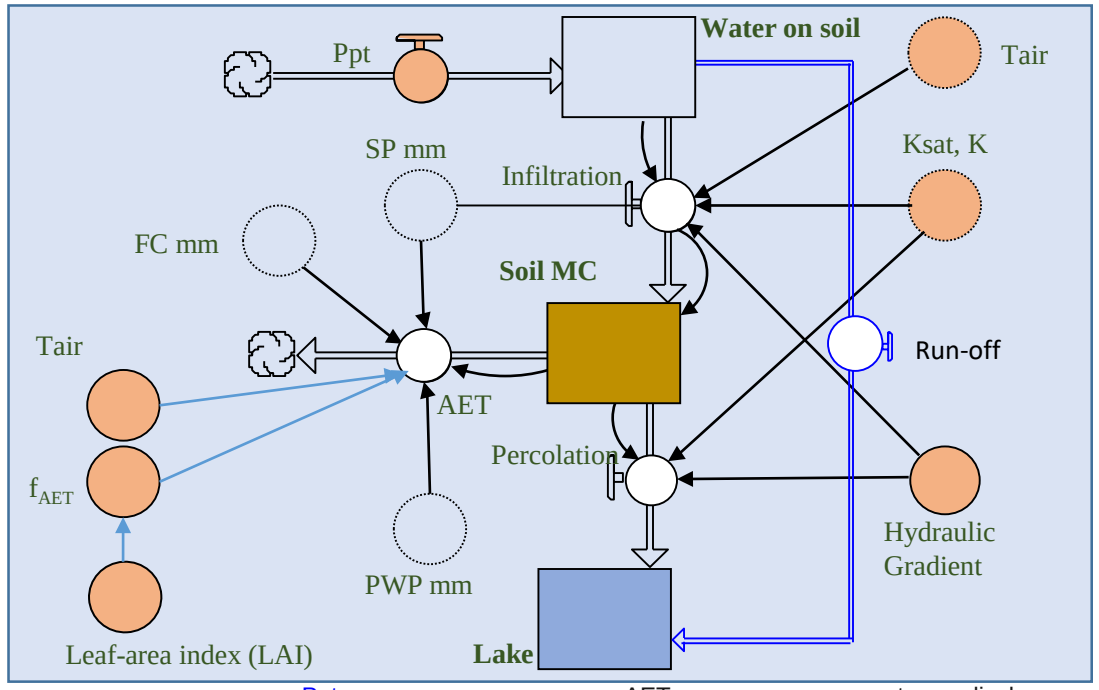
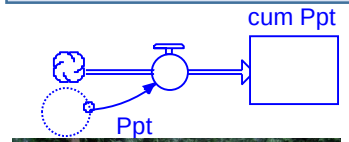
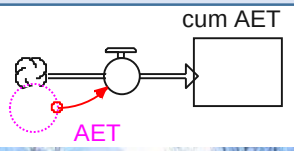
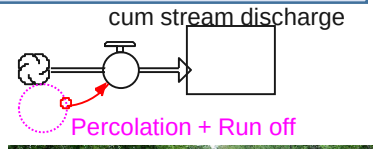
For3456/3457, Lecture 7: Watershed Model

This summary introduces a simple hydrology model that tracks the accumulation of water on soils and the flow of water through soils towards a lake, using daily weather records for precipitation and air temperature. It accounts for temperature- and vegetation-affected evapotranspiration (**AET**) by way of the leaf area index (**LAI**), and the loss of soil moisture (**Soil MC**) towards the permanent wilting point. Changing Soil MC levels affect the off-road trafficability of soils.





