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Hydrology and Earth System Sciences Discussions

Interactive comment on "Spatially explicit seasonal forecasting using fuzzy spatiotemporal clustering of long-term daily rainfall and temperature data" *by* M. B. Plain et al.

M. B. Plain et al.

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- We believe what the reviewer pointing out is that the seasonal cycle is always easy to predict (as it is seasonal). What is more difficult to predict is the anomaly, or the deviation from the expected seasonal values (long term means). This means that our correlations would be inherently high (As most of the variation is explained by the seasonal cycle). We could start a discussion here about whether long term means are actually really valuable in Australian climate, but we will leave that for another forum.

What we can say is that particularly the seasonality of rainfall is not standard across the space that we have used for our forecasts. The southern part would experience a typical seasonal trend with more rainfall in winter, however the northern part is summer rain dominated, while the middle shows very little seasonality. Our model performs similarly across the whole space.

In addition our forecasts are aggregated up to a larger temporal scale, we are not predicting actual rainfall, but producing a seasonal forecast.

There is another reason why we chose to use real rainfall rather than anomalies. We envisioned that the use of this model was applied (as evidenced from the last section of our discussion) rather than theoretical. Rather than working with a physical model for forecasting we were using the inherent spatial and temporal statistics to come up with a forecast. This forecast was aimed to be useful for agricultural producers and natural resource managers. Thus we stuck with actual temperatures and rainfall. We have now included anomalies in Table 3 and the results indicate that the forecasting power of the model is similar for anomalies and real rainfall.

In summary, in this paper we are doing two things, one is to provide a new way of predicting seasonal cycle, second is to also account for both spatial and temporal anomalies in both predictive and forecasting mode.

- In Figure 1 we explain the flow of the methods used in this paper. We have simplified the figure to make the methods more clear. Basically Fuzzy classes were generated from the 40 years climate data from 75 stations, this predicts the existing spatial and temporal variation in rainfall and temperature. For forecasting we included lagged SOI and elevation together with the fuzzy membership were then used to forecast seasonal temperature and rainfall.

- The comparison between directly modeled rainfall and temperature without fuzzy classification is through the comparison with the RAINMAN predictions. Rainman is a transition probability based model including climatic drivers and also forecast the probability of exceeding a certain seasonal rainfall. This is the current standard. While we understand that anomalies are the norm in the research on seasonal predictions using climate models, part of this work was aimed at the model being useful at an applied

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level (agricultural producers, natural resource managers). We have made this clearer in the text to highlight these differences. In addition we have indicated the predicted anomalies in Table 3 as well as the actual rainfall. However there is little difference in terms of the comparison between the models.

- This comment is a part of the core of our assumptions. What we mean is that people often remark how a past season resembles (or not resembles) some other season: This summer was just as hot as the summer of 1957. Similarly, people remark about how a season is similar to another place or time: This is just like when we were in X in the winter of 1967. Basically it argues that there are similarities in weather and seasonal trends across a continent and in time due to climatic drivers, levels of atmospheric feedback, elevations and proximity to oceans. This is discussed in the introduction line 12 – 23 p 162

- Yes, daily temperature and precipitation were aggregated to weekly min. temperature, max. temperature, and total rainfall. In the end we only considered maximum temperature, as minimum and maximum temperature tend to be highly correlated. However, we agree with the reviewer that an extension of this project would also consider minimum temperature as the gap between maxima and minima seems to be widening in Australia, particularly during droughts (Nicholls 2004)

Nicholls, N. 2004. The Changing Nature of Australian Droughts. Climatic change 63:323-336.

- Because our data coverage did not include southern Victoria

- The split data set was only used for the validation of the regression rules model. The forecasting involved all stations as we are now forecasting, so all predictions are new

- The dataset used in the modelling is set up as follows: Each row contains weekly rainfall and temperature data for 6 months, the final 6 month data matrix contained 77 columns and 75,285 rows and the 1 year matrix contained 149 columns and 37,273

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rows. Even using k-means algorithm, this will take hours to complete a number of cluster. The fuzzy k-means, rather than straight k-means takes a significantly longer time as we are utilizing the Mahalanobis distance, and the distance matrix, memberships, and centroids needs to be recalculated at each iteration. See equations (2), (3) and (4)

- We have fixed this part, and explain Rainman more explicitly. Table 3 now shows the median along with its 10 and 90 percentiles prediction. We also show the prediction along with anomalies.

- We have inserted the full description of these parameters

- We have changed the text to make this more clear what we mean. We meant to say that our approach sits in between those other two scales and can be seen as an alternative to downscaled GCM’s

- All technical issues have been fixed.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 1159, 2008.

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