

Working group Discussions

International Multi-model Efforts And Collaborations

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- How can we encourage the development of more commonly agreed metrics and diagnostics to evaluate and compare model performance, in line with what has been done with the MJO? (e.g. Taylor diagram as for seasonal)

An example non-exhaustive list for illustrative purposes – to be more comprehensively developed through the recommendations below.

Science/Research Focus – Items that have value for forecast verification and science but not so much a user application

- MJO and BSISO – e.g. WH Index, adding more location/intensity discrimination
- Air-sea interaction e.g. Subseasonal SST Variability
- PNA, NAO, Blocking, etc – modes of variability & their frequency/likelihood
- Teleconnection – e.g. MJO-NAO, MJO-SSW, including impacts on T, Prec
- Stratospheric Warming/Vortex Index, SSW and surface T

Science/Research + Application Focus - Items that have value for forecast verification and science and also would have potential use by applications communities.

- Sea Ice Cover
- Snow Cover
- Soil Moisture
- Drought Indices e.g. SPI, EDI
- Cold and Warm extremes in Temp; deg-Day anomalies
- Extreme Precip Indices
- Extreme Wind Indices
- TC frequency
- Monsoon Onset/Break
- Ocean wave state

Recommendations – with intention to connect the “Research Issues and Modelling Issues” Boxes on the S2S Architecture Graphic

- Subseasonal Metrics/Diagnostics Task Team (SMDTT) to identify a set of subseasonal performance metrics for measuring model performance and providing applications utility. Leverage the Verification S2S Subproject; lessons learned from WGSIP; JAWGR. Could be a joint TT between S2S and NMME-subseasonal. *Possibly under the purview of WGNE.* For developing process-oriented diagnostics, suggest drawing on the disciplinary based groups and asking for them to develop/recommend (e.g. MJO TF and Teleconnection S2S Subprojects; GEWEX GLASS; Monsoon S2S Subproject/CLIVAR; Extreme Weather S2S Project; PPP)
- Ensure codes associated with metrics/diagnostics are developed and documented for ready uptake by the research community (e.g. MJO Diagnostics); possibly leverage crowd-source/open-source capability (e.g. GitHub) for archive/dissemination.

➤ **How could we harmonize the studies using S2S data/NMME/CBS?**

- Near-term teleconference(s) between NMME Core Team, S2S Project Co-Chairs and S2S Verification Project leads, and CBS leads (M. Delay, K. Koli, J.P. Ceron) and the representatives from the Secretariat (TBS – P. Ruti).
- Joint workshop(s). Leverage the International CLIVAR September 2016 meeting in Qingdao (POC – A. Kumar), or others, joint AGU, EGU, AMS, ASCE sessions.
- Utilize the Subseasonal Metrics/Diagnostics Task Team (SMDTT) recommended above. Leverage the proposed (team selections Sp'16) NOAA MAPP Task Force on S2S, that includes a charge to coordinate with S2S Project; Leverage S2S Subprojects, in particular the Verification Subproject; Leverage WMO/CBS CCI Expert Team OPSLS – subseasonal to longer time scale.

- What coordinated experimentation should we encourage? (resolution or process oriented, coupling, data assimilation...)?
- Coordinate on planned cases studies from S2S Extremes Subproject and the desire to do case studies by NMME Subseasonal activity. This may also include S2S Teleconnections (e.g. YofT) and MJO Subprojects (e.g. YMC).
 - Coordinate as yet undefined activities related to model and forecast sensitivity studies between NMME and S2S. May want to leverage WGNE to help encourage operational forecast centers to participate.
 - Consider how to leverage WGSIP plans to perform snow sensitivity experiments for subseasonal to seasonal forecast impact (SNOWGLACE) possibly leverage NOAA MAPP selections that may include similar experimentation.
 - Coordinate/leverage Polar Project Prediction's Forecast/Hindcast Experimentation plans for YOPP mid 2017- mid 2019 with S2S and NMME activities (POC: Matthieu Chevalier).
 - Consider coordination / leveraging of S2S and NMME for Year of Maritime Continent field campaign for validation, forecast guidance, process evaluation.
 - Where possible, develop coordinated experimentation that leverages YOPP, YMC and S2S in the area of coupled data assimilation, resolution dependencies, etc.

➤ How could we increase the links between research and operational prediction centers?

