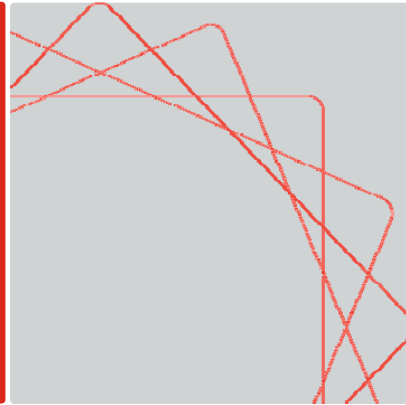




Integrating Data from Multiple Sensors in the *Deepwater Horizon* Damage Assessment

Jamie Holmes
Abt Associates
October 21, 2015



NRDA Remote Sensing Group



- Convened after the spill
- Mission: use available data to quantify the extent of oil on water
 - Discern areas of thick oil vs. thin oil

Sensors



- Satellite
 - SAR
 - MODIS
 - Landsat Thematic Mapper (TM)
- Airborne
 - AVIRIS
 - Ocean Imaging DMSC

SAR



- Greatest sensor coverage
 - TerraSAR-X
 - Envisat
 - RADARSAT (-1 and -2)
 - COSMO-SkyMed (-1, -2, and -3)
 - ALOS (PALSAR)
 - ERS-2
- Coverage of northern GOM nearly every day



MODIS



- Advantages
 - High spatial and temporal coverage
 - Published methods for detecting oil
- Disadvantages
 - Clouds, sun glint, and wind limitations
 - Coarse resolution
 - Visible: 250 m
 - Thermal: 1,000 m



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Landsat TM



- Advantages
 - Relatively high resolution (30 m)
- Disadvantages
 - Clouds, sun glint, and wind limitations
 - Temporal coverage
 - During DWH, one image every 8 days



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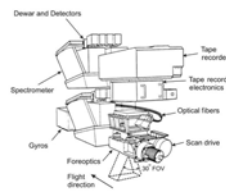
AVIRIS

- Advantages

- High resolution (<10 m)
- Hyperspectral (>200 bands)

- Disadvantages

- Clouds, sun glint, and wind limitations
- Spatial coverage
 - Relatively narrow flight lines
- Temporal coverage
 - USGS analyzed data from one day (May 17, 2010)



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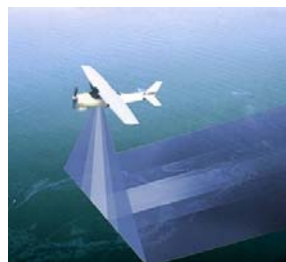
Ocean Imaging DMSC/TIR

- Advantages

- High resolution (<10 m)
- Near-daily imagery
 - Part of response

- Disadvantages

- Weather limitations
- Spatial coverage
 - Narrow targeted flight lines



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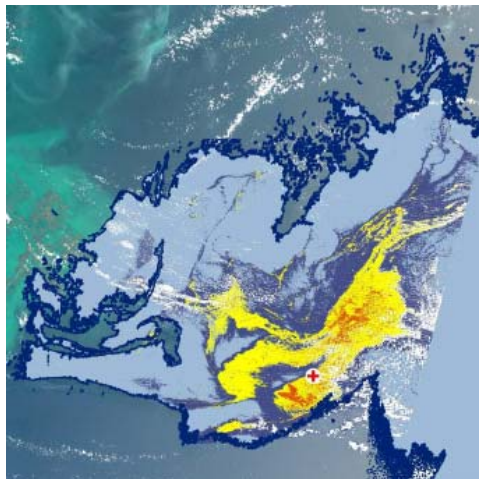
Data Analysis



- Inference from high resolution sensors
 - AVIRIS and DMSC could discern thick oil
 - Previously published methods
 - Use similar spectral relationships to infer presence of thick oil in coarse satellite data
- SAR analysis method for detecting emulsions

