SCOAPE (Satellite Coastal Oceanic & Atmospheric Pollution Experiment): Overview with OMI and Pandora NO_2 Column Comparisons in the Gulf of Mexico, May 2019

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for Pandora Data

Aura STM, Pasadena, 28 Aug. 2019

OUTLINE

- **Why, Who, How, When & Where of NASA-BOEM Project & SCOAPE**, arranged by NASA HAQAST (Health and Air Quality Appl. Sciences Team)

- **Total & Tropospheric Column NO_2 Comparisons**
  - Ship Pan 66, LUMCON* Pans 67 & 68 vs *Std L2 OMI Total Column (TC) NO_2*
  - Pans 66-68 *with High-Resolution Data (HRD) (v 3) OMI Tropo. Column NO_2*

- **Summary & Looking Ahead**

* LUMCON = Louisiana Universities Marine Consortium, Cocodrie, LA; SCOAPE base for land operations & Port for *Research Vessel Point Sur*

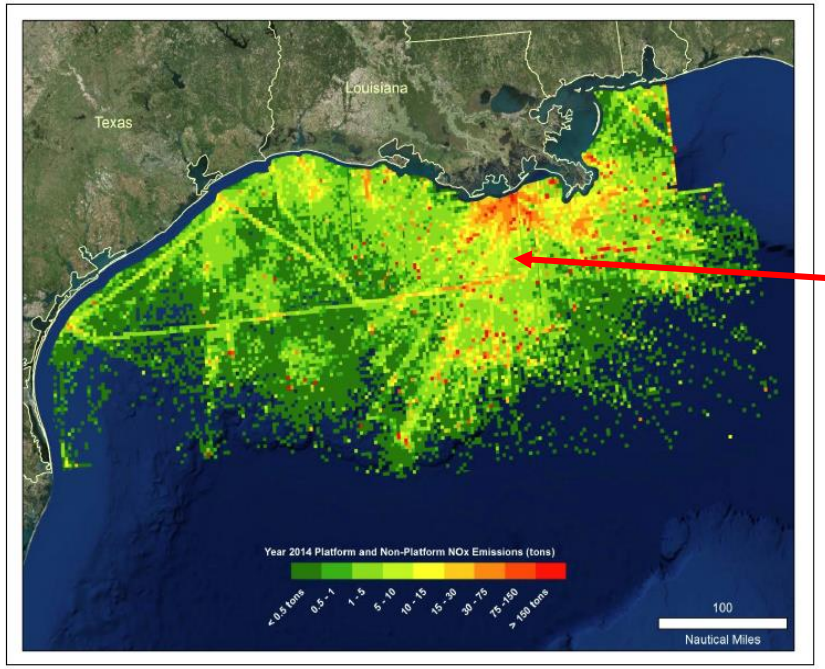
WHY: NASA/GSFC-BOEM Inter-Agency Agreement (2017-2020) for Assessing Feasibility of using Satellite Data for Offshore AQ Applications

WHO: NASA-GSFC: Bryan Duncan (PI), Anne Thompson (Co-I); **BOEM:** Holli Ensz (COR)

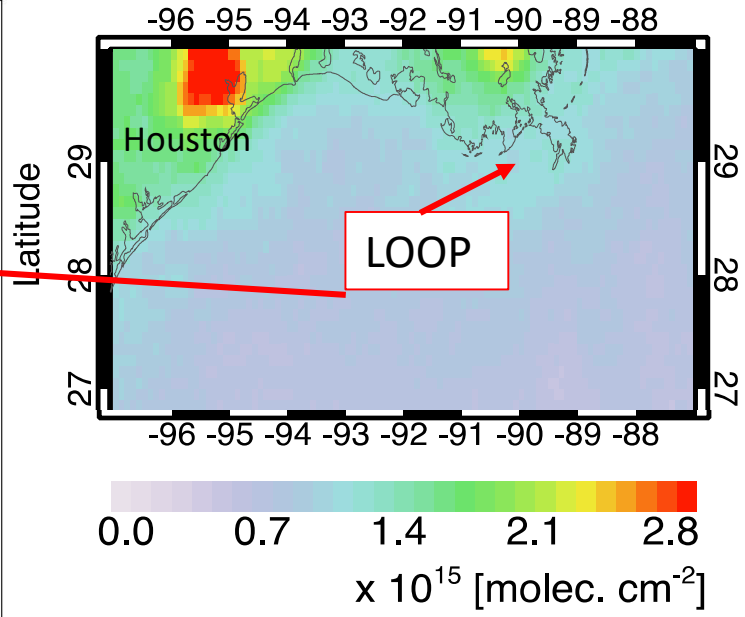
HOW: (1) Report on satellite product coastal applications with OMI/TROPOMI NO_2 focus; **(2) Cruise** for 2019 baseline AQ (O_3, NO_2, VOC, CO, CH_4), & OMI & TROPOMI NO_2 evaluation by newest Pandora spectrometers (Pan). NO_2-sondes on Louisiana (LA) coast.

