# Data Processing Challenges and Opportunities

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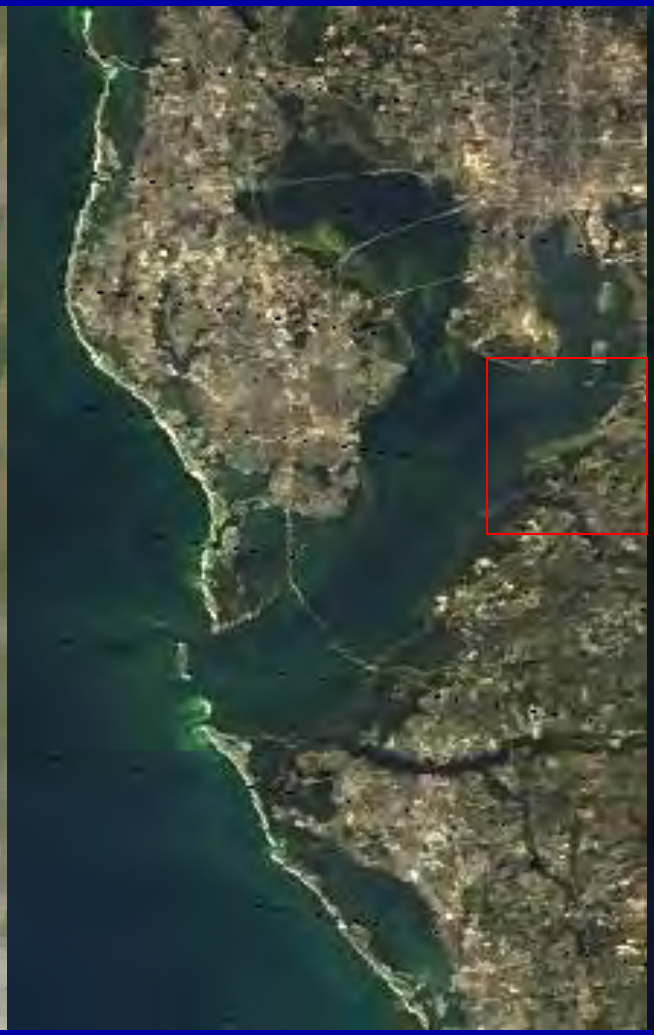
# Questions

- Compared with low- or medium-resolution ocean color processing, what are the additional challenges for high-res data processing?
- Any opportunities for algorithm development and new applications?

