

# Working Group on Numerical Experimentation (WGNE)

## 40th Session of the WCRP Joint Scientific Committee

*Carolyn Reynolds and Keith Williams*

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*Geneva, Switzerland*



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# WGNE

→ fostering the **development of atmospheric circulation models** for use in weather prediction and climate studies on **all time scales**, and **diagnosing and resolving shortcomings**.

*Objectives are achieved through*

- Identification of **systematic errors** common to many models.
- Sharing **diagnostic tools and techniques** to get to the root of the error.
- Sharing knowledge around **sensitivity of errors to model formulation** (parametrizations, dynamical core, etc.).
- Work with other groups (e.g. GASS & GLASS) to **develop solutions**.

- WGNE reports to both

**WCRP Joint Scientific Committee (JSC)**



**Commission for Atmospheric Sciences (CAS)**



- WGNE has been a **pioneer of seamless work** (e.g. developing the AMIP and Transpose-AMIP methodologies)



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# Progress and achievements

## WGNE MJO-Task Force

- Process-orientated diagnostics
- Evaluation of real time forecasts
- Assessment of intraseasonal variability CMIP models
- Joint MJO-TF – GASS diabatic processes experiment
- Investigation of MJO air-sea interaction

## DCMIP & Exascale

Dynamical core summer school held.  
First Exascale progress report

## Routine model evaluation/verification

Paper written on WGNE tropical cyclone verification. Passed to CBS to make routine

## WGNE-WGCM Climate Metrics and Diagnostics Panel & JWGFVR

Two groups developing plans together focussed on precipitation.  
JWGFVR report on process-orientated verification written

## WGNE Table of supercomputing development

Ongoing monitoring of architectures and centre model plans

## Aerosols Project

Phase 1 complete (paper being written)  
Phase 2 planned joint with S2S

## Drag Project

Phase 1 complete  
Phase 2 planned joint with GASS

## WGNE Workshops on Systematic Errors

Next slide ...



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# Progress and achievements

## 5<sup>th</sup> WGNE Workshop on Systematic Errors (WSE)

*Zadra et al. (2018) Systematic Errors in Weather and Climate Models: Nature, Origins, and Way Forward. BAMS. <https://doi.org/10.1175/BAMS-D-17-0287.1>*

Attended by 200 scientists covering weather and climate, global and convective scale modelling

