WGNE Conference call
1400 UTC 29 April 2021
Meeting Minutes

Present (WGNE members, exofficios, WWRP/WCRP) : Carolyn Reynolds (co-chair), Nils Wedi (co-chair), Mike Ek, Masashi Ujiie, Huijun Wang, Elena Astakhova, Romain Roehrig, Rachel Albrecht, Peter Lauritzen, Daniel Klocke, Günther Zängl, Fanglin Yang, Charlotte Demott, Paola Salio, Ariane Frassoni, Ron McTaggart-Cowan, Barbara Casati, Sandrine Bony, Caio Coelho, Daehyun Kim, Ariane Frassoni ; Michael Sparrow, Wenchao Cao (WCRP Secretariat)

1) Update on recent RB and WCRP activities (10min)

Carolyn Reynolds gave an update on recent research board and WCRP activities. She reported on the RB virtual meeting held on 28 January and went over the WGNE response on how the RB can help identify synergies and support the programs. She also gave a brief review of the WCRP leadership meeting on 21 April, which included reports from the Lighthouse activities. The Lighthouse groups are developing their science plans, which should be completed by June. The Lighthouse activity that WGNE projects most strongly onto is Digital Earths, although there is also a projection onto the monitoring and modelling Earth system change component of 'Explaining and Predicting Earth System Change'. Digital Earths will have four sub groups, (Km-scale modelling, observations and DA, digital technologies, and regional demonstrations). Nils noted that Christian Jakob and Peter Bauer will be stepping down from their co-chair roles later this year and the group will be looking for new leadership. Carolyn also noted that under the new WCRP organization, WGNE will be under the new Earth System Modelling and Observational Capabilities (ESMOC) core activity. Nils and Carolyn are on the ESMOC SSG committee, lead by Cath Senior and Susan Tegtmeier. That group meets next week and WGNE members will be asked to provide input on the group's activities as this effort progresses. Mike Sparrow noted that the ESMOC will replace the WMAC and WDAC as a new core activity of WCRP.

2) Report on HIW workshop and RDP Paris 2024 Olympics (10 min)

Ariane Frassoni gave a brief update on topics that came out of the HIW workshop that would be of interest, and also noted that WGNE can follow HIW's successful example of having presentations or collections of presentations of interest before our meeting. An advertisement from HIW: the Multi-scale Hazard Forecast Task Team is open for new members with expertise in coupled-hazard modelling. She also reported on developments as part of RDP Paris 2024 Olympics, specifically focused on urban modelling, that may be of interest to WGNE, with simulations on spatial scales of 100m or less. See additional information in Appendix B on HIW and Appendix C on RDP Paris 2024 Olympics.

3) Updates on Aerosol project (5 min):

Ariane gave a brief update on the Aerosol project, noting that the project was highlighted as part of the recent S2S seminar series on aerosols and composition, and noting that the periods of interest had been expanded to include the high-impact fire season of northern hemisphere summer-fall 2020.

4) WGNE36 discussion & planning (10 min):
Nils Wedi led the discussion on WGNE36. He noted the various topics that we want to include in the meeting, in which we plan to have joint sessions with WGCM, who will be meeting at the same time. There was discussions of possibly having JWGFVR also have a meeting at the same time, with joint sessions on process-based diagnostics and an emphasis on coupled systems. Given the uneven rollout of the COVID19 vaccines around the world, there is still uncertainty as to if this meeting will happen in person or virtually. We should have more information from NCAR in early June. Mike Sparrow noted that WCRP has budgeted support for the meeting, however, it is uncertain if WCRP will be supporting in-person meetings by this Fall due to the ongoing COVID issues. There were several good topical suggestions for the meeting regardless, and depending on how the meeting will be conducted, some topics could also be taken forward in separate webinars as suggested by Ariane Frassoni. Check to see if WMO has a capability to host video presentations at times convenient for them before the meeting. Also note that problems with visas may arise.

5) WGNE35 Action items review (30 min):
With input from everyone, Carolyn updated the action item list from WGNE35. The updated list appears in Appendix A.

