

Original Noah-MP source code

```
MODULE MODULE_SF_NOAHMPLSM
CONTAINS
SUBROUTINE NOAHMP_SFLX (parameters, ILOC, JLOC, LAT, &
YEARLEN , JULIAN, COSZ, DT, DX, DZ8W, &
NSOIL, ZSOIL, NSNOW, SHDFAC, SHDMAX, &
VEGTYP, ICE, IST, CROPTYPE, SMCEQ, &
.....
PAHG, PAHB, PAH, LAISUN, LAISHA, RB) &

CALL SUBROUTINE ATM (parameters, SFCPRS, SFCTMP, Q2, &
PRCPCONV, PRCPNONC, PRCPSHCV, &
PRCPSNOW, PRCPGRPL, PRCPHAIL, &
.....
RAIN, SNOW, FP, FPICE, PRCP) &

CALL SUBROUTINE PHENOLOGY (parameters, VEGTYP, &
SNOWH, TV, LAT, YEARLEN, JULIAN, &
LAI, SAI, TROOT, ELAI, ESAI, IGS, PGS) &
.....
.....

END SUBROUTINE NOAHMP_SFLX

SUBROUTINE ATM (parameters, SFCPRS, SFCTMP, Q2, &
PRCPCONV, PRCPNONC, PRCPSHCV, &
PRCPSNOW, PRCPGRPL, PRCPHAIL, &
.....
RAIN, SNOW, FP, FPICE, PRCP) &
.....
.....

END SUBROUTINE ATM
.....
.....

END MODULE MODULE_SF_NOAHMPLSM
```

Single Fortran file of >12 000 lines of code

Refactored Noah-MP source code

```
module NoahmpMainMod
contains
subroutine NoahmpMain(noahmp)
type(noahmp_type), intent(inout):: noahmp
call ProcessAtmosForcing(noahmp)
call PhenologyMain(noahmp)
.....
.....
end subroutine NoahmpMain(noahmp)
end module NoahmpMainMod
```

Individual process-level modules

```
module AtmosForcingMod
contains
subroutine ProcessAtmosForcing(noahmp)
type(noahmp_type), intent(inout):: noahmp
.....
.....
end subroutine ProcessAtmosForcing
end module AtmosForcingMod
```

