Oil Spill Detection Using NASA Active and Passive Sensors

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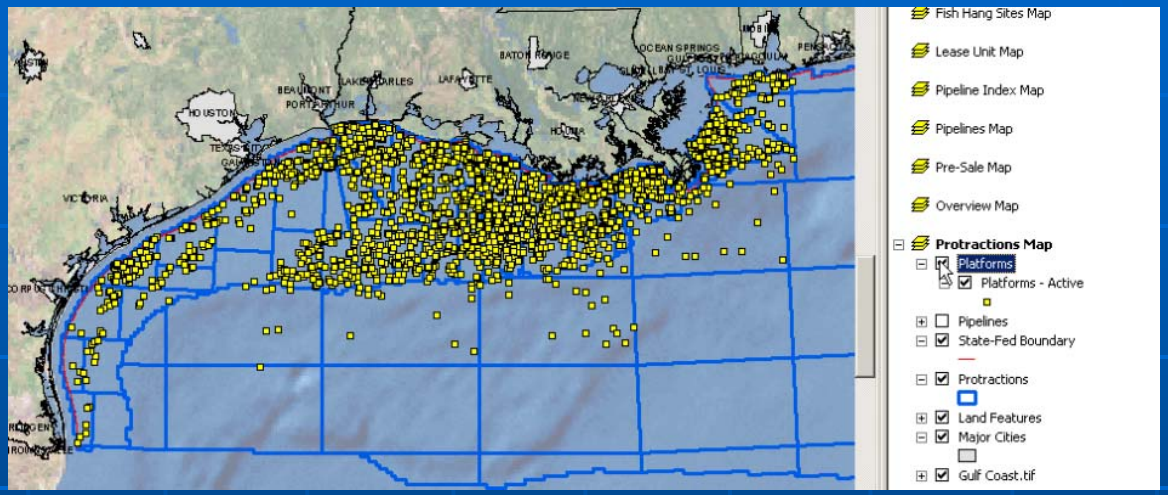
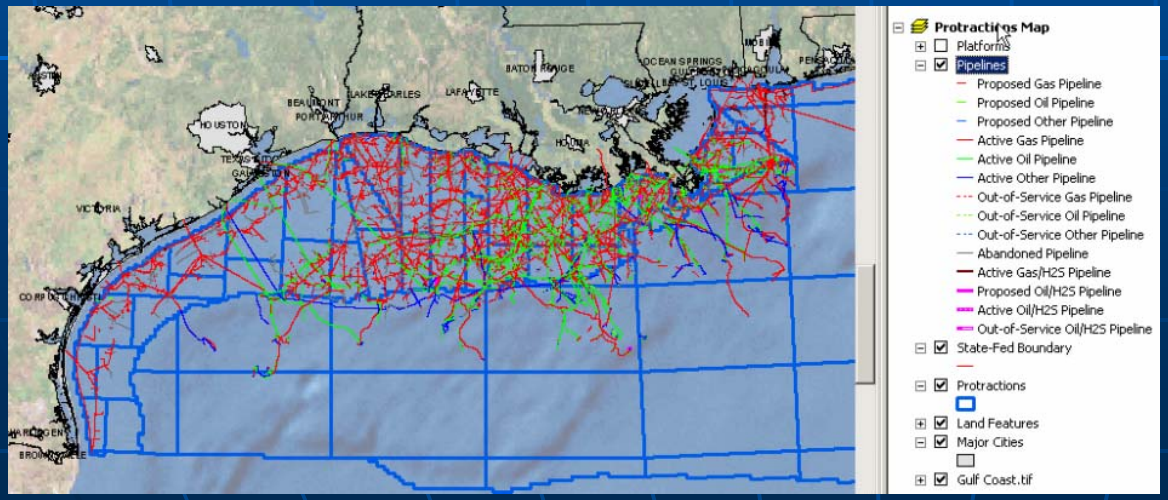


Location and distribution of the oil and gas facilities in the Gulf of Mexico

3,800 fixed platforms
42 million leased acres



Oil and gas pipeline distribution in the continental shelf of the Gulf of Mexico

37,000 miles of pipelines

Source: MMS – Rate Control Unit – New Orleans Office

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Natural seeps cover 850 km

Gulf of Mexico natural oil seeps
MODIS/TERRA 3/16/2006

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Short-term Goal:

Quicker response to oil spills (1-3 days) after hurricane landfall or ship accident while underway or docked

Long-term Goal:

Create the infrastructure for an operational oil detection system for Gulf with MODIS and CALIOP providing the “first alert” for SAR

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Current Operational Status of Oil Spill Detection at NOAA

- Product is generated on an ad hoc basis by STAR,
- Timeliness is 1-2 days
- After data receipt, response is during normal working hours
- Accuracy of Product is unknown
- Not all data sources are exploited (mostly SAR)

Maturity of oil spill algorithms

- An ad hoc research product produced by manual analysis
- No oil detection algorithm using existing data is fully automated
- Interactive systems must be employed to minimize false positives.

