P3.7 Modeled moisture fluxes in the North American monsoon experiment region warm season

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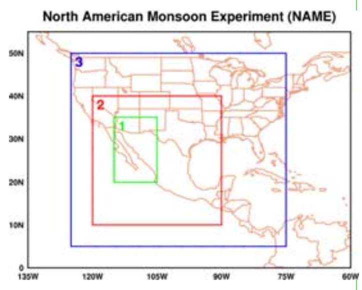
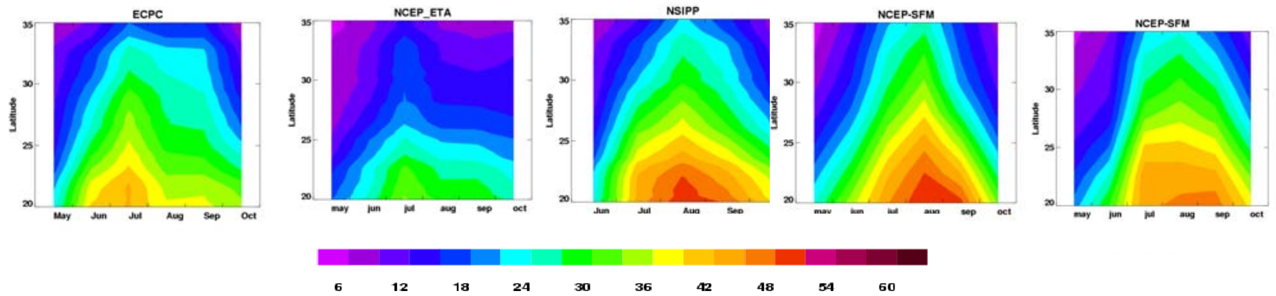
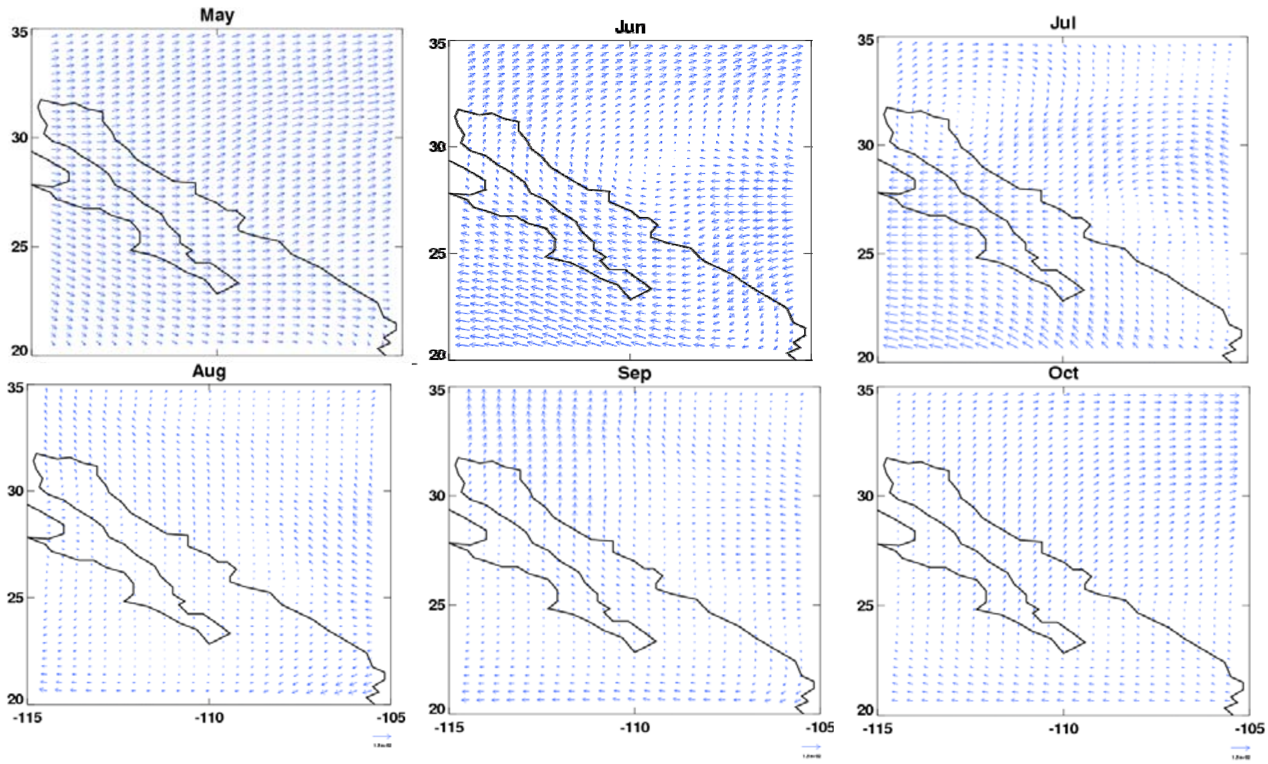
ABSTRACT. The study involves the modeling of moisture and moisture fluxes during the warm season over North America in general, and the North American Monsoon Experiment (NAME) region in particular. We already focused on results from the general circulation models in the second version of the Atmospheric Model Intercomparison Project (AMIP-2), where we found generally adequate simulation of the monsoon circulation system, where precipitation and moisture convergence in general advance from southern latitudes in the spring, achieve a nothernmost level in midsummer, and retreat in late summer/early autumn. The strength of this progression varies significantly in the AMIP-2 models, with important dependence on the land-surface characteristics, among other attributes. Here we also turn to the regional models to examine similar attributes of the monsoonal circulation. These higher resolution models, which have contributed to the NAME Model Assessment Project (NAMAP) have simulated one warm season. We can examine more clearly the moisture transport vectors and moisture divergences in that season with the regional models. Moisture flux patterns change significantly during the months constituting the monsoon season. In one such model, for example, early in the season, there is a build-up phase, in middle summer the mature phase of the monsoon with a gyre that includes the Gulf of California area, and the decay of the monsoon occurs in the autumn. Despite the general agreement in the seasonal cycle, differences exist between these models as well. There appears to be different amplitudes of the vertically integrated moisture transport vectors as well as their direction, sometimes significantly.



