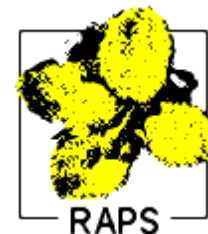# RAPS Introduction

George Mozdzynski, ECMWF
RAPS Chairman

What is RAPS?

- **Real Applications on Parallel Systems**
- **European Software Initiative**
- **RAPS Consortium (founded early 90's)**
- **Working group of hardware vendors**
- **Programming model (MPI + F90/F95 + OpenMP)**

"The partners of the RAPS Consortium develop portable parallel versions of their production codes which are made available to a Working Group of Hardware Vendors for benchmarking and testing."

RAPS Consortium

CCLRC	**Fraunhofer SCAI/ITWM**
CERFACS	**Met Office UK**
CPTEC	**MPI-M**
CSCS	**METEO-FRANCE**
DWD	**NCAR**
DKRZ	**NERC**
ECMWF	**ONERA**

Working Group of Hardware Vendors

Bull	**INTEL**
Cray	**NEC**
Fujitsu	**Oracle**
HP	**SGI**
IBM	

Why RAPS

- **Portability of codes (F90/F95/F2003, C/C++, MPI, OpenMP)**

- **Availability of benchmark codes ahead of a formal procurement**

- **RAPS community**

  - **Some influence on vendors adopting standards**

- **Regular meetings in past years**

RAPS process

- **RAPS benchmarks distributed by individual organizations**

- **No official membership required for vendors**

- **Vendors approach individual orgs for benchmarks**

    - **Confidentiality / Licence agreement**

- **Meetings**

    - **Even years: as part of ECMWF 'Use of HPC in Meteorology workshop'**

    - **Odd years: informal meeting at NCAR organised Annecy CAS workshops**

- **Rotating Chairmanship**

RAPS benchmarks

- **Today**

    - **DWD**

    - **ECMWF**

    - **Met Office**

    - **MPI-M**

    - **Meteo-France**

- **Commitment to produce up to date benchmarks reflecting key operational applications of consortium members**