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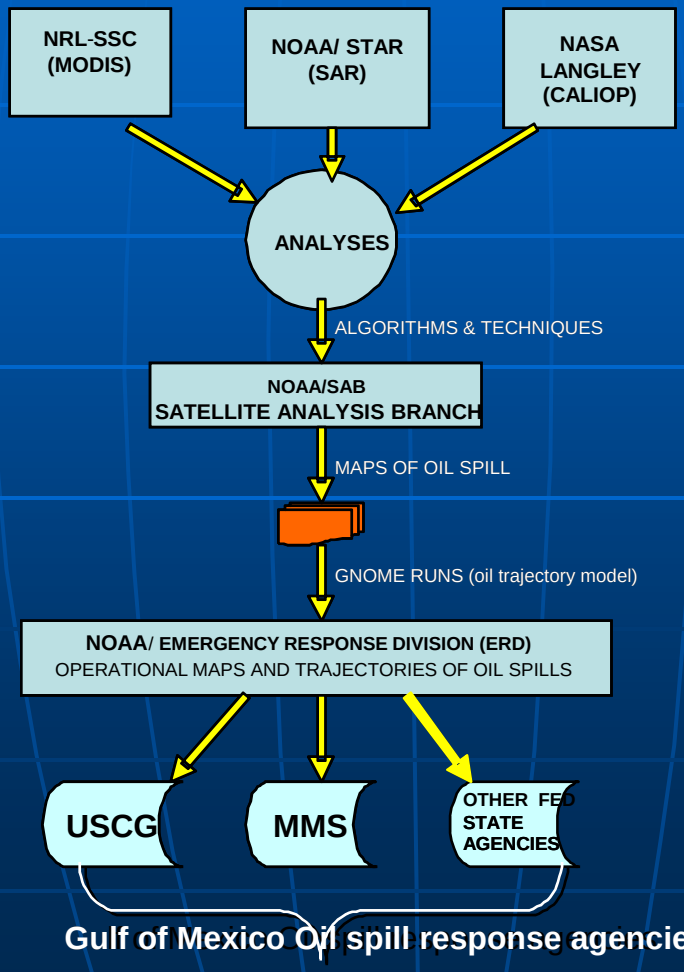
OPERATIONAL SATELLITE OIL SPILL DETECTION
DECISION SUPPORT SYSTEM FOR THE GULF OF MEXICO



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Purpose:

1. To identify anomalies associated with oil spills or natural seeps in MODIS and CALIOP data of the Gulf of Mexico
2. To develop automated oil-spill detection products from MODIS
3. To develop interactive methods to rapidly determine oil spills or natural oil seeps using SAR data
4. To merge the MODIS automated products into the operational OSDPD/SAB environment
5. To introduce the CALIOP data into NOAA/STAR

Expected Results after the introduction of the Oil-Spill DSS

- New and automated satellite products from SAR and MODIS will be used in generating oil detection products for NOAA/OSDPD/SAB

