Hurricane Harvey Coastal Effects in Texas

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Hurricane Harvey

- Category 4 storm with 115knot (59m/s) wind and 937mb pressure at landfall near Rockport Texas on August 26, 2017
  - The storm then stalled for several days and caused huge rainfall in the Houston area

- Teams of NSF investigators went to the landfall area to characterize wind/water environmental conditions and damage to the built environment
SURVEY ZONE: HARVEY

Figure Courtesy of T. Kijewski-Correa
Waves and Surge

• Max recorded Hs, Tp
  • Hs=9.27m, Tp=13.79s, NDBC 42020
  • Hs=8.57m, Tp=11.43s, NDBC 42019

• Surge was relatively low
• 0.5-2m on open coast (higher in uninhabited areas)
• 2-3.5m in inland bays
• Locally higher wave runup
Harvey Surge Hindcast from CERA

Coastal Emergency Risks Assessment

Maximum Water Height above NAVD88 (23-Aug-2017, 12:00 - 31-Aug-2017, 00:00 UTC)
Hindcast Storm HARVEY, Track: NHC Best Track, 17-Aug - 31-Aug 2017

Aug 26, 16:00
Aug 28, 3:00
Aug 28, 9:00
Aug 26, 9:00
Aug 28, 15:00
USGS, NOAA, NSF Measured Inundation
Steep Slope, 4.4m Runup

- USGS high water mark
- Runup debris line
- Surveyed GPS elevations
- 125 USGS representative High Water Marks
- 13 NOAA time series of water levels

Photo by Christine Blickenstaff, USGS Texas
Coastal Erosion

• Most inhabited areas were on the weak side of Harvey, and with low surge
  • Erosion here was similar to a bad winter storm
• Inland bays had minor erosion at most
• Greatest effects were on largely uninhabited barrier islands
• San Jose Island was at landfall
  • West end of island was breached in a location that has likely been breached many times before
March, 2017, San Jose Island
August, 2017, San Jose Island
Storm Damage

• Three major types of coastal water damage seen
  1. Structural damage from wave impacts
     • Generally confined to <50m coastal strip
  2. Erosional damage from sediment/foundation loss
     • Immediate coastal area
  3. Water damage from surge inundation
     • Further inland in many cases

• Because coastal inundation was not widespread and most-affected barrier islands were uninhabited, damage was lower than in many other major storms
Corpus Christi
Salt Lake
Holiday Beach
Houston
Wind Damage

• In the area of landfall, wind damage greatly exceeded wave/surge damage
• Exacerbated by very poor construction in some neighborhoods
• Greatest damage to:
  1. Old residential construction
  2. Cold-formed steel commercial/agricultural buildings
• Lowest damage to:
  1. Newer residential construction, particularly with standing seam metal roofs
  2. Heavy concrete/steel buildings
Flythrough of Salt Lake (Ground ~1m ASL)
Conclusions

• Relatively moderate coastal inundation and erosion for such a severe hurricane
  • Worst effects were in sparsely inhabited regions
  • Some structure/infrastructure wave damage in immediate coastal vicinity
  • Salt water inundation damage in low-lying areas
• Wind damage much more widespread in vicinity of landfall
• Inland flooding catastrophic in Houston area
Questions?

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