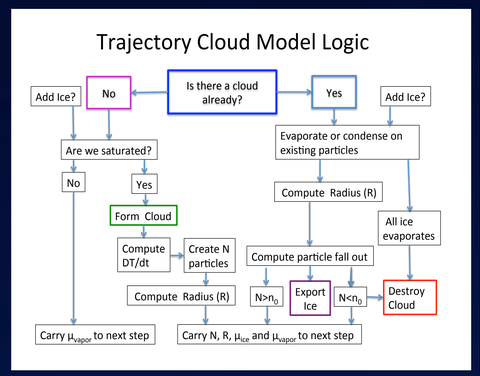
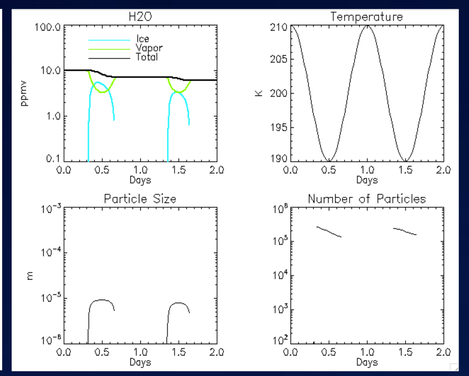
# Water Vapor and Clouds in the UT/LS

M. Schoeberl, STC, Lanham, Md.
A. Dessler, T. Wang, TAMU, College Station, Tx.
E. Jensen, NASA ARC, Moffett Field, CA

### *Overview*

- **We use the Schoeberl-Dessler-Wang trajectory model to investigate the role of cloud formation and anvil cirrus in modifying stratospheric water vapor.**
- **We have developed a trajectory cloud model (TCM). The TCM includes particle formation, condensation, evaporation, sedimentation and allows for ice to added into the cloud domain so that the model can run in curtain mode. The TCM is similar to that developed by Fueglistaler and Baker [2006].**
- **The trajectory model normally forms wide scale uplift cirrus; to include convectively generated cirrus we use MERRA convective anvil locations and ice mixing ratio to create additional cirrus in the model.**

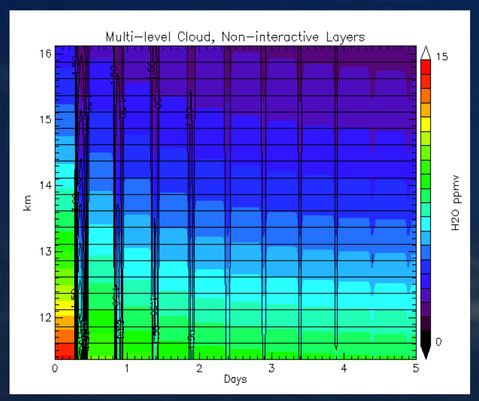


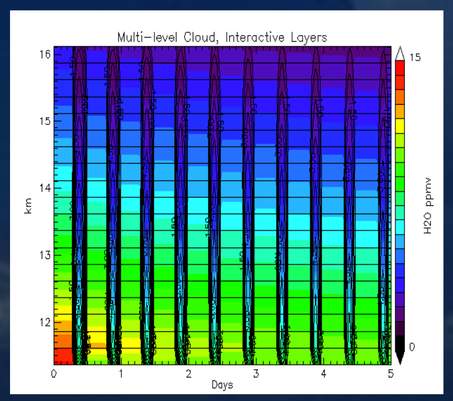

Above [left] TCM logic [right] TCM test. Clouds are generated as a parcel experiences a temperature oscillation over two days. Initially parcel is 10 ppmv $H_2O$ but dehydrates to 6 ppmv. When the cloud forms, particles are created (we use Kärcher et al. [2006] simulations to estimate the initial number). As the parcel continues to cool particle size grows as ice condenses. As ice falls out of the domain (500m depth) the number of particles decreases accelerating growth on remaining particles. As the parcel warms, ice begins to move back into vapor phase.

