Summary and Thanks

Sue Gray and Bob Plant
With apologies for the many good things that will get missed out
What we learned about OpenIFS developments within ECMWF

• Cycle 43r3 – we’re the first to use this with openIFS!
• New developments in dynamics (such as cubic octahedral grid in cy43r3 reduces cost and improves mass conservation).
• ecRAD (new modular radiation scheme)
• Lake model (depth is the key parameter)
What we learned about OpenIFS developments outside ECMWF: 1

• OpenIFS can be run using 4 raspberry pi’s glued to be a piece of wood.
• openifs@home is launched and results from 571 integrations were shown! (80% of 2000 integrations were returned in 50hrs).
• Uncertainty in parametrizations can be investigated by tiling regions with single column models at every grid point.
What we learned about OpenIFS developments outside ECMWF: 2

- OpenIFS initial conditions can be (more) easily generated from ERA reanalyses with AutoSubmit.
- OpenIFS (instead of IFS) will be used in the next generation of the EC-Earth model (ECEarth4).
- FOCI-OpenIFS exists as a flexible climate model for high-resolution simulations.

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<th>Model</th>
<th>Resolution</th>
<th>Run Time Settings</th>
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<td>FOCI-OIFS LR</td>
<td>T1.159L91</td>
<td>ORCA05 L46</td>
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<td>32 SYPD @ 760 CPU ~ 570 CPUh</td>
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<td>ORCA05 L46 (+ ORION12°)</td>
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<td>FOCI-OIFS VIKING</td>
<td>~0.25°?</td>
<td>ORCA05 L46 (+ VIKING10X)</td>
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<td>Planned for new project</td>
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Klaus Wyser
Xavier Yepes Arbós
Joakim Kjellson
What we learned about science being pursued with OpenIFS

- OpenIFS is a great tool for analysis of case studies (e.g., Hurricanes Debby and Ophelia)
- OpenIFS is a great tool for idealised applications such as the Held-Suarez test
- OpenIFS can be used for ensemble forecasts (Typhoon Damrey)
- OpenIFS can be used for sensitivity studies (flattening the south African orography decreases the number of tropical lows)

Hurricane Ophelia – contributions to total diabatic heating

[Graph showing contributions to total diabatic heating]

Typhoon Damrey
20 ensemble members started from different initial states

[Map showing tropical low locations]

Emma Howard

Mika Rantanen

Lorenzo Silvestri

Terhi Laurilla

Pirkka Ollinaho
What we learnt about diabatic processes and forecast error: 1

• Atmospheric rivers and precipitation from ascending warm conveyor belts can have a common cause: a feeder airstream.

• Stronger warm conveyor belts (i.e. more latent heating) are associated with more intense cyclones (for C1 cyclones).

• The effects of heating in large-scale vertical wind shear are systematic and can cause (real) negative PV.
What we learnt about diabatic processes and forecast error: 2

- Warm conveyor belts outflows amplify ridges and the tropopause PV gradient and jet speed.
- Forecast busts in ridge building can occur if poor diabatic processes lead to poor representation of warm conveyor belt branches.
- Uncertainty growth is associated with moist processes: warm conveyor belts and mesoscale convection.
- Parametrization improvements such as prognostic entrainment (memory) can reduce model biases.

Impact of prognostic entrainment on the diurnal cycle
What we learnt about diabatic processes and forecast error: 3

• Moisture injection can be critical to predict which African Easterly Waves will trigger tropical cyclones.

• There is little to be gained from reducing initial condition error at the synoptic scale in terms of global predictability, but improvements at the sub-synoptic scales are possible.

• It is possible to construct a closed budget of Available Potential Energy density for a tropical cyclone.
What we learnt about diabatic processes and forecast error: 4

• For southern hemisphere meridional moisture flux (MMF) variability the strongest relationship is with **genesis latitude** (closely followed by **speed**) but changing the **intensity of cyclones** has a small impact.
Thanks!

• To Gabi, Marcus and Glenn from ECMWF for all their work in preparing the case study
• To Maria for supporting and troubleshooting all our IT needs
• To Kathryn for all the practical arrangements and behind-the-scenes work
• To all of our speakers for their informative and intriguing talks

• And to all of the participants for some imaginative experiments, nice posters and contributions to discussions