**Changes in Cable\_roughness.F90**

Constant value of soil roughness length of z0soil=1.e-6 m was replaced with a formula which will allow for larger values for z0soil for bare ground and increasing further in the presence of canopy litter on the soil surface

z0soil=1.e-3 \*mn(1.,LAI) + 1.e-4.

This allows soil roughness to vary from 1.e-4 for deserts to 1.1e0-3 for areas with vegetation cover.

**Changes in cable\_soilsnow.F90**

1) Inclusion of the correction term for soil evaporation fes\_cor into the water balance. Fes\_cor term used for energy balance correction is now added to soil evaporation term segg which is extracted from the soil moisture. This allows for the consistency between energy and water balance.

2) Rescaling of the drainage term to allow for the removal of the total water added to lakes.

This is a simple change which subtracts water added to the lake from the drainage. This update is only applied for grids allocated to the same processor hence does not solve the problem at the global scale.

**Change in cable\_canopy.F90**

1) There were occasional instances of negative exchange coefficient for heat cdtq in the presence of very tall canopy. This was because there were inconsistencies in the formulation of cdcq and friction velocity which is being used in the formulation of the drag coefficient for momentum cduv.

Additional terms were added to cdtq as marked in bold;

**Old**: Canopy%cdtq = min(1.0,max(0.1, (LOG(rough%zref\_uv / rough%z0m) - &

psim( canopy%zetar(:,niter) \* rough%zref\_uv/rough%zref\_tq ) &

)/ (LOG(rough%zref\_uv/(0.1\*rough%z0m)) - psis(canopy%zetar(:,niter)) ) ) )

canopy%cdtq = canopy%cduv \* xcdtq

**New:** canopy%cdtq = canopy%cduv \*( LOG( rough%zref\_uv / rough%z0m) -              &

                psim( canopy%zetar(:,NITER) \* rough%zref\_uv/rough%zref\_tq )   &

**+ psim(canopy%zetar(:,NITER)\*rough%z0m/rough%zref\_tq) &    !new term**

                ) / ( LOG( rough%zref\_tq /(0.1\*rough%z0m) )  - psis( canopy%zetar(:,NITER)) +

**psis(canopy%zetar(:,NITER)\*0.1\*rough%z0m/rough%zref\_tq) )  !new term**

This update has removed all instances of negative cdtq.