# What high resolution?

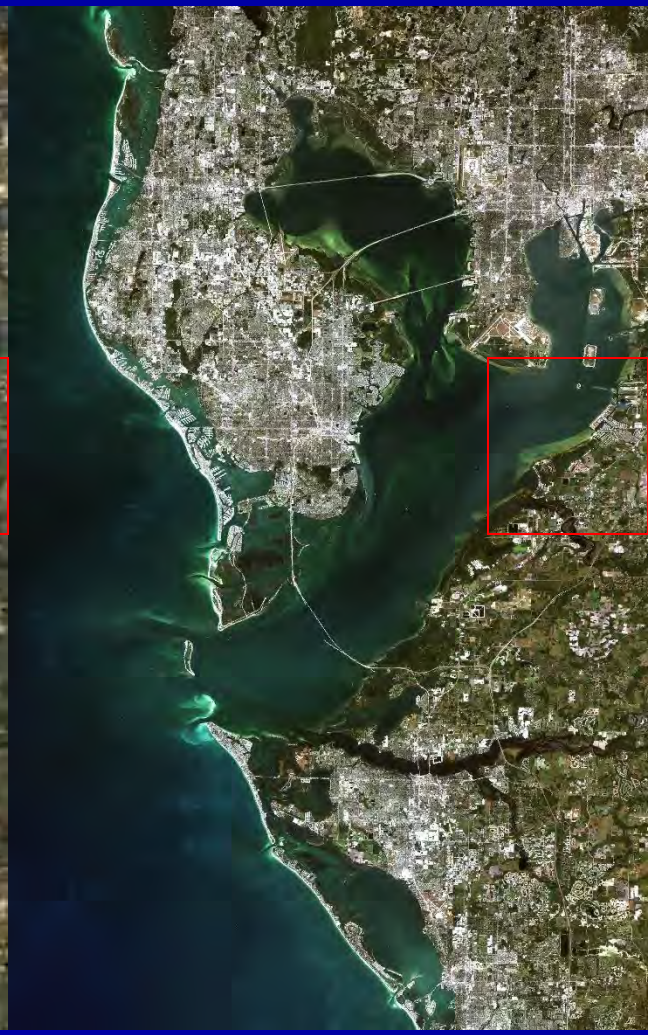
SeaWiFS, 10/31/2000

18:00 GMT, 1-km



MODIS, 11/1/2000

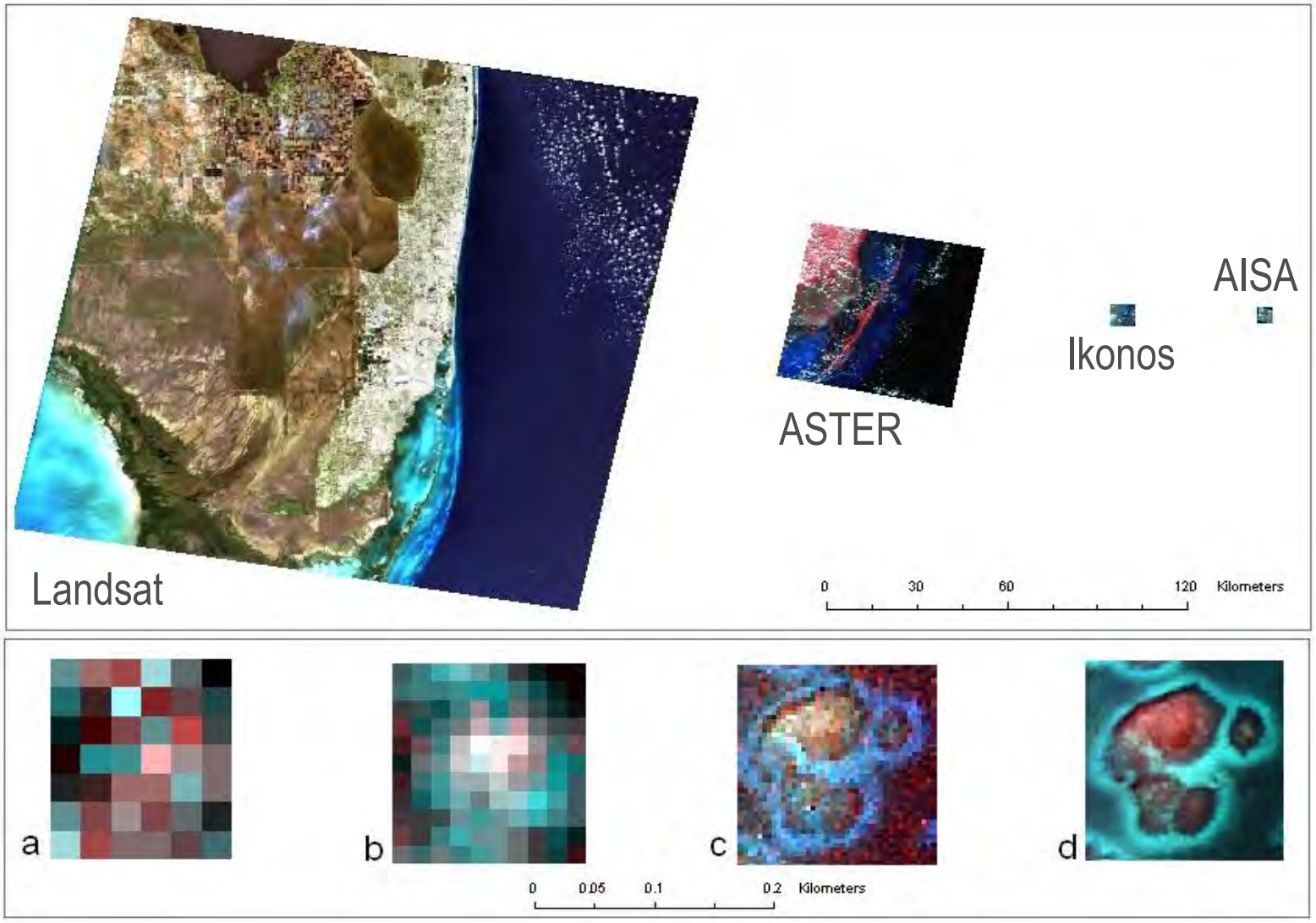
16:30 GMT, 250-m



Landsat/ETM+, 11/1/2000

15:52 GMT, 30-m

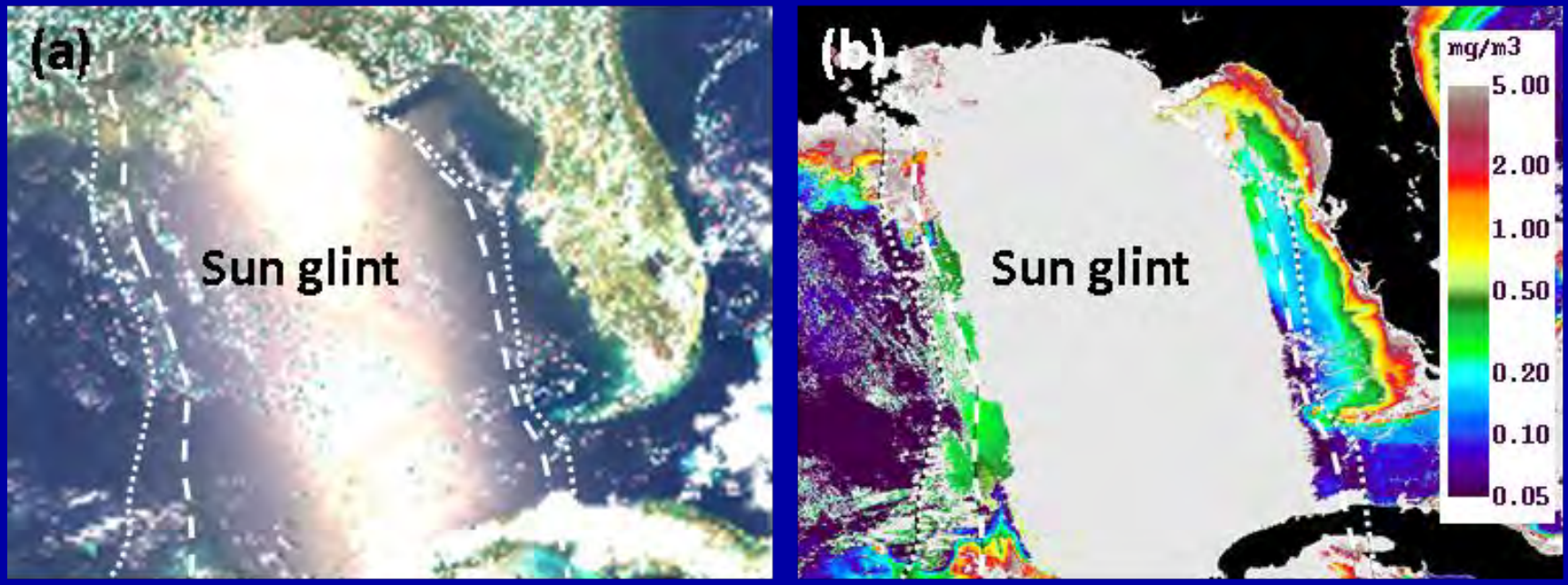
# What high resolution?




Credit: Damaris Torres-Pulliza

# Challenge on sun glint correction

Cox-Munk model based, or image band based



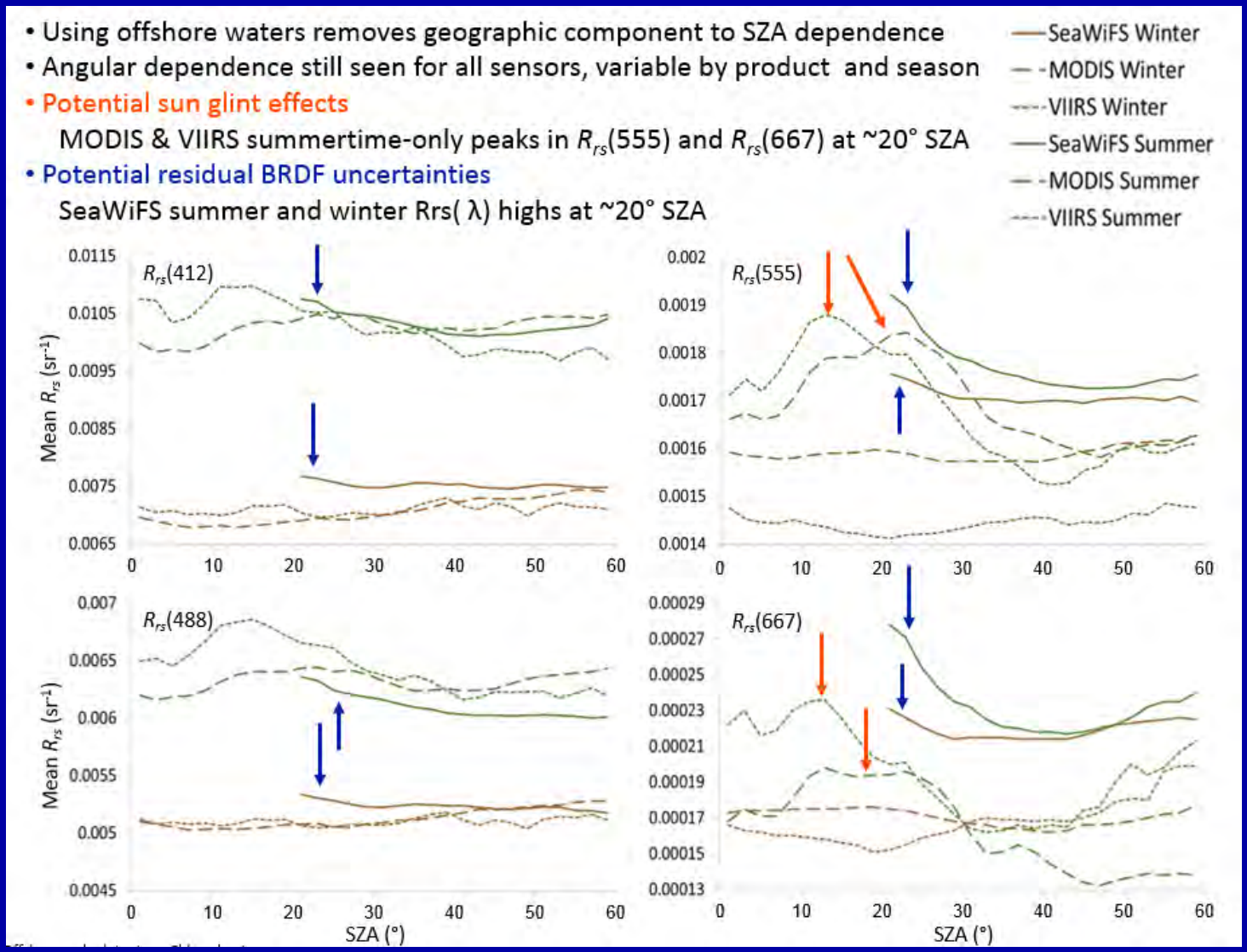
# Challenge on sun glint correction

Residual correction errors showed up in statistics (Barnes & Hu, Poster #7)