- Research CALIOP products identifying oil spill will be available to NOAA/STAR

- Product will be made operational with 24/7/365 support

- Product will be validated by NOAA/ERD

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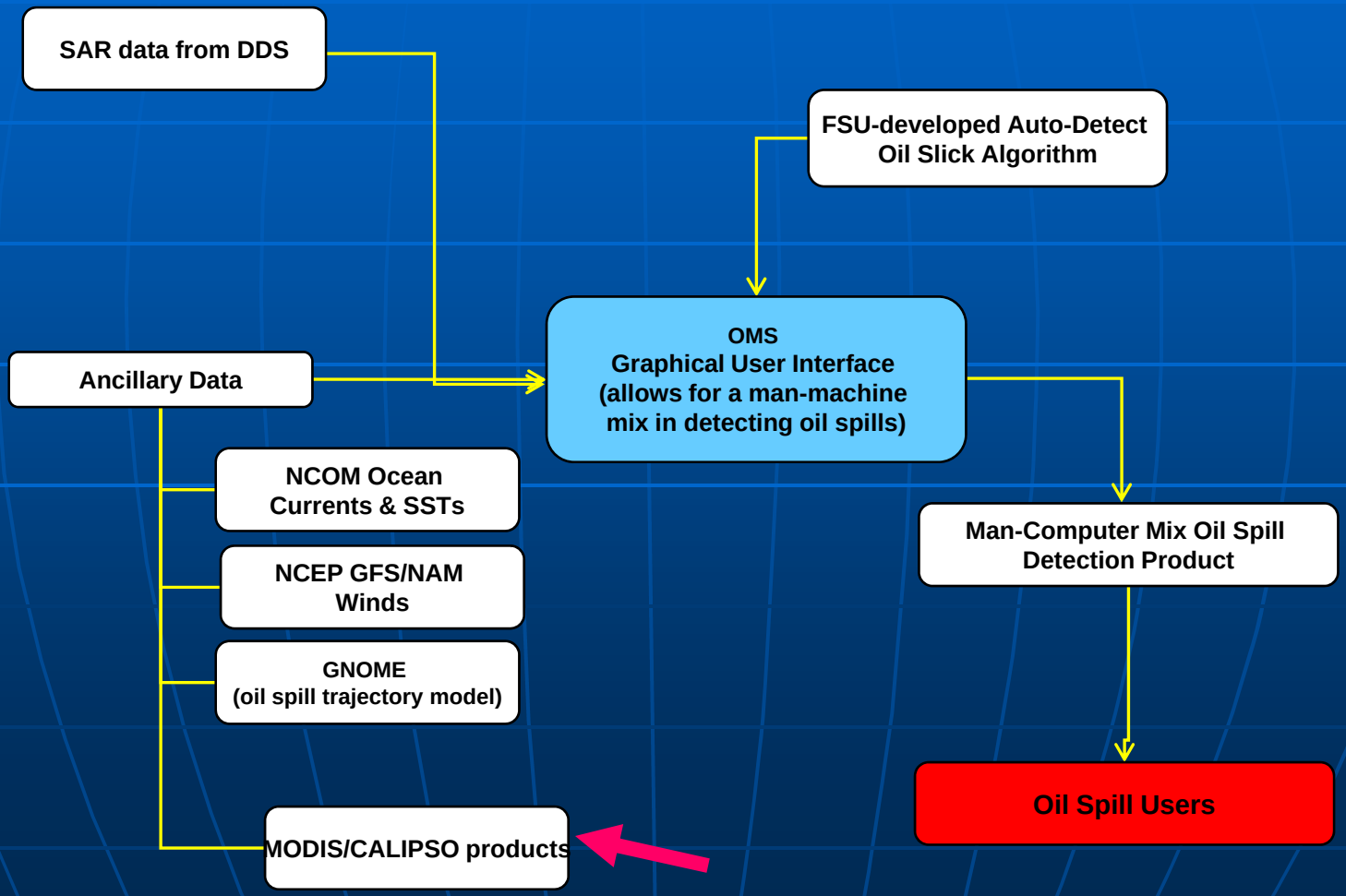
NOAA/Ocean Monitoring System (OMS) IT System Architecture



