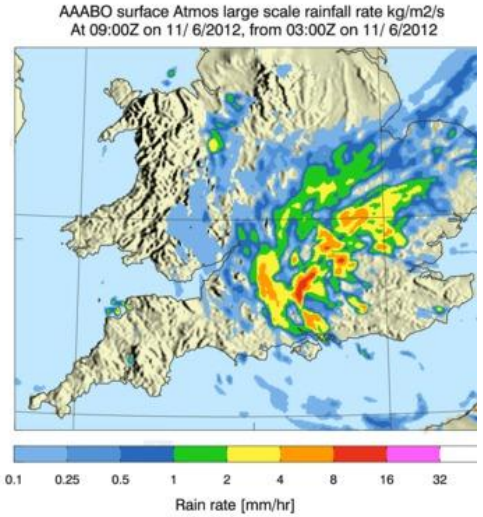


Nowcasting Demonstration Project

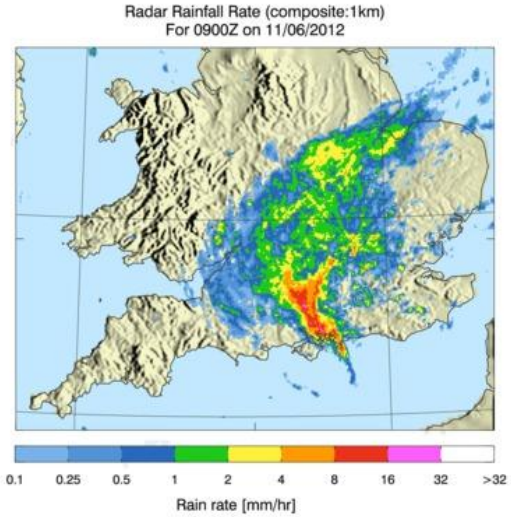
Hourly 4DVAR 1.5km grid
using Radar Doppler Winds & Reflectivities



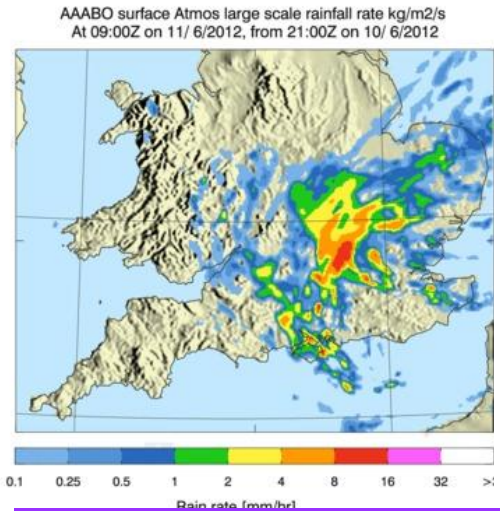
T+6 4DVAR Nowcast



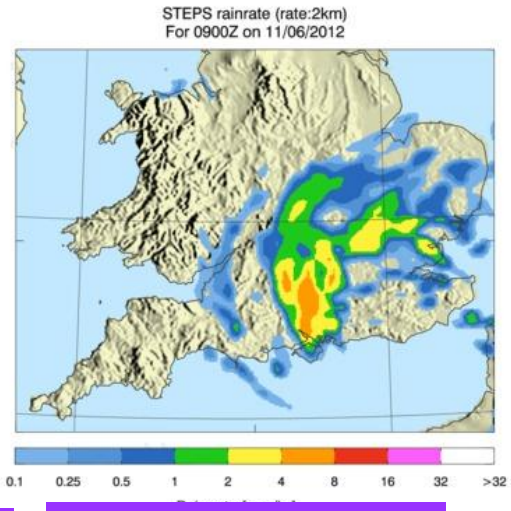
T+6 UK 1.5km (3DVAR)