Below: CM is run as a curtain with 90% RH initially at each level. We impose a temperature oscillation to form clouds (ice is contoured) – colors are water mixing ratio. Left plot, layers do not interact. Right plot, ice falls from layer to layer. If the layers interact, dehydration slows as ice falling into the layers below moisten the system.

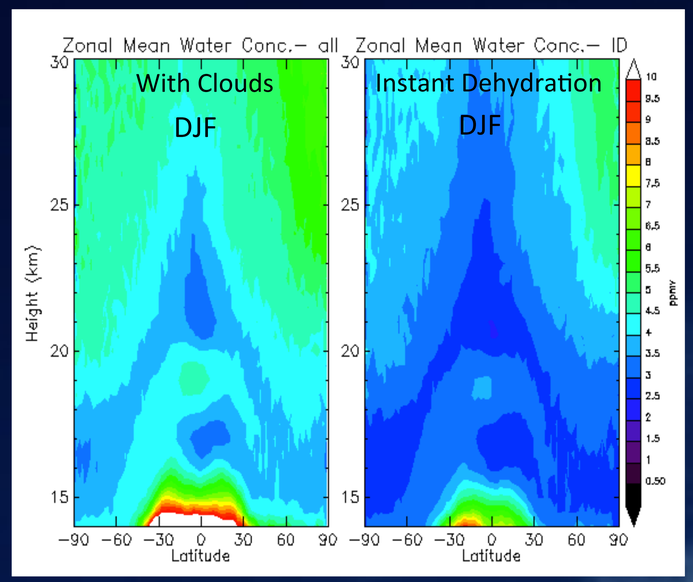
## Non-Interacting Curtain

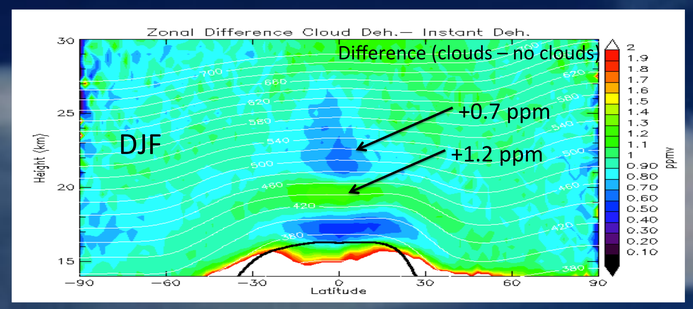


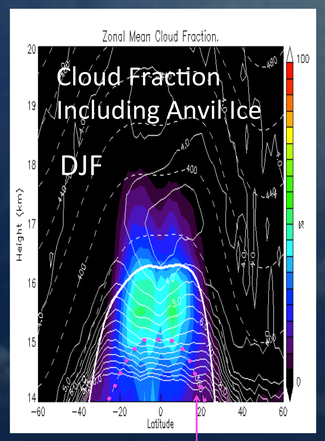

## Interacting Curtain

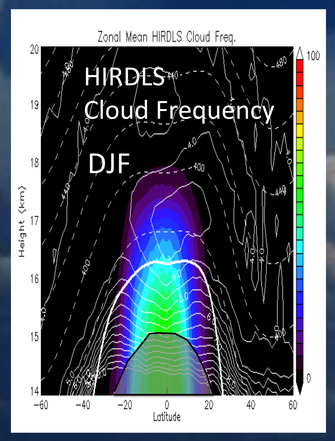



Author contact: mark.schoeberl@mac.com




Particle Injection level

### *Summary of Results*

- **Including cloud processes increases the water vapor in the stratosphere between 0.7 and 1.2 ppm.**
- **Model cloud fields generated are broadly consistent with CALIPSO and HIRDLS observations, but more validation (e.g. ATTREX) needs to be done.**
- **Inclusion of Anvil Ice increases stratospheric water vapor between 0.5 and 1 ppm**
- **Final dehydration pattern (FDP) is mostly insensitive to inclusion of anvil ice**