- Using offshore waters removes geographic component to SZA dependence
- Angular dependence still seen for all sensors, variable by product and season
- Potential sun glint effects

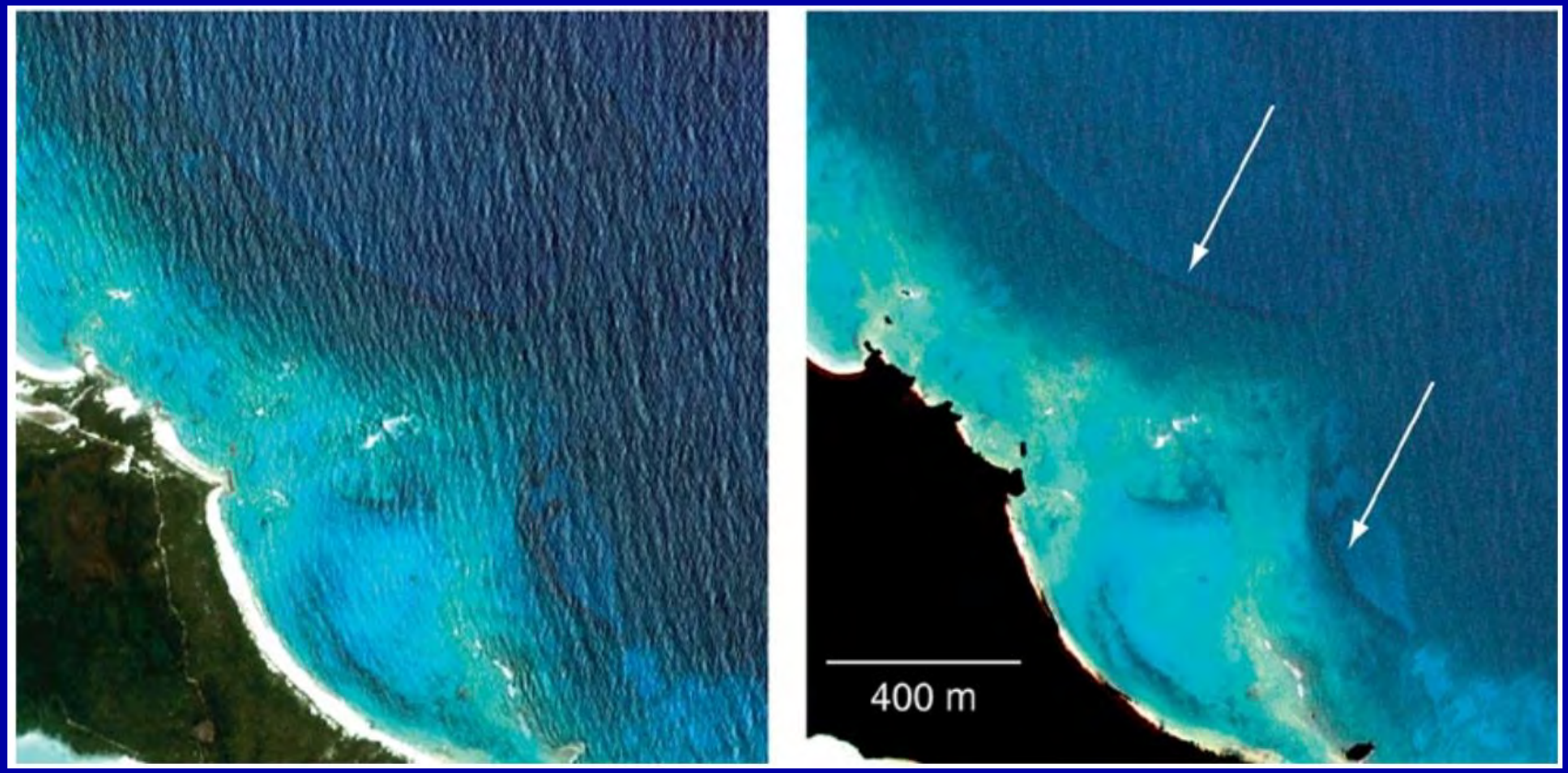
  MODIS & VIIRS summertime-only peaks in $R_{rs}$(555) and $R_{rs}$(667) at ~20° SZA
- Potential residual BRDF uncertainties

  SeaWiFS summer and winter Rrs( λ) highs at ~20° SZA



# Glint features due to surface waves

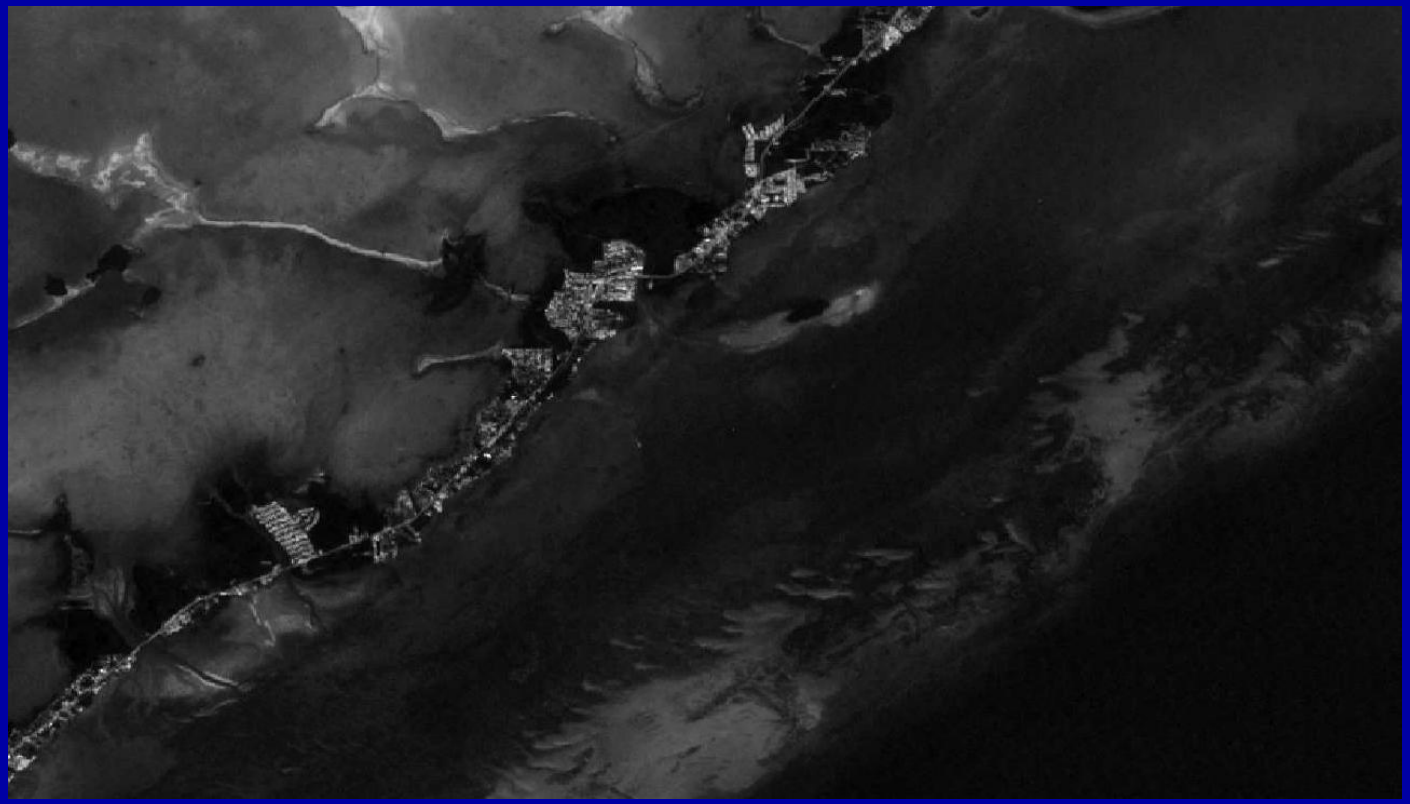
From Hochberg et al. (2003, IEEE TGRS)