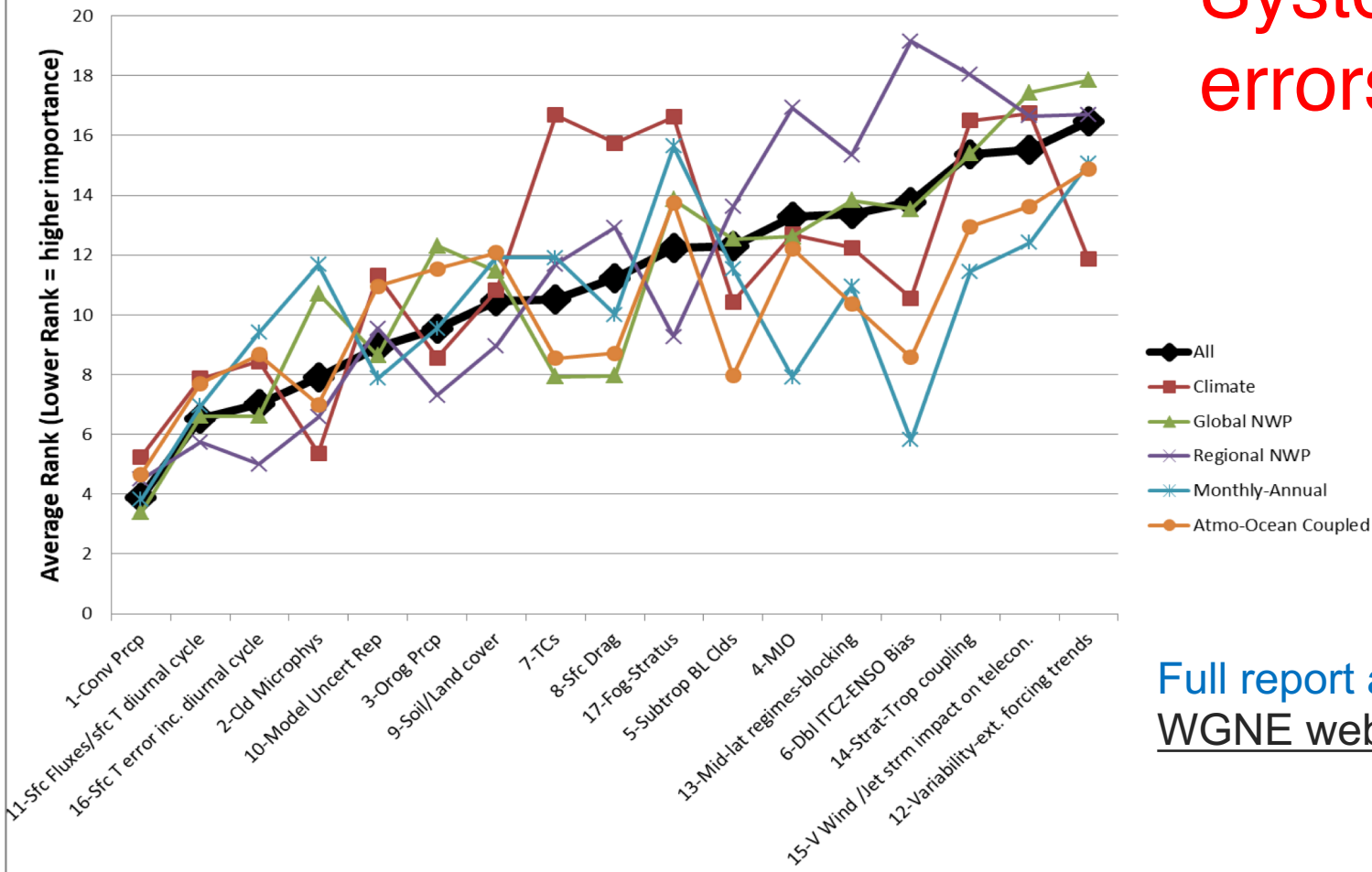
### **Recommendations from 5<sup>th</sup> WGNE WSE:**

- Extend drag project to consider momentum more generally and consider representation of orography, etc.
- Consider setting up a group or extend drag group to look at surface flux errors.
- More research is required on how to represent model uncertainty.
- Encourage community to make use of S2S drifts database.
- Discuss with S2S/WGSIP regarding extension of aerosols project to seasonal timescale.
- Consider a cross weather-climate group looking at initial tendency analysis of common biases.
- Hold another WSE in 4-5 years time, possibly inviting submissions on solutions rather than just problems.
- **Prioritise the list of identified systematic errors.**



# Progress & Future plans

Average Rank Sorted by Scores for All Entries



Systematic errors survey

Full report available on the [WGNE website](#)

# Future plans

## Rank 1 - Convection:

Several independent activities underway (e.g. Delft workshop, UK ParaCon project, etc.).

Joint WGNE-GASS grey zone phase II project being initiated based around EUREC4A and GATE III field campaigns.

WGNE MJO-TF future focus on exploiting the Years(s) of Maritime Continent (including the propagation of MJO across MC).

# Future plans

## Rank 2 - Surface Fluxes:

Project launched on surface fluxes (call out now). Being led by Carolyn Reynolds (*NRL*) and Francois Bouysse (*Meteo-France*). Initial focus will be over oceans.

Rank 3 – Surface temperature: GLASS have several initiatives plus international modelling activities around field campaigns such as LIAISE.

Rank 4 – Microphysics: Many national activities on cloud microphysics and aerosols. International activities around SOCRATES, LANFEX/Toulouse-fog, etc.

