Hydrological Distributed Model for Flash Flood

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For the :

CSU-KOREA RADAR TEAM

SEMINAR AND MEETING

INTRODUCTION

- Floods cause social, environmental, and economical losses.
- Leading cause of deaths from natural hazards in the USA.
- Flooding conditions …
- Need of more timely and accurate warnings:
  - Deployment of weather surveillance radars
  - Development of predictive hydrological models with spatially distributed structure and parameters

CASC2D-SED

Physically-based, distributed-parameter, raster, two dimensional infiltration-excess (Hortonian) hydrologic model for simulating the hydrologic response of a watershed subject to a rainfall field

CASC2D-SED PROCESSES

PRECIPITATION

Spatially distributed

INTERCEPTION

INFILTRATION

Green-Ampt model

OVERLAND FLOW ROUTING:

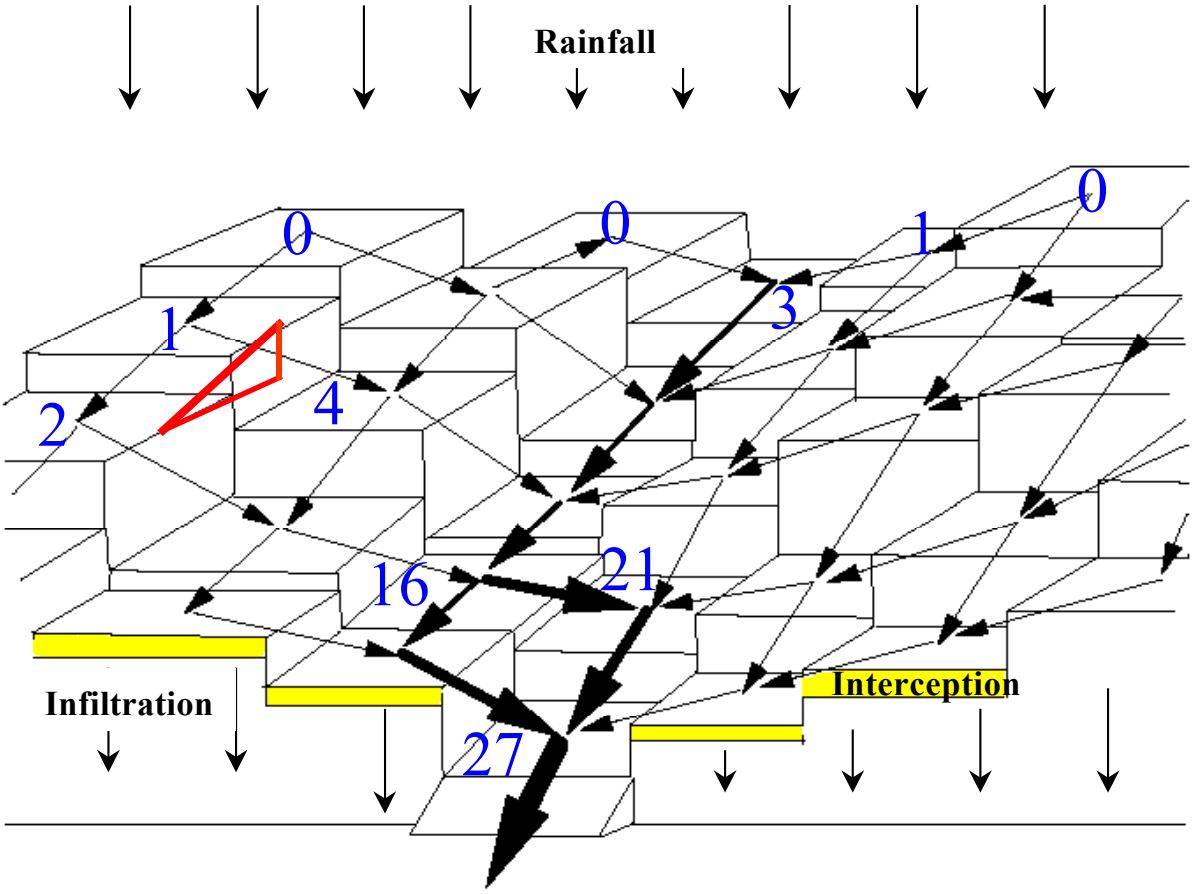
Explicit, 2-D, finite-difference, diffusive-wave formulation