RADAR

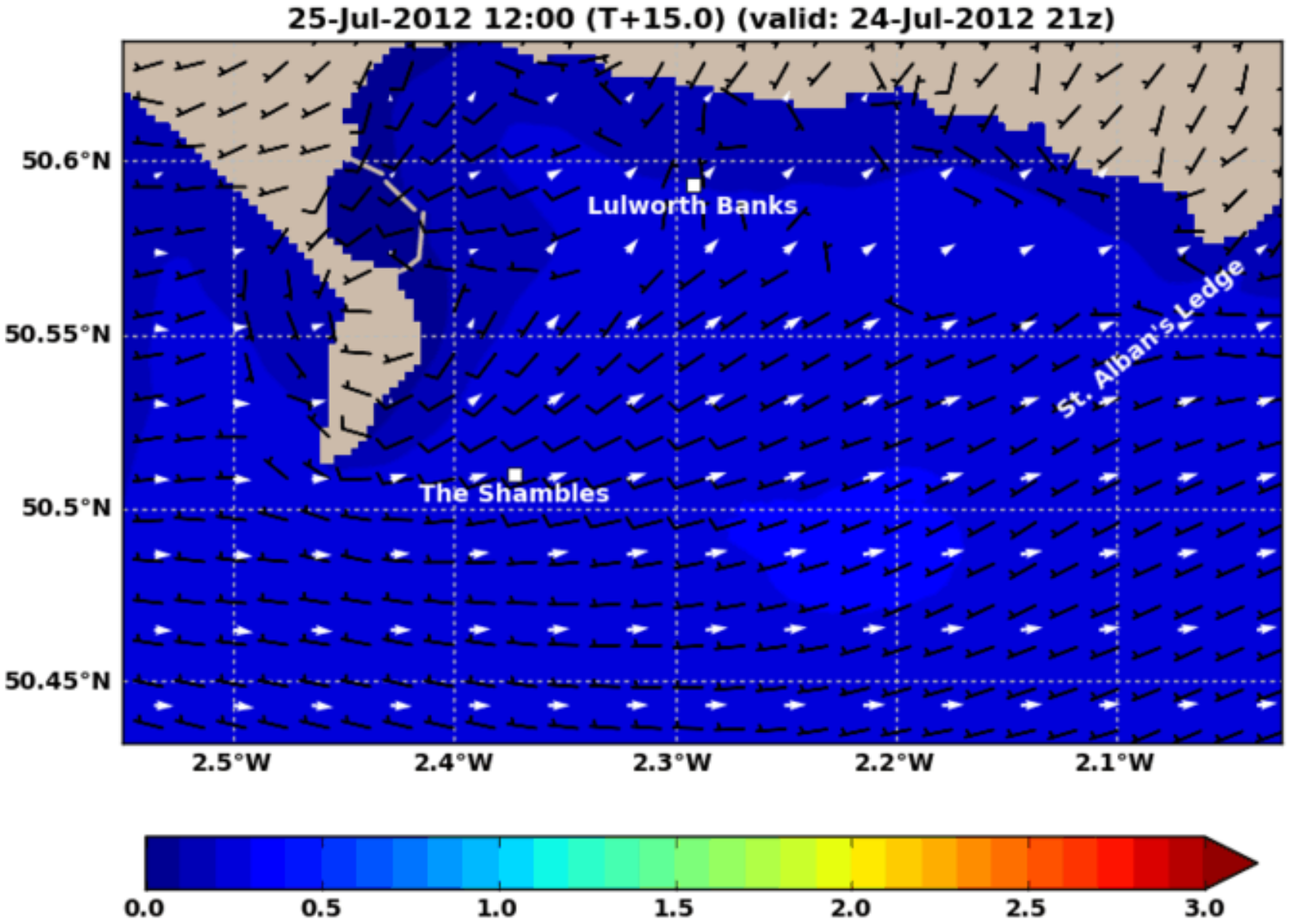


T+12 UK 1.5km (Ibc provider)



T+6 Oper. Nowcast
(STEPS / Blending UK 4km)

