

Interannual to decadal climate prediction and services

Dr Nick Dunstone

FOCRA-II 9th May 2022



www.metoffice.gov.uk







Interannual to decadal prediction timescale



Interannual to decadal timescale is 1-10 years ahead – an important planning timescale

Beyond the seasonal prediction timescale of ~6 months

Increased attention now been given to research on the interannual timescale (years 1-2) in order to give early warning of extremes

Decadal prediction timescale has been subject of CMIP5&6 co-ordinated multimodel retrospective forecasts and is now an official WMO activity (ADCP).



Interannual predictions



- Two 40 member ensembles (Met Office DP3 & NCAR DPLE)
- 1st November starts, 1959-2017



- Significant seasonal ENSO skill (r>0.5) out to second winter (forecast months 14-16)
- Advantage from combining systems





- Skill for boreal summer monsoon rainfall at 6 month lead time (MJJAS)
- Flow dependent higher skill when active ENSO event is forecast (red)

Dunstone et al 2020

https://doi.org/10.1088/1748-9326/ab9f7d



Extended lead-time Yangtze rainfall climate service

(mm/day)

Precipitati

- Current Yangtze rainfall service has lead time of up to 3 months using East Asian Summer Monsoon (EASM) index
- Using DePreSys3, we have found good skill (r>0.6) for EASM forecasts for MJJ, from November: 6 month lead time
- This leads to the potential for skillful forecasts of MJJ Yangtze Basin rainfall from November (r>0.5)
- Provides potential for early flood warnings



Bett, Dunstone et al. (in prep)





WMO operational decadal predictions

WMO Lead Centre for Annual-to-Decadal Climate Prediction

The Met Office is a designated Lead Centre for Annual-to-Decadal Climate Prediction (LC-ADCP). The LC-ADCP collects and provides hindcasts, forecasts and verification data from a number contributing centres worldwide.





Plots available:

- maps, e.g.:
 - temp, precip, SLP
- timeseries, e.g.:
 - Global T, AMV, PDV, AMOC

New for 2022:

- multi-year seasonal, e.g.:
 - Year 1-5, May-Sep.

WMO operational decadal predictions





Global Producing Centres



LASG MRI Reading BCCR DMI MIROC NCAR SMH SMHI CERFACS GFDL NCAR Cmcc IPSL MPI NRL CMCC

Web site: http://www.wmolc-adcp.org

Lead centre: Met Office

International effort

Annually updated - tomorrow!



North Atlantic Oscillation (NAO) prediction and Eurasian winter surface impacts

NAO shown to be skilful on seasonal, interannual and decadal timescales:





Agriculture prototype decadal service



Barcelona Supercomputing Center Centro Nacional de Supercomputació







- Recent EU funded project to work with users to codevelop 4 prototype decadal climate services
- This example is for agriculture sector: decadal predictions of global wheat production
- Need to tailor forecast for each region according to local harvest month
- Standardized Precipitation Evapotranspiration Index (SPEI) is calculated over preceding 6 months growing season

Four prototype decadal climate services available to view at:

https://climate.copernicus.eu/sectoral-applications-decadal-predictions

Solaraju-Murali et al 2021 (NPJ) Dunstone et al 2022 (BAMS)





Conclusions

- There is growing interest and increasing capability for making skilful interannual to decadal climate predictions, beyond the seasonal timescale
- CMIP5/6 co-ordinated decadal prediction experiments (DCPP MIP) have led to establishment of the WMO annual-to-decadal operational activity
- Useful interannual to decadal climate services are beginning to be developed
- A future co-ordinated multi-model experiment on interannual prediction could be useful... [e.g. high-resolution, multiple start dates (e.g. 1st May, 1st November), 2-3 year forecasts, large ensembles (e.g. m>20), long hindcast period (e.g. 1980-present)]