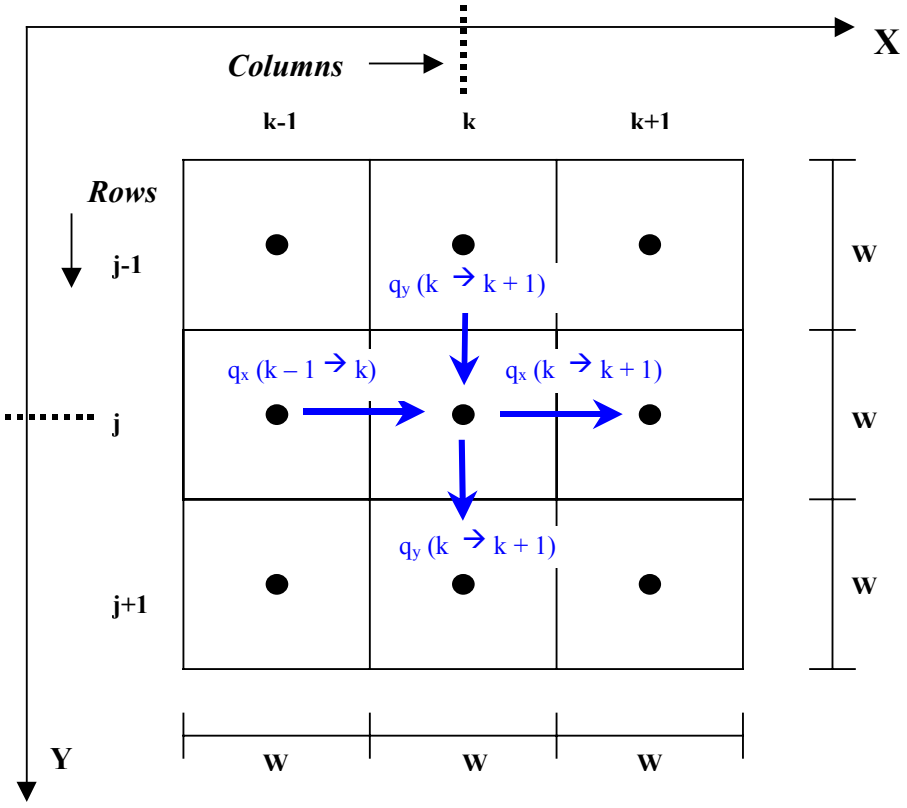
CHANNEL FLOW ROUTING:

Explicit, 1-D finite-volume, diffusive-wave formulation

UPLAND EROSION

Kilinc & Richardson model


Rainfall
0
0
1
0
1
3
2
4
16
21
27
Infiltration
Interception


X
Columns
k-1
k
k+1
Rows
j-1
j
j+1
q_y (k → k + 1)
q_x (k – 1 → k)
q_x (k → k + 1)
q_y (k → k + 1)
w
w
w
w
w
w
Y

CASC2D-SED MODEL INPUT

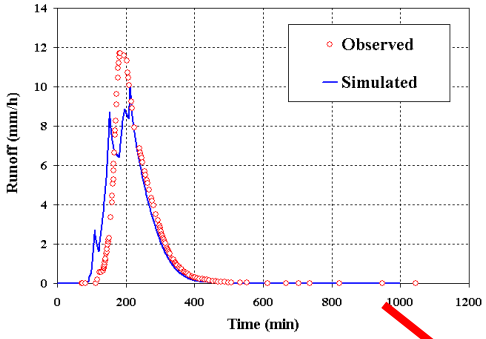
- PRECIPITATION: uniform or distributed
- ELEVATION MAP
- SOILS MAP: infiltration parameters, soil texture, soil erodibility
- LAND USE / LAND COVER: roughness coefficient, interception depth, USLE C and P factors
- HYDROGRAPHY