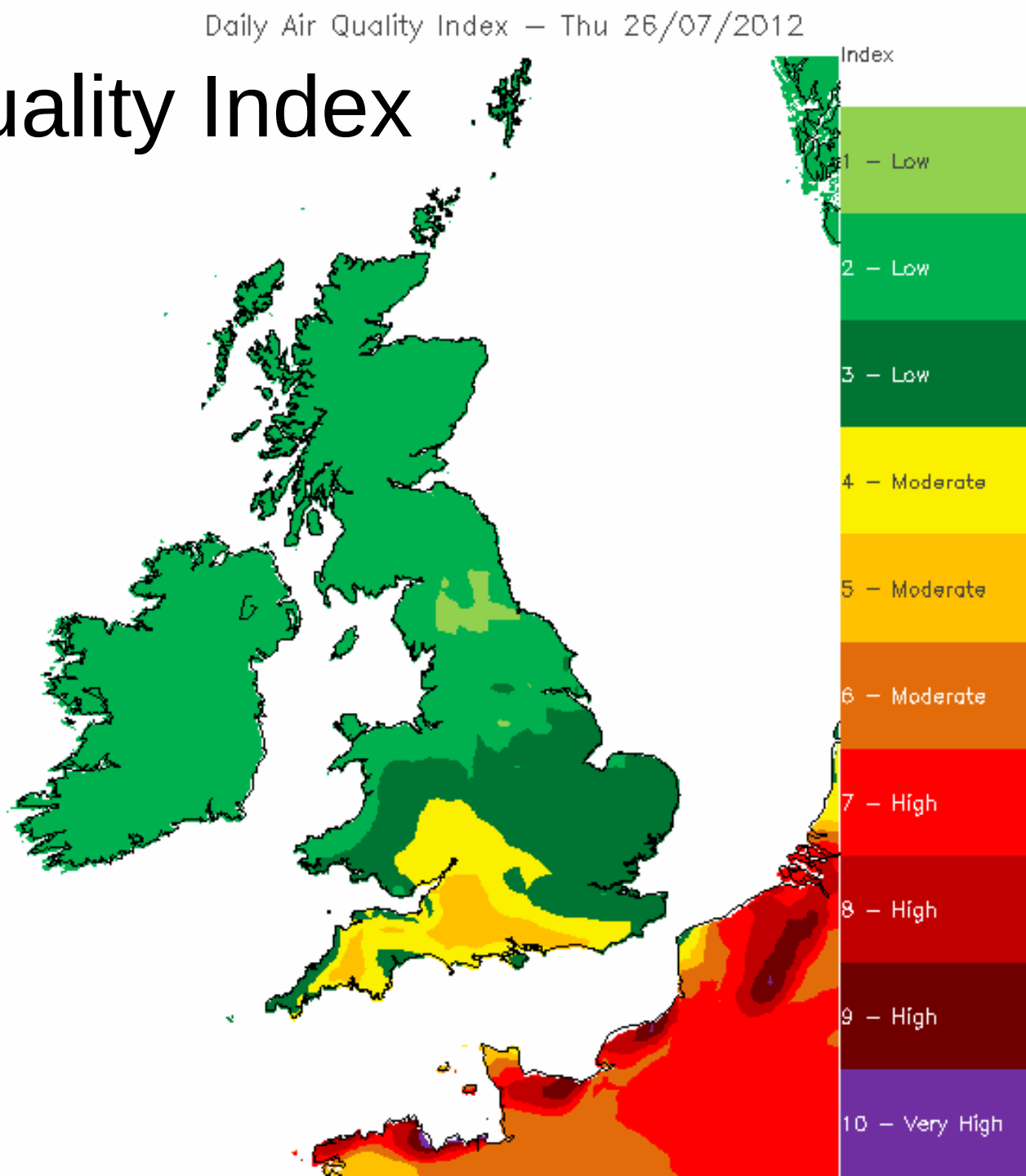
Weymouth Bay wind & wave



- 300m UM atmosphere (100kmx100km domain)
- 250m SWAN wave model

Air Quality Index

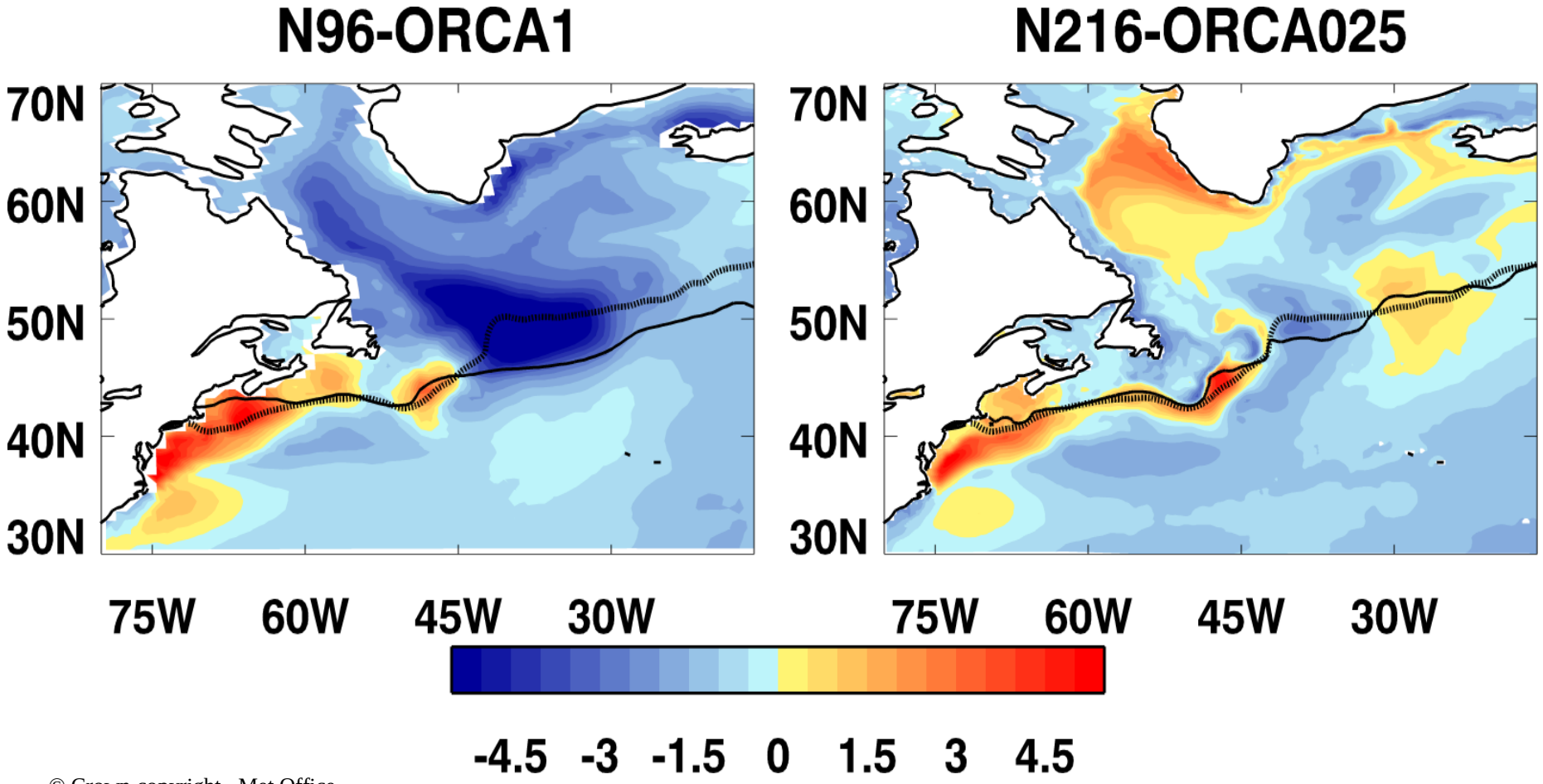
- Uses UKCA aerosol & chemistry
- Configured (online) in a 12km NW Europe forecast model
- Run to 5 days, once daily
- Operational in site-specific forecasts on Met Office & BBC web sites



Systematic investigation of impacts of resolution on seasonal and climate predictions

Malcolm Roberts, Adam Scaife, Keith Willaims (MO); Pier-Luigi Vidale (NCAS)

