Modeling Hydrologic Responses to Climate Change

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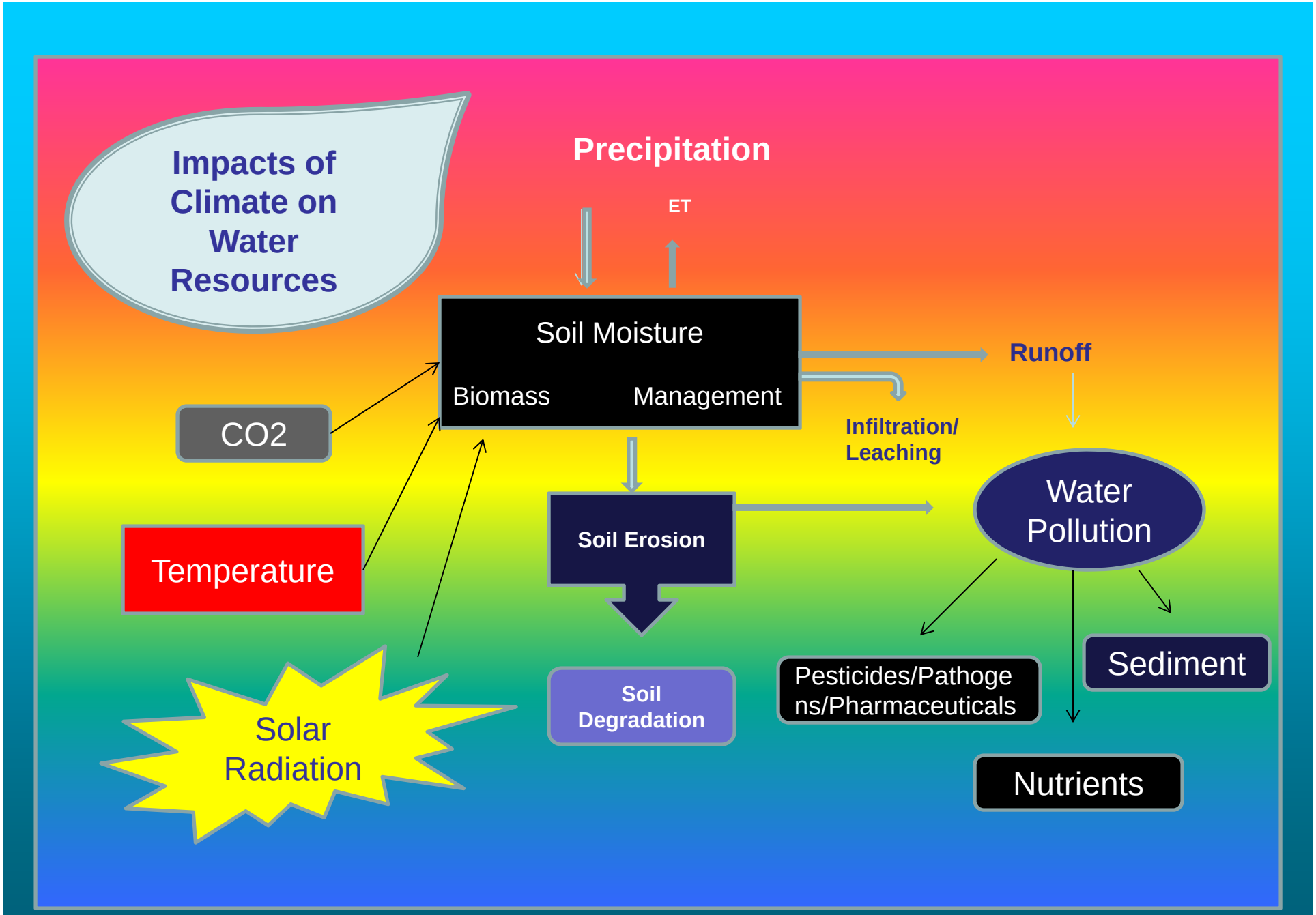
U.N. panel 95 percent certain climate change is man-made

