Floodplain Discussion

SWOT Science Definition Team Meeting
Washington DC
January 14-16, 2014
On many fronts, researchers have found that existing data are inadequate for characterizing 2D distributions of surface water storage changes and flows in flood plains.
Can regional and global extends of floodable land be quantified through combining remotely sensed river heights, widths, slopes and inundation edge with coordinated flood modeling?
Discuss possible methods to build DEMS from shoreline “contours”
Clarify status of SWOT Land DEM
Update on other new global DEMs
  - TanDEM-X (TerraSAR - DLR)
  - ASTER GDEM (Japan)
Clarify DEM needs (specifications)
Discuss possibility of DEM working group
Toulouse Workshop: could data assimilation be used to decrease error on official floodplain and cross-section topography SWOT product?
“Contour” Method

102.3 m
100.7 m
98.1 m
“Contour” Method

- Input Data for DEM construction
  - Polylines (or spot heights) of elevation data along water/land interface
    - Not exactly contours due to variable heights
  - Other sources of data (SRTM, other global DEMS, regional DEMs)
- Parameter estimation problem
  - Estimate \( z(x,y) \)
- Challenges
  - Vertical and horizontal uncertainties
    - Layover, vegetation, resolution effects, height errors, topographic change, etc.
  - Data gaps
    - Land above highest observed water level
    - Land lower than lowest observed water level
- Coverage of SWOT data
  - Platte R. – An example
Platte R. – An Example

What distribution of stage heights will SWOT see?

Platte River near Overton, Nebraska
Stage/Discharge at USGS Gage 06768000
Redundant sampling of low flow river stages

Limited or nonexistent sampling of high flow stages
Maps of Water Level Frequencies (Planar Extrapolation from Gage)

Limited or nonexistent sampling of high flow stages

Redundant sampling of low flow river stages
SWOT DEM may support improved models of channel geometry below bank-full stages
  ∗ Redundant information at low stages
  ∗ Could have major impact on LSMs, Q estimation schemes, etc.
  ∗ Horizontal and vertical uncertainties are critical
SWOT DEM may not be well suited to flood hazard analyses
  ∗ Infrequent sampling of high stages
  ∗ Can we merge multiple data sources (or use other DEMs) to address this limitation?
    ∗ Including SWOT land signal
SWOT DEM coverage may improve (in a relative sense) with increasing river size
  ∗ Longer floods (weeks to months) allow for increased sampling of high water levels
DEM Studies

- Trigg et al. (2009)
  - Flood hydraulics of Amazon relatively insensitive to bathymetric model (SRTM)
  - 10-11 m flood amplitude
- Yesou et al. (2014)
  - Modeling over Yangtze middle reaches
  - Challenge of obtaining representative DEM
  - Study of TanDEM X (Commercial DEM)
    - 12 m resolution
    - <2 m vertical accuracy
- Sanders (2008)
  - SRTM better at larger scales (~1 km), but errors at local scales (~100 m)
  - Engineered features (e.g., levees) are a challenge

St. Francis Dam-Break Flood Zone (1928)

- 10 m NED
- 30 m NED
- 30 m SRTM
- 90 m SRTM
Open Discussion

- Possible methods to build DEMS
  - Insights from Platte
- Status of SWOT Land DEM
- Update on other new global DEMs
  - TanDEM-X (TerraSAR - DLR)
  - ASTER GDEM (Japan)
- Input on DEM needs (specifications)
- Interest in DEM working group?
- Interest in a benchmarking exercise?