LID Modeling and GIS – Utilizing the Latest Technologies for Enhanced Stormwater Management

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Presentation Overview

- Worldwide context
- Data that can help stormwater / LID management
- 2D Modeling
- Delaying vs. Detaining vs. Capturing
- The 3 key factors in LID
- How modeling helps LID design

Stormwater Worldwide

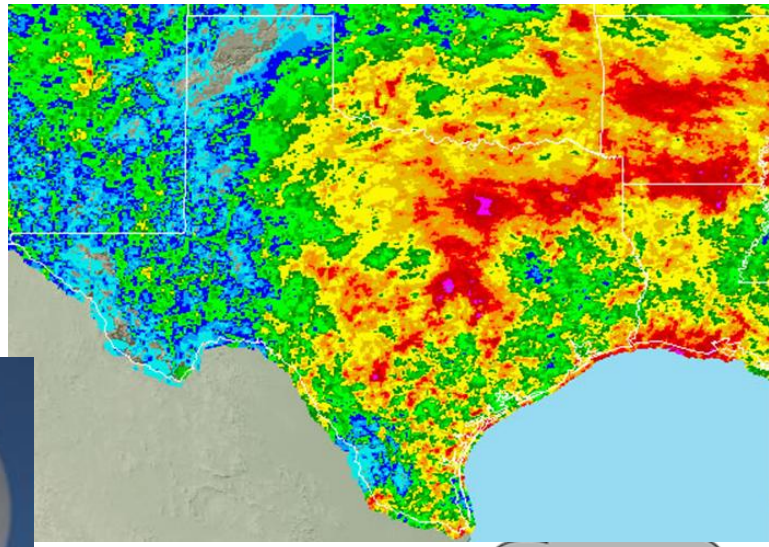
- Similar issues around the world
  - Flooding
  - Surface water management
  - Data availability
- Local solutions common
  - Hydrology
  - Design rainfall
  - Design standards
- Reliance on old studies

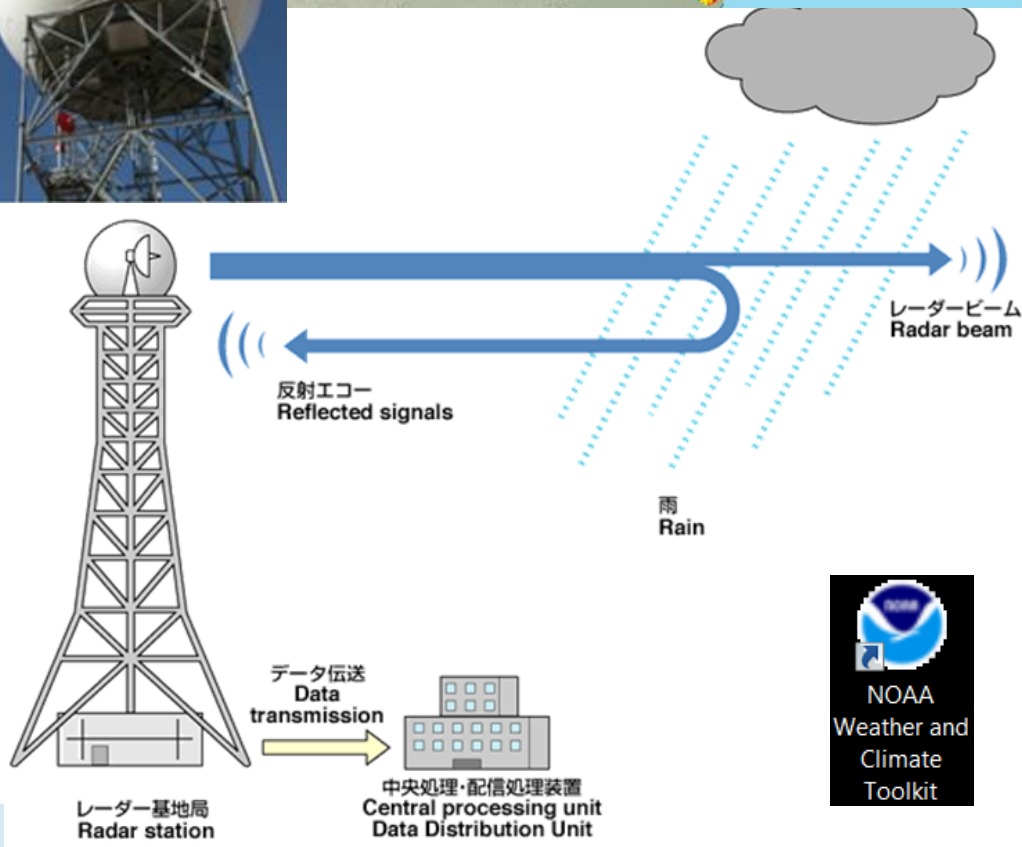
Why Reference Globally

- Look at possibilities
- Provides good context for scaling the advancement of stormwater modeling
- There really are not that many differences around the world

RADAR Rainfall Data

- Spatial resolution
- Temporal resolution
- Elevation of RADAR
- Output rainfall values
- What format do I want from NOAA?