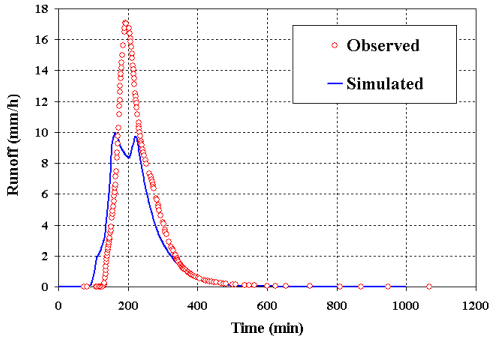
CASC2D-SED MODEL OUTPUT

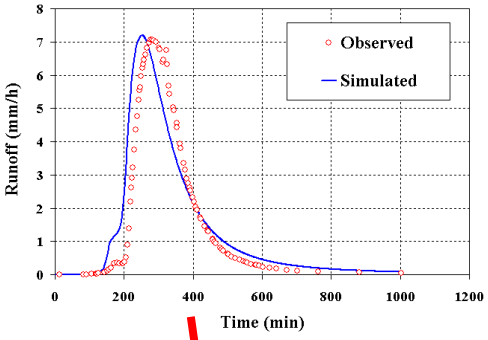
A) Hydrographs and sedigraphs

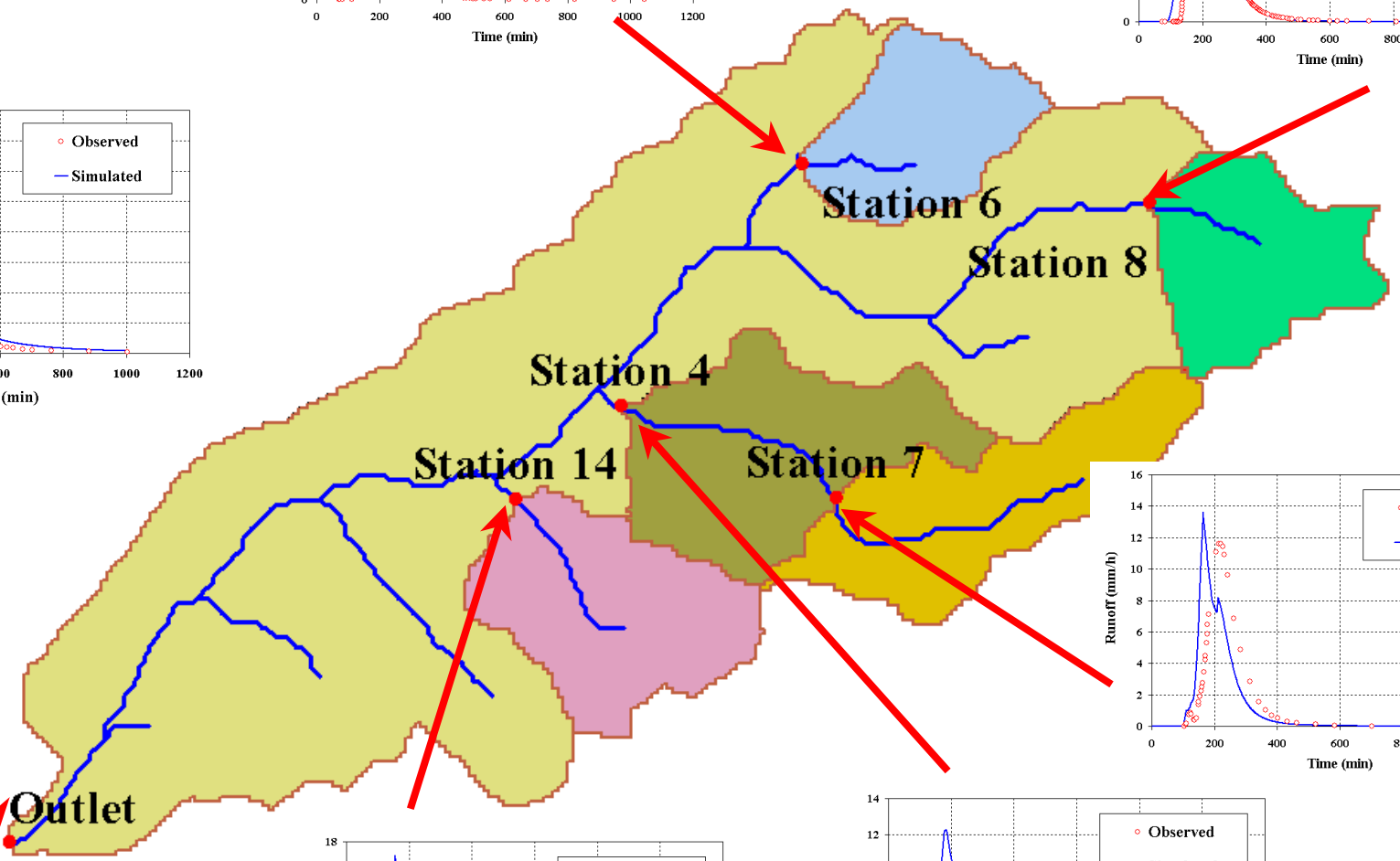
B) Time-series thematic grids: rainfall rates, infiltrated volume, water depth, eroded/deposited material, sediment flux and suspended sediment

