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Project Title: Global-Scale, Intraseasonal Fluctuations of Diabatic Forcing of the Atmosphere

Progress:

Fields of diabatic heating rate estimates (H) for 5-day periods have been calculated from ECMWF analyses since 1985 as the residual of the dry thermodynamic equation. Included in these fields are the horizontal and vertical divergences of heat for both mean and eddy statistics. Previous work dealt with 4-day periods, however, with the emphasis in the Global Precipitation Climatology Project for 5-day period totals the change was made to accommodate the GPCP product.

H has long been associated with cold tropical cloud-top temperatures as measured by polar orbiting OLR sensors. Correlations between H and OLR fields on three time scales indicate a moderate amount of agreement. For periods less than 90 days, significant negative correlations are found between H and OLR for 1) tropical and NH midlatitude oceanic areas and 2) for zonal and hemispheric mean values. Positive correlations are seen in NH mean and continental areas of N. Africa, N. America, N. Asia and Antarctica. These latter results reflect seasonal heating and cooling.

Comparisons have been made between H as calculated from the ECMWF analyses and output from the CCM1 T42 simulations. The CCM1 tends to have a more cellular structure with more heating (precipitation) over land versus that observed (ECMWF) over oceans.

Future Work:

Fields of H will continue to be produced from the ECMWF analyses. It is anticipated that by the end of 1992 the ECMWF reanalysis effort will be underway so that consistent maps will be available from 1979 onward. A modeling study is also underway in (no-cost) collaboration with Dr. S.-C. Chen of Scripps. We are analyzing the unique atmospheric forcing which occurred in the NH spring of 1988 over the subtropical Pacific and the resulting flow which may have caused the severe drought in the Central and Eastern US that year. Using known forcing anomalies (from H) we are able to reconstruct the modelled fields to determine the source of the forcing (i.e. surface heating, eddy or mean flow forcing etc.).

Publications:

Christy, J.R., 1990: Diabatic heating rate estimates from ECMWF analyses. J. Geophys. Res., D, accepted for publication.

Conferences:

Christy, J.R., and F.R. Robertson 1990: NCAR CCM1 at MSFC, Validation against satellite layer temperatures and ECMWF analyses. CCM Workshop, 16-20 July 1990, Boulder CO.

Christy, J.R., 1989: Global distribution of diabatic heating rate estimates. Symposium on Role of Clouds in Atmospheric Chemistry and Global Climate. 30 January - 3 February 1989, Anaheim CA, pp. 56-59.

Robertson, F.R., R.W. Spencer and J.R. Christy, 1989: Geophysical parameters from microwave retrievals. Workshop Proceedings. Workshop on the use of Satellite Data in the European Centre for Medium Range Weather Forecasts model. 8-12 May, 1989. Reading UK, pp. 435-451.

Christy, J.R., 1988: Global scale diabatic heating rate distribution and atmospheric mass anomalies. Proceedings of the Thirteenth Annual Climate Diagnostics Workshop. 31 October - 4 November 1988, Cambridge