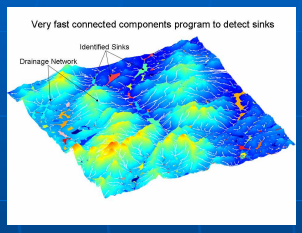
Drainage Network and Watershed Reconstruction on Simplified Terrain

Jonathan Muckell[a], W. Randolph Franklin[a], Marcus Andrade[b], Barbara Cutler[c], Metin Inanc[c], Zhongyi Xie[c], Daniel M Tracy[c]
[a]Department of Electrical, Computer and Systems Engineering, Rensselaer Polytechnic Institute
[b]Universidade Federal de Vicosa, Visco Brazil
[c]Department of Computer Science, Rensselaer Polytechnic Institute

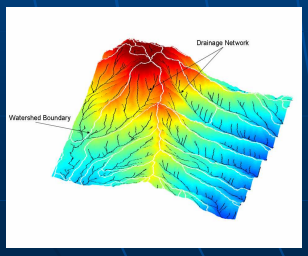
PROBLEM

• Large Dataset Sizes: Terrain data is being sampled at ever increasing resolutions over larger geographic areas requiring special compression techniques to manipulate the data

• Sampling Issues: Dataset inaccuracies due to insignificant resolution sampling and data collection errors impedes water flowing causing small and unrealistic watersheds.



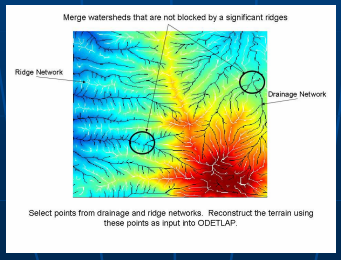
We first compute the initial flow. Sinks and plateaus are detected using very fast connected components program. A breadth-first search from the spill points is used to determine plateau water flow.



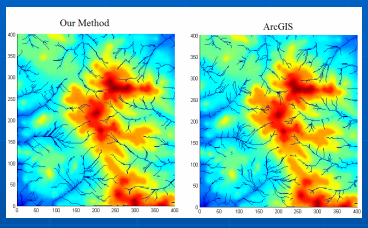
METHOD

1. Compute Initial Flow. Where every cell flows to the lowest adjacent neighbor.
2. Very fast connected components program is used to detect plateaus and sinks
3. We use a breadth first search to assign directions to flat regions
4. Flow is recomputed using new directions
5. Connected components program is used to determine watersheds
6. Steps 1-5 are repeated for the inverse of the Terrain. This provides the Ridge Network
7. Douglas-Peucker is used to select the most significant points from the Ridge-River networks. These are stored as our compressed representation of the terrain.
8. To reconstruct the terrain we use Over-determined Laplacian Partial Deferential Equations (ODETLAP) to "fill in" the missing data points
9. Flow is computed on reconstructed terrain. Resulting in fewer, more realistic watersheds since flow can run passed small insignificant ridges.

RIDGE-RIVER NETWORK



Select points from drainage and ridge networks. Reconstruct the terrain using these points as input into ODETLAP.



RESULTS

• Realistic watersheds and drainage networks
• Better compression
• Terrain is reconstructed without small insignificant ridges
• Reconstructed terrain fixes some sampling and dataset errors.