

REQUEST FOR ADDITIONAL RESOURCES IN THE CURRENT YEAR FOR AN EXISTING SPECIAL PROJECT

MEMBER STATE: UK

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Project title: Seasonal forecasts of the 20th Century: Reliability, attribution and the impact of stochastic perturbations

Project account: SPGBAWSF

Additional computer resources requested for	Current Year
High Performance Computing Facility (units)	3,750,000
Data storage capacity (total) (Gbytes)	3500

¹The Principal Investigator is the contact person for this Special Project

This form is available at:

<http://www.ecmwf.int/en/computing/access-computing-facilities/forms>

Technical reasons and scientific justifications why additional resources are needed

We wish to extend the scope of the work included in this project to include investigations of the causes of the extreme winter of 2013/14. The weather in this winter had a large impact and was not well forecast by seasonal forecast systems, at ECMWF or elsewhere. Understanding the events of this winter is important for understanding whether seasonal forecasts are reliable at predicting extreme seasons like this, which is a key aim of this project.

Previous work has shown that the tropics had a key role in the development of the 2013/14 winter extremes [1]. We wish to examine the role of the tropics in more detail using experiments where different regions of the tropics are relaxed. The experimental method would be to do seasonal hindcasts using the IFS Cy41r1 at T255L60 resolution coupled to the 1 degree NEMO ocean model. We would do 28-member hindcasts beginning on 1 November 2013 and ending at the end of February 2014 with different regions of the tropics relaxed, and we would diagnose anomalies in these experiments with respect to climatologies computed as the mean of 2-member seasonal hindcasts for winters 1981/82 to 2012/13. It is necessary to compute a climatology separately for each relaxation region in order to be able to separate the influences of tropical anomalies in the 2013/14 winter and the influence of having relaxation [2]. Sensitivity tests using the experiments used in reference [1] indicate that obtaining robust results requires ensembles of this size. We would plan to use the same relaxation parameters as used in reference [2].

The regions to be relaxed would be the whole tropics (20S-20N), the tropical West Pacific (20S-20N, 120-180E), the central and eastern tropical Pacific (20S-20N, 180E-90W), the tropical Atlantic (20S-20N, 90W-20E) and the tropical Indian Ocean (20S-20N, 20-180E). These sectors are chosen to correspond to those indicated by previous work to have important teleconnections to the extratropics. Additionally, there would be an experiment done with no relaxation applied, to examine the seasonal forecast produced by the free-running model. There would therefore be 6 sets of experiments in total.

Tests show that the cost of a single 4-month seasonal hindcast is approximately 3,400 SBUs. Each set of 28-member 2013/14 hindcasts will therefore cost approximately $28 \times 3,400 = 95,000$ SBUs and each set of 2-member 1981/82-2012/13 hindcasts will cost about $2 \times 32 \times 3,400 = 220,000$ SBUs. The **total cost for the six sets of experiments** would therefore be about $6 \times (95,000 + 220,000) = 1,900,000$ SBUs.

Additionally, we would like to do **sensitivity tests** to test the sensitivity of the results to changing the relaxation strength and to changing the distance over which the relaxation strength is gradually tapered to zero near the edges of the relaxation region (which prevents large gradients in atmospheric fields being introduced). We would do this for the whole-tropics relaxation experiment and would test one stronger relaxation coefficient and both a larger and a smaller tapering distance, giving 3 extra experiments in total, costing $3 \times (95,000 + 220,000) = 950,000$ SBUs. Our previous work [1] also indicated that with regard to tropical West Pacific relaxation, there may be sensitivity to the northernmost latitude of the relaxation region – we would therefore like to do two extra experiments with relaxation between 120-180E and 20S-10N and 20S-30N in each case respectively, costing $2 \times (95,000 + 220,000) = 630,000$ SBUs.

The total estimated cost is therefore 3,500,000 SBUs. **We request 3,750,000 SBUs**, where the extra is to cover units required to do additional short tests to make sure that the experiments are working as they should.

References:

1. Watson, PAG, A Weisheimer, JR Knight, TN Palmer, 2015, "The role of the tropical West Pacific in the extreme northern hemisphere winter of 2013/14", J. Geophys. Res., under review.
2. Jung, T, T Palmer, M Rodwell, S Serrar, 2010, "Understanding the Anomalously Cold European Winter of 2005/06 Using Relaxation Experiments", Mon. Wea. Rev., 138, 3157-3174.