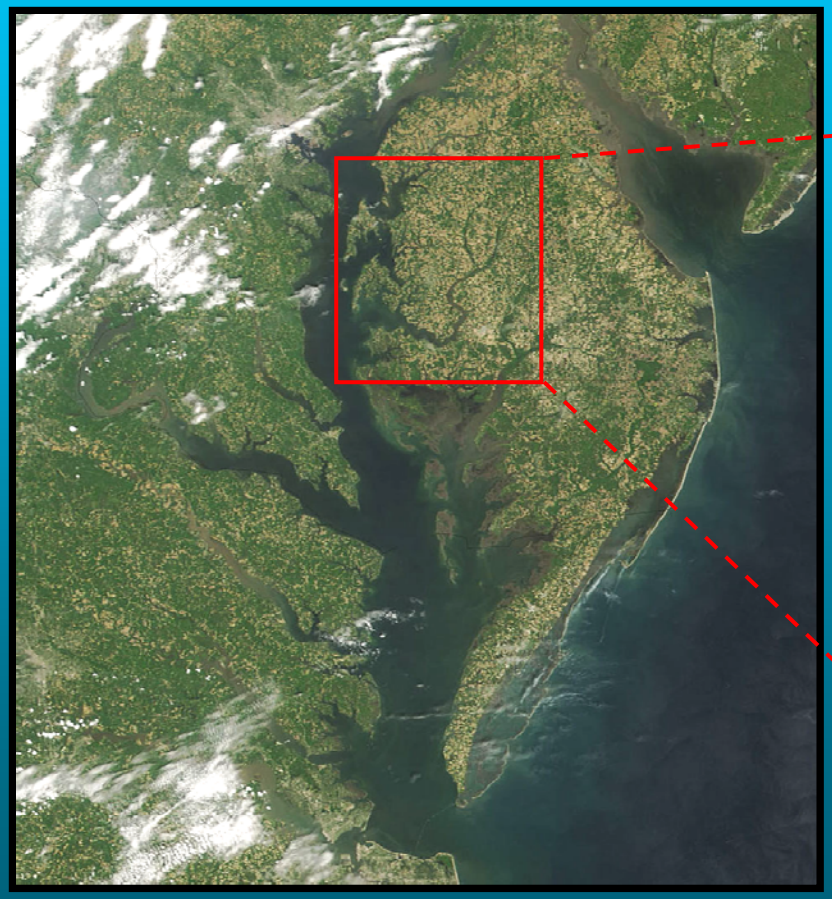


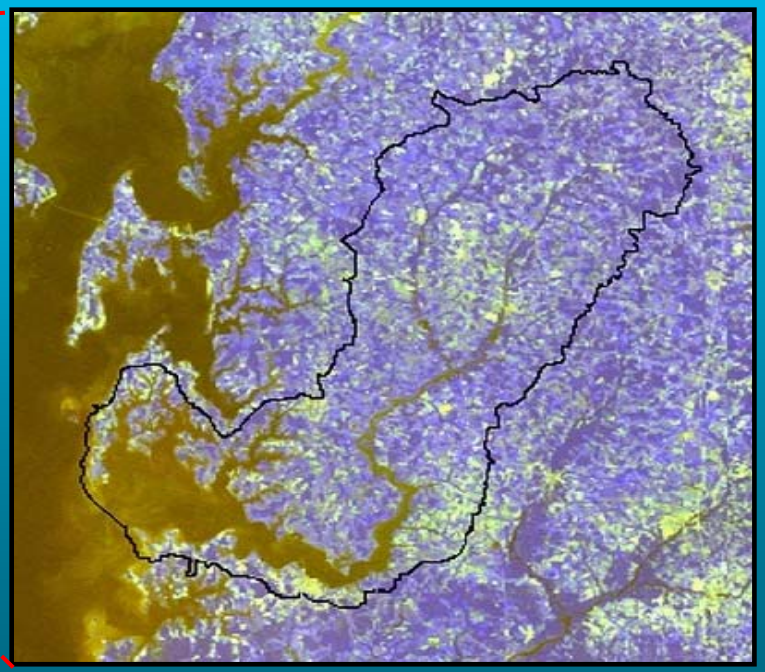
This conceptual model is a modification from Figure 1, presented in a report from Soil and Water Conservation Society, January 2003 , "Conservation Implications of: Climate Change; Soil Erosion and Runoff from Cropland."