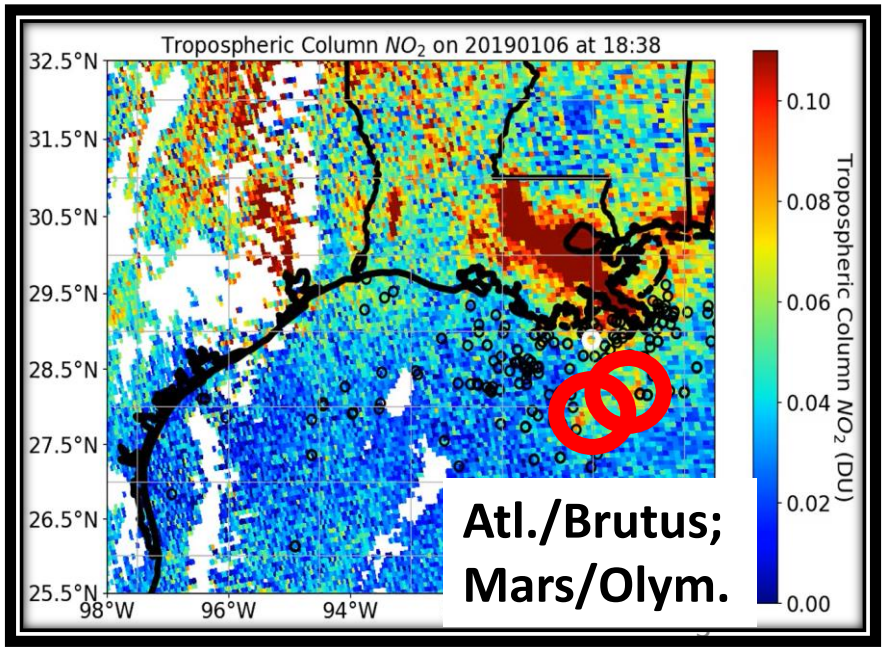
WHEN: 10-18 May 2019 experiment based at **LUMCON, Cocodrie, LA (29.26°, -90.66°)**

BOEM, 2014: NO_2 "Guess"



Satellite NO_2 Data, OMI (Left), TROPOMI (Right)

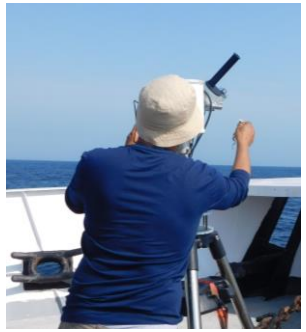




SCOAPE Instruments on USM's *R/V Point Sur* (LUMCON-operated)

Species	Instrument	Collaborator
NO_2 (and gas calibrator)	***In-situ* (*Point Sur* and LUMCON)**	**NASA GSFC (Thompson and Sullivan)**
Column NO_2 and O_3	**Pandora (1 Ship, 2 LUMCON)**	**NASA GSFC (Swap)**
NO_2	Sondes (coastal mobile measurements)	KNMI (den Hoed & Duncan)
O_3	*In-situ*	NASA GSFC
	Ozonesondes	NASA GSFC
Temperature, RH, winds, etc.	Met system	*Point Sur*
Aerosol (AOD) & O_3 columns	MicroTops Sunphotometer	NASA GSFC
VOCs (plus CH_4)	*In-situ* flasks	UCI (Blake)
CH_4, CO_2, H_2O	Picarro	NASA GSFC (Kawa/Hanisco)
PBL height	Remote sensing ceilometer (*Point Sur* and LUMCON)	UMBC (Delgado) and Univ. of Houston (Flynn)
Aethalometer (black carbon)	*In-situ*	Conny (NIST)