North Atlantic SST bias in coupled model

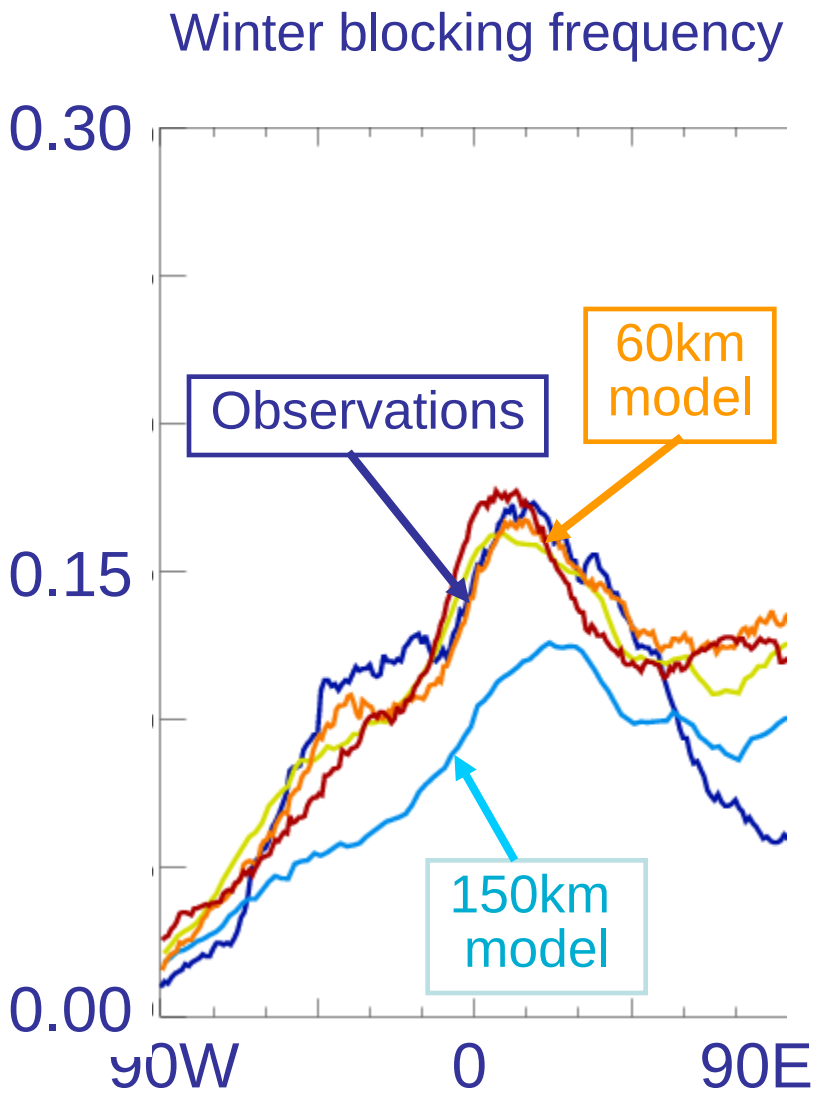


High resolution seasonal predictions

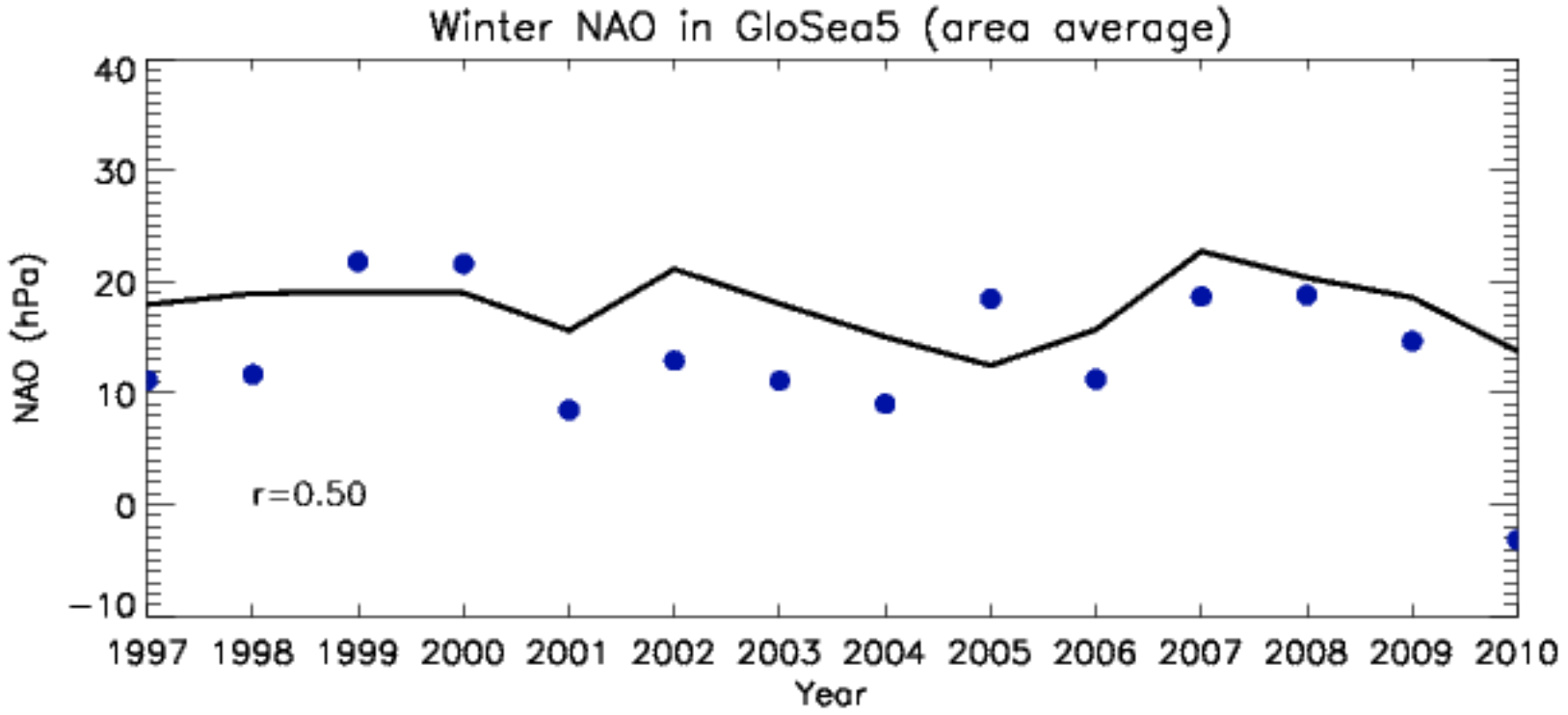
Hadley Centre

Higher resolution model :

- **Better representation of Gulf Stream**
- **More atmospheric realistic mean state**
- **Better representation of blocking**



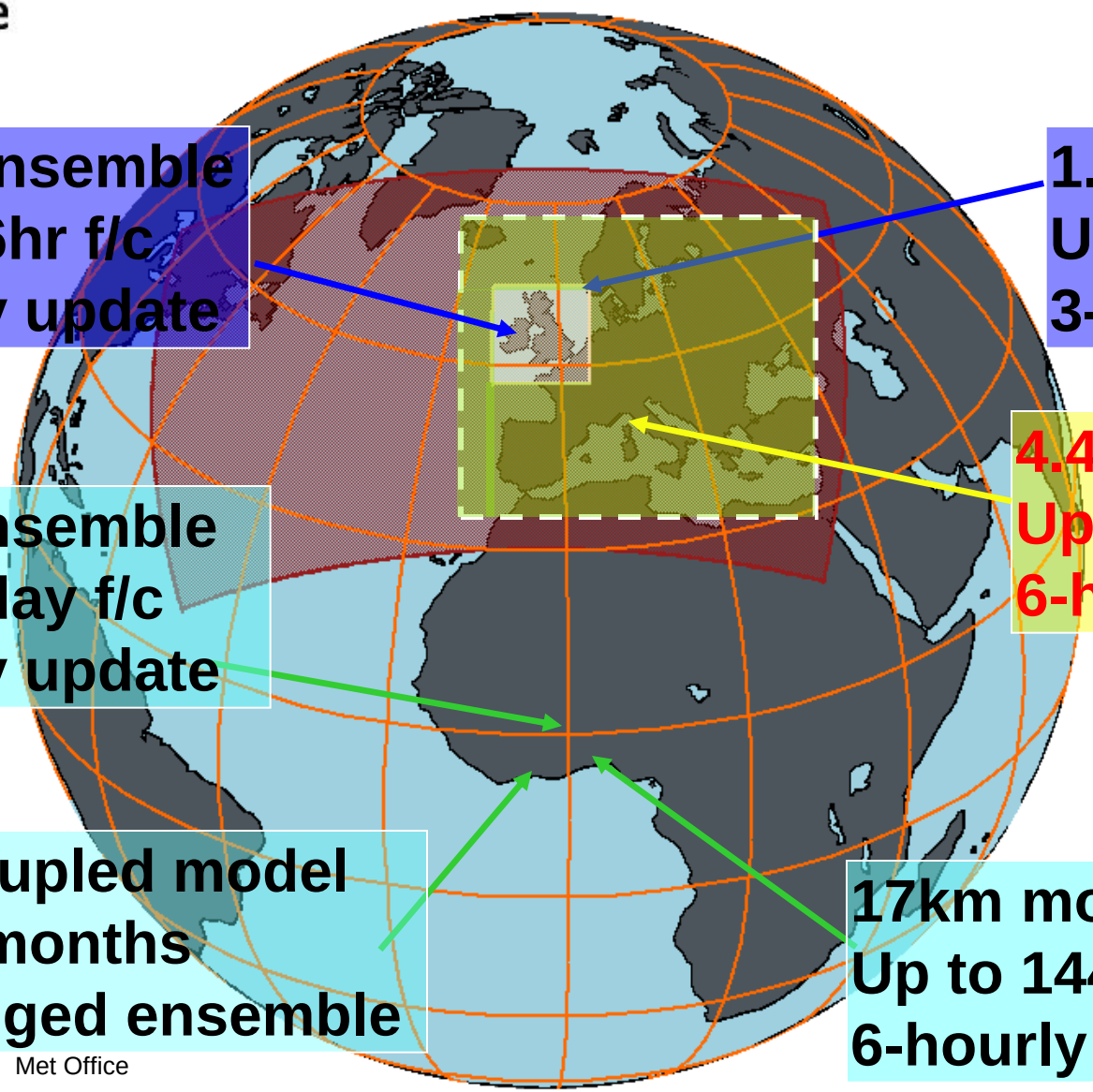
Glosea 5 has significant skill for winter NAO prediction



- Significant winter NAO skill (correlation 0.5)
- Glosea 4 had a correlation near 0.2

What’s next?