Three nested regions of NAME

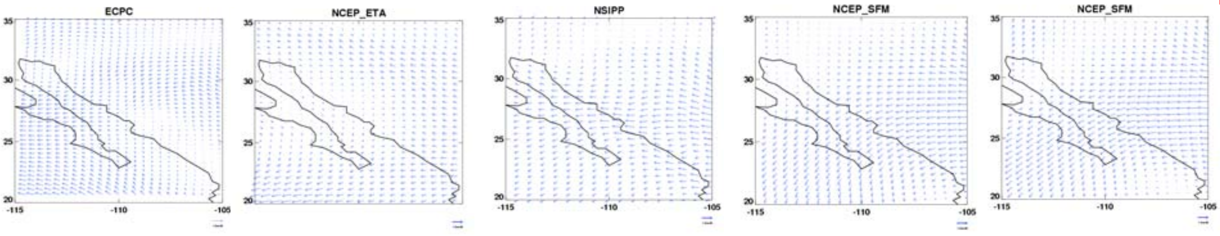


1. Integrated water vapor from models For the different during NAMAP we show the vertically integrated moisture, averaged over longitudes in the NAME-2 region. There is a significant difference among models; the NCEP-ETA model, for example has particularly low. Two of the NCEP-SFM ensemble members are also given.