WGNE monitoring both of these

## Rank 5 – Representing uncertainty:

Joint meeting held with PDEF. Coarse graining project being developed by Hannah Christensen (U. Oxford).



# Future plans

Addressing other WSE recommendations:

Joint WGNE-GASS drag phase II project (COORDE) being initiated. Led by Irina Sandu and Annelize van Niekerk.

Sharing of progress with developing codes suitable to run on Exascale architectures. May require some coordinated experiments. Led by Nils Wedi.

Joint WGNE-S2S aerosol phase II project initiated – focus on short range convective scale and global seasonal simulations. Led by Ariane Frassoni, Francois Engelbrecht, and Frederic Vitart.

Joint WGNE-PDEF initial tendency intercomparison in planning.

# Links to the WCRP Strategic and Implementation Plans

## WCRP strategic plan:

1. Fundamental understanding of the climate system
2. Prediction of the near-term evolution of the climate system
3. Future evolution of the climate system
4. Bridging climate science and society

The need for accurate physical models fundamentally underpins at least the first 3.



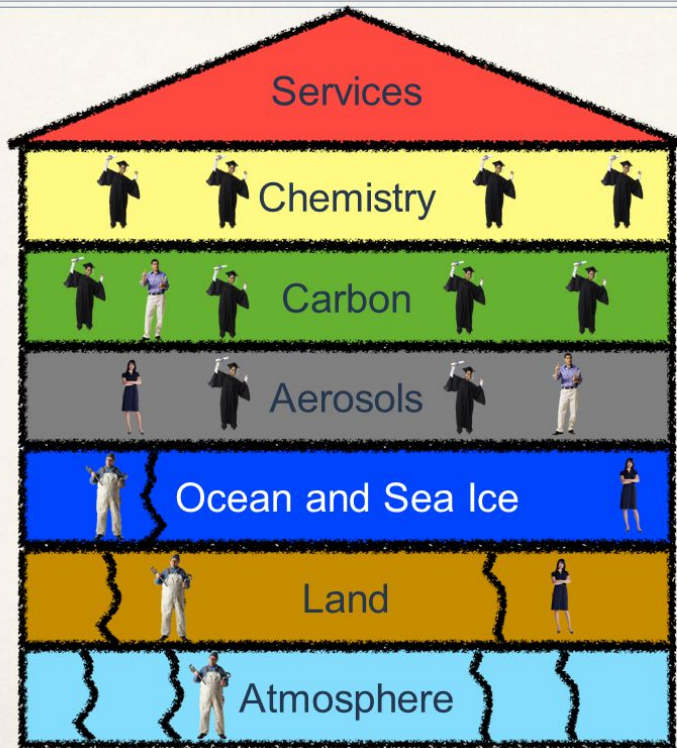
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# Links to the WCRP Strategic and Implementation Plans

## The model development house

Today



Solution

Strengthen the foundations of the existing house.

The climate information we give and services we provide require robust foundations in terms of minimising systematic errors in core modelling components



# Emerging issues

- Weather and climate science has seen rapid change since WGNE started over 30 years ago.
- Many of the traditional differences between models used for climate and weather forecasting no longer exist.
  - Coupled atmosphere-ocean-ice models are now being used for operational NWP.
  - Earth system components such as interactive aerosols and chemistry are being used for climate change projections, air quality forecasting and subseasonal to seasonal predictions alike.
  - Convective permitting models are increasingly being used to downscale climate projections for specific regions.
- The earth system model development community needs to share best practice and work together on common systematic errors.
- WGNE is unique in reporting to both WCRP-JSC and CAS – both undergoing change
- WGNE's purpose and seamless methodologies can allow it to evolve into an earth system model development focal point

## Evolved purpose of WGNE:

fostering the **earth system development of atmospheric-circulation models** for use in weather prediction and climate studies on **all time scales**, and **diagnosing and resolving shortcomings**.



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