

## V9-01-01 Wet Deposition Update with MERRA

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### Updates to v9-01-01 wet deposition include:

1. GEOS-Chem can now be run with GEOS met fields or MERRA met fields.

2. Changes specific to wetscav\_mod.f:

i. Define QQ and PDOWN directly from MERRA met fields (for MERRA only). QQ is the rate of precipitation production and PDOWN is the downward flux of precipitation through the bottom of each grid box. Both are defined in *SUBROUTINE MAKE\_QQ*. The old definitions for QQ and PDOWN from Liu *et al.* (2001) are still used when running for all other met fields met fields.

ii. New subroutine for MERRA wet scavenging. If you're using GEOS met fields *SUBROUTINE WETDEP* is called and if you're using MERRA met fields, *SUBROUTINE WETDEP\_MERRA* is called.

iii. Washout and rainout processes have been broken into separate subroutines for readability.

- Washout is now contained in *SUBROUTINE DO\_WASHOUT\_ONLY* and rainout and now contained in *SUBROUTINE DO\_RAINOUT\_ONLY*.
- Washout at the surface is now contained in *SUBROUTINE DO\_WASHOUT\_AT\_SFC* and complete re-evaporation (i.e. precipitation enters a grid box but does not leave the same grid box) is now contained in *SUBROUTINE DO\_COMPLETE\_REEVAP*.

These subroutines are called upon by both GEOS and MERRA met fields.

iv. Qiaoqiao Wang's updates for fraction of a grid box experiencing rainout (F\_RAINOUT) or washout (F\_WASHOUT) are standard when using MERRA.

v. During washout, ALPHA is restricted to be less than or equal to unity. Jacob *et al.* (2000) describes ALPHA as the fraction of raindrops falling down from grid box (L+1) to grid box (L) that will evaporate along the way. Previously there was nothing to prevent ALPHA from being greater than 1 (or in some cases ALPHA >> 1).

3. Changes specific to convection\_mod.f

i. *SUBROUTINE DO\_MERRA\_CONVECTION* has been created to handle MERRA convective wet scavenging separately from GEOS scavenging.

ii. Convection is not restricted by latitude when using MERRA.

iii. The cloud base is determined by the presence of non-zero convection precipitation formation (MERRA only). When using all other met fields the cloud base is always set to level 3 (i.e. levels 1 and 2 are always below the cloud base).

iv. Re-evaporation of soluble tracers is allowed above and below the cloud base (MERRA only).