IFS RAPS12 model-only benchmark

- **Model resolutions T159, T399, T1023, T1279 and T2047**

- **Full outputs from IBM Power6 (all resolutions)**

- **No output of model fields (i.e. not an I/O benchmark)**

- **Reference job scripts**

  - **24 time steps**

  - **test of correctness**

> Results of ERROR calculation (T159/Intel/pgi-10.6)
>
> The error calculated from the results shows that the calculations are correct
>
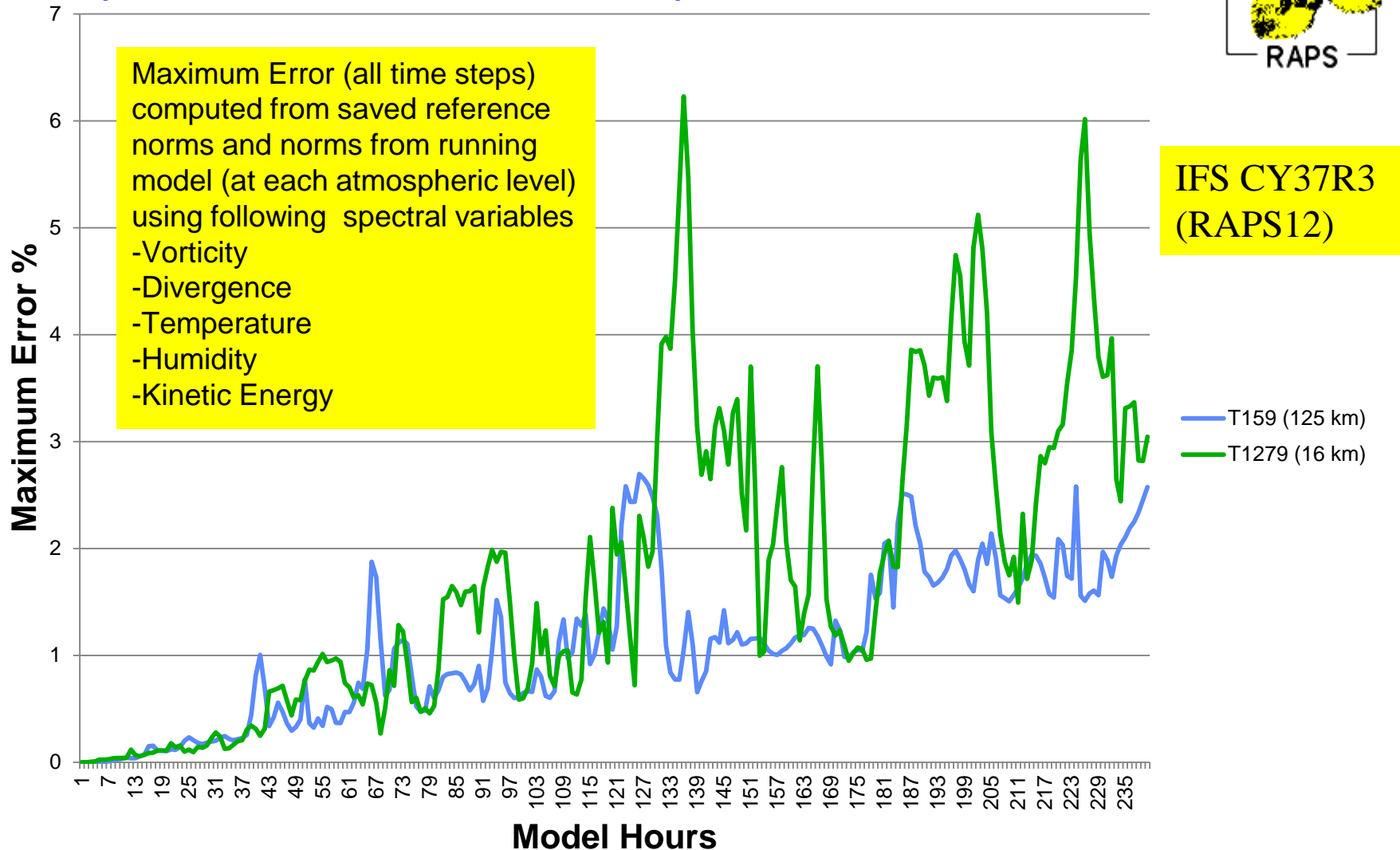> The maximum error is =   0.16518 %

- **Long run job scripts, for performance runs**

  - **use same executable as for reference runs**

- **Results ([SP,GP] norms) should be bit-reproducible when changing**

  - **number of MPI tasks**

  - **number of OpenMP threads**
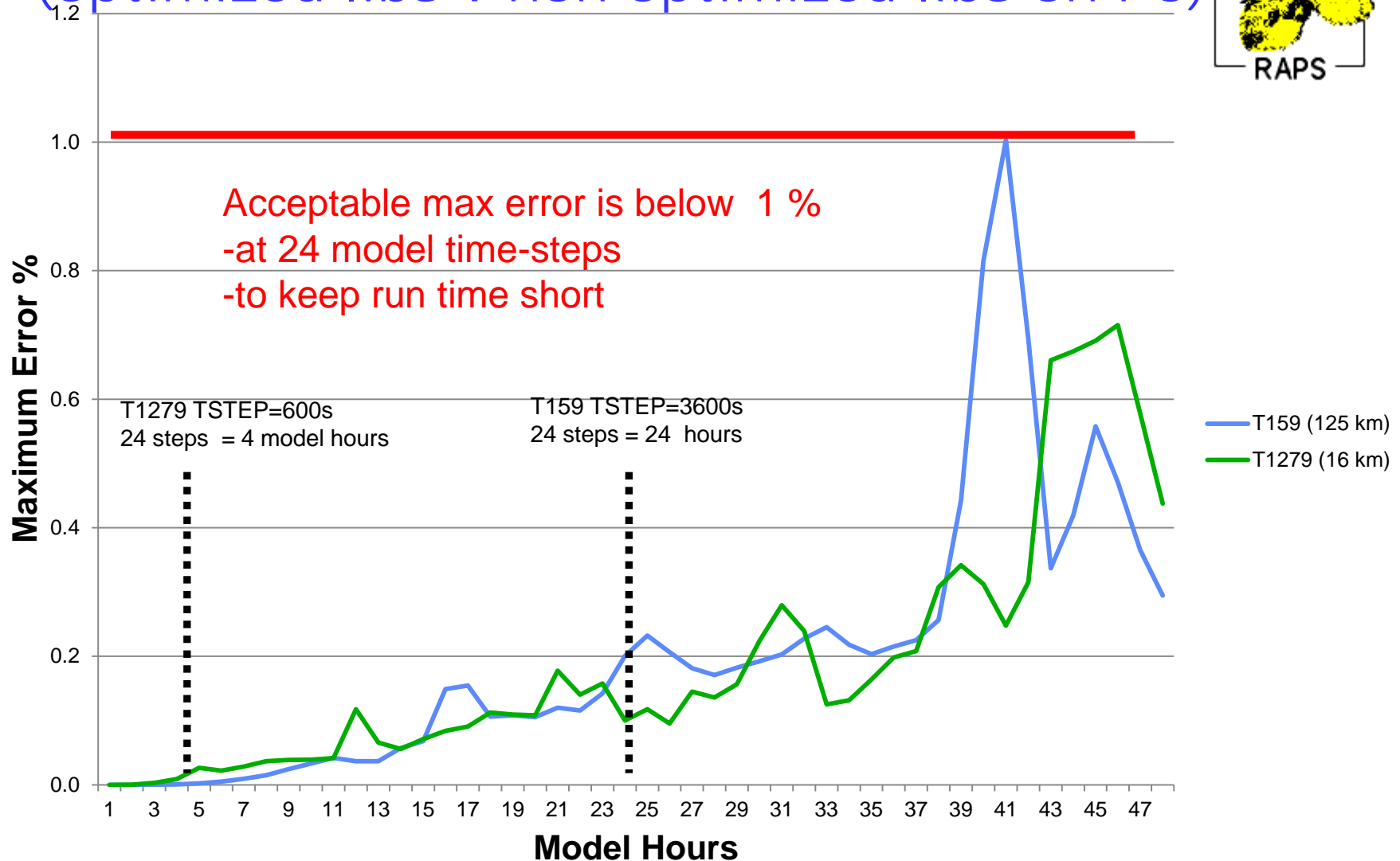
Next IFS RAPS benchmark