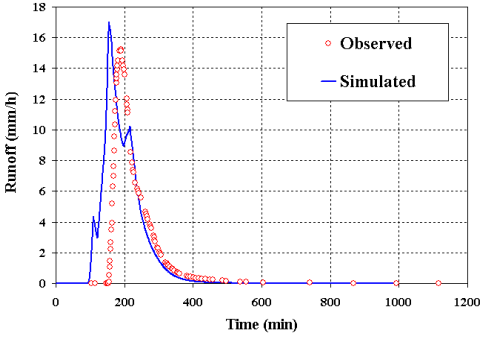
A) CASC2D-SED OUTPUT: Hydrographs and Sedigraphs

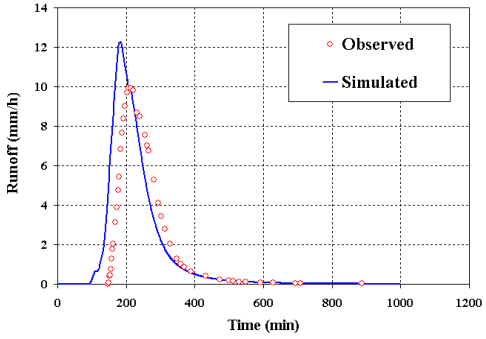




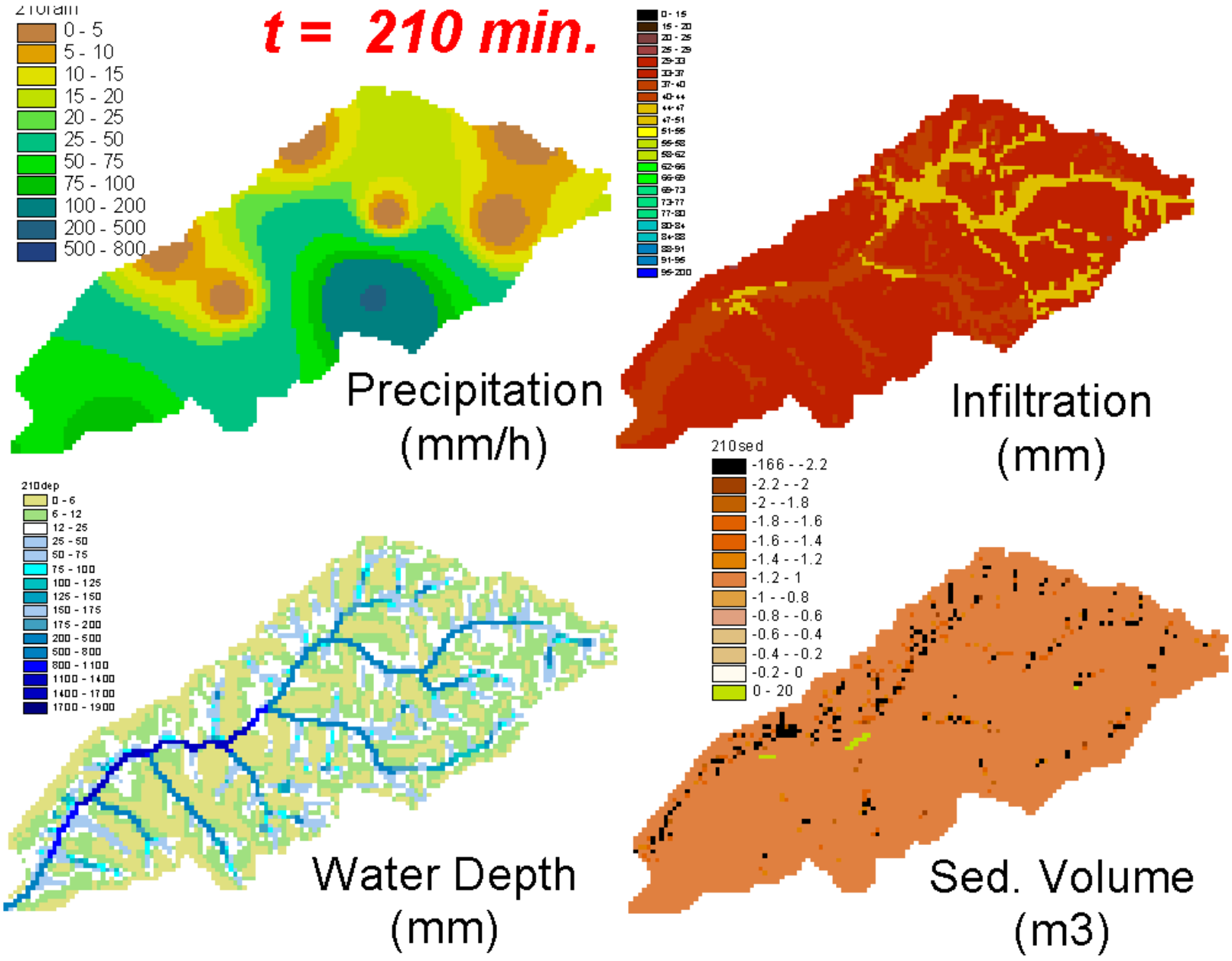






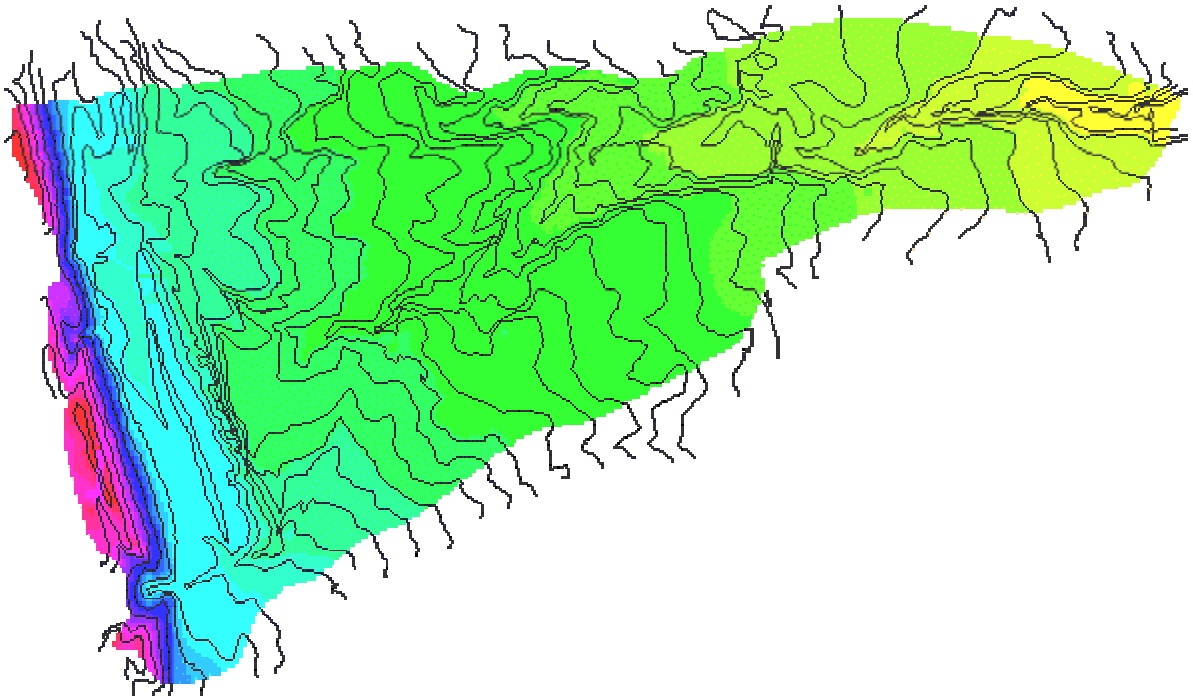


B) CASC2D-SED OUTPUT: Time