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JSC-42
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FINAL

Grand Challenge on Near Term Climate Prediction

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1. Highlights for JSC

- We have now met our original objectives to operationalise decadal prediction with WMO:
  - White paper, Kushnir et al., Nature C.C., 2019
  - WMO operational predictions, GPCs and Lead Centre
  - Global Annual to Decadal Climate Update issued

2. Future of the GC

- Now documenting applications of decadal prediction
- Finish at end of 2021
- We think RIFS could take forward the regional use of decadal predictions using WMO Lead Centre and CMIP6 data

3. Advice from or questions to the JSC

- We highlight the ongoing signal to noise paradox in predictions and invite suggestions for avenues to tackle this problem
- We ask the JSC to consider how to increase use of regional decadal prediction information, e.g. through the RIFS group
- We invite members of the JSC to make us aware of further applications of decadal

Summary

The Grand Challenge on Near Term Climate Prediction has now met its original objectives: to document the state of play of decadal predictions and the necessary next developments in the peer reviewed literature, to operationalize decadal predictions with WMO and to create an annual summary of real time multimodel forecasts. Brief details of each are given below along with future recommendations. In our final year we are focusing on documenting the current applications of decadal predictions across different sectorial users.

'White paper' on Decadal Prediction

We issued our plans and a summary of the state of play of decadal predictions in an article in Nature Climate Change by Kushnir et al., 2019. The paper highlighted the state of play, sources of predictability, current outstanding issues and the need for operational real-time predictions.

Operational Decadal Predictions

Through close and careful working with other areas of WMO, for example the Expert Teams in what was previously the Commission for Basic Systems, and by liaising with national meteorological and hydrological services and decadal predictions experts worldwide, we have succeeded in establishing the formal basis for operational decadal predictions. These are now written into the WMO Global Data Processing and Forecasting System manual, where the requirements of Global Producing Centres (GPCs) for annual to decadal predictions and the responsibility of a WMO Lead Centre for Annual to Decadal Prediction are set out. This required many iterations and discussions across a broad range of WMO groups and took several years to achieve but we now have a number of designated WMO GPCs and an operating Lead Centre: www.wmolc-adcp.org

A Global Annual to Decadal Climate Update (GADCU)

We have also established produced and released an annual summary of the latest decadal predictions. These are produced by the WMO Lead Centre and are based on real time multimodel predictions from around 10 GPCs and non-designated contributing centres. The GADCU is issued with WMO each year and provides the latest consensus outlook for the coming years. Products are based on diagnostics and the initialized decadal climate predictions available at the WMO Lead Centre.

Outstanding issues and Recommendations

The production of real time decadal forecasts is now a routine activity for many centres and is acknowledged by WMO as such. However, the use of regional information from these real time forecasts, based on demonstrations from CMIP decadal hindcasts is far from optimal. We therefore recommend that WCRP takes this activity forward by making good use of the regional information available in real time decadal predictions through the Regional Information for Society (RIfS) Core Project.

Our second recommendation relates to the outstanding 'Signal to Noise Paradox', whereby decadal predictions (along with seasonal and subseasonal predictions) in certain regions are better able to predict the real world than they are able to predict their own ensemble members. This problem prevents the application of raw forecast information and necessitates the use of very large ensembles to generate skilful forecasts. It has also now been shown to apply to uninitialized climate simulations produced under CMIP. We suggest that this is an important research topic that urgently needs resolving in order to provide reliable climate information, especially in and around the Atlantic sector and could be taken forward in the lighthouse activity on prediction and attribution.