6) GASS - WGNE topical discussion between chairs (5min):

Nils gave a brief report on the telecon that he, Mich, and Carolyn had with GASS co-chairs, Sandrine Bony and Daniel Klocke on 23 March, to discuss WGNE-GASS collaboration. Topics of interest to both groups include boundary layer drag, convective organization and surface fluxes. With GASS offering more a process deep dive on processes and feedback what has been learned and what should be eliminated as a source of systematic errors. Charlotte Demott's presentations on analysis of the surface fluxes was shared with Sandrine and Daniel, and a potential future topic of joint interest in the parameterization of cool skin temperatures over the ocean, and the use of field campaigns (EUREC4A; Mosaic also in the context of low polar clouds).

7) Update on WGNE Systematic Error Workshop Nov 2022 (at ECMWF) (10 min): Nils provided an update on planning for the Systematic Error Workshop. The local organizers will be Nils, Irina Sandu, and Linus Magnusson. Nils has already received input on the meeting announcement and volunteers to serve on the Science Steering Committee. (see also https://events.ecmwf.int/event/241)

8) AOB, there was a mention on coordination of WMO meeting dates, especially after delays due to Covid, with some meetings listed below

- 1-3 November WGCM; 1-5 November 2021 WGNE-36
- 2022/2023 (SPARC GA)
- Last week July 2022 GEWEX Pan-GASS meeting (Monterey)
- 31/10/2022 – 04/11/2022 WGNE systematic error workshop (ECMWF)
- ? November 2022 ? WGNE-37
- March 2023 WCRP Open Science Conference

9) Meeting ended about 4 minutes early (15:26 UTC), which made everyone happy.

APPENDIX A : WGNE35 2-5 November 2020 Action List

Updates during the 29 April 2021 Telecon

(R - Recommendation, AI - Action Item)

1. **Systematic errors :** extend survey to other components of the ESM:
   a. Systematic errors in land models and their priority order. **AI: Mike Ek** to consider whether a current document exists providing a community view or whether GLASS could co-ordinate something (e.g. survey or a new BAMS Review paper covering weather and climate). Will be updated in the Fall. Ongoing.
   b. Systematic errors in ocean and sea-ice models and their priority order. **AI: Baylor** to consider whether a current document exists providing a community view or whether OMDP could co-ordinate something (e.g. a survey; review paper): Follow-up with Barbara and with Ocean Predict.
   c. Atmospheric composition/bio-geochemistry (**AI: Ariane** to ask GAW about this, ties with Aerosol project): Following discussion at the SAG-APPs/GAW meeting, Ariane has reviewed literature and started a draft list of systematic errors identified by scientific community. Next step is to review the list from a WGNE perspective then check with SAG-APPs co-chairs on moving forward with distributing the list to GAW. Draft list of systematic errors in separate document. (ongoing)
   d. Coupled system systematic errors (**AI: Oscar** will reach out to Cath Senior/WGCM/CMIP or others as appropriate to find out if something currently exist, or is a new survey worthwhile): In progress.
   e. Middle atmosphere (**AI: Carolyn** will ask John McCormack/SPARC about this): Zac Lawrence and Judith Perlwitz will give a presentation at WGNE36 on SPARC/SNAP common stratospheric errors. Closed.

2. **Stochastic physics :**
   a. centers to consider running SCM and/or analysis and refining protocols (**AI : all**) : Closed.
   b. WGNE contact for the stochastic physics project (**AI: Nils**): Closed

3. **Synergies on High Altitude Modeling :** include presentation from SPARC and NCAR on this topic at WGNE36 (AI Co-chairs): TBD to give a presentation at WGNE36 or combine with SPARC talk Closed

4. **GASS:**

a. Coordinate with momentum flux project COORDE and GEWEX. Recommend GEWEX to form a formal link between COORDE and TEAMX (**R : GASS**) : Groups are communicating. Discussions on COORDE end-of-project ongoing. Closed.

b. Presence at PanGASS in Monterey (**AI: Carolyn/Ron to present WGNE priorities on systematic errors and parameterization**). PAN-GASS meeting delayed to probably late July 2022. Plan to have a WGNE presence at the meeting. Closed

5. **MJO Task Force** : Recommend considering both options to get two more members AND entrain early career scientists through e.g. presentations (**AI : Charlotte**) : The two new members enhance diversity from a geographic and career stage perspective. MJO TF is also forstinger early-career scientists through a seminar series. Charlotte also noted that AI is replacing some of the air-sea interaction focus (which has made great progress. Closed.