Series Thematic Grids

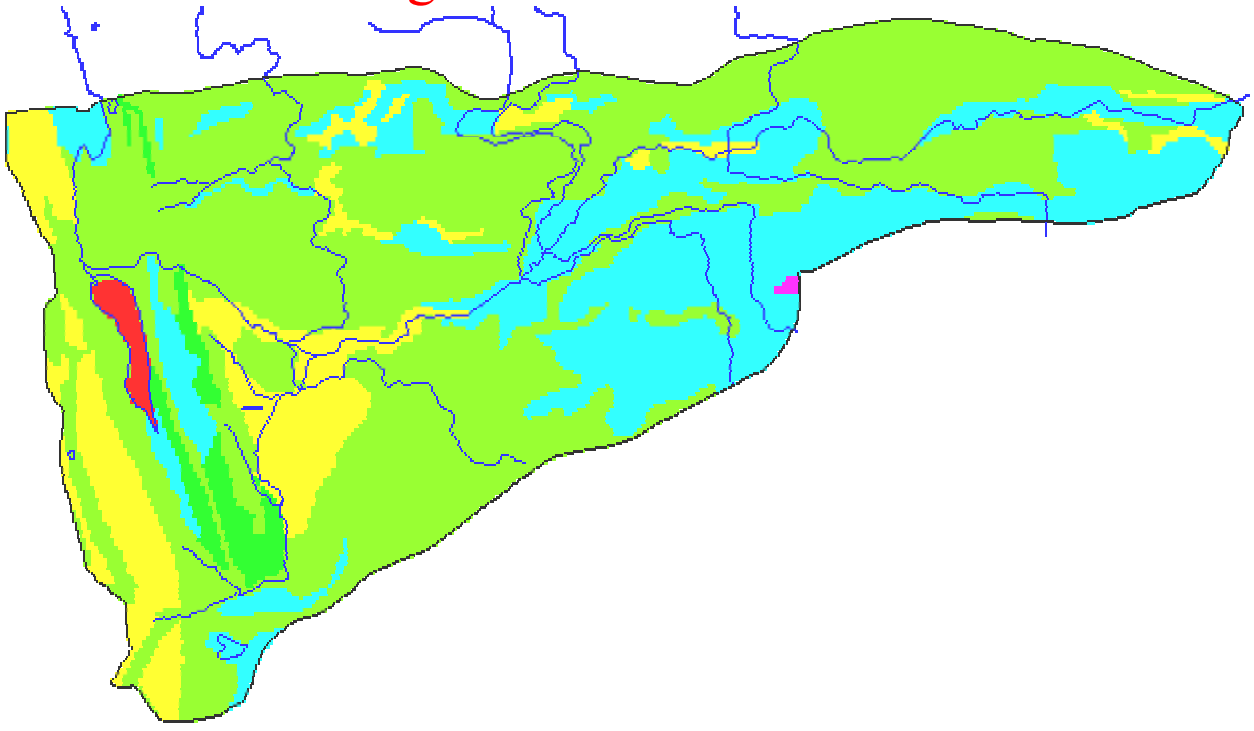


APPLICATION EXAMPLE:
SPRING CREEK WATERSHED (28 July 1997)

