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4.2 Joint sessions on moisture processes and cumulus parameterization

4.2.1 Session on measurement/modeling of moisture processes

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The specific recommendations of the workshop session on the measurement and modeling of moist processes are as follows:

- *MCS measurement strategies must extend well beyond the "visible" cloud boundaries.* All the important sources and sinks of moisture associated with MCS genesis and evolution (e.g., large-scale advection, evapotranspiration, precipitation) must be identified in three dimensions and with sufficient temporal resolution to be useful for developing, improving, and verifying boundary layer, radiation, and convective parameterizations.

- *Do not limit observation of MCSs to their dynamically active stages, but include measurements of "fossil" MCS residue.* Middle and upper tropospheric moisture and cloud formation are examples of MCS "fossil" effects which can have profound upscale feedback effects.

- Use the "best" soil hydrology model and its adjoint to "retrieve" soil moisture and vegetation parameters.

- *Design "plug"-compatible routines.* Cumulus parameterization, microphysics, radiation, and turbulence schemes should all be made easier to implement and test, including documentation for general use prior to CME. Community access to "radiation" codes should be provided.

- Couple aerosol and cloud microphysics models, and obtain measurements of aerosols and hydrometeor spectra for radiation calculations.

- *Provide soundings over the eastern Pacific* to identify sub-tropical jets and jet streaks entering the southwest and impacting the MCS genesis region. Some suggested approaches to obtaining these measurements include: use of remotely piloted vehicles equipped with automated (i.e., jukebox units) dropsonde systems, and expanding the ACARS systems to include automated dropsonde units on a few overseas commercial aircraft.

- *Integrate satellite, surface (e.g., ASOS ceilometer), and radiosonde data to provide an observational analysis of atmospheric moisture with mesoscale resolution.* This is urgently needed for further development and validation of coupled multiscale models.

- *Hydrological cycle improvements are needed in models.* Improvements are critically needed to not only produce accurate precipitation in all kinds of situations (both strongly forced and quasi-barotropic), but also to transport moisture vertically to produce clouds in a physically consistent manner. Furthermore, the model treatments of clouds as they relate to the radiative budgets, which typically rely upon arbitrary and crude statistical relationships between cloud coverage and relative humidity, need to be greatly improved by using explicit prediction of condensate fields and knowledge in the initial state of the models of the cloud bases, cloud tops, and optical properties.

- *A critical need exists to understand the moisture cycling properties of MCSs and the dynamic/thermodynamic processes that control their evolution.*