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Sub-seasonal to Seasonal Prediction Project (S2S) Report

1. Highlights for JSC

- The S2S Phase 1 report has been published by WMO. Printed copies will be prepared for EC 70 in June.

- A major achievement of S2S has been the creation of the S2S database of sub-seasonal forecasts (3 weeks behind real time) and re-forecasts, archived at ECMWF and CMA, and later on in the IRI Data Library.

- Six S2S sub-projects were established to coordinate research and to foster development of a global S2S climate & weather research community: Extremes, Teleconnections, Madden-Julian Oscillation, Monsoons, Verification and Africa.

- A series of case studies has been carried out as part of the sub-project on extremes. The science findings are rapidly evolving, with the database launched only two years ago. To date, 25 articles have been published that use the S2S database.

- For example, evidence from the S2S database forecast ensembles suggests that the severe flooding event that afflicted eastern Canada in May 2017 was at least in part attributable to a strong MJO event propagating into the western Pacific. This (and analogous findings from other case studies) has important implications for extreme event attribution studies.

- The skill of MJO forecasts in 7 of 10 S2S models exceeds a bivariate correlation skill of 0.5 at 20-day lead, while only one model reaches that level after 30 days. MJO teleconnections over the North Atlantic are of realistic sign, but too weak in all the models. MJO skill is enhanced by up to a week during the easterly phase of the stratospheric QBO in several S2S models, demonstrating a cross-timescale interaction that climate models need to capture.

- The S2S project has fostered S2S research by organizing/co-organizing 18 science workshops/sessions in the project's first 4 years, together with 8 training courses.

- Several regional S2S research activities have been established, including a major NOAA initiative in the US.

- S2S has increased the coordination among operational centres. All 11 now issue forecasts on Thursdays (including the 4 models with daily starts), facilitating multi-model ensemble forecasts. The WMO Lead Center began a pilot real-time sub-seasonal MME prediction system for its members, enabled by access the S2S database without the 3-week delay placed on public access.

- A draft report on S2S forecast use for applications, potential benefits and developments needs was prepared by the WWRP's Working Group on Societal and Economic Research Applications. (Please include, if you consider appropriate, major science achievement for the JSC's attention.)

2. Early success and/or planned activities in 2018/2019

A proposal for Phase II of S2S (Nov 2018 – Nov 2023) has been prepared and endorsed by the WCRP JSC and WWRP SC, with the following core activities:

- S2S Database enhancement, including more surface variables 4xdaily, the ocean variables listed in the original S2S plan, and additional models, e.g. Indian Meteorological Department.

- New Research sub-projects: MJO Prediction and Teleconnections, and links with weather extremes; Land Initialization and Configuration, including impacts of the observing system & land-atmosphere coupling; Ocean and Sea Ice Initialization and Configuration, including role of ocean-atmosphere coupling and predictability of sub-seasonal marine variability (eg relevant to fisheries & coral bleaching); Ensemble Generation, including studying impact of burst and lagged ensemble & relative importance of random and systematic errors on forecast spread, and potential benefits of stochastic parameterization; Atmospheric Composition, including impact prognostic aerosols on S2S forecasts; and Stratosphere, including role of vertical coupling, stratospheric systematic errors and impact of quality of stratospheric initial conditions.

- Enhancing operational infrastructure and user Applications. A major component of the Phase II will be devoted to this goal, recognizing that, while much progress has been made, there is much to be done in order to translate progress in modeling understanding of predictability into useful forecast information.

3. Issues and challenges

How do you work with CPs, GCs and other major WCRP groups?

- S2S is closely related to WGSIP activities, with existing collaboration on tropical-extratropical teleconnections, impact of snow initialisation on subseasonal-to-seasonal forecasts (SNOWGLACE), and analysis of initial transients and model drift [Long-Range Forecast Transient Intercomparison Project (LRFTIP)]

- S2S and WGSIP are also related through the WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble (LC-LRFMME), which is expanding from seasonal to include the subseasonal scale.

- S2S is also closely related to SPARC, with SERC/SNAP taking the lead on analyzing the stratospheric processes in the S2S models.

- S2S and WGNE/MJO-TF are also closely related through common activities around the prediction of the Madden Julian Oscillation and its teleconnections.

- There is increasing interest in S2S from the WMO's Regional Climate Outlook Forums (RCOFs).
- There is mutual interest in more interaction between S2S and the WCRP GC on Extremes which should be expanded

How you see your community evolving?

- The S2S has grown rapidly over the last 5 years, helped by the availability of new forecast databases (S2S, NOAA SubX) that complement existing ones (TIGGE for weather forecasts, NMME and CHFP for seasonal forecasts, and CMIP), to provide a much more complete set of model archives across temporal scales. There is a need to make access across these easier to both the research and applications-development communities, as well as to provide forecasts in real time where possible. The S2S mailing list, maintained by the S2S International Coordination Office at KMA, is growing and currently has over 300 subscribers.

How the current funding affects your community, your activities, your service Etc?

- The S2S database has huge community benefits but currently has no WCRP/WWRP/WMO funding. ECMWF is facing difficulties with sustaining it. IRI has made a large fraction of the S2S database available through the IRI Data Library which provides a more convenient access point for the climate and applications and developing counties communities, but its sustainability is threatened without external funding.

- Support from WCRP for our meetings goes a long way to making the project work. More support/collaboration across WCRP would be highly beneficial, including for the Phase II real-time forecast demonstration project.

- The pan-WCRP modeling meeting in Exeter in 2017 was very valuable and making such meetings a priority for support in the future would be helpful

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