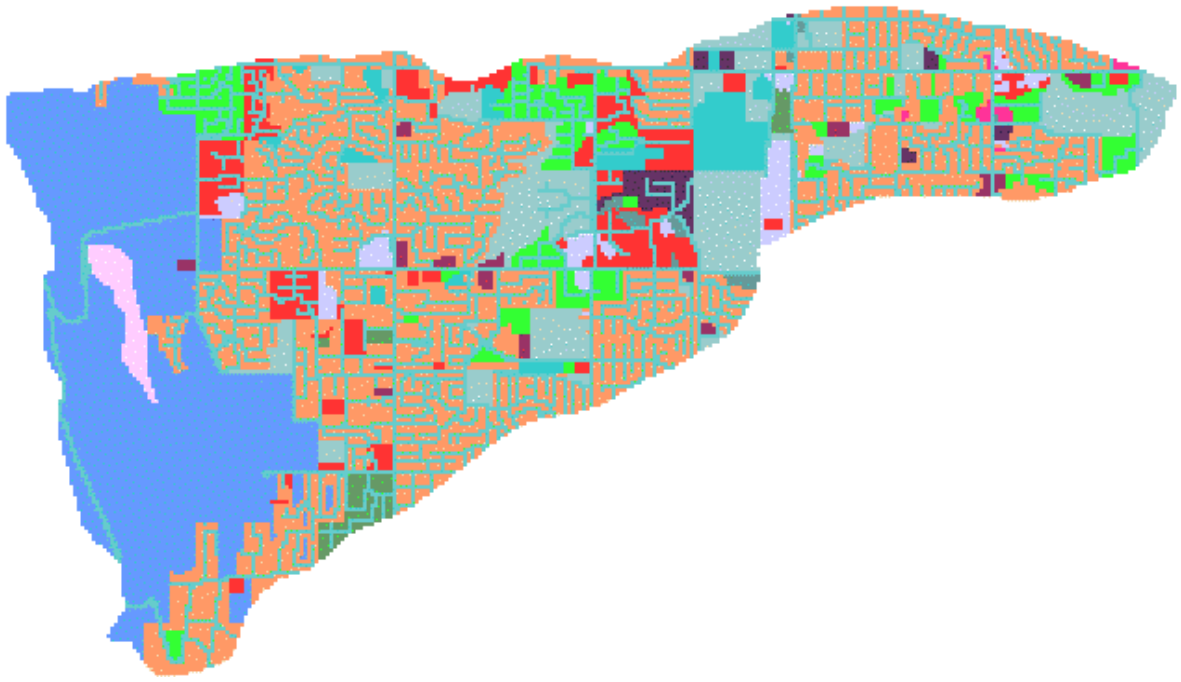
Source: Ogden, 1998 http://horton.engr.uconn.edu/FortCollins/Main.html



