

Global Distributions of Moisture, Evaporation-Precipitation,
and Diabatic Heating Rates

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Accomplishments:

1. Global archives were established for:
ECMWF 12-hour, multilevel analyses beginning 1 January 1985
(U, V, RH, Z, T, Omega on 2.5 degree grid)
Day and Night IR temperatures (OLR on 2.5 degree grid)
Solar incoming and solar absorbed (for albedo calculations)
2. Routines were written to access these data conveniently from NASA/MSFC MASSTOR facility for diagnostic analysis.
3. Calculations of diabatic heating rates were performed from the ECMWF data using 4-day intervals. A major component of the calculation is the vertical divergence of the heat flux due to the mean vertical velocity. After several methods were examined, it was determined that the best results were obtained using the ECMWF archived values of vertical velocity rather than by any method using the divergent wind. Considerable variability over periods longer than 20 days is evident in the results when viewed in time-lapse animation, especially in the Indian Ocean to South Pacific sector of the tropics.
4. Calculations of precipitable water (W) from 1 May 1985 were carried out using the ECMWF data. Because a major operational change on 1 May 1985 had a significant impact on the moisture field, values prior to that date are incompatible with subsequent analyses. Global mean values of W range from 28.3 mm in late July to 23.3 mm in early January. This variability in W affects the global mean surface pressure by about 0.5 mbar in the course of a year.
Regional results indicate that monsoon areas are very moist, as expected, with point values of W up to 60 mm. The moisture budget equation reveals that in these rainy areas, Evaporation-Precipitation (E-P) drops below -20 mm/day while in broad areas of the subtropical oceans E-P exceeds +6 mm/day. The zonal mean moisture flux, when the constraint of conservation of mass is applied, agrees with accepted notions that the main moisture divergence occurs out of the summer subtropical oceans.

Focus of Current Research:

The present goal in data analysis is to determine what is the current state of the global atmosphere. The moisture component is of intense interest because of its non-trivial feedback into the circulation.

Plans for the coming year:

Continued diagnostic analysis of the ECMWF archive and comparisons with satellite data will be carried out. Again, the focus will be on the global atmospheric hydrologic cycle as well as the areas of large scale heating and cooling. Modeling efforts using the NCAR CCM1 will concentrate on simulation of the present climate, as determined in the ECMWF analyses, rather than on prediction.

Publications:

Christy, J. R., K. E. Trenberth, and J. R. Anderson, 1988: Large-scale redistributions in atmospheric mass. accepted, J. Climate.