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Predictability of onset of the West African monsoon in the Met Office's seasonal forecasting system GloSea4

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The West African monsoon has, over the years, proven to be difficult to model realistically in global coupled models. We show that the current operational seasonal forecasting system of the UK Met Office, GloSea4, has a much improved representation of monsoon rainfall over West Africa. In hindcasts initialised between April-June and run out for 7 months, the model is able to reproduce the various distinct stages of the monsoon that are seen in observations: a coastal phase in May and June, followed by onset of the Sahelian phase in July when rainfall maxima shift northward of 10N until September; and a secondary coastal rainfall maximum in October.

We explore the dynamics of monsoon onset in GloSea4 and compare it to that in reanalyses. An important difference is the change in the Saharan heat low around the time of onset (early July): in Glosea4 this change introduces moisture into the central Sahel whereas in the reanalyses this moisture gets diverted away towards the Sahara. The lack of observations in the Sahara makes it difficult to verify this process in GloSea4 and suggests that the reanalyses may not be strongly constrained by observations there.

Because timing of the monsoon onset has significant socio-economic importance for many countries in West Africa we explore onset predictability in GloSea4. We use tercile categories to calculate forecast probabilities for onset occurring well before, near and well after average. We find that probabilistic forecasts with GloSea4 for monsoon onset have modest skill at 2-3 months' lead time, with a ROC score of 0.6-0.8. This means the system can distinguish events from non-events 60-80% of the time (compared to 50% of the time that a system without any skill would achieve).