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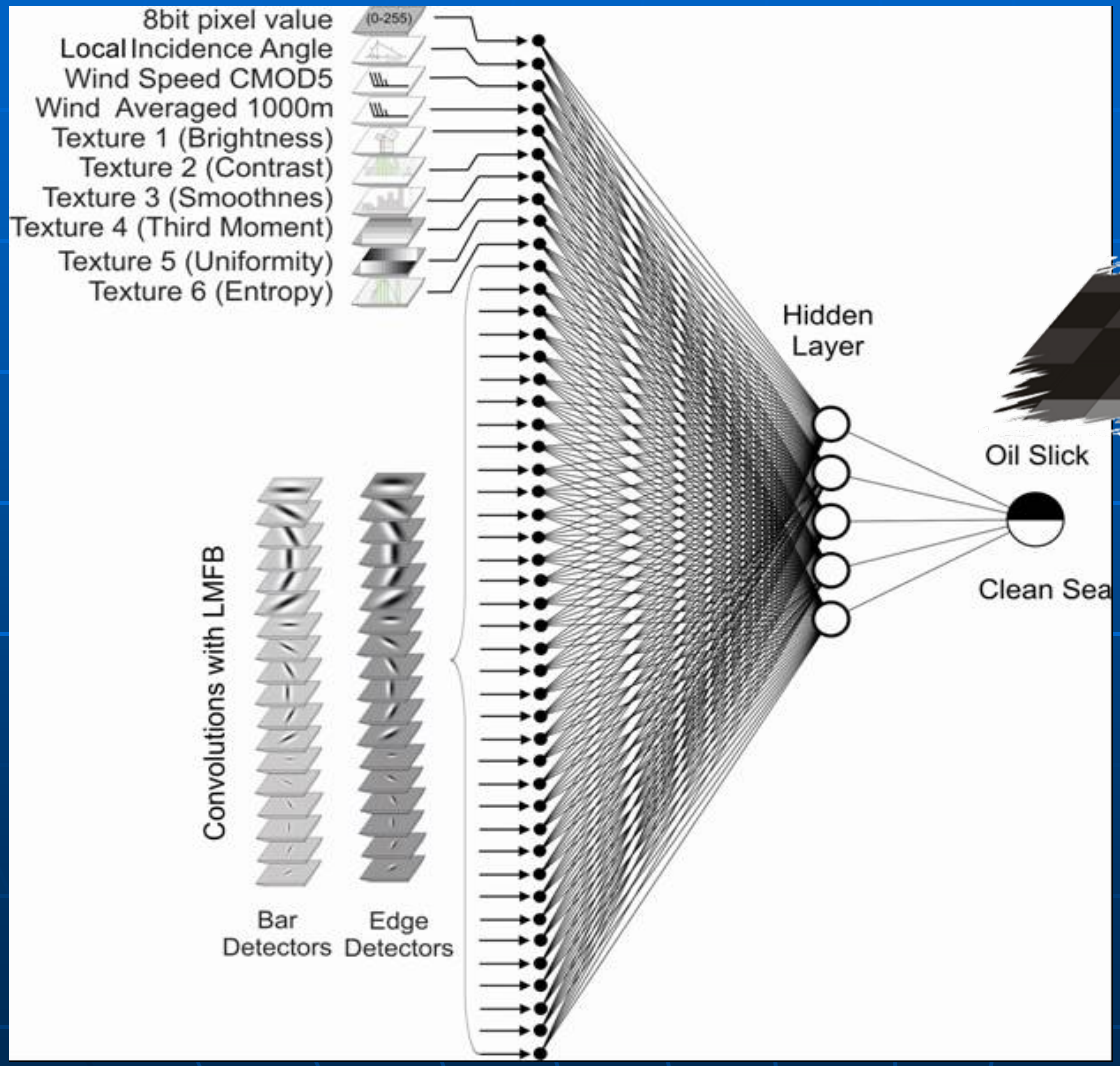
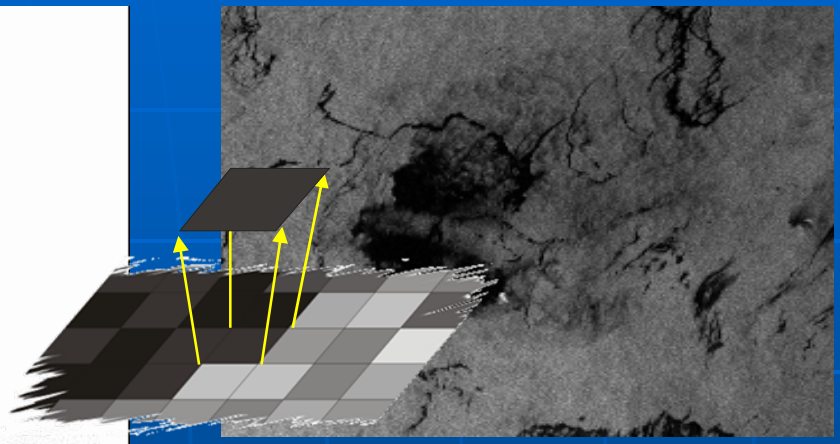
SAR ANALYSES





Four types of Data Integrated:

- Satellite Variables e.g. (Incidence Angle, Beam Mode)
- Texture Features
- Neighborhood
- Environmental Data

Algorithm: Oscar Pineda-Garcia (FSU)