Monitoring & Modeling at Choptank Watershed of the Chesapeake Bay, USA

Personnel Involved:

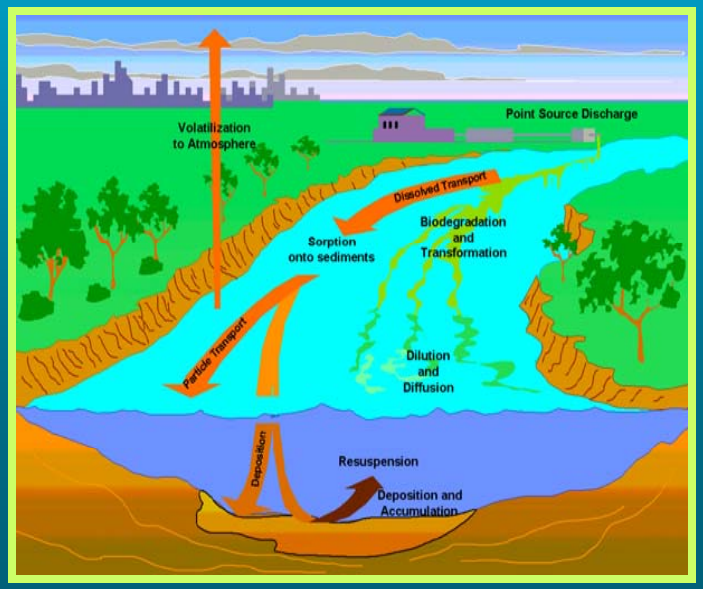
Ali Sadeghi & Greg McCarty (ARS),
Dean Hively (USGS), Megan Lang (FS)
Adel Shirmohammadi, In-Young Yeo &
Sangchul Lee (Collaborators, UM)