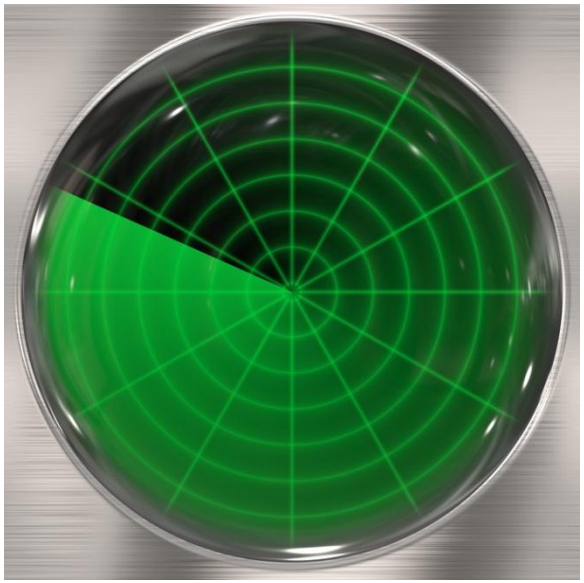




NOAA Weather and Climate Toolkit

Calibrated RADAR Rainfall

- RADAR adjusted to match gauge values
- Available real-time from vendors
- Could use calibrated data as a bases for new design storms



Spatial and Temporal Variation[1]

- Just looking at one catchment and simple hydrograph models
  - A spatially uniform moving storm causes varying TOC and Tp
  - A spatially distributed stationary storm causes varying TOC and Tp depending where the peak intensity is located
  - Moving storms have a larger impact on TOC and Tp for slow moving storms and larger flatter catchments

Hyperspectral Imagery

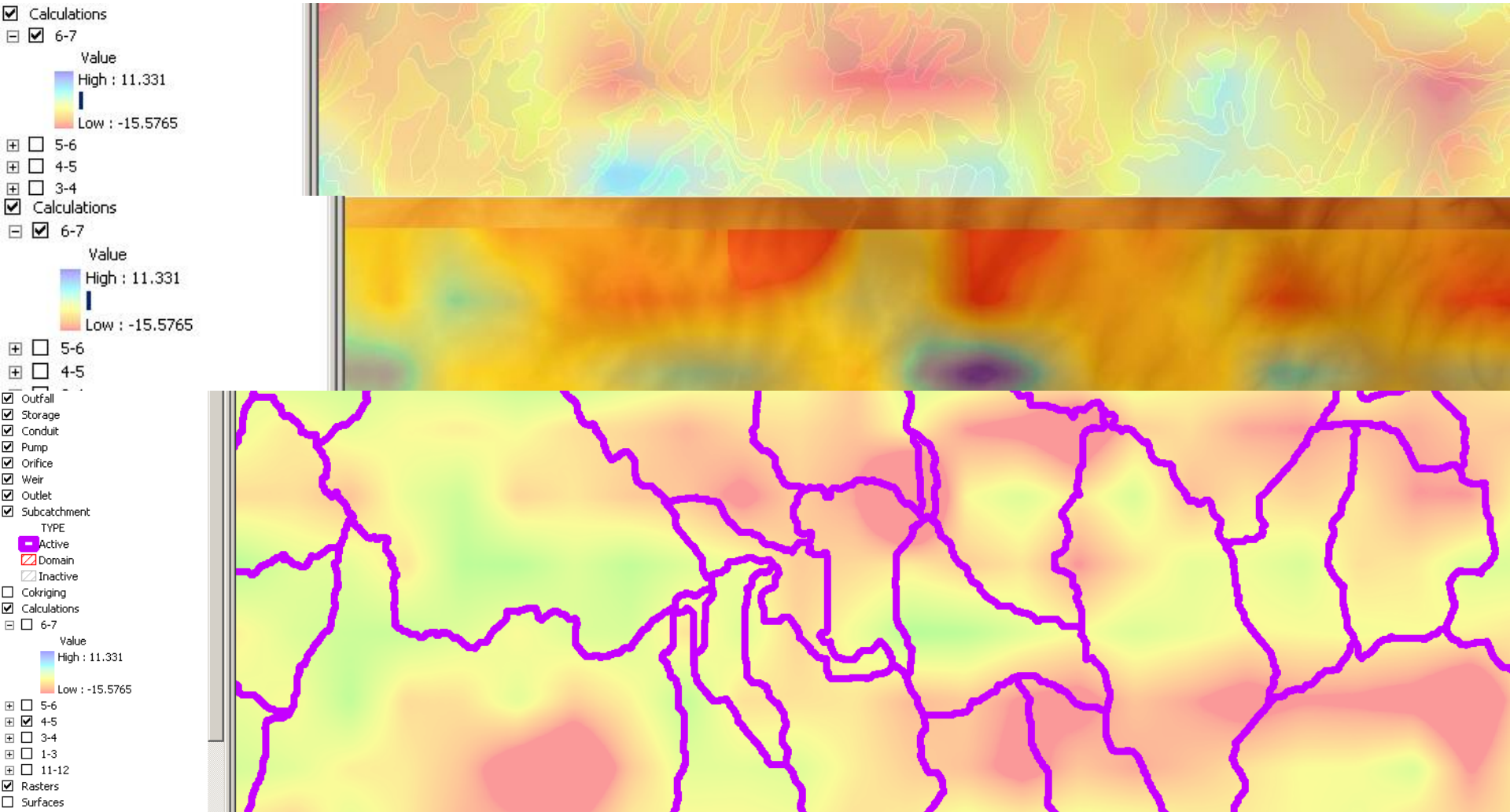
- Usually 128 or 256 continuous spectral bands
- Aerial based – higher spatial resolution
- Detailed studies on % impervious
- Highly costly, but surely some day will be more practical (2030?)
- Data collaboration helps