IKONOS image showing sky glint patterns due to surface waves

# Challenges on geo-referencing

Errors are often (90% of time) within a pixel for L5, in this extreme example the shift is about 800 m (from Barnes unpublished data)



17 Jan 1996

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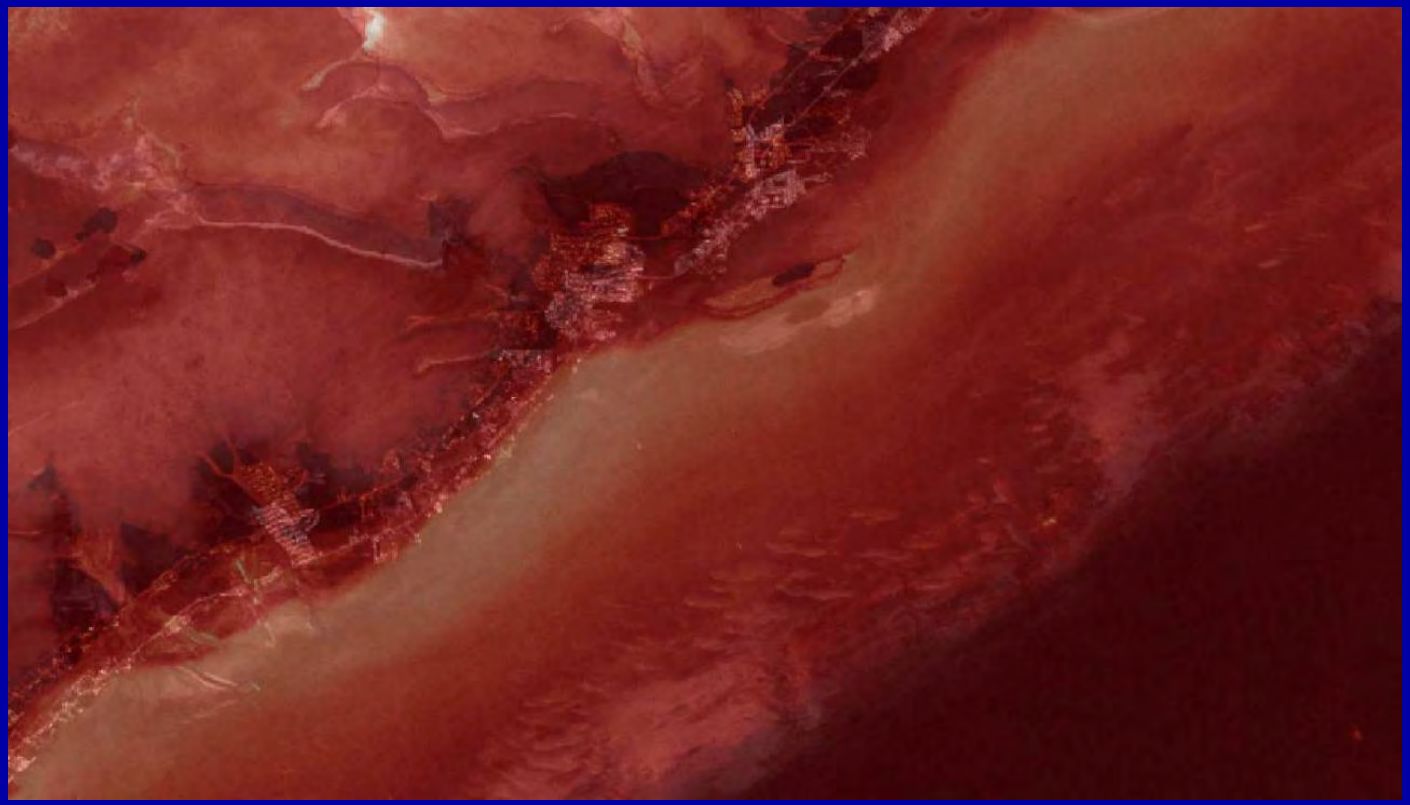
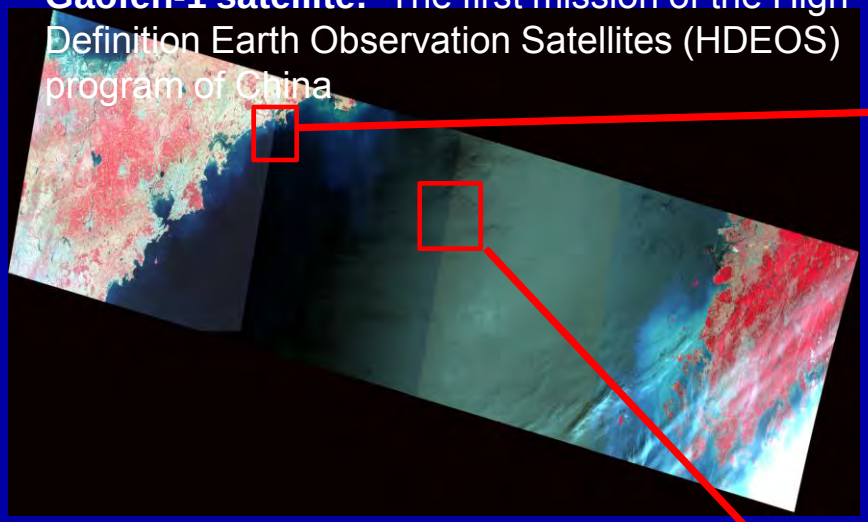


17 Jan 1996

13 Sep 1996

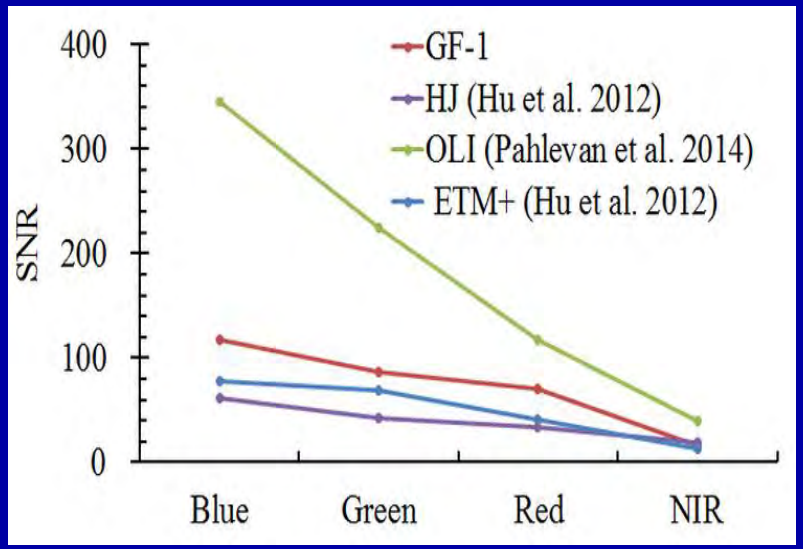
# Challenges on calibration and correction