6. **Exascale/scalability:**
   a. Encourage use and make available community tools, develop best practices and standards (**AI: all,** post appropriate links on the WGNE web site): The review *High performance computing (HPC) readiness and the road to Exascale* prepared by Nils was posted on the WGNE site. Closed.
   b. Develop a summary of community tools and advice for modelling centres and publish on WGNE web page, should be evolving document that folks can add to (see above) (**AI: Nils**): Member contributions to the above document encouraged. Closed.

7. **Machine Learning**: prepare ML review for next year WGNE session (**AI: Fanglin and Francois E**). Consider Machine Learning approaches to understand and correct systematic errors. Ongoing.

8. **WMO Research Board Task Team on Exascale and Machine Learning Task Team**: act as WGNE rep. Length of commitment TBD after January. (**AI: a volunteer to be identified and Oscar as backup for Machine learning**): Tim Graham has agreed to be the WGNE member and has provided this update: The research board has approved an extension for the task team to October 2021. We are also now having meetings every 2 weeks to make more progress on the concept notes. It became clear that a single concept note on Exascale, AI and data handling was too large so it has now been split into 2 separate concept notes with the first focussing on the data production side (i.e. Exascale and data handling). The 2nd will be from a user's perspective on AI & data handling (e.g. post processing). There is still some ongoing discussion about where machine learning within models (e.g. replacing physical parameterisations will sit) but I think it's likely to be in the first concept note. The first concept note is being lead by Mark Govatt (NOAA) and is due to be finished in early May. The 2nd is being lead by Adrian Hines (Met Office) and is expected to be finished by October. Closed.

9. **Ensemble methods**: consider Exploring ML to derive uncertainties instead of running ensemble and contribute inputs at future WGNE meetings (**R: all**)

10. **TC verification**:

a. Review paper of TC initialization with DAOS involvement (**AI: Masashi** as contact point for WGNE).
Coordinate work to understand why all current initialisation methods result in TC's which are too weak despite models being capable of producing stronger TC's (**AI: Masashi** with DAOS, possibly part of review above): Masashi provided information to DAOS about (1) trends in the choice of TC initialization method and (2) recent common issues (e.g. intensity of TCs) in TC initialization recognized by the WGNE's TC verification effort.
Masashi also suggested to DAOS that the paper could contain review of these common issues among global NWP centres and discuss some implication for these issues. (ongoing).

11. JWGFVR:
a. Increase focus on process orientated metrics to address systematic errors in support of WGNE ala Charlotte's diagnostics (**R: JWGFVR**)
Identified JWGFVR members interested in being involved in process-oriented diagnostics research. JWGFVR organized a teleconference for the 9th June 2021 with presentations from Charlotte and Jess Baker to start discussions with participation of WGNE members. Closed.
b. Keep liaising with TC verification / JMA /CMDP (**R: JWGFVR**)
Ongoing.
c. Adopt an Earth system verification approach (coupling, atmospheric composition) (**R: JWGFVR**). Next workshop will have a session on ocean verification. (**AI: Caio** to send JWGFVR meeting info to OMDP)
JWGFVR sent an invitation to OMDP to attend the international verification methods workshop (2020-IVMW-O) last November. Following up from 2020-IVMW-O, JWGFVR is planning a teleconference with OMDP and OceanPredict researchers. The latter are also interested in process diagnostics (atmosphere-ocean coupling) and will be invited to the 9th of June's telecon mentioned above in 11a. Closed.
d. Explore DA or climate verification person to join as member (**AI: All**, pass recommendations onto Caio) (Ongoing)

12. **Precipitation verification**: Consider distribution of precipitation (e.g. SEEPS scores) and entrain NWP in the effort (**AI: Peter**): Ongoing, need to follow-up with Peter G.