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TM Output Based on DMSC

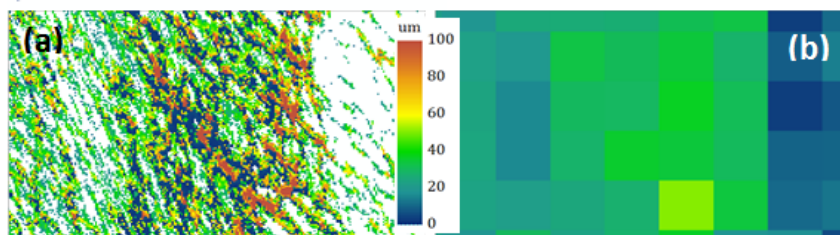


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MODIS Visible from AVIRIS

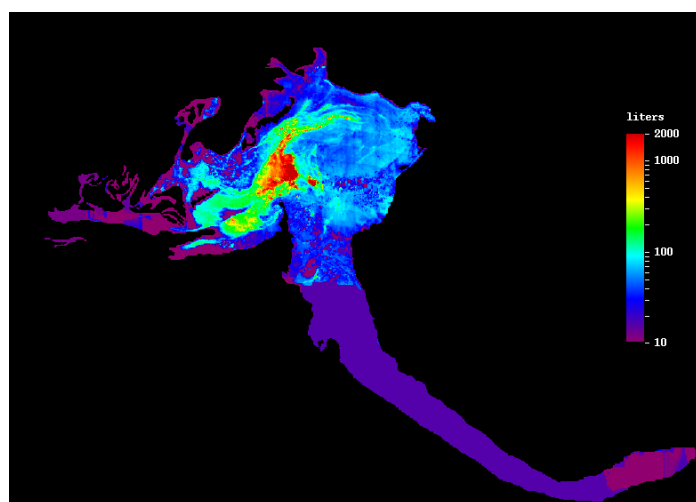


- MVIS: 250 m pixel
- AVIRIS: 7.6 m pixel
 - > 1,000 AVIRIS pixels in each MODIS pixel



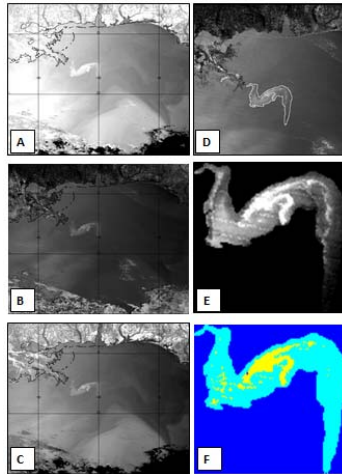
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MVIS Output



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MTIR Based on AVIRIS



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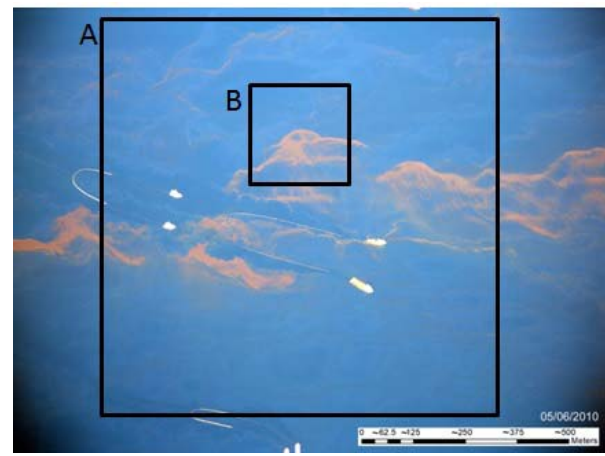
Multi-Sensor Integrated Model



- Integrates data from SAR, MVIS, MTIR, and TM
 - Single product using all available data
- Sensor data integrated into 5 km² equal area grid
- Rough thickness assessment
 - Identifies “thin” and “thicker than thin” oil
 - Very approximate quantitative (under)estimates