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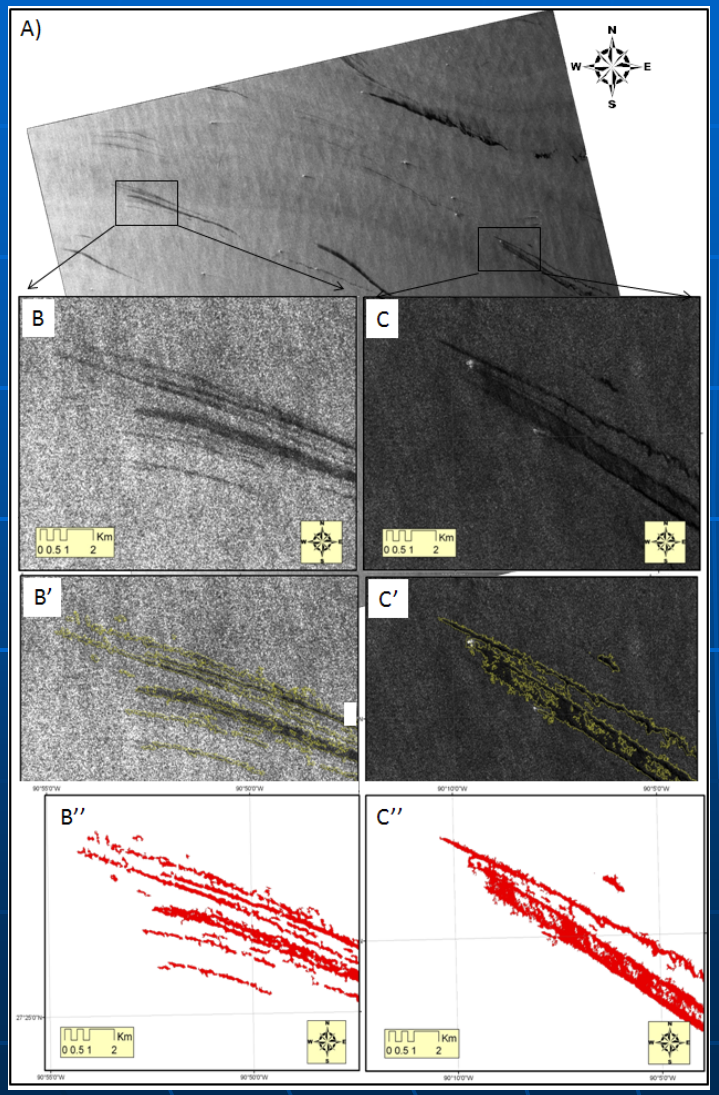