13. **Verification**:
a. Bring topic to Research board to check best approach to synergize across timescales and programs (**AI: Keith or Carolyn**): This recommendation was made at the RB meeting in January. Closed.
b. Keep liaising with TC verification (**R: JMA and CMDP**, and keep JWGFR informed to provide feedback if needed) Closed.
c. Liaison between CMDP and JWGFVR on NWP-Climate collaboration (via Verification workshop and joint review of CMDP precipitation verification effort) (**R: Caio and Peter to consider**): Caio invited Peter to invite workshops and telecons, and share reports. (ongoing)

d. **WGCM**: Systematic errors: breakdown of cloud feedbacks (CF) (cf CFMIP study) can help gaining insights into high sensitivity components. Once key systematic errors are identified, these could form the basis of joint work between WGNE and WGCM (**R: co-chairs**). This recommendation can be taken forward in GASS as part of cloud error studies considered there, also DIMOSIC shows global systematic cloud errors and will be reported on at WGNE36. (**AI: Ron will talk to Linus**). (Closed)

14. **PPP/YOPP/MOSAIC**: Consider using high resolution sea-ice models to explore parameterization of sea-ice (leads, etc) at coarser resolution e.g. for climate models (**R: Thomas and Gunilla**). Closed.

15. **DAOS: Potential areas for collaboration**:
    a. Coupled initialization – Agreed would be a good joint project between WGNE, DAOS and OMDP. Next step is to set up a meeting between interested people from the three groups. Daryl recommended Andy Moore from DAOS, Baylor and others from OMDP (**AI: Tim Graham as WGNE rep**): An initial scoping meeting was held in February to gather ideas for a collaborative project on this with talks from each of the groups (WGNE, DAOS, OMDP). Thanks to Oscar for the WGNE talk. A summary of the meeting with possible ideas to take forward is now on the WGNE website under ongoing activities. I have a follow up meeting with Baylor Fox-Kemper, Andy Moore and possibly Oscar & Julie Deshayes to see if we can develop these ideas. If there are any significant developments I'll let you know before the WGNE telecon. Closed
    b. Use of DA for activities outside of creating initial conditions – Agreed next step is for WGNE to conduct a review of current activities in this area, to be presented at WGNE36 and a future activity with DAOS discussed there. (**AI: Reynolds with DAOS**): ongoing.
    c. Including evaluation, defining boundaries, of AI/ML methodology including TL/AD emulators. (**R: Daryl to consider this for part of their DA workshop. Could be a topic for WGNE error workshop in 2022**): AI approaches are included in the methodology topic for the DA/reanalysis meeting 13-18 Sept. 2021 Bonn, Germany and will also be considered at the WGNE error workshop. Closed.

16. **OMDP: Potential areas for collaboration:**
    a. Work on getting an OMDP member or ex-officio. Baylor said appropriate person would depend on what joint project we take forward (which may end up being coupled DA). Secretariat recommends we bring them on as official member (OMDP member or possibly ex-officio could become WGNE member) (**AI: Co-chairs**). Ongoing.
    b. High Performance Computing (hybrid GPUs, mixed precision) (**AI: Nils** will get input from Baylor or OMDP for next year's exascale overview). Ongoing.

17. **HIWeather connection**: possibly through very high-res nowcasting for Paris Olympics demonstration (2022 and 2024) and/or how to measure value of sub-km scale/urban forecasting. (**AI: Co-chairs** to invite presentation on this topic for WGNE36 and to remember to loop in GLASS - Kirsten Findell, Anne Verhoef - and GAW group focused on

urban modelling - GURME): Ariane provided update, WGNE could have separate telecon presentations on this. Ongoing.

18. **WGNE table** in re system configuration and provide Günter with contacts for centres without WGNE representation (**R: all members**): Günter recently sent out table for updates. He has found contacts from some centers not directly represented by WGNE membership but some are still missing. Ongoing.