**Gaofen-1 satellite:** The first mission of the High-Definition Earth Observation Satellites (HDEOS) program of China



800 km

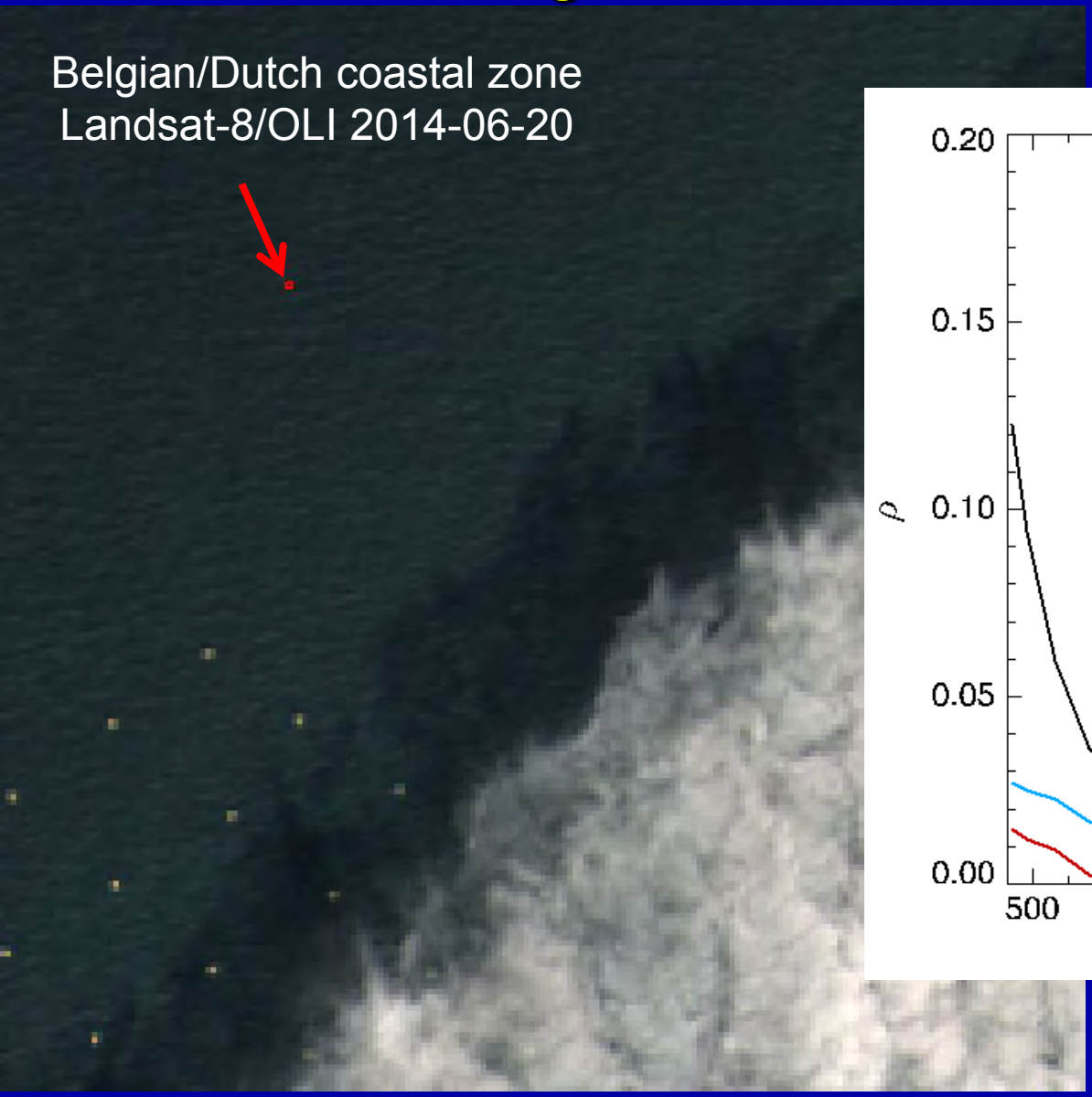
Four parallel cameras with 16-m resolution