Soil Moisture[2]

- NASA JPL and PALS data
- Is soil moisture uniform?
- What does soil moisture correlate to?

Is Soil Moisture Simple? [2]

- No



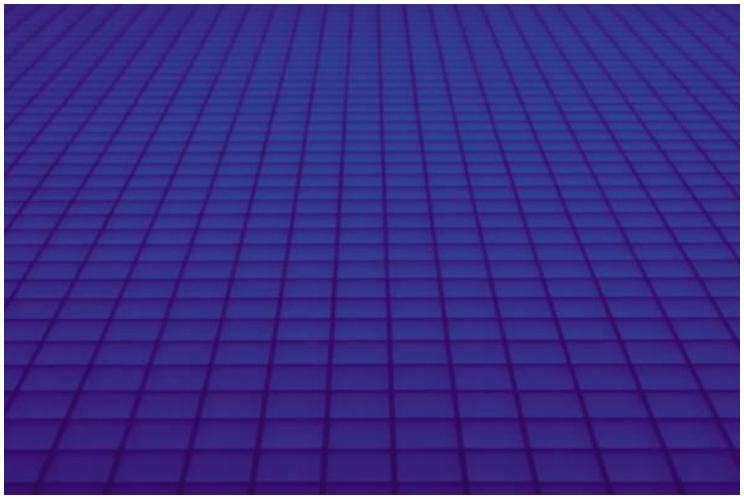
What does Soil Moisture Correlate to? [2]

- Statistically not 1 single parameter can be correlated (not even soil class)

- Soil moisture is not directly correlated to any one factor; Factors include:
  - Rainfall length and distribution
  - Soil characteristics
  - Proximity to rivers / lakes
  - Temperature
  - Amount and angle of sunlight
  - Elevation (slope, depressions)
  - Etc.

2D Modeling

- What really happens to flooded water?
- Can 2D modeling detail new system issues?

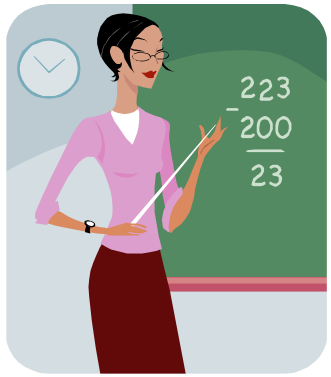


What really happens to flooded water?

- It goes on the surface and:
  - Sits there and re-enters the system later
  - Travels overland and re-enters the system (pond, river, inlet)
  - Both, plus it could fill depressions, change saturation rates, infiltrate, etc.
- 2D modeling accounts for this

Can 2D modeling detail new system issues?

- Many things can be determined and seen:
  - Flooding in one area may worsen problems elsewhere
  - Keeping flow on the surface longer can be beneficial
  - The pipes and streets have been designed – are they really meeting criteria
  - Are there any depth / velocity concerns on the surface under extreme events



Managing Surface Water

- Detaining vs. Delaying
- Reducing runoff with green technology

Delaying

- Flow slips
- Inlet optimization
- Green Infrastructure Design
- Small delays can create huge gains

Reducing Runoff with Green Technology

- Rain barrels
- Porous pavement
- More green areas
- Infiltration basins
- Swales

- We need help from landscape architects

- Combine with the previous

LID – Modeling for Any Size Watershed

Looks / Usage / Design Matter with LID – How do these Rate?

Smart LID Design + Aesthetic Design + Good Usage = Everyone Wins

Hydraulic Modeling is a Key Component

- Ensure design works
- Integrate the entire system for better stormwater management
- Ensure locally designed LID is improving the system globally

Hopes for the Future

- New studies on soils / Imperviousness using GIS analysis
- Real rainfall for design
- Both reduce and increase the scale that is viewed
- Green Infrastructure that maximizes the 3 main criteria

References

- 1 – D.M. Scott **THE EFFECTS OF SPATIALLY DISTRIBUTED RAINFALL ON CATCHMENT RESPONSE** Lincoln College 1973 http://researcharchive.lincoln.ac.nz/dspace/bitstream/10182/2167/6/scott_me.pdf
- 2 – My esri presentation
- Papers I wrote in Grad School
- All the great engineers I have worked with around the world

Other images from wikipedia

Questions?

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