2013 Primary Modelling Suites



2.2km ensemble
Up to 36hr f/c
6-hourly update

1.5km model
Up to 36hr f/c
3-hourly update

4.4km model
Up to 120hr f/c
6-hourly update

33km ensemble
Up to 3day f/c
6-hourly update

60km coupled model
Up to 6 months
Daily lagged ensemble

17km model
Up to 144hr f/c
6-hourly update

Planned Changes: Q4 2012 - Q1 2013

1. Ensembles

- Global Ensemble resolution increase to N400 (~33km)
- UK Ensemble embedded directly within Global
- 22 Additional Global Ensemble members to T+9 to improve Hybrid DA.
- Regional Ensemble **deprecated** and flagged for future retirement.

2. Global Data Assimilation

- Hybrid DA benefits from increase in Ensemble Resolution and Increased members
- 4DVAR inner loop resolution increased to N320 (40km) plus new DA covariances
- Observation usage. Candidates include
  - NPP -ATMS & CrIS,
  - SSMIS revision,
  - AMSU over land,
  - variable/correlated obs errors ATOVS/AIRS-IASI
  - Surface cloud obs with GEOCLOUD

3. New LAM Configurations

- Euro 4km; Falkland 1.5km?; East Africa 4km?; Middle East 4km?
- All current LAMs bar UKV **deprecated** and flagged for future retirement

Dynamical core: ENDGame

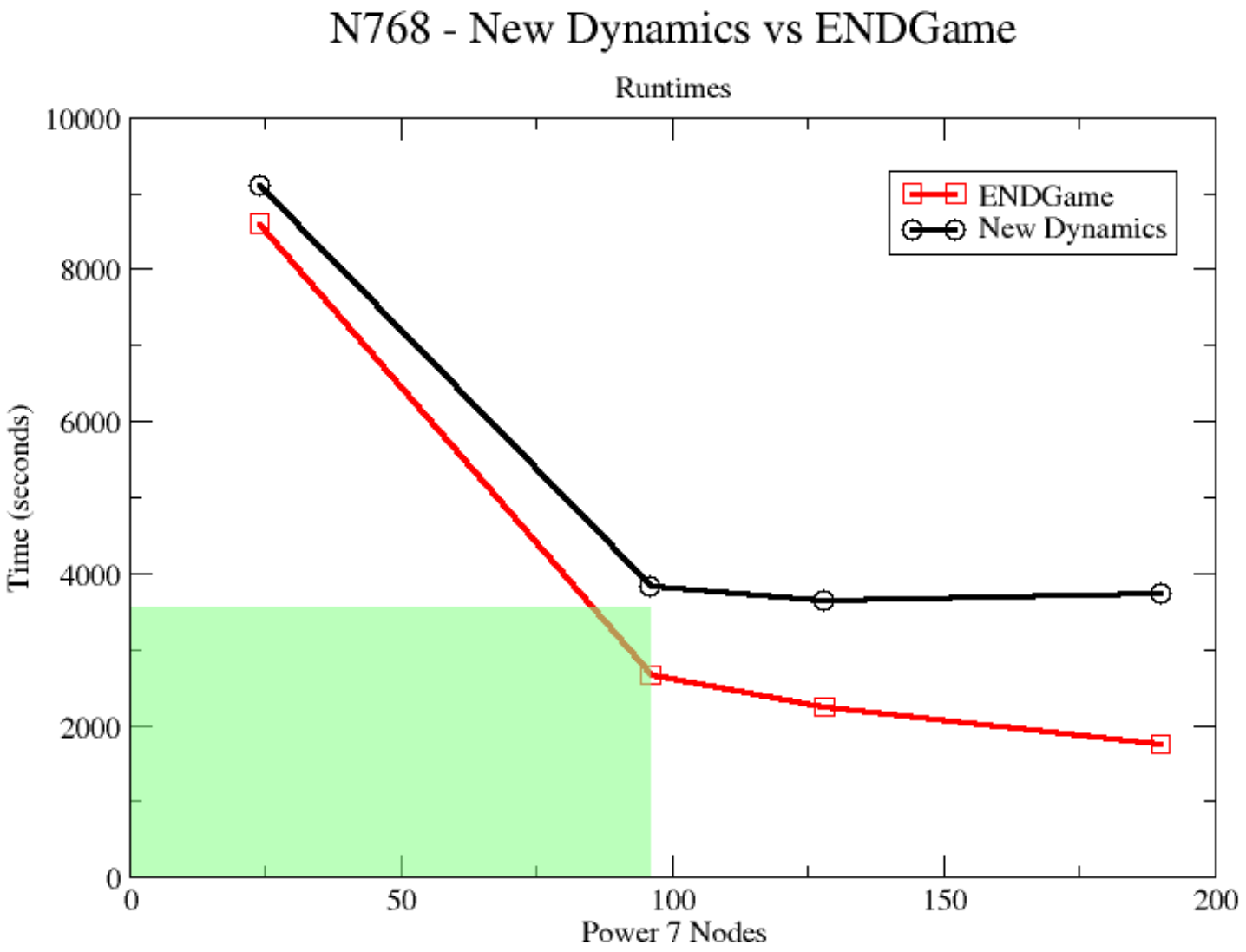
ENDGame

- Improved (iterative) solution procedure:
  More implicit, approaching Crank-Nicolson
  $\Rightarrow$ Improved robustness and accuracy

