Downscaling ERA-Interim reanalysis of African climate variability for CORDEX

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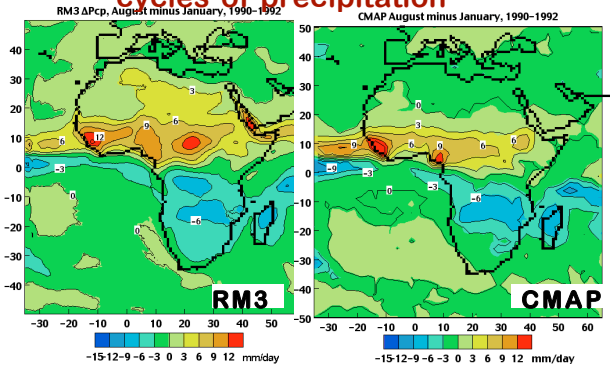
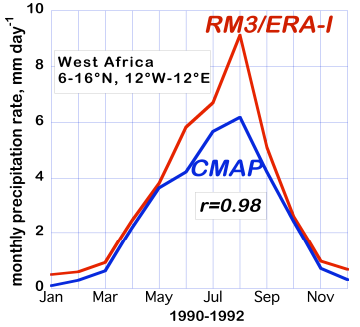
The RM3 is a primitive equation sigma coordinate atmospheric model, integrated at 28 vertical levels. For these simulations grid spacing is 0.44° and the domain covers all of Africa (see figures). Intitial conditions on Jan 1, 1989 and Nov 1, 1990 and 1991 are taken from the ERA-Interim reanalysis, gridded at 0.75° spacing. Lateral boundary conditions to drive the simulations are from the same ERA-I. Absence of adverse lateral boundary effects is probably attributable to the high resolution of ERA-I driving data.

Downscaling seasonal cycles of precipitation

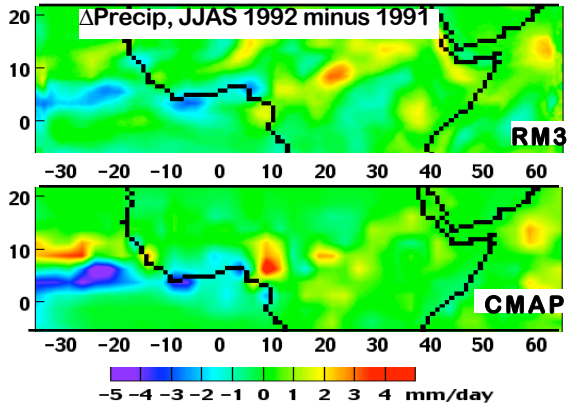


Migration of the tropical rain band from southern Africa in January to the Sahel in August is reflected in these August minus January precipitation (Δpcp) differences averaged over three consecutive years. RM3 regional model simulated precipitation is validated against CMAP observations, which blend satellite and rain gauge data. RM3 negative Δpcp (blue) match CMAP evidence quite well, indicating January maxima vacated by the northward migrating rain band. RM3 August rainfall gains over the Sahel are somewhat exaggerated, but the orographic maximum along the Guinean coast is realistic.

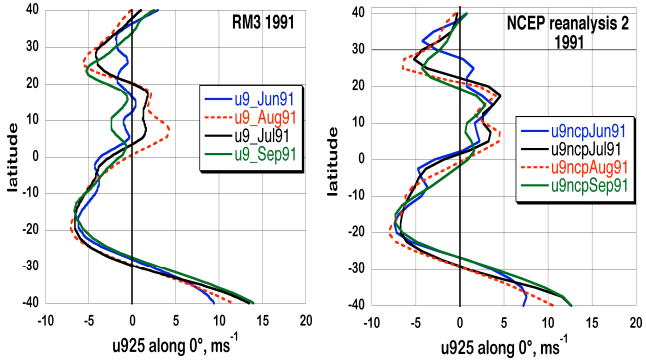
Time series of 3-year average monthly Sahel precipitation illustrates the skillful simulation of the seasonal cycle. The model's consistent summertime positive bias is highlighted by a 47% overestimate in August.



Downscaling interannual precipitation differences

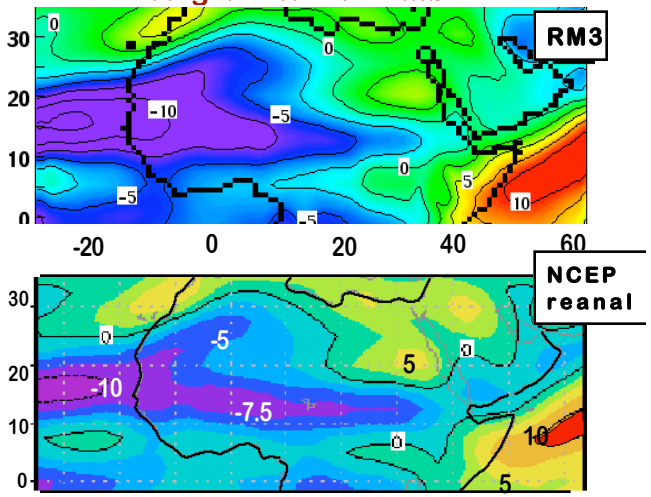


The ITCZ in JJAS 1992 was less rainy than in JJAS 1991, as evidenced by the observed (CMAP) negative differences along 5°N. RM3 simulations for 1991 and 1992 successfully capture this component of interannual variability, represented by the (blue) swath.



Above: N-S transect of near-surface winds along 0° shows that simulated monsoon westerlies between 0-20°N are realistic for July & August 1991, but are absent during June and September.

African Easterly Jet in Aug 1991: u 700 mb



The African Easterly Jet (AEJ), an important component of the West African monsoon system, reaches its most northerly latitude in August when the rain band also arrives at its northward extreme. This RM3 simulation of u at 700 mb features a realistic jet core along 15°N, as well as an appropriate Somali westerly jet over the Indian Ocean. The simulated AEJ core is realistically positioned along 10°N during June and September (not shown).

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