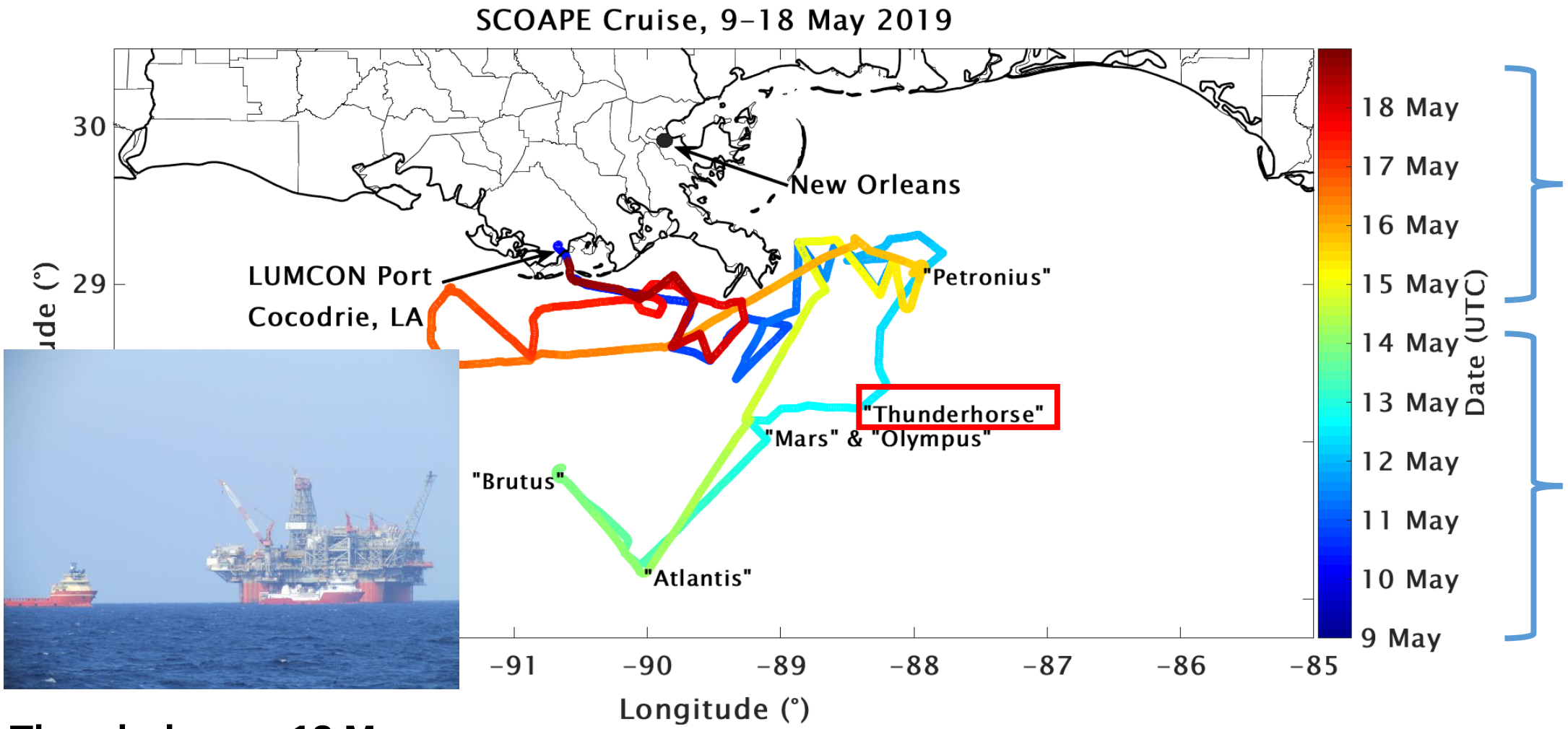
HOW & WHO:
1 BOEM, 4 NASA scientists, 8 crew



← Stein-Zweers POSTER!