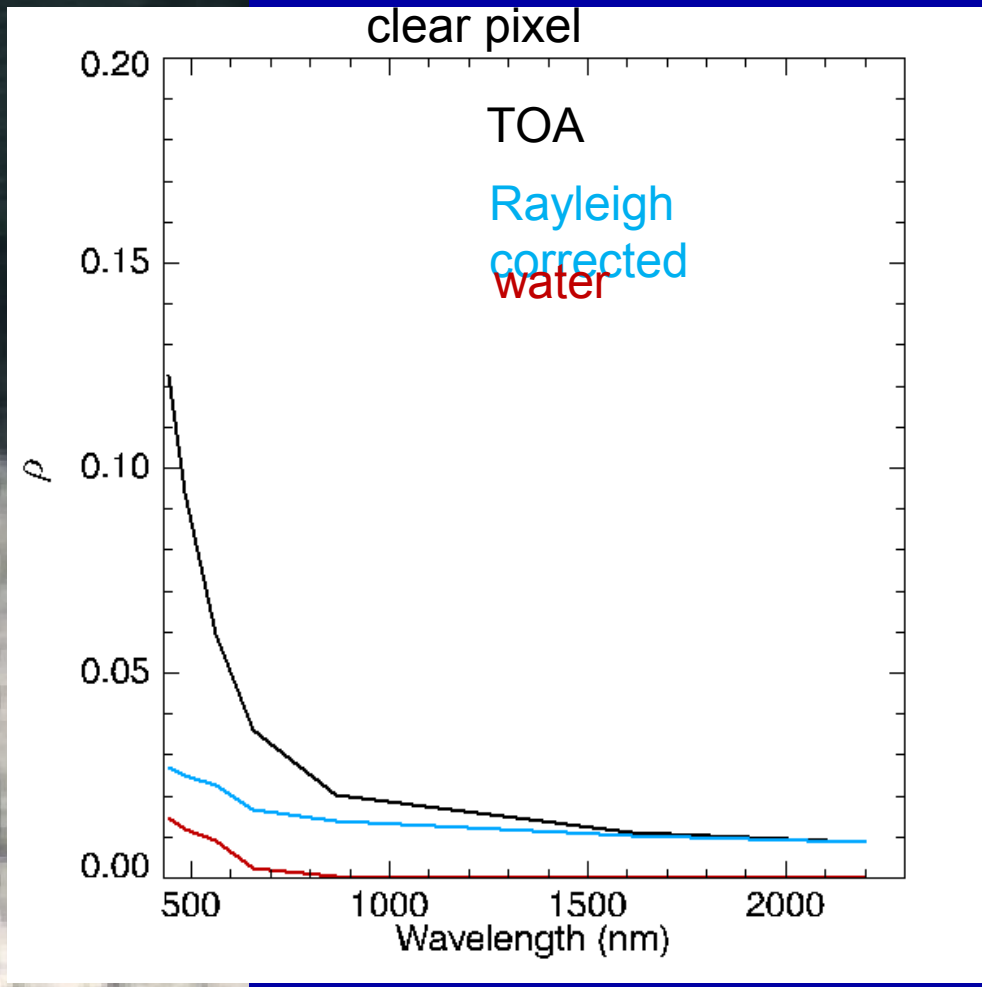



**Credit: Lian Feng, Univ South Florida**

# Challenges on cloud-shadow correction

Belgian/Dutch coastal zone
Landsat-8/OLI 2014-06-20






From Quinten Vanhellemont

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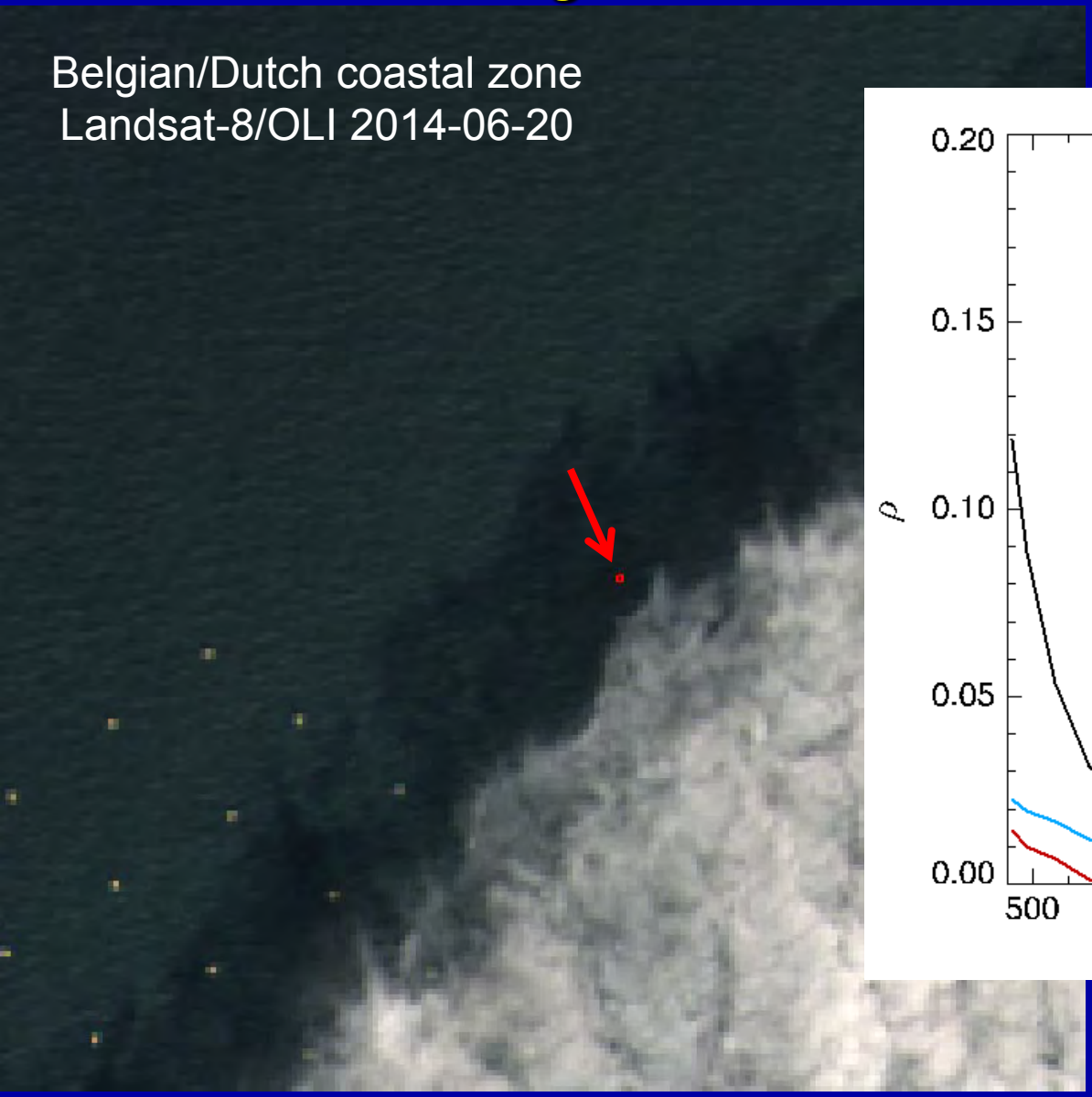
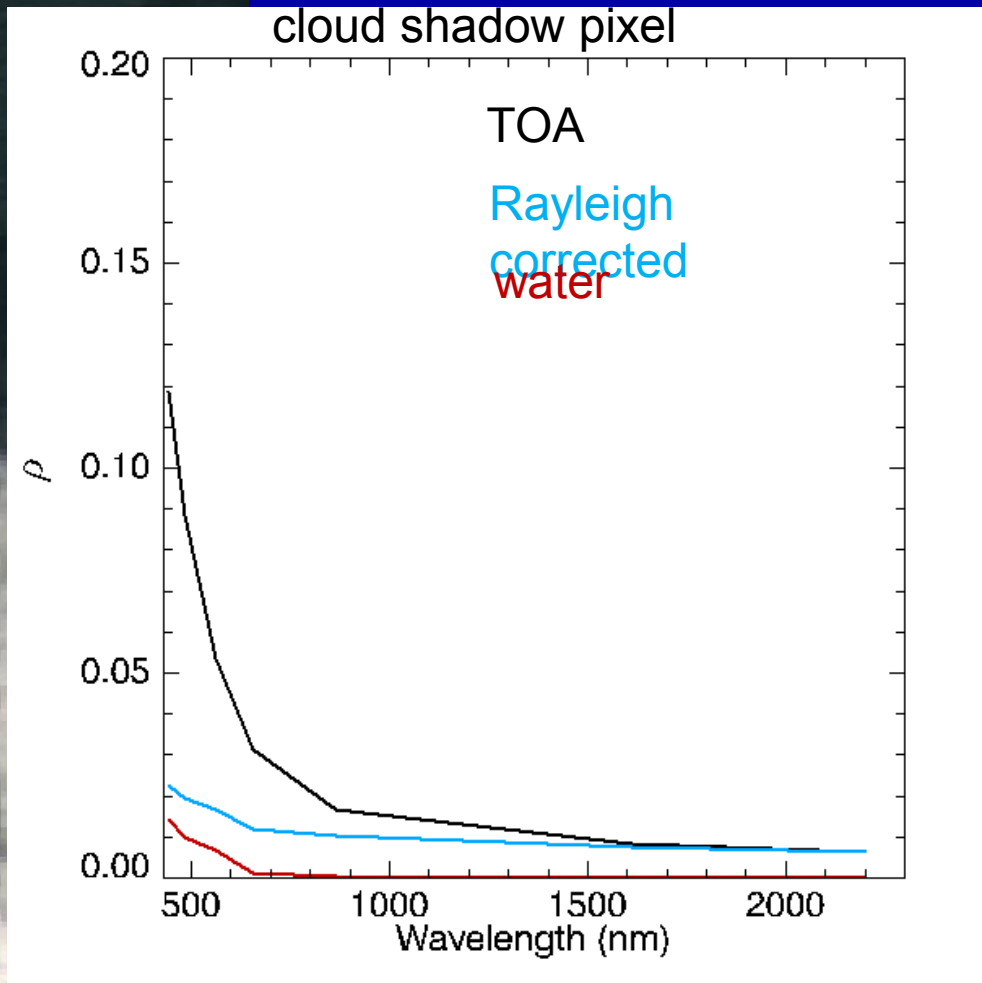
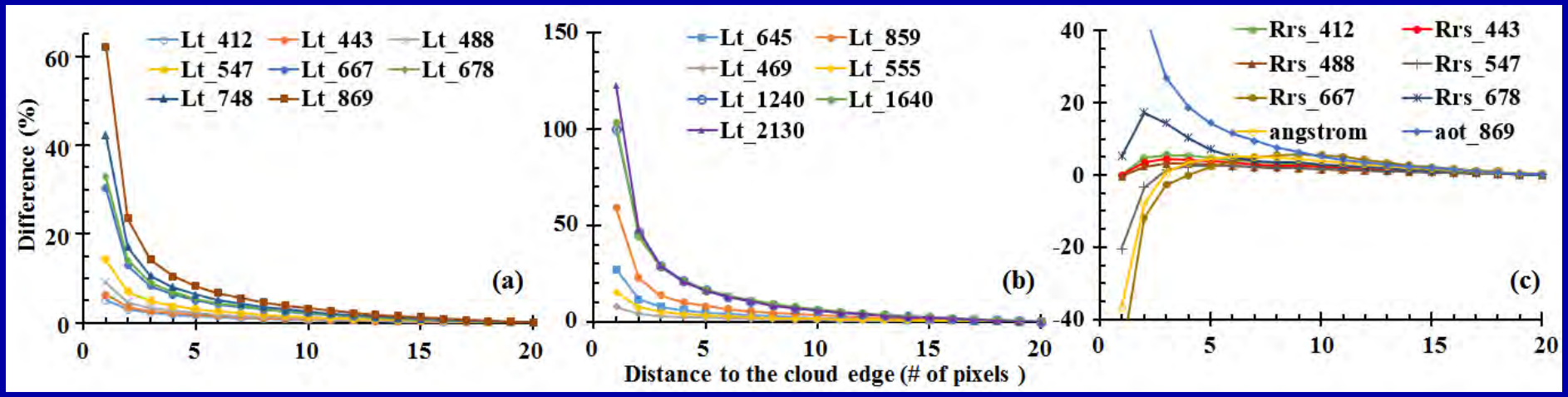




