Photolysis in WRF-Chem

- Ozone column density above the model top:
  - TUV: specified value above the model top (specified_du=325)
  - fast-J: specified value at the model top for the whole domain
  - f-TUV: MOZART model climatology at the top (input file exo_coldens.nc)
  - New TUV: uses ozone climatology distributed from model top to 50km, and then several options available above 50km

- Cloud optical properties:
  - Recalculated in each photolysis scheme, different from physics (e.g. RRTMG)
  - typically, COD calculated from LWP/IWP and effective drop radius (Slingo 1989, with fixed SSA = 0.9999 and f_{assym} = 0.85)
  - Various treatments of Sub-grid cloud overlap
    - Scaled by cloud fraction (fast-J)
    - Max random overlap for f-TUV (expensive)
    - Simplified ($COD_{subgrid}$ = COD * $FCLD^{3/2}$, equivalent to max random overlap)

- Aerosols:

  accounted for through the namelist option **aer_ra_feedback = .true.**

Settings for phot_opt = 4 (default in red)

Download the data file TUV.phot.tar from the ACOM website
(add data directories DATAE1 and DATAJ1, and wrf_tuv_xsqy.nc file)

- phot_opt = 4, 4

- is_full_tuv = .false. : use wrf_tuv_xsqy.nc table interpolation
- is_full_tuv = .true. : use hard-coded data and formulas (updated)

- du_at_grnd = 300 : default total o3 column density
- has_o3_exo_coldens =.false. : o3 column density above 50 km = 0.
- has_o3_exo_coldens =.true. : o3 column density above 50 km from mozart climatology
- scale_o3_to_grnd_exo_coldens = .true. : total o3 column at ground scaled to climatology
- scale_o3_to_du_at_grnd = .true. : scaled to the du_at_grnd value at the ground

- pht_cldfrc_opt = 1 : grid cell cloud fraction is either 0 or 1
- pht_cldfrc_opt = 2 : grid cell cloud fraction varies between 0 and 1

- cld_od_opt = 1 : cloud optical depth is scaled by cloud fraction
- cld_od_opt = 2 : cloud optical depth is scaled by (cloud fraction)**1.5