- Improved scalability
  - Change to what is stored at the poles

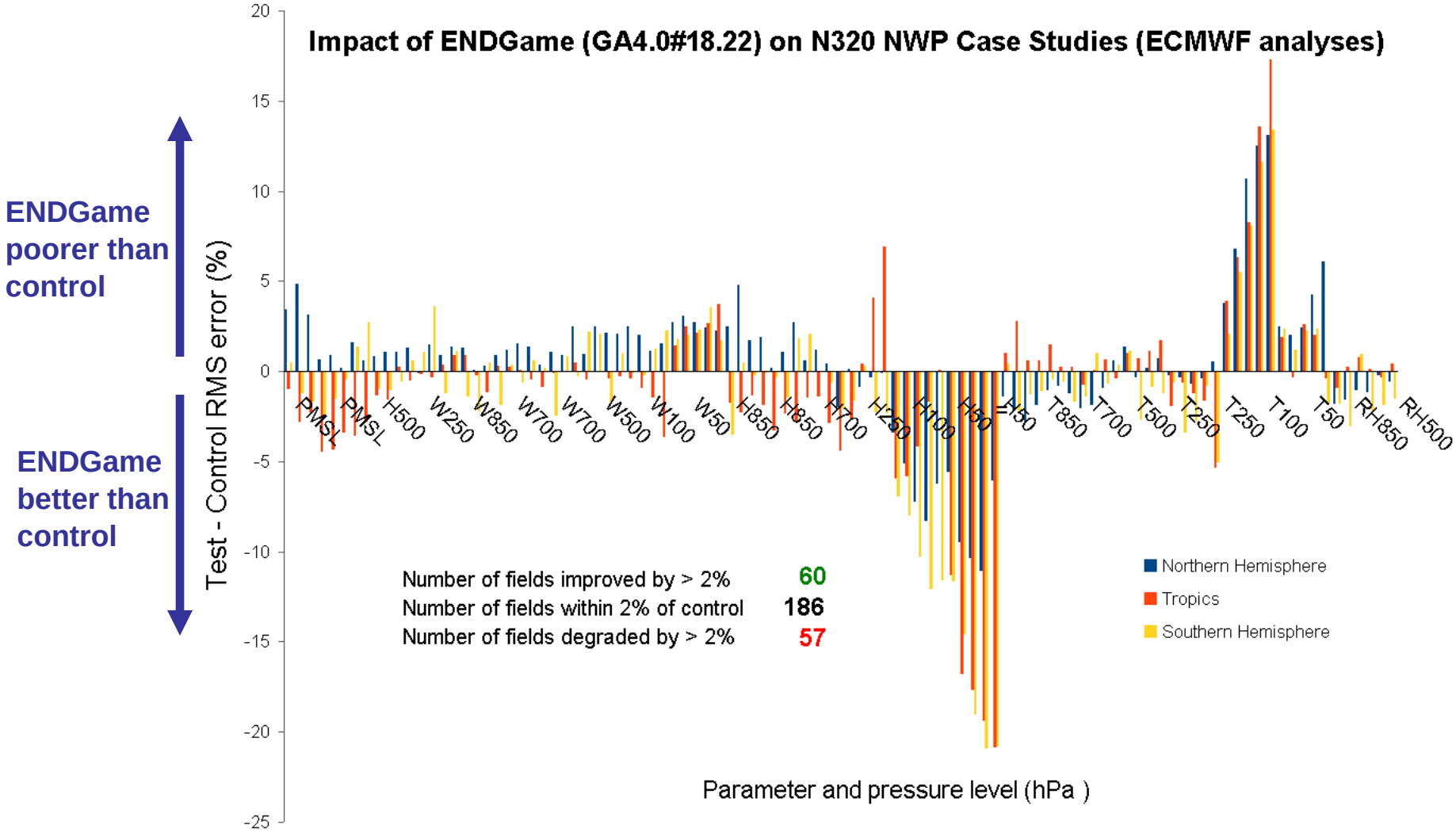
- Option for improved conservation via SLICE

ENDGame Runtimes



ENDGame accuracy: NWP

Clean NWP case study test of ENDGame vs GA4.0

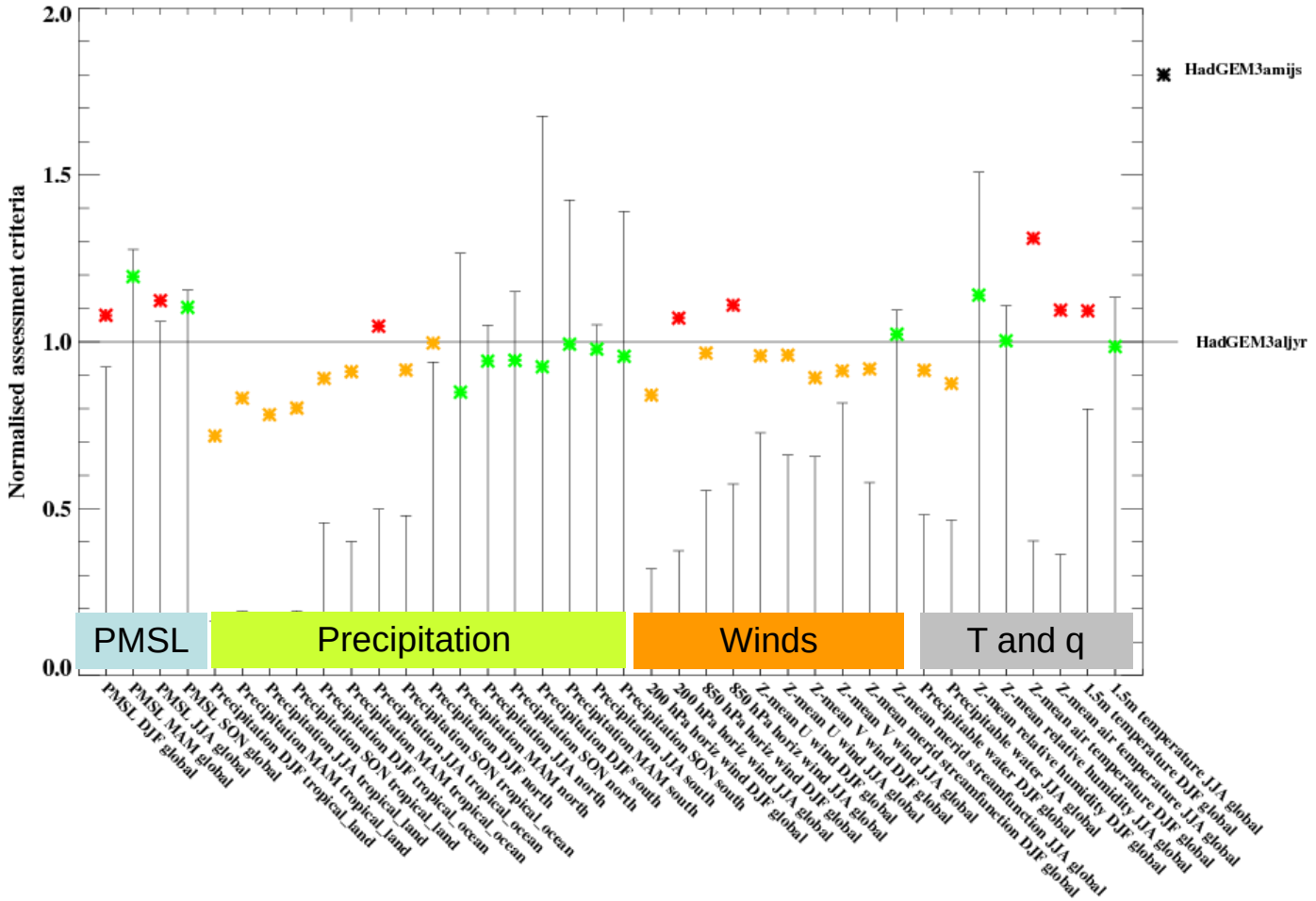


ENDGame accuracy: climate

Atmospheric normalised assessment criteria
20 year N96ORCA1 of latest package (vs GA4.0)

