# Development of a Groundwater Recharge Model using the USGS SWB Method

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## What is Recharge?

(Precipitation + Snowmelt + Inflow)
- (Interception + Outflow + ET)
- Δ Soil Moisture

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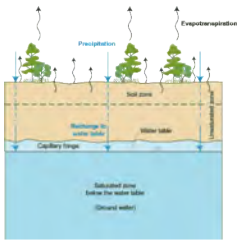
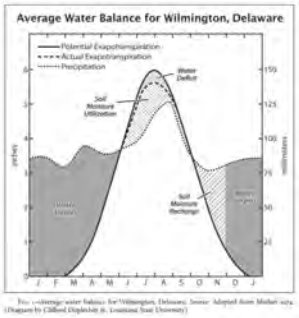
Recharge





- Uses commonly available GIS data
- Can use tabular or gridded climate data
- Calculated on a daily time step
- Gridded output for groundwater flow model



## Estimating Outflow (Runoff)

(Woodward et al 2002)

**$R=(P-I_a)^2/(P+[S_{max}-I_a])$ Where $P>I_a$**

R=Runoff
P = Daily Precipitation
$S_{max}$ = Maximum Soil Moisture Holding Capacity
$I_a$ = Initial Abstraction

## MODEL INPUTS

- Land Use/ Land Cover
- Hydrologic Soil Group
- Available Soil Water Capacity
- Flow Direction Derived from DEM
- Climate Data

## Estimating Potential Evapotranspiration

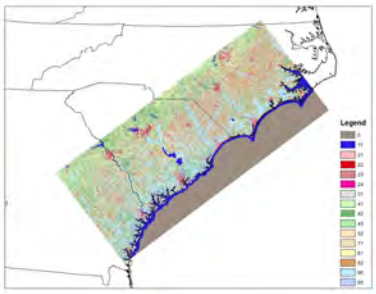
(Hargreaves and Samani, 1982, 1985)

**ET = 0.0135(KT)(Ra)(TD) 1/2 (TC+17.8)**

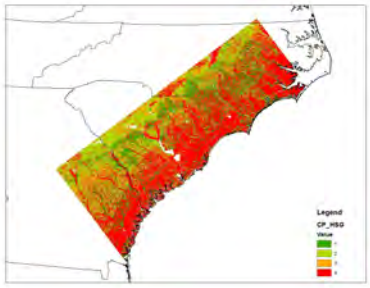
TD = Tmax-Tmin
TC = the average daily temperature
Ra = extraterrestrial radiation
KT = empirical coefficient
(KT = 0.162 for interior regions, KT = 0.19 for coastal regions)

## Land Use

- National Land Cover Data Set
- Used in combination with soil water capacity to calculate surface runoff
- Used to determine rooting depth

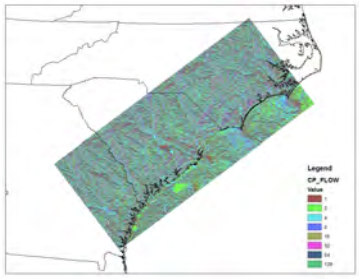


## Hydrologic Soil Group



- From Natural Resource Conservation Service Soils Maps
- A (High Infiltration Capacity / Low Runoff Capacity)
- D (Low Infiltration Capacity /High Runoff Capacity)

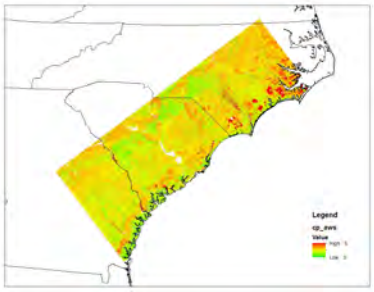
## Flow Direction



- Derived from DEM
- Used to routing overland flow

## Available Soil Water Capacity

- Capacity of the soil in inches per foot to hold water
- Used in conjunction with root zone depth to calculate maximum soil water capacity

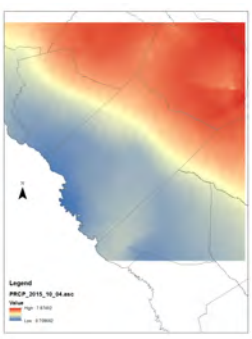


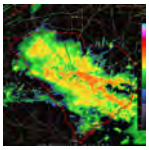
## Gridded Climate Data

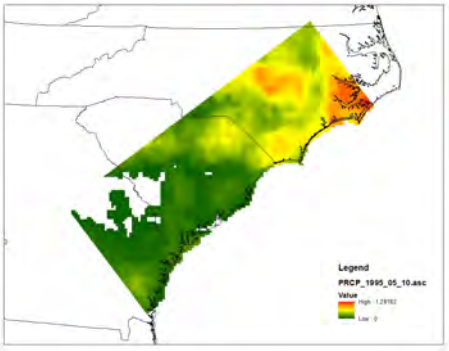
METDATA from the University of Idaho

"Desirable spatial attributes of gridded climate data from PRISM are combined with desirable temporal attributes of regional-scale reanalysis and daily gauge-based precipitation fromNLDAS-2 to derive a spatially and temporally complete, high-resolution (1/24th degree ~4-km) gridded dataset of surface meteorological variables required in modeling…"

http://climate.nkn.uidaho.edu/METDATA/



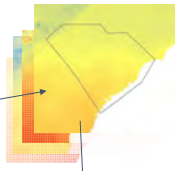




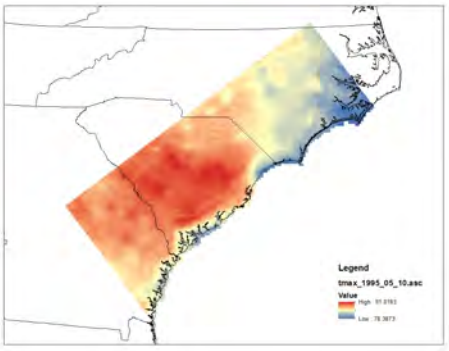

Python Scripting

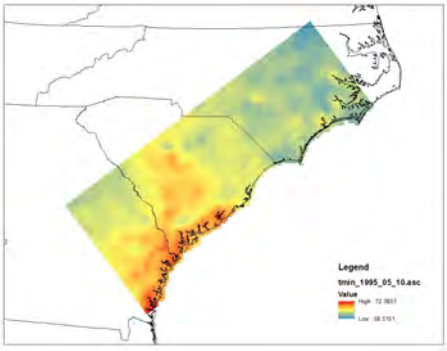
Converting NetCDF files to ASCII

Each day of the year, for 37 years, for 3 variables
= **40,515 ASCII Files**

- Clip to area
- Resample
- Align to SWB data
- Save to ASCII



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- (Interception + Outflow + ET)
- Δ Soil Moisture

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Recharge