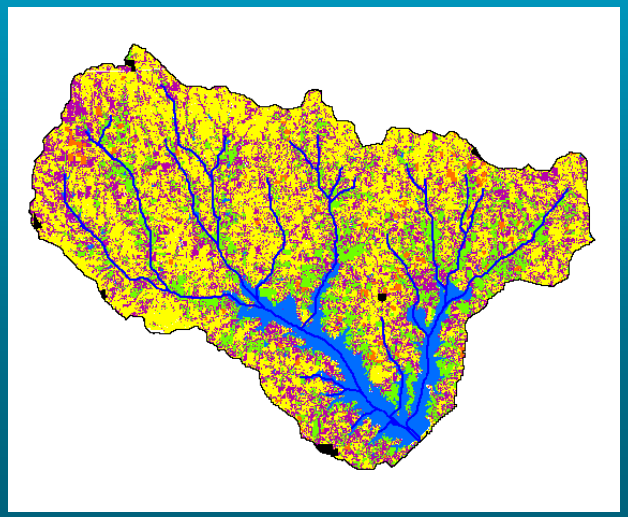


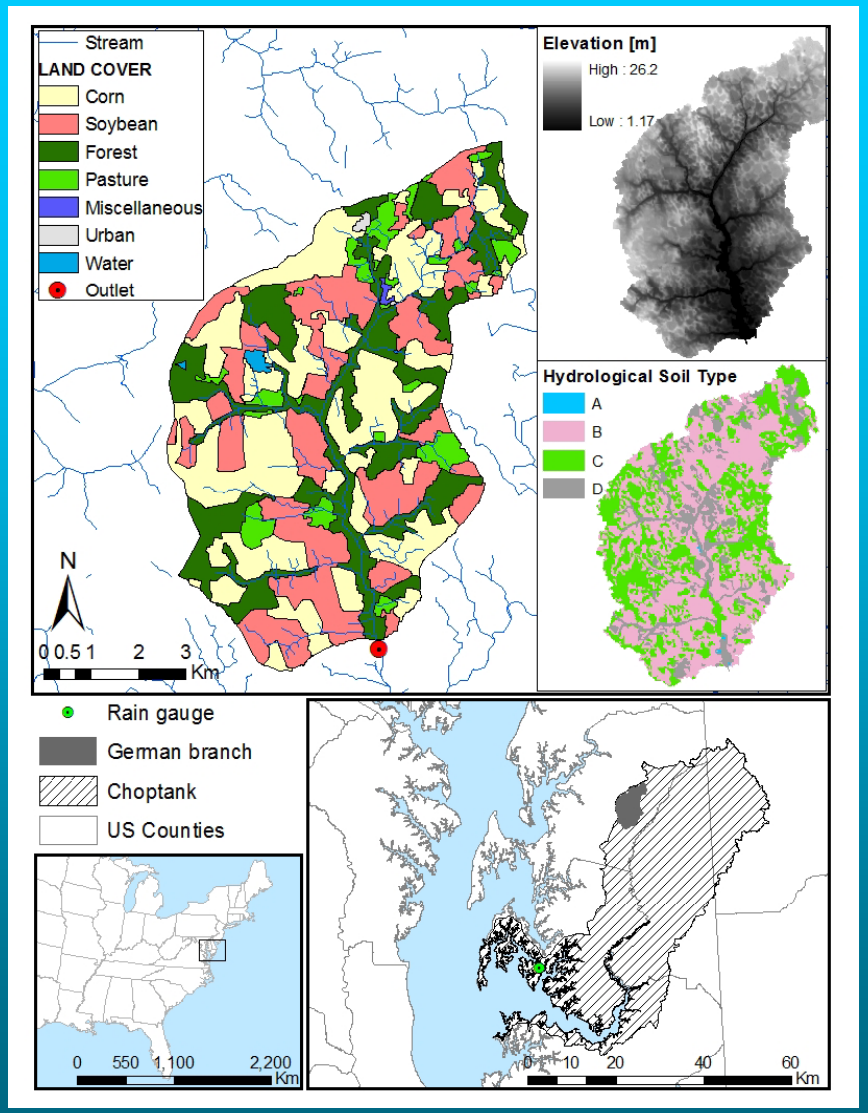


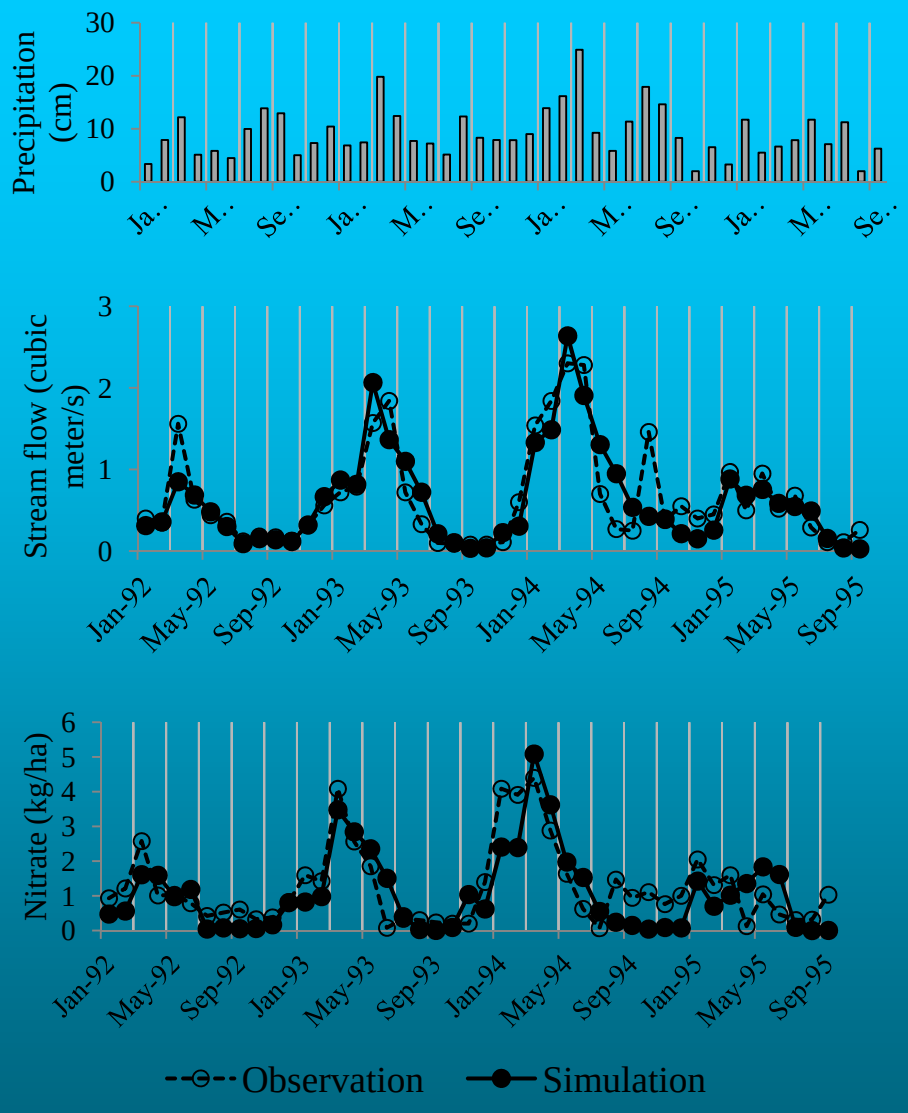
Brief Model Description:

SWAT (Soil & Water Assessment Tool): *A physically, continuous based model, mainly composed of: Hydrology, Nutrients, Sediment, Pesticides, & Pathogen components. Watershed is first divided into sub-watersheds, based on drainage areas of the tributaries, and each sub-watershed then is further divided into HRUs (Hydrologic Response Units) by superimposing land cover and soil type within each given sub-watershed. Model simulations perform at the HRU levels.*






Stream
LAND COVER
Corn
Soybean
Forest
Pasture
Miscellaneous
Urban
Water
Outlet
Elevation [m]
High : 26.2
Low : 1.17
Hydrological Soil Type
A
B
C
D
N
0 0.5 1 2 3
Km
Rain gauge
German branch
Choptank
US Counties
0 550 1,100 2,200
Km
0 10 20 40 60
Km


Precipitation (cm)
30
20
10
0
Ja..
M..
Se..
Stream flow (cubic meter/s)
3
2
1
0
Jan-92
May-92
Sep-92
Jan-93
May-93
Sep-93
Jan-94
May-94
Sep-94
Jan-95
May-95
Sep-95
Nitrate (kg/ha)
6
5
4
3
2
1
0
Observation
Simulation

(In SWAT, the PET is required as an input)

- computed internally by 3 methods: i) Priestley-Taylor; ii) Penman-Monteith; and iii) Hargreaves

- Estimated by an external source and provided to SWAT as an input.

The actual ET (AET) is then calculated in SWAT based on available water, crop and soil moisture conditions.

Using RS Approach:

Looking at 2 options for estimating PET:

i) using Atmosphere-Land Exchange Inverse (ALEXI) model output)

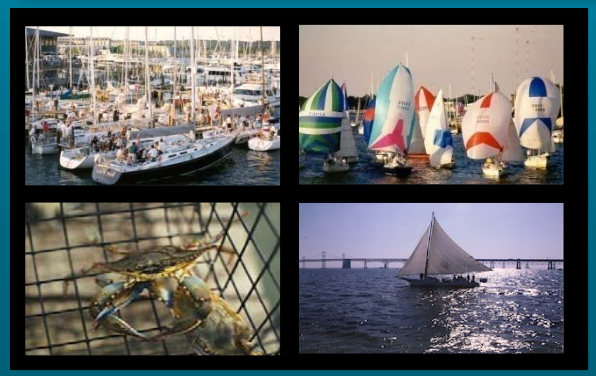
ii) using the NDVI/crop coefficient method from two in situ towers our lab has in the corn and soybean fields.

South Fork of the Iowa River

Preliminary findings:

- Remotely Sensed ET greatly helps SWAT Calibration/Validation at much larger scales.

- Compared with internal SWAT ET calculations, the RS ET estimated independently and read-into SWAT performed well for regional SWAT applications.



Water Management

Predict Drought & Excessive Wet Periods

Food, Water & Environmental Security

Thank you☺

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