19. **Projects final review**: consider some form of objective evaluation (**AI: co-chairs** to include as discussion topic at WGNE36). Ongoing.

20. **WGNE web site : (AI : Elena, all)**
    a. Check information is up to date on website on projects (MJO TF, model uncertainty, etc) : Information on MJO TF, model uncertainty project, ocean initialization project and aerosol project was updated (thanks to Daehyun and Charlotte, Hannah, Tim, and Ariane). Information on drag project updates is necessary. Ongoing.
    b. Update « Upgrades of NWP systems » web page: Information from WGNE members is necessary. Information for 2020-2021 is available now for ECMWF, JMA, DWD and RHMC. Ongoing.

21. **Meetings**:
    a. **WGNE36**: Possible offer from NCAR to host the session in 2021 and from CPTEC 2022 (**AI: Mike and Peter to confirm NCAR to host in 2021**): NCAR has reserved a room for the week of 1-5 November. Closed.
    b. Systematic Error Workshop: offer from ECMWF to hold meeting on 31 Oct - 4th Nov 2022 (**AI: Nils**): Initial call is on the ECMWF web site events calendar. Looking for volunteers for the science steering committee. Closed.

22. **WGNE Membership :** continue expanding expertise to include wider Earth system modeling components (**AI: co-chairs**). Ongoing.

APPENDIX B: Report on HIW workshop by Ariane Frassoni:

Main Outcomes from the HIW Workshop and Seminars

- Multi-scale Hazard Forecast Task Team is open for new members with expertise in coupled-hazard modelling.

Multi-scale Forecasting of Weather-Related Hazards: this theme covers forecasting by coupled physical modelling systems including atmospheric physics and chemistry, ocean and the land surface, and covers modelling of floods, landslides, bushfires, pollution, etc.

Links with the project: GEWEX; S2S; WGNE; GAW/GURME

Goals: effective and successful forecasting and warning of high impact weather events on timescales of minutes to one hour

Key-research areas (WGNE interest): Coupled km-scale DA methods; km-scale hazard prediction (improved physical phenomena, as convective initiation, microphysics etc); coupled km-scale ensemble predictions; user-oriented post-processes products.

Model Development: Improved forecasts of High Impact Weather depend on model improvements both to extend predictive skill of synoptic scale environments associated with high impact weather and to provide more precise and accurate small scale detail.

Talks of WGNE interest highlighted research on ensemble nowcasting and forecasting, Multi-scale Forecasting of Weather-Related Hazards and Convective-scale hazard prediction and predictability

Challenges

- improve forecast systems (links to WGNE);
    - For example, the **Convective-scale hazard prediction and predictability** research theme: talk from NCAR mentioned High-impact weather prediction is skillful on the mesoscale when strong synoptic forcing leads downscale drivers for convection; as errors grow rapidly, more skill is observed in the early stages of evolution of convection.
- more computing power for higher resolutions;
- exchange of model data is useful→better understanding of systematic errors across models = model diversity;
- AI → challenge is to optimize predictors for hi-impact events.

Novel datasets

- Observations of water vapor MPDs – Weckwerth et al, NCAR: assimilating MPD* improves short-term forecasts of convective initiation (attributed to the correction of elevated moisture air ahead of MCS, which is possible due to the frequent updates of MPD water vapor profiles dataset in higher vertical res), evolution and precipitation of MCS studied; MPD data assimilation increases precipitation forecasts in almost all thresholds evaluated.

MPD: MicroPulse Water Vapor Differential Absorption Lidar (WV-DIAL), capable of measuring water vapor in the lower troposphere with the appropriate vertical range, resolution, and measurement time needed for monitoring, verification, and data assimilation.

- Crowdsourcing: under development in DWD: several weather parameters reported. Plans to incorporate Crowdsourcing on the DA chain for Nowcasting, Verification and ML (post-processing for impact database) research and development chain; in France and Canada similar systems have been used combined with official observations.

General comment: ML is a technique mentioned in almost all sections and talks. HIW might be interested in the ML review provided by WGNE.