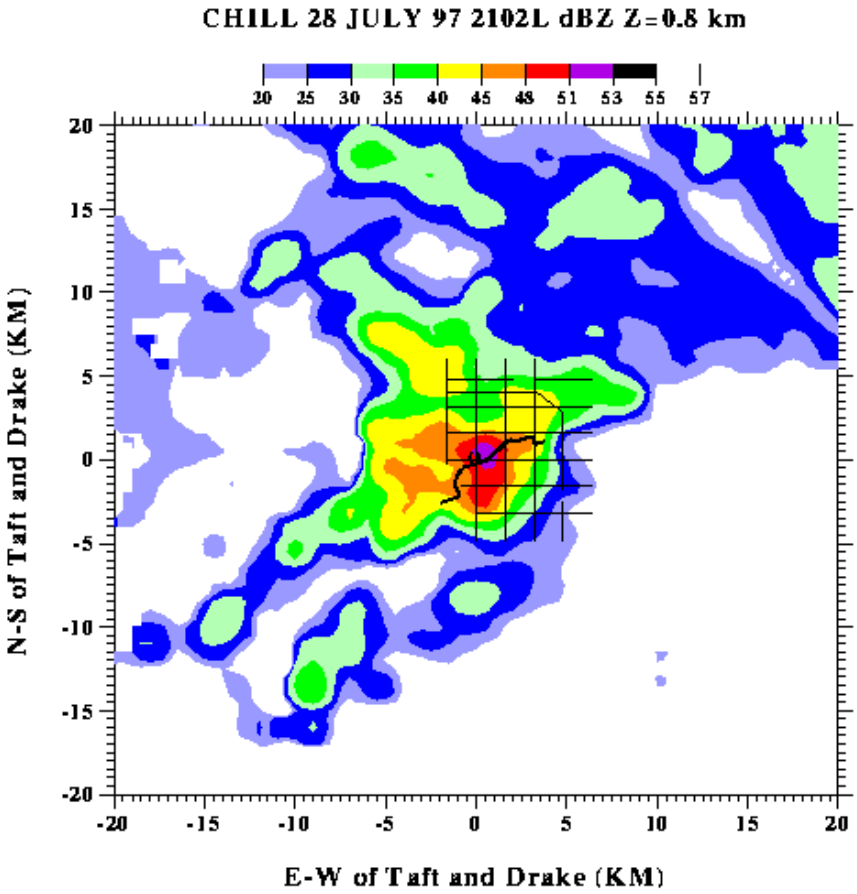
INPUT GRID: Digital elevation model



INPUT GRID: Hydrography and Soils grid

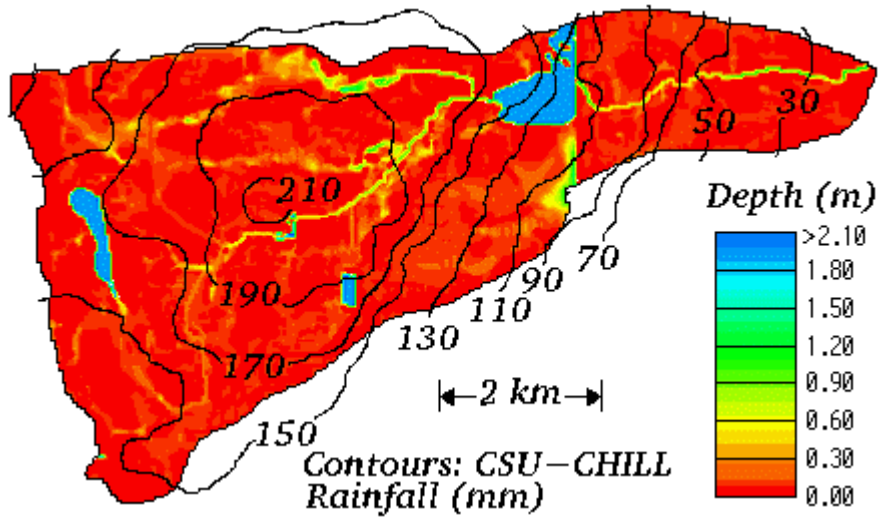


INPUT GRID: Land Use / Land Cover grid



INPUT GRID: Spatially-Distributed rainfall

CASC2D-SED OUTPUT:
Prediction of water depth (flooded zones)



FINAL REMARKS

- CASC2D-SED is able to predict local flooding conditions in a watershed using distributed rainfall data (Ogden, 1998; Jorgeson, 1999)

- CASC2D-SED has been successfully coupled with precipitation forecasts from radar data via linear extrapolation of the rainfall pattern. Forecast lead-time increased by 6 hours (Jorgeson, 1999)

Hydrological Distributed Model (CASC2D-SED) for Flash Flood

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