SHIP DATA at: https://www-air.larc.nasa.gov/missions/scoape/index.html

Cruise Track, Major Deep Water Platforms Highlighted



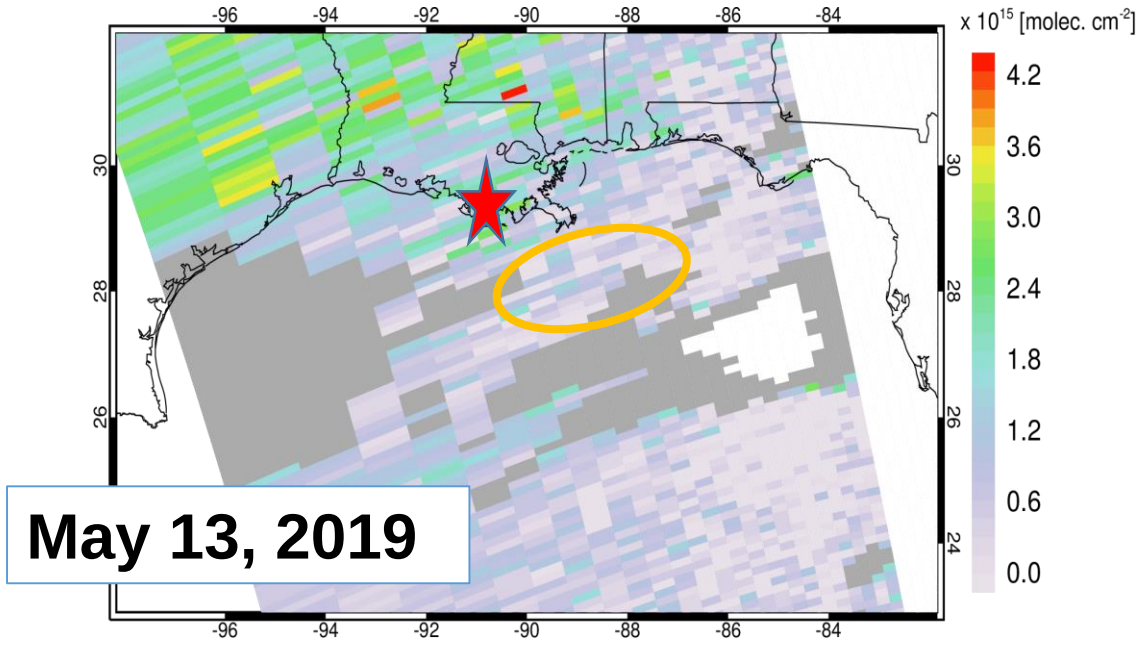
Phase 2, cont. air, off-shore