Appendix C: Report on RDP Paris 2024 Olympics by Ariane Frassoni

- The strategic objective of the Research Demonstration Project (RDP) is to focus on the Olympic Games of Paris in 2024 in order to advance meteorological research on the theme of the "future Weather Forecasting systems at 100m (or finer) resolution for urban areas". Such systems would point to the NWP at the horizon 2030.
- The team is composed of many partners, among them meteorological services and universities of many countries.
- The RDP is endorsed by the WWRP and supported by the GURME (the GAW Urban Research Meteorology and Environment) project.

The objective of the meeting was to present the already planned instrumentation and goals for the atmospheric experimental campaign that will take place in Paris in Summer 2022, and to discuss what involvement and additional measurements the RDP partners may be interested to add for the campaign.funded by

Of WGNE interest is the Urbisphere project, funded by the European Research Council. The Co-PIs are Andreas Christen (univ freiburg) and Sue Grimmond (univ. Reading).

The goals include:

1) to understand regional scale effects of cities on the climate system

2) to develop a simplified urban surface representation in regional to global models (including urban physics, chemistry and urban transformation).

The project has close collaboration with (thanks to William Morrison for the information provided):

- Met Office: intend to use/develop/evaluate the 100 – 300 m grid length versions of the UM https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/qj.3519
- ECMWF, who are looking to increase the resolution of their 7 km model - they are collaborating on observations and detailed modelling particularly with RT schemes http://www.met.reading.ac.uk/clouds/spartacus/, http://www.met.reading.ac.uk/~swrhgnrj/publications/urban_rad.pdf

Ubisphere will incorporate new agent-based modelling techniques (that include behavioural characteristics of urban residents) to compute anthropogenic heat fluxes. The focus cities

are Berlin, Paris, London, Bristol - this effort will provide improvements in parameterizations for regional and global models.

APPENDIX D: Updates on Aerosol project: Ariane Frassoni

We were invited to give a talk on the Webinar on atmospheric composition organized by the S2S steering group. The talk focused on the presentation of the project protocol.

- **Angela Benedetti** (ECMWF) gave a talk on the impact of aerosols at the S2S scale in the ECMWF model
    - Recent work has shown that the atmospheric constituents such as aerosols, ozone and other trace gases can be important modulators of the radiative processes at the S2S scale. In their paper published in 2018, they discussed the role of the direct effect of aerosols that may influence predictability via the MJO modulation of the aerosol fields.
- **Donifan Barahona** (NASA) gave a talk on the Aerosol-cloud interactions in the NASA GEOS S2S prediction system. NASA has been developing the representation of direct and indirect effects of aerosols.
    - Among the participating modelling systems, NASA has the most complex model in terms of aerosol effects representation.
    - Aerosols interact with radiation, stratiform and convective cloud evolution, and ice cloud formation.
    - Donifan performed experiments removing the direct and indirect effects from GEOS-S2S to understand their effect on the forecast skill. Preliminary analyses demonstrate that they have a significant effect on the regulation of aerosol concentration and may impact precipitation forecast on subseasonal and seasonal timescales.
    - It is likely that aerosol concentrations are regulated by the feedback between aerosol scavenging and droplet activation. Hence ACI and ARI may be required for their correct representation in forecasting systems.
- **Georg Grell** (NOAA) gave a talk on the plans for Sub-seasonal Forecasting and preliminary results of the Impact of Aerosols on Regional Forecasting
    - The regional experiment covered the 1-30 September 2020 wildfire period: evaluating the impact of aerosols on weather (and AQ) prediction with RAP-Chem
    - Changes in temperature and atmospheric structure were observed when the direct effect on radiation is included

Updates:

- Model verification:
    - The assessment of regional NWP forecasts is progressing.
    - We have preliminary results for South America for near-surface variables.
    - We have been performing model verification taking into account the South American synoptic and regional network database.

- In terms of RMSE mean over the South American domain, for example, results indicate improvement in near-surface temperature in both CPTEC and ECMWF models.
- Model data: ECMWF and the Institute of Athens* and provided model data

Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing (IAASARS) / National Observatory Athens (NOA)