Multi-model ensemble forecasts in South Africa

Willem A. Landman
Cobus Olivier
Asmerom Beraki
Operational Forecast Skill
From CONSENSUS discussions

Verification work by Peggy Moatshe

SON ROC analysis

DJF ROC analysis

Expected Total Rainfall for the period
August-September-October 2008
New objective multi-model forecast

Assessment of Rainfall for April to June 2008

Old subjective consensus forecast

Expected Total Rainfall for the period April-May-June 2008
Figure 3. ROC scores, averaged over the southern African domain, for the above-normal and below-normal rainfall categories. Scores for the single models and for the two multi-models are shown.

Figure 5. Reliability diagrams and frequency histograms for above- and below-normal DJF rainfall forecasts produced by the single models. The thick black curves and black bars of the histogram represent the below-normal rainfall category, while the thick black dotted curves and white bars of the histogram represent the above-normal rainfall category. For perfect reliability the curves should fall on top of the thick black diagonal line. The thin solid and dotted lines are respectively the weighted least-squares regression lines of the above-normal and below-normal reliability curves.

Figure 6. As in Figure 5, but for the two multi-models.

Figure 7. ROC scores, averaged over the southern African domain, for the above-normal and below-normal rainfall categories during El Niño, La Niña and neutral seasons. Scores for the MMcca multi-model are shown.
Seasonal modelling efforts at the CSIR for operational forecast production are focussed towards
1. Multi-model sea-surface temperature (SST) forecast system development.
2. The development of the conformal-cubic atmospheric model (CCAM) as operational seasonal forecasting system.

Both the multi-model SST and the CCAM systems’ forecast output will be provided to SAWS for inclusion in their forecasting systems. The real-time predicted global SST fields of the CSIR will be used to force the ECHAM4.5 being run at SAWS for fulfilment of their role as Global Producing Centre for Long-Range Forecasting (GPC for LRF).

The CSIR will stop producing multi-model SADC forecasts, and multi-model streamflow forecasts for South Africa.

The multi-model-multi-institutional SADC and streamflow forecasts for South Africa will become the responsibility of SAWS, with additional partners such as UCT, JAMSTEC, IRI, UKMO, etc. also contributing to the products. The names of the contributing agencies will appear on the forecast maps. These multi-model forecasts will also be displayed on the website of the South African Risk and Vulnerability Atlas.

The institutions in South Africa currently running global models are encouraged to use the website of the Global Forecasting Centre for Southern Africa (GFCSA; www.gfcsa.net) to display their respective global model forecasts.
The multi-model seasonal rainfall and surface temperature forecasting system for SADC under development through ACCESS

Multi-model ensemble of $N_1+N_2+N_3+N_4+N_5+N_6+N_7+N_8+N_9$ members
The multi-model sea-surface temperature forecasting system under development through ACCESS

- Ensemble 1: COUPLED models at CSIR NRE, $N_1$ members
- Ensemble 2: CFS at NCEP, $N_2$ members
- Ensemble 3: ESM at CPTEC, $N_3$ members
- Ensemble 4: Two ECHAM4.5 CGCMs at IRI, $N_4$ members
- Ensemble 5: SINTEX-F at JAMSTEC, $N_5$ members
- Ensemble 6: Antecedent SSTs at CSIR NRE, $N_6$ members
- Ensemble 7: GloSEA4 at UK Met Office, $N_7$ members

Multi-model ensemble of $N_1 + N_2 + N_3 + N_4 + N_5 + N_6 + N_7$ members
Seasonal forecast examples: Issued Nov 2010
SADC forecast issued in August 2011
In summary

• The change from subjective “multi-model” forecasts to objective multi-model combination and verification is complete
  – SADC
  – Global SST, and for key ocean areas such as NINO3.4

• The multi-model forecasts for SADC has become the responsibility of SAWS
  – Local and international centres contribute