- **IFS RAPS13 (Cycle 38R2) model-only benchmark**

- **Is NOT the ITT benchmark (which based on CY38R1)**

- **Plan to release Dec 2012**

- **Model cases from RAPS12**

- **New T3999L137 model case with Non-Hydrostatic dynamics**

- **Fast Legendre Transform (already in CY38R1)**

- **Coarray developments from work in CRESTA project**

  - **Compile with –DCOARRAYS if you have F2008 compiler**

  - **Namelist NAMPAR1 flag LCOARRAYS**

  - **LCOARRAYS=T to use coarray optimisations**

  - **LCOARRAYS=F to use original MPI implementation**

- **Faster initialisation for FLT (suleg)**

Maximum Error Correctness Check
(optimized libs v non-optimized libs on P6)

Maximum Error Correctness Check
(optimized libs v non-optimized libs on P6)

Acceptable max error is below 1 %
-at 24 model time-steps
-to keep run time short

T1279 TSTEP=600s
24 steps = 4 model hours

T159 TSTEP=3600s
24 steps = 24 hours

— T159 (125 km)
— T1279 (16 km)

Maximum Error % (y-axis: 0.0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2)

Model Hours (x-axis: 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47)

RAPS forum

- **http://raps.enes.org/**

- **Click on register (in the top right hand corner), where you will be asked to provide some basic information (id/pw/email address) and submit your registration.**

- **Registration could take up to a day to process (my experience was just 1 hour), after which time you will receive an email confirming that your account has been activated.**

- **Contact: luis.kornblueh@zmaw.de**

RAPS forums

- **Parallel I/O initiative**

  This forum should be used for developing a project for a portable parallel I/O library for NWP and climate modelling

- **Measurement tools initiative**

  Discuss the design and implementation of a common lightweight measurement tools library

- **Fortran 2003**

  Debate about Fortran 2003 usage

- **Fortran 2008**

  Debate about Fortran 2008 usage

RAPS matters

- **Improving scalability, maintainability and portability of our production applications**

- **Use of standards are paramount**

- **RAPS programming model today**
  - **F90 / F95 / F2003 / C / C++ / MPI / OpenMP**

- **Fortran 2008 (coarrays)**
  - **Many thanks to Bob Numrich and John Reid**
  - **To be adopted in the future**
  - **Requires more vendors to support**
  - **Interested to hear F2008 plans from vendors**

- **Need for thread checking software**

Thank you for your attention

QUESTIONS?

HPC workshop in Meteorology, 1-5 Oct 2012