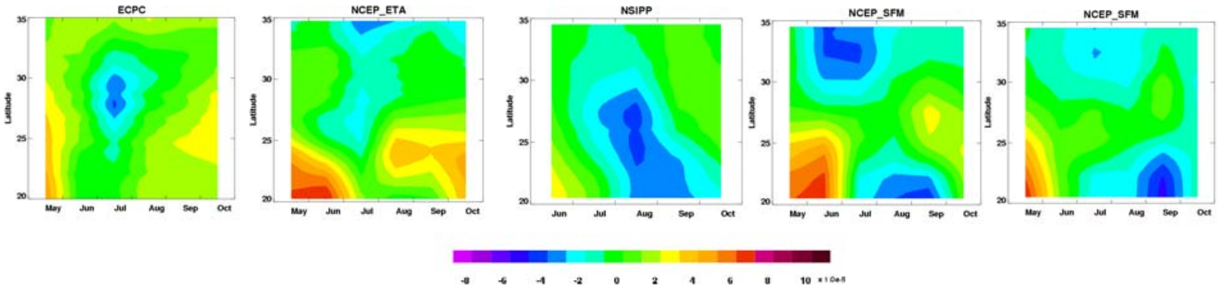
2. Moisture fluxes from May-Oct 1990

For the NAMAP period we show the map of vertically integrated moisture fluxes for each month from the ECPC model. Here we see the progression during the summer moist period. Moisture transport directions change, for example between early in the season (May) and the midseason (July).



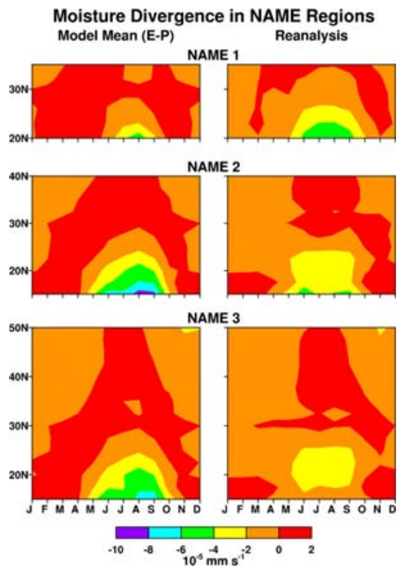
3. July moisture fluxes from 5 models in NAMAP

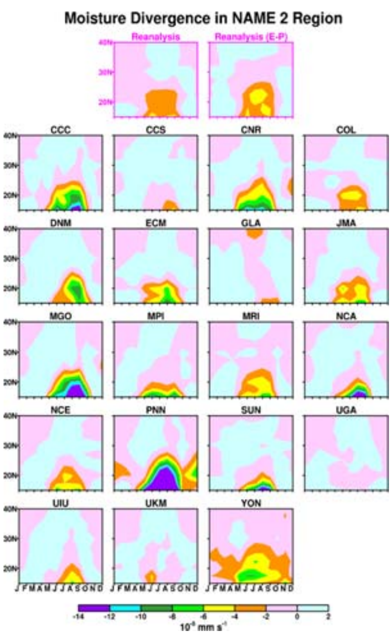
Here we see the variability in the moisture fluxes for the period. Not all the models capture the peak July conditions for the monsoon.



4. Progression of moisture divergence from 5 models during the NAMAP season

Here we judge the differences in model-produced fields of moisture divergences from the five models. Convergence of moisture occurs in the middle of the monsoon season (July) in all cases, but the structure is quite different, including the latitude of maximum convergence. The early season strong moisture divergence in the lowest latitudes is a common feature of the simulations.





5. AMIP-2 simulations of moisture divergence

To compare the regional models, above, to lower resolution simulations over a longer period, we show (left) the ensemble- and calendar- mean of the longitudinally averaged moisture divergence patterns from 19 available models in AMIP-2, covering the period 1979-1993, in the NAME regions. A residual approach considering divergence as Evaporation – Precipitation is used for the long-term mean model and for the NCEP-NCAR reanalyses here. Individual model patterns are given on the right. The models are quite variable, but in general do reproduce the mid-monsoon season divergences of moisture, especially the means in the NAME-2 region. Estimates from the NCEP-NCAR reanalyses are given as well on the top two panels, right, based on both residual and flux approaches.