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Subpixel Heterogeneity



May 17 Example



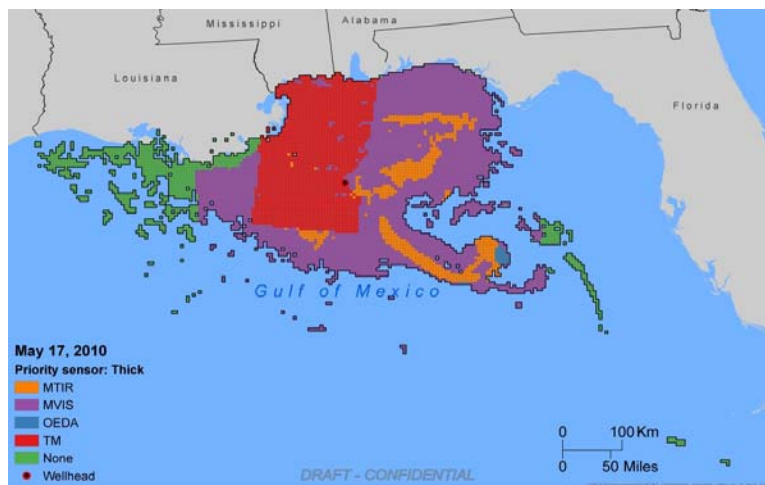
Area of Interest

- Cells where SAR saw oil at least once during spill



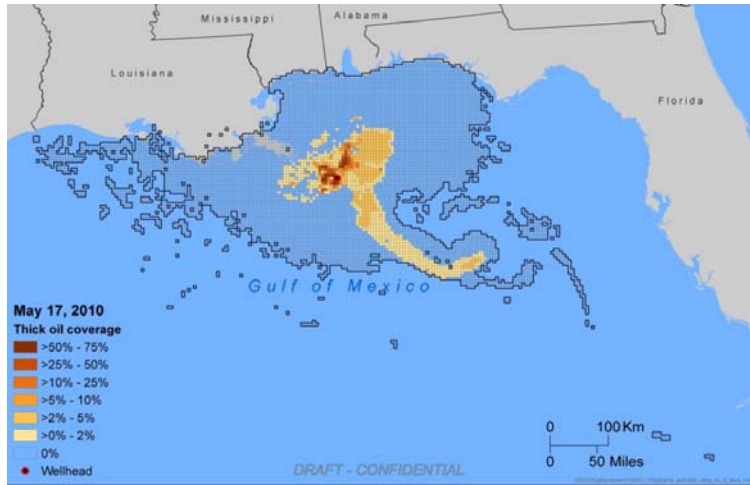
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Sensor Coverage: Priority Thick



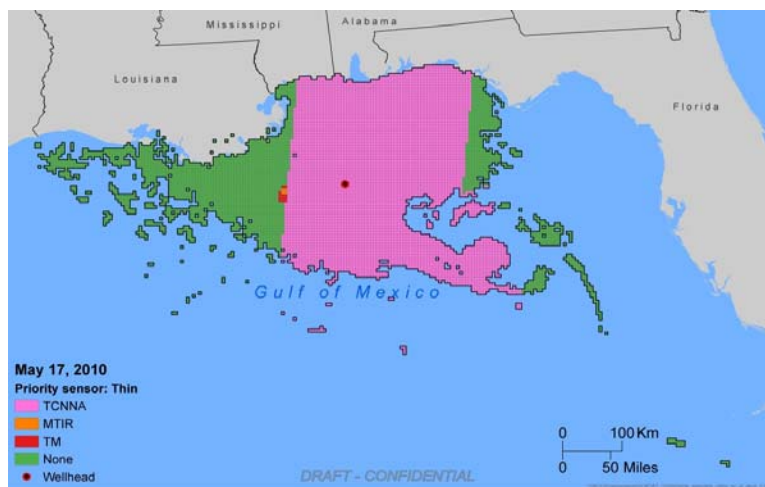
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Model: Percent Thick Oil



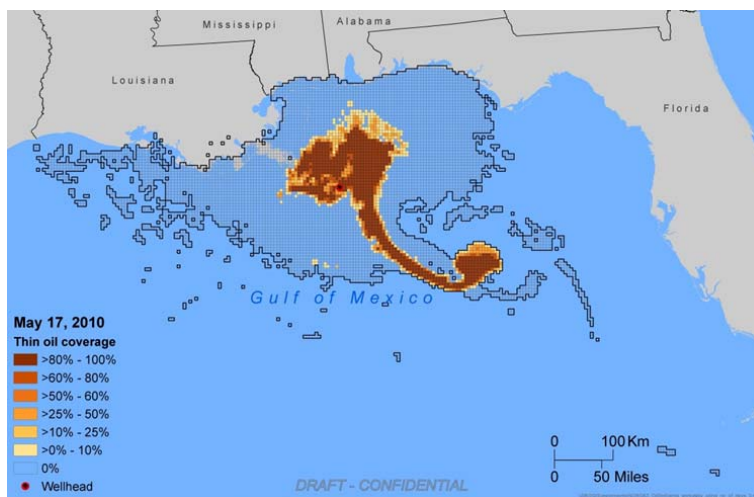
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Sensor Coverage: Priority Thin



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Model: Percent Thin Oil



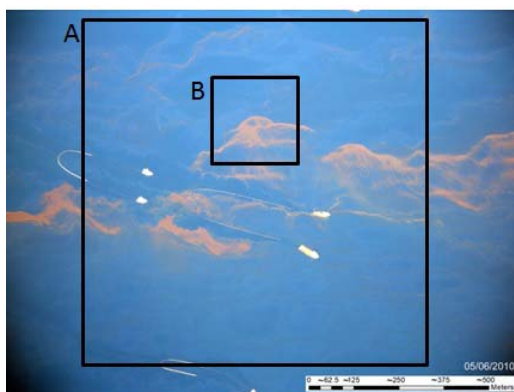
Moving Forward

- Collect additional data during a spill
 - DWH NRDA remote sensing analyses started after the spill
 - Relied on weight-of-evidence
 - Little data for ground truthing
 - No planned synoptic sampling

Moving Forward



- Challenge of using remote sensing data to estimate adverse impacts on critters



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Questions?

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