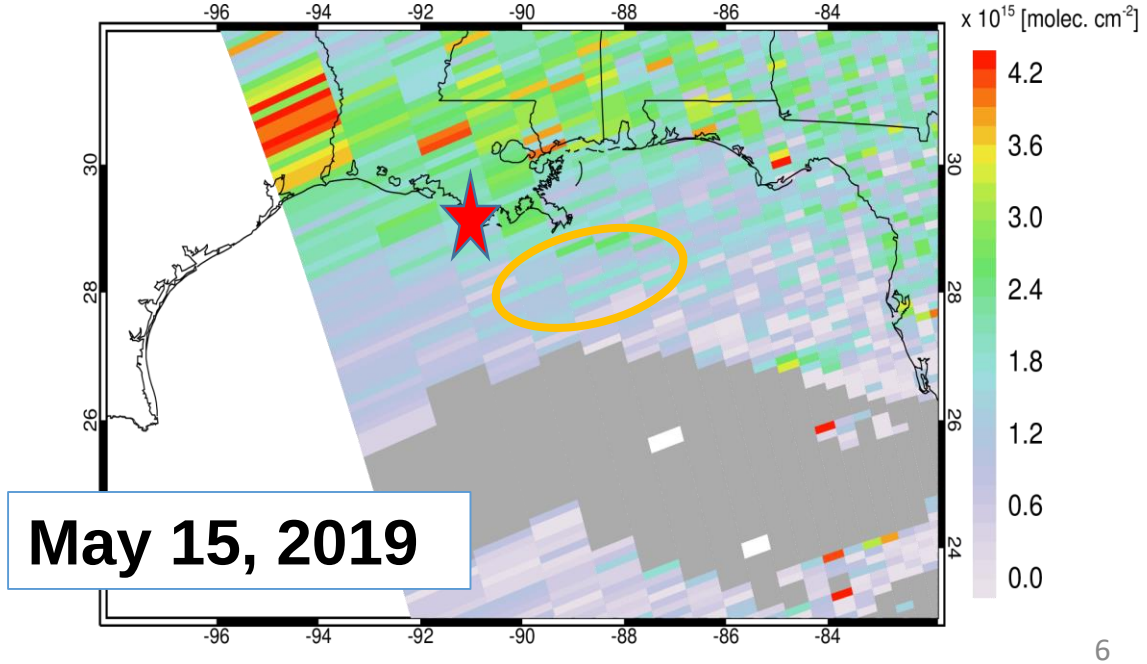
Phase 1, clean, marine, onshore

Thunderhorse, 12 May

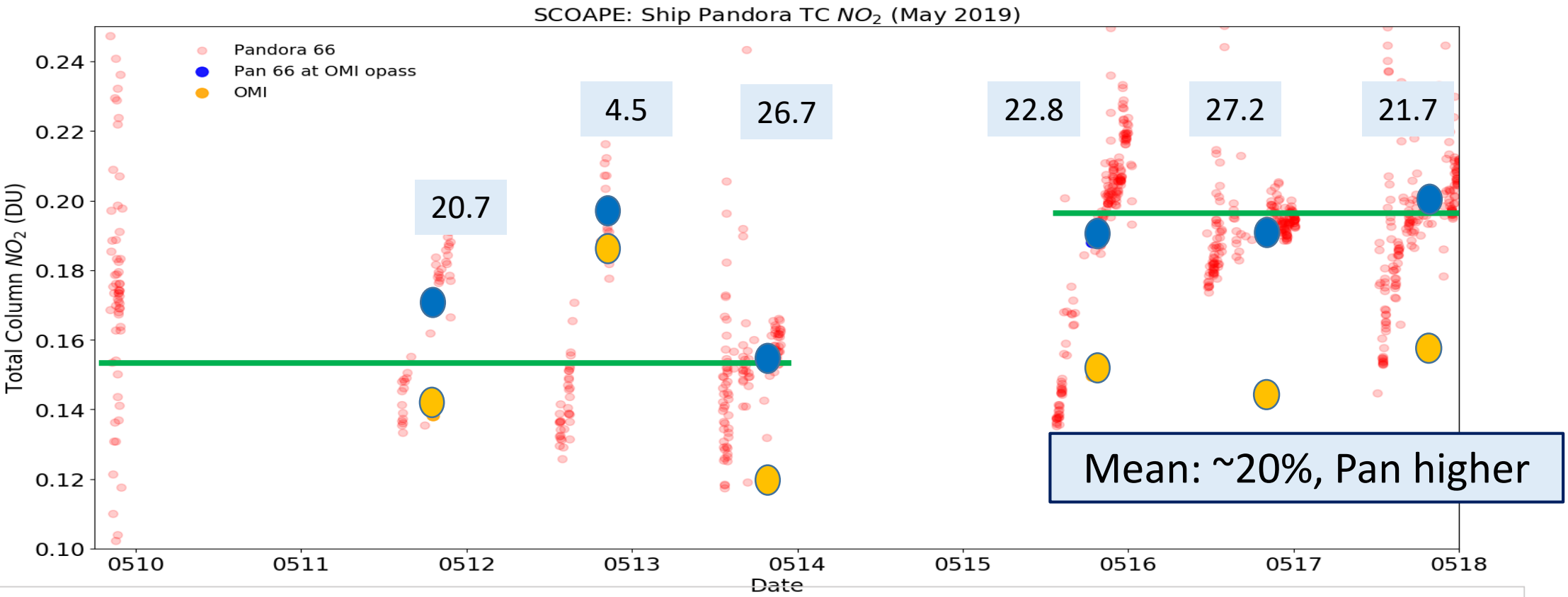
Compare OMI v3 and Pan Total Column (TC) NO_2 from *Point Sur* (Pan 66) & LUMCON (Pans 67, 68)