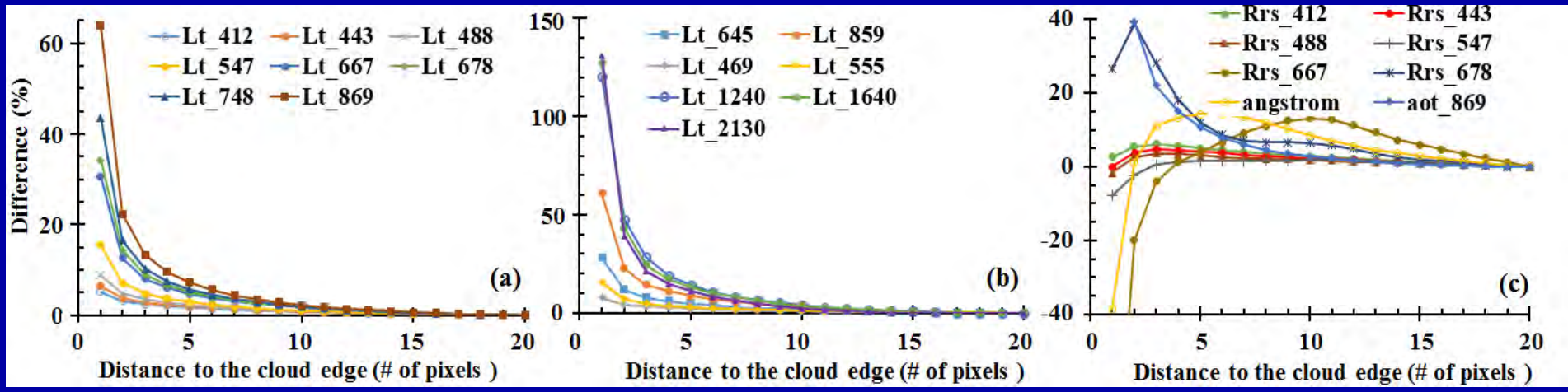

From Quinten Vanhellemont

# Challenges on adjacency correction

(Feng and Hu, Poster #39)




ME-free direction MODISA




ME-free direction MODIST

# Automatic near real-time processing

http://optics.marine.usf.edu, *Sargassum* monitoring

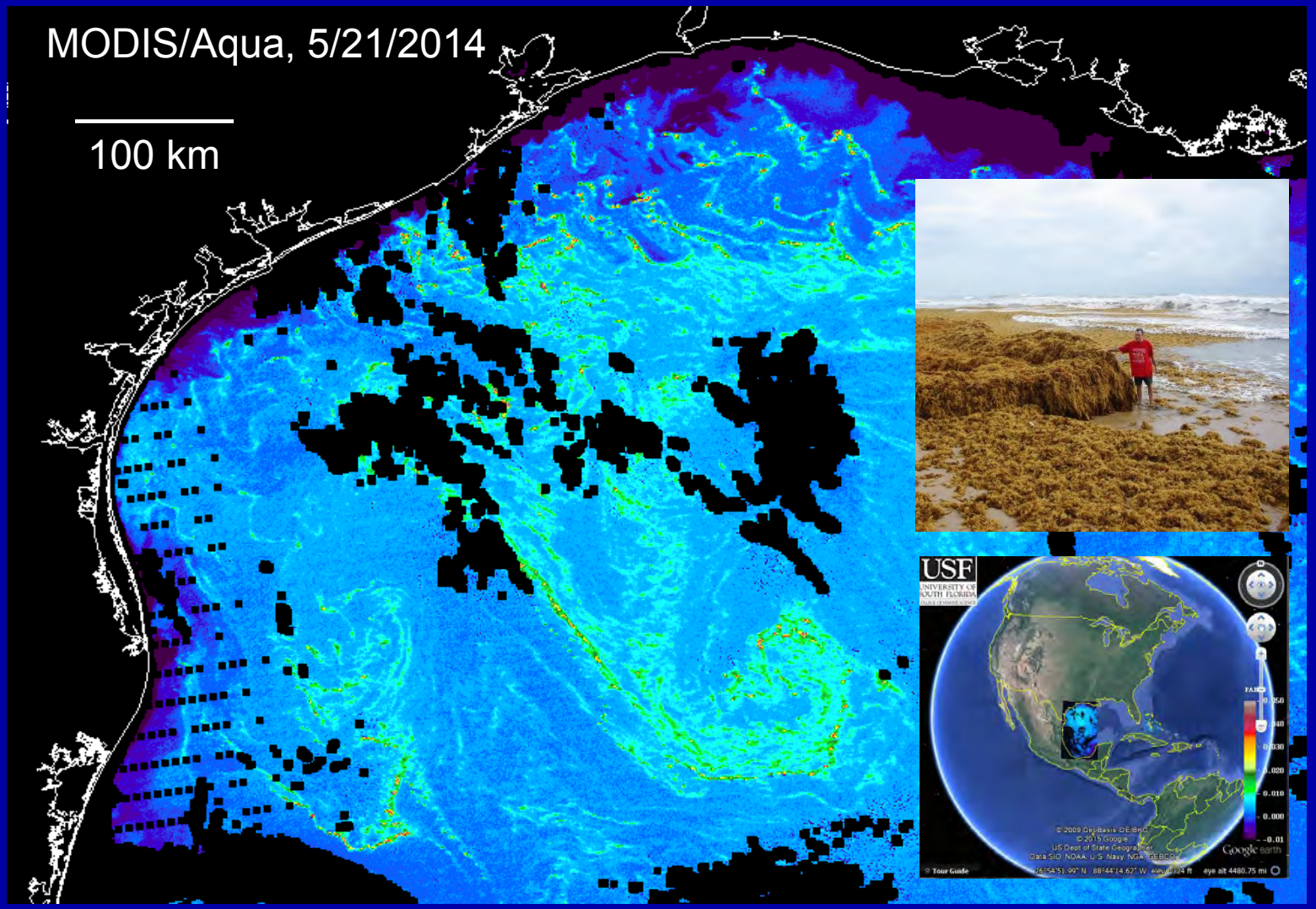



Photo credit: Richard Roach, Barbados)

