## Noah-MP Options With Indicators of usage with WRF-Hydro/NWM

*Last updated: 2020/01/20*

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! ======================options for different schemes============================
! ** = NoahMP recommended options
!      = WRF-HYDRO recommended options
!      = NOAA National Water Model ver. 2.0 options (if different from "recommended")
!      = unsupported in WRF-Hydro

! DYNAMIC_VEG_OPTION
    INTEGER :: DVEG     ! options for dynamic vegetation:
                !   1 -> off (use table LAI; use FVEG = SHDFAC from input)
                !   2 -> on  (together with OPT_CRS = 1)
                !   3 -> off (use table LAI; calculate FVEG)
                ! **4 -> off (use table LAI; use maximum vegetation fraction)
                ! **5 -> on  (use maximum vegetation fraction)
                !   6 -> on  (use FVEG = SHDFAC from input)
                !   7 -> off (use input LAI; use FVEG = SHDFAC from input)
                !   8 -> off (use input LAI; calculate FVEG)
                !   9 -> off (use input LAI; use maximum vegetation fraction)

! CANOPY_STOMATAL_RESISTANCE_OPTION
    INTEGER :: OPT_CRS  ! options for canopy stomatal resistance
                ! **1 -> Ball-Berry
                !   2 -> Jarvis

! BTR_OPTION
    INTEGER :: OPT_BTR  ! options for soil moisture factor for stomatal resistance
                ! **1 -> Noah (soil moisture)
                !   2 -> CLM  (matric potential)
                !   3 -> SSiB (matric potential)

! RUNOFF_OPTION
    INTEGER :: OPT_RUN  ! options for runoff and groundwater
                ! **1 -> TOPMODEL with groundwater (Niu et al. 2007 JGR)
                !   2 -> TOPMODEL with an equilibrium water table (Niu et al. 2005 JGR)
                !   3 -> original surface and subsurface runoff (free drainage)
                !   4 -> BATS surface and subsurface runoff (free drainage)
                !   5 -> Miguez-Macho&Fan groundwater scheme (Miguez-Macho et al. 2007 JGR;
                !                Fan et al. 2007 JGR)

! SURFACE_DRAG_OPTION
    INTEGER :: OPT_SFC  ! options for surface layer drag coeff (CH & CM)
                ! **1 -> M-O
                ! **2 -> original Noah (Chen97)

! SUPERCOOLED_WATER_OPTION
    INTEGER :: OPT_FRZ  ! options for supercooled liquid water (or ice fraction)
                ! **1 -> no iteration (Niu and Yang, 2006 JHM)
                !   2 -> Koren's iteration
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! FROZEN_SOIL_OPTION
    INTEGER :: OPT_INF  ! options for frozen soil permeability
                ! **1 -> linear effects, more permeable (Niu and Yang, 2006, JHM)
                !   2 -> nonlinear effects, less permeable (old)

! RADIATIVE_TRANSFER_OPTION
    INTEGER :: OPT_RAD  ! options for radiation transfer
                !   1 -> modified two-stream (gap = F(solar angle, 3D structure ...)<1-FVEG)
                !   2 -> two-stream applied to grid-cell (gap = 0)
                ! **3 -> two-stream applied to vegetated fraction (gap=1-FVEG)

! SNOW_ALBEDO_OPTION
    INTEGER :: OPT_ALB  ! options for ground snow surface albedo
                !   1 -> BATS
                ! **2 -> CLASS

! PCP_PARTITION_OPTION
    INTEGER :: OPT_SNF  ! options for partitioning  precipitation into rainfall & snowfall
                ! **1 -> Jordan (1991)
                !   2 -> BATS: when SFCTMP<TFRZ+2.2
                !   3 -> SFCTMP < TFRZ
                !   4 -> Use WRF microphysics output

! TBOT_OPTION
    INTEGER :: OPT_TBOT ! options for lower boundary condition of soil temperature
                !   1 -> zero heat flux from bottom (ZBOT and TBOT not used)
                ! **2 -> TBOT at ZBOT (8m) read from a file (original Noah)

! TEMP_TIME_SCHEME_OPTION
    INTEGER :: OPT_STC  ! options for snow/soil temperature time scheme (only layer 1)
                ! **1 -> semi-implicit; flux top boundary condition
                !   2 -> full implicit (original Noah); temperature top boundary condition
                !   3 -> same as 1, but FSNO for TS calculation (generally improves snow; v3.7)

! SURFACE_RESISTANCE_OPTION
    INTEGER :: OPT_RSF  ! options for surface resistent to evaporation/sublimation
                ! **1 -> Sakaguchi and Zeng, 2009
                !   2 -> Sellers (1992)
                !   3 -> adjusted Sellers to decrease RSURF for wet soil
                !   4 -> option 1 for non-snow; rsurf = rsurf_snow for snow (set in MPTABLE); AD v3.8

! GLACIER_OPTION
    INTEGER :: OPT_GLA ! options for glacier treatment
                ! **1 -> include phase change of ice
                !   2 -> ice treatment more like original Noah (slab)
```