- Deployed 3 Pandoras at LUMCON in early April 2019 with TAPI NO_2 analyzer
- Two Pandoras (67, 68) & TAPI stayed @ LUMCON during cruise w/ NO_2-sondes
- OMI Std L2 Total Column (TC) NO_2 maps ➔ 2 phases: 10-14 May, clean, marine air (10 ppbv O_3), onshore flow vs 15-17 May, polluted (75 ppbv O_3), flow offshore.





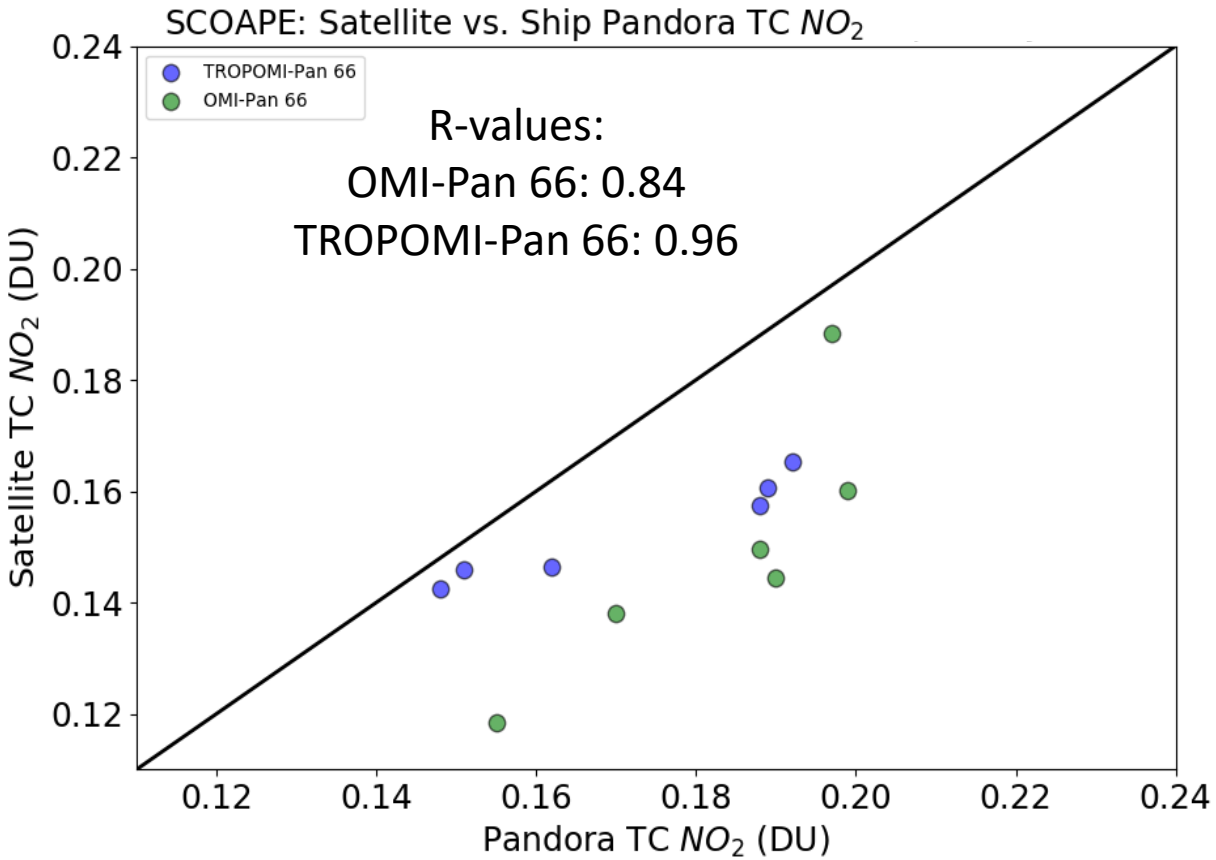
Ship Pan 66 Comparisons w/ OMI v3 L2 Std TC NO_2