- (Operations to Research) Make effort to infuse S2S/NMME products into coordinated research activities (e.g. SPARC/SNAP, GODAE, GEWEX, MJOTF, Sea Ice Prediction Network/C. Bitz). Rely on attending relevant meetings and targeted email by S2S/NMME chair(s)/steering groups and WCRP leadership.
- Hold targeted Research to Operations Workshops – joint with and/or at operational research centers (e.g. 2016 NOAA Climate Diagnostics and Prediction Workshop).
- Encourage region/country specific targeted research/experimental products that could feed into wider operational capabilities (e.g. cultivate collaborations between a local met service and a global operational center).

- Does the multi-model approach add value at subseasonal time scale (widely demonstrated for seasonal forecasting but not for TIGGE)?
- A central objective of NMME-Subseasonal activity (relevant to research and operational considerations).
 - Lead Center – Long Range Forecast MME (LC-LRFMME; KMA) expected to address elements of this question for S2, with current plans for this including a subset of S2S models. (mainly relevant to operational considerations).
 - For S2S, MME research is in the scope of the Verification Subproject (mainly relevant to research considerations).
 - MME research will be undertaken by the European Commission Joint Research Center for drought forecasting.
 - Above MME activities could utilize the performance metrics developed above to establish threshold capabilities for individual models, and then combine the higher fidelity models to explore potential increases in skill in a MME context.
 - Leverage lessons learned from the seasonal prediction community (e.g. NMME, APCC) as well as the calibration expertise from the weather forecast community.

➤ How to improve the visibility of sub-seasonal prediction with the funding agencies?

- In US:
 - Ready exposure will occur through the upcoming release of the 2015 National Academy Study on Setting the US Research Agenda on S2S.
 - US CLIVAR is the natural vehicle to raise visibility with the main funding agencies, namely through their 3 panels, especially the Predictability, Prediction, Applications Interface (PPAI).
 - Within NOAA, work with the NOAA MAPP S2S Task Force
- In Canada:
 - May be able to leverage the NOAA-funded NMME Task Force (namely H. Lin).
- In Europe:
 - Work with Horizon 2020 and Copernicus interacting with European Commission to promote the future applied research solicitations and services based on S2S Project forecast information.
- In Korea:
 - Efforts underway to establish and obtain funding a Korea S2S Working group, including KMA and university participants. It may be useful for to get a letter of support from WMO signed by the S2S Project co-chairs. *This may be relevant to other in-country efforts.*
- *Other countries/regions that could be queried for their participation and whether they need assistance in obtaining funding support.*
 - *India via their National Monsoon Mission (inquire R. Krishnan and Rajeevan/IITM).*
 - *Australia ... (inquire with H. Hendon).*
 - *APCC ... (inquire with Hej Kim – lead of research and development, J. Lee – lead of external affairs)*

- More generally, utilize the outcomes from the exemplar cases of S2S success to raise awareness with international development agencies (e.g. USAID, WFP, Development Banks).
 - *Middle East ... Islamic Development Bank may be a vehicle to obtain funding support for participation/development by national meteorological, hydrologic and environmental service organizations.*
 - *Similarly for Asian, Latin America, Africa... Development Banks.*

For this conversation, it is helpful to keep in mind how/where we want to expand or extend S2S Project / NMME (e.g. what parts of the recommendations enclosed here or from other discussion groups will be difficult without (more) funding support?)

- Conducting sensitivity experiments (e.g. resolution, initialization, ensemble characteristics, coupling).
- Forecast product development for applications.
- Target specific asks for support to specific sponsors, building on exemplar cases for societal benefits from subseasonal predictions.
- Support for graduate student research projects and involvement and training workshops.
- Support for field campaigns relevant to S2S research objectives.

➤ What is the communication strategy to raise the profile of S2S operational prediction products/capabilities with services and the application community?

- Key to this strategy is the development of exemplar cases illustrating the capabilities and successes of S2S prediction, particularly those that address the GFCS priorities.
- Identify sector specific (e.g. agriculture, water management, energy, health, disaster response) workshop/conferences to present S2S activities/capabilities (e.g. WMO Commissions, International Committee on Irrigation Drainage Conference).
- Utilize “intermediaries” such as Red Cross, World Food Program, USAID, DFID, NASA SEVIR, RIMES, FAO, etc to convey the utility of S2S products in the context of the services they provide.
- Attend sector-specific and intermediary organization meetings and prepare targeted material, co-developed demonstration projects, training programs (e.g. ICTP) – possibly leveraging GFCS funding/support, including plans for S2S side event at WMO Executive Council, potential pitch to European Commission, look to leverage outcomes and momentum from upcoming release of US NAS study on S2S Research Agenda, etc.
- Expose research community results and experimental products (particularly well tailored and high profile exemplars) to WMO’s GFCS – possibly leveraging WMO’s regional climate outlook forum (RCOF).