ENDGame poorer than control

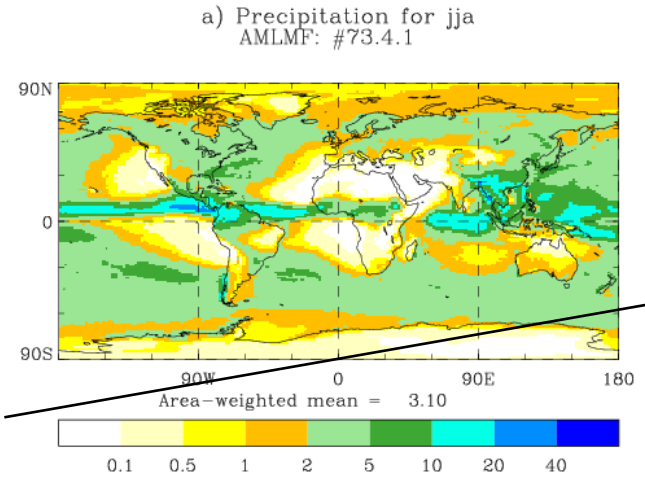
ENDGame better than control

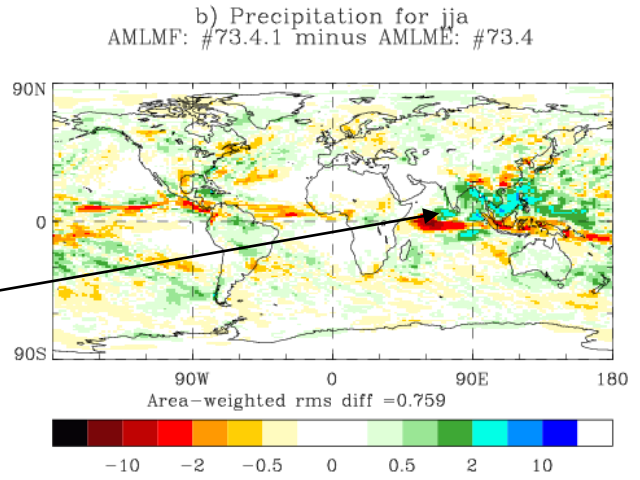


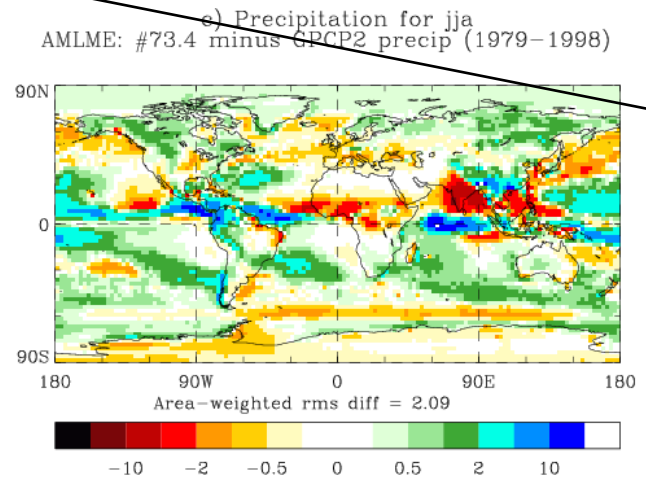
ENDGame accuracy

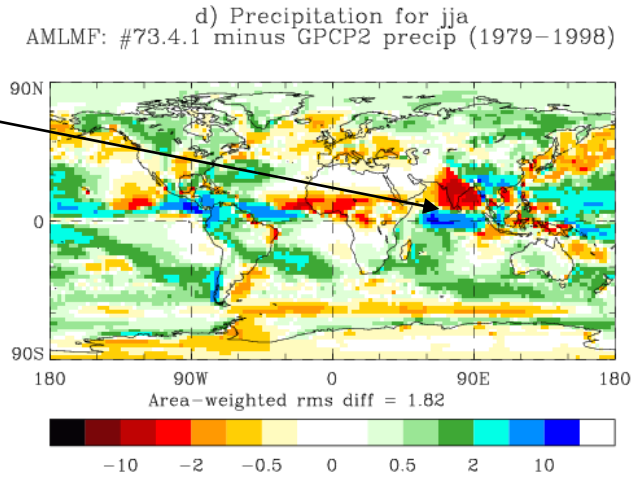
Mean JJA precipitation
10 year N96 AMIP of latest package (vs GA4.0)