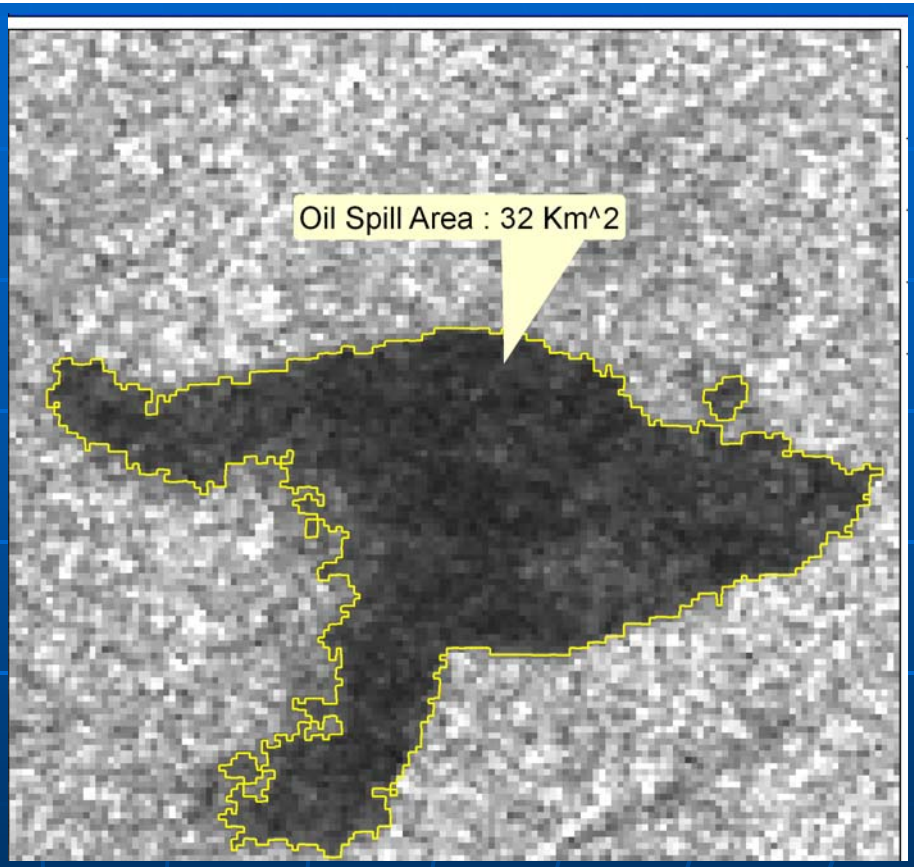

Results of the oil slick detection by TCNNA (neural network SAR analyses)

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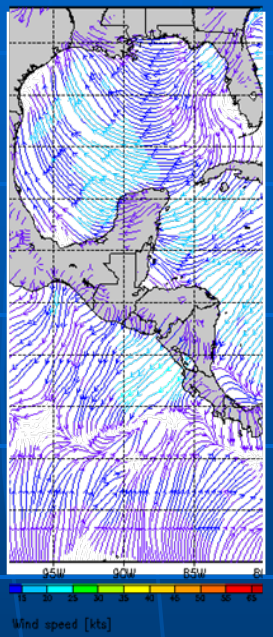
Winds:
GOES-12
SSM / I
Windsat

NCEP winds at NOAA



Surface stream lines and wind speeds COAMPS

Oil identification

- Read channels
- Cluster shade
- Edge generation
- Area search
- Link areas
- Area statistics
- Fill areas
- ID slick

Spectral

+

Textural

Features

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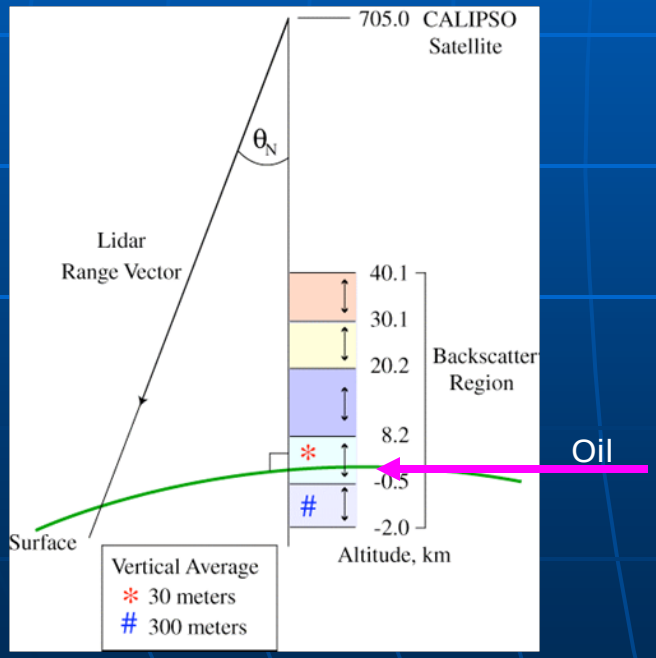
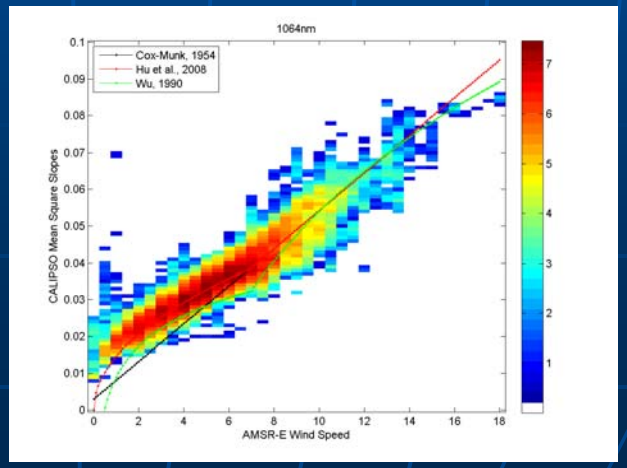
CALIOP

CALIOP
Cloud-Aerosol Lidar with Orthogonal Polarization

2 wavelength polarization bands:
1064 nm (parallel)
532 nm (perpendicular)



Experimental products from CALIOP
- Ocean particle distributions
- Absorbing aerosols for correcting passive data
- Cloud droplet number density and distribution
- Ocean surface wind speed



Thank You