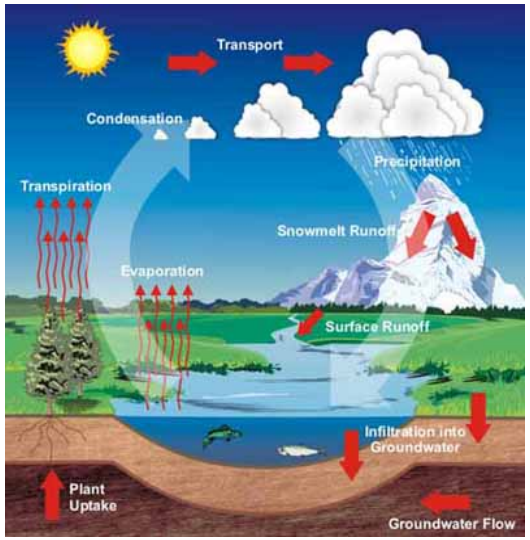


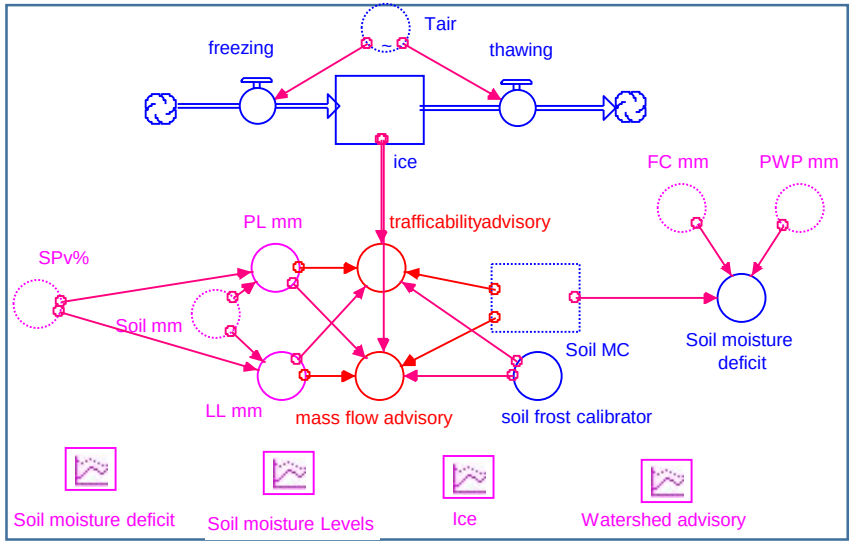


AET = if Soil MC > PWP mm and Soil MC < FC mm and Tair > 0 then
Faet Tair (Soil MC – PWP mm)/(FC mm-PWP mm) else
if Soil MC > FC mm then Faet Tair (SP mm-Soil FC)/(SP mm-FC mm) else 0

f_{AET} = 0.4 (1-0.5 Percent cut/100)

Infiltration = if Water on soil > 0 and Tair > 0 then
min(Water on soil, SP mm-Soil MC)/dt + K Hydraulic Gradient else
if Tair > 0 then + K Hydraulic Gradient else 0
Percolation = K Hydraulic Gradient
Hydraulic gradient = if Soil MC = SP mm then (Water on soil + Soil mm)/Soil mm else
if (Soil MC >FC mm and Soil MC < SP mm) then 1 else 0





Trafficability advisory = if ice > soil frost calibrator then 0 else
if Soil MC >PL mm then [(Soil MC - PL mm)/(LL mm - PL mm)] $^{0.5}$ else 0

Mass flow advisory = if ice > Soil frost calibrator then 0 else
if Soil MC > PL mm then ((Soil MC – PL mm)/(LL mm –PL mm))^2 else 0

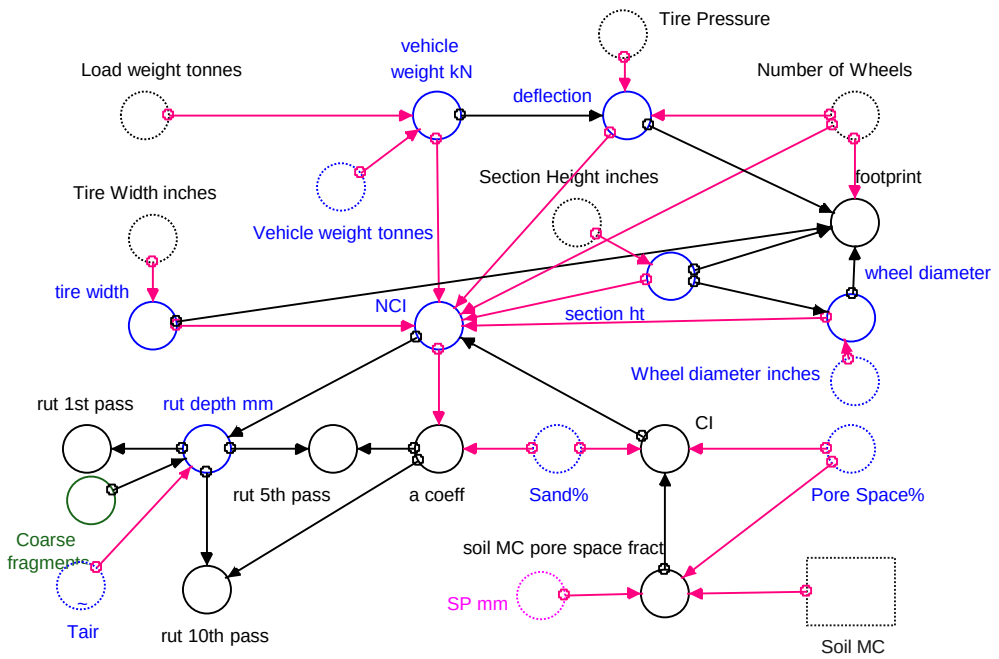
For3456/3457, Lecture 8: Off-road Trafficability

This summary introduces matters pertaining to assessing off-road trafficability, as it changes with machine type (or recreational vehicle), soil and daily, year-round weather conditions. For this assessment, one needs to specify machine load, wheel based foot print (machine weight per contact area with soil), and the resistance of soil to penetration, estimated by way of the Cone Index **CI**. The Nominal Cone index, **NCI**, is given CI / (machine foot print pressure), which is then used to estimate rutting depths and soil compaction percentages.

Choose equipment used for off-road transportation (forwarder, harvester, tractor, bike, ATV ,etc...). Specify equipment weight, load and tire dimensions as detailed here.

Number of Wheels | Section Height inches | Load weight tonnes

Tire Width inches | Tire Pressure | Vehicle weight tonnes | Wheel diameter inches



CI = 1.08 $10^{1.99-0.38\ Sand\%/100-2.23\ SPv-0.72\ MC_{PS}}$

NCI (Nominal cone index = CI /(Machine weight / Foot print area)

Machine weight = Vehicle weight in kN

Foot print = Tire width x Wheeldiameter x Number of Wheels x (deflection/section height) $^{0.5}$ /[1+tire width/(2 wheel diameter)]

Rut depth in mm = if SMTH1(T_{air},10) <-3 then 0 else [1487/(NCI+0.1)] (1-Coarse fragments)^2