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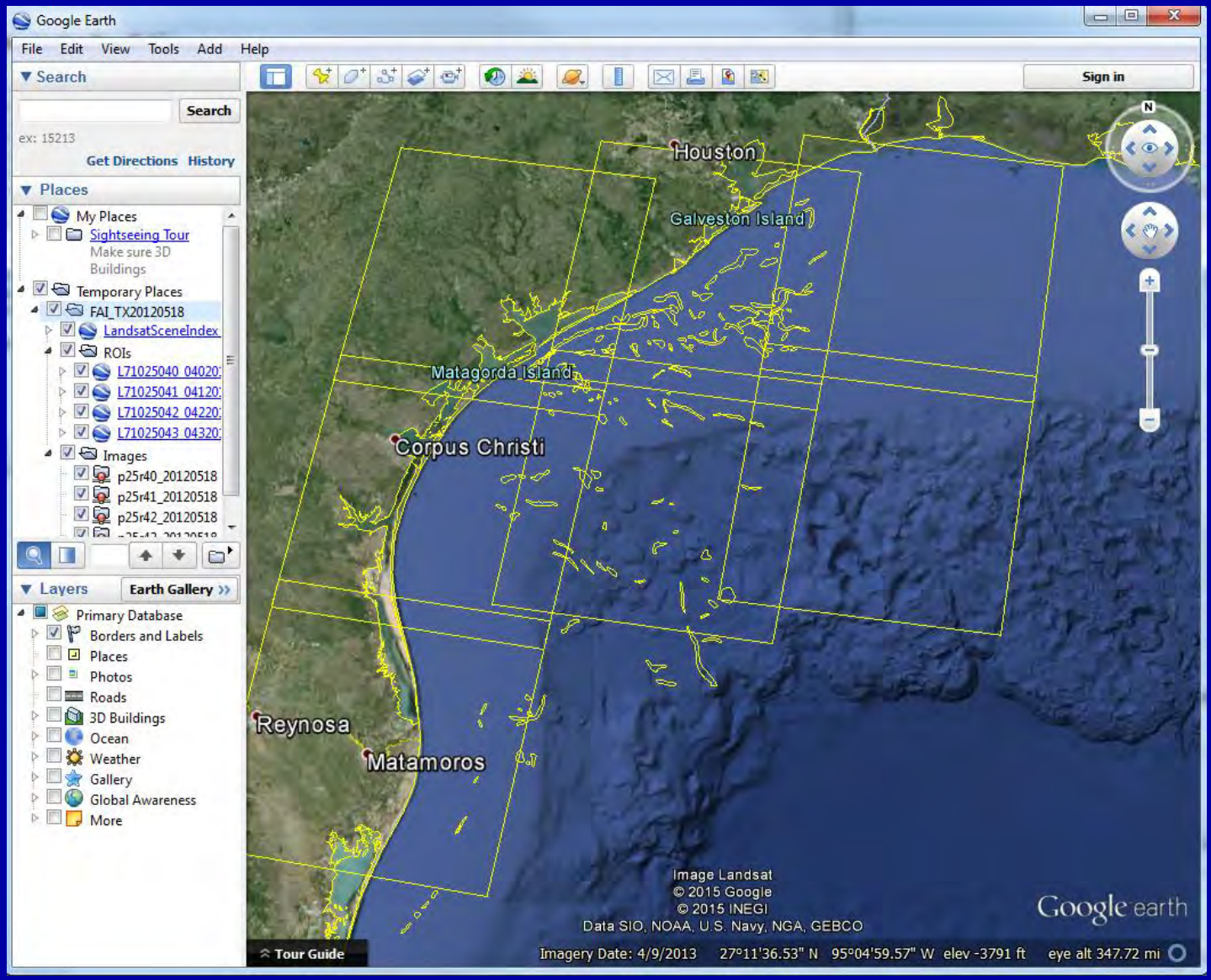
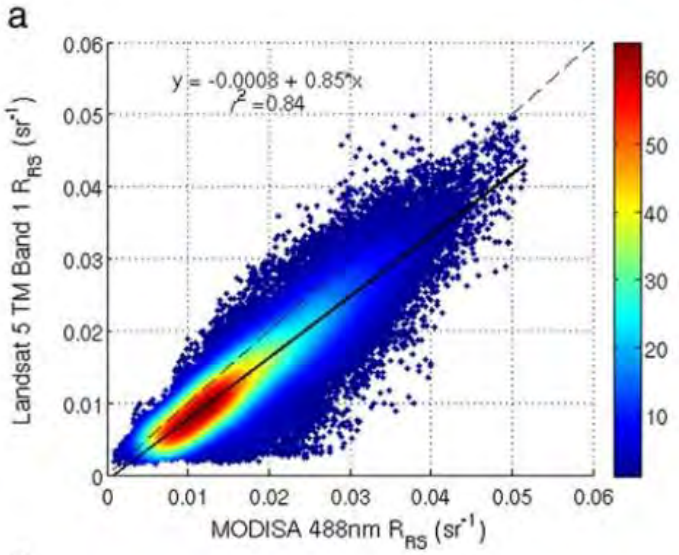
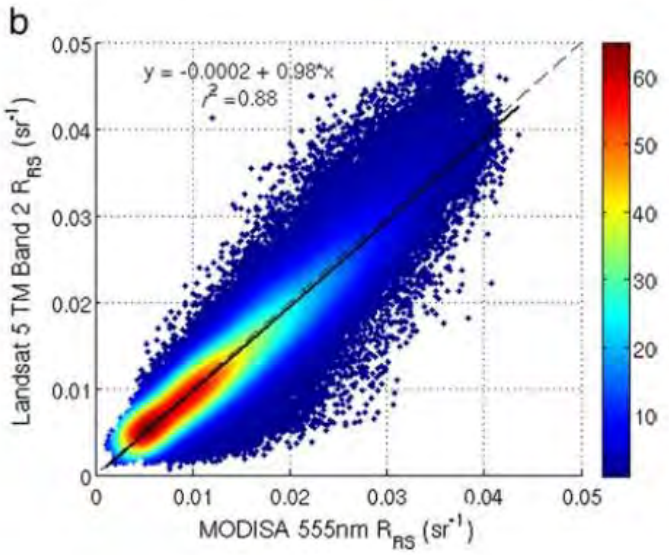
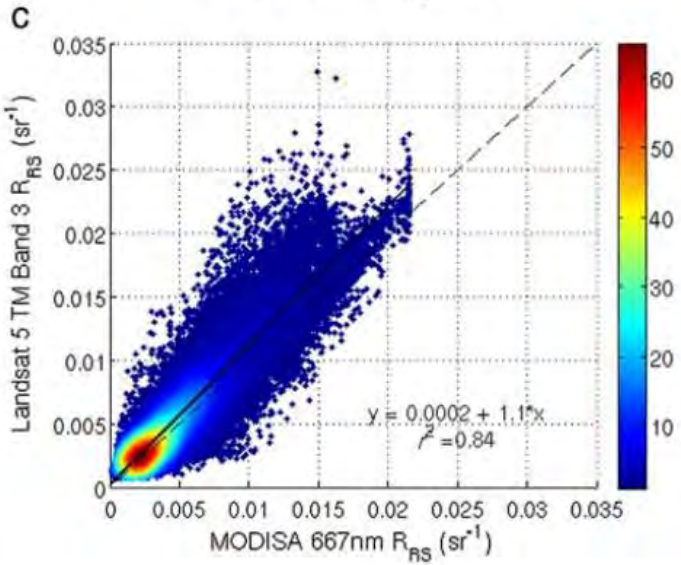


# Opportunities in algorithm development

SWIR-based atmospheric correction, Florida Keys (Barnes et al. 2014)




For L5, 8x8 average is required to enhance SWIR SNR.

Now pixle-wise correction possible with L8 OLI's higher SNR (Vanhellemont and Ruddick, 2015; Franz et al., 2015)

# Some remarks to stimulate discussion

- Additional challenges for high-res data processing
  - Sun glint correction, sky glint correction, geo-referencing, cloud shadowing, cloud adjacency, atmospheric correction, automation
  - Bio-optical inversion – not touched in this talk, but fewer and wider bands than medium-resolution data will pose additional challenge (Lee et al., 2007); so a lot is yet to be done
- Opportunities
  - Fill knowledge gaps in several applications (see other presentations), e.g., detection of small oil slicks and *Sargassum* mats, monitoring dredging impact
  - Reduce uncertainties in other applications due to increased resolution