Changes over India/Indian Ocean improve S. Asian monsoon







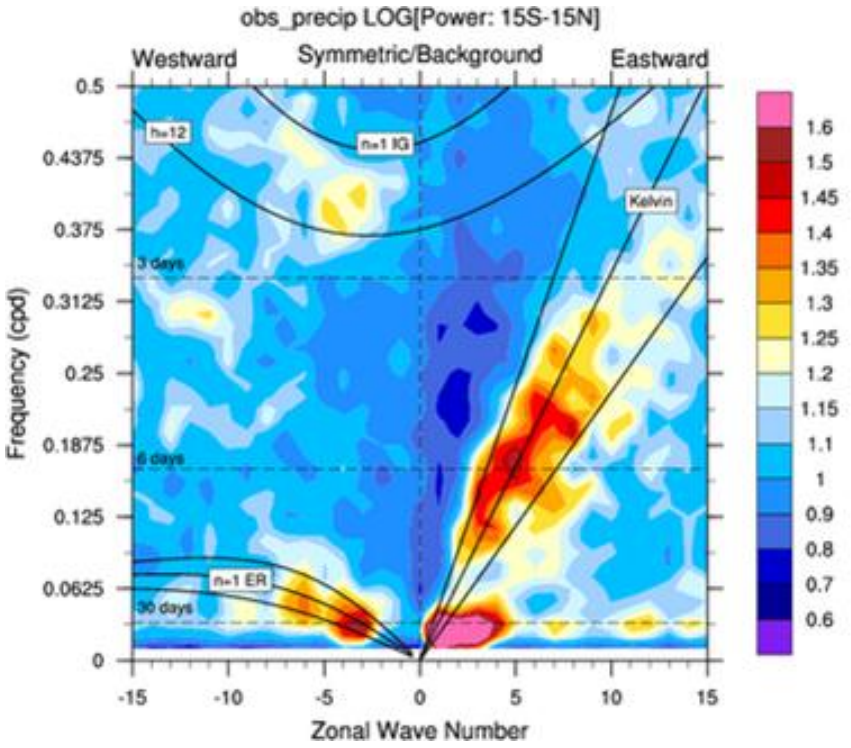


0815

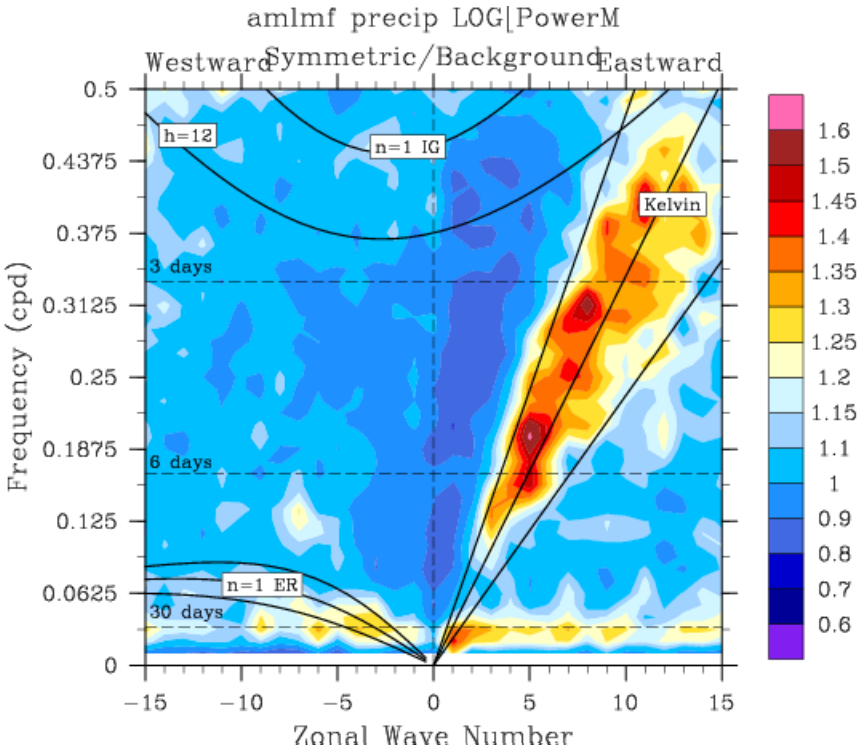
ENDGame accuracy

Frequency-wavenumber spectra of precipitation

Observed



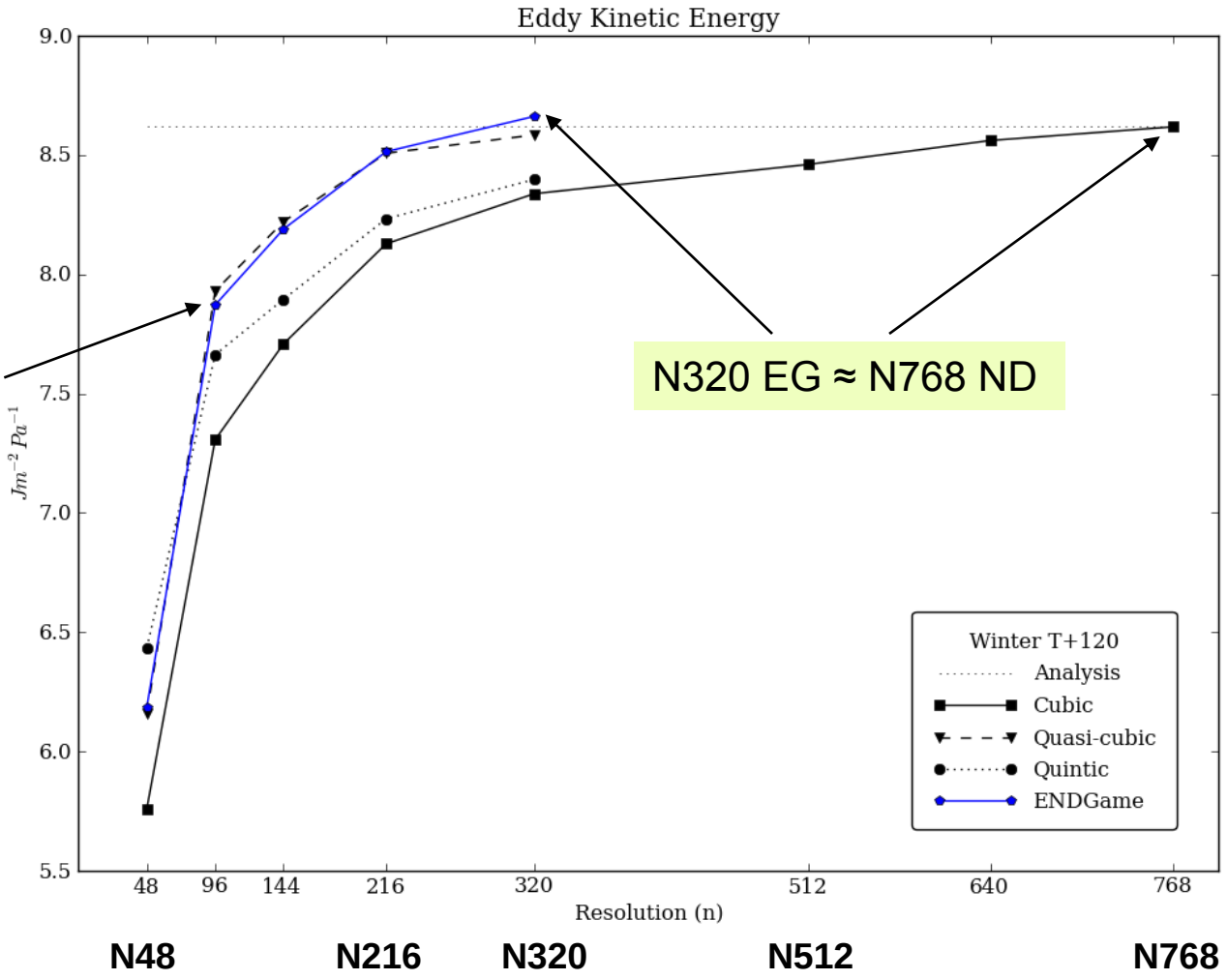
N96 ENDGame package GA4.0#73.4.1



ENDGame variability

EKE from 10 GA3.0-based 5-day forecasts (DJF)

N96 EG + cubic
≈ ND+quasi-cubic



N320 EG ≈ N768 ND

N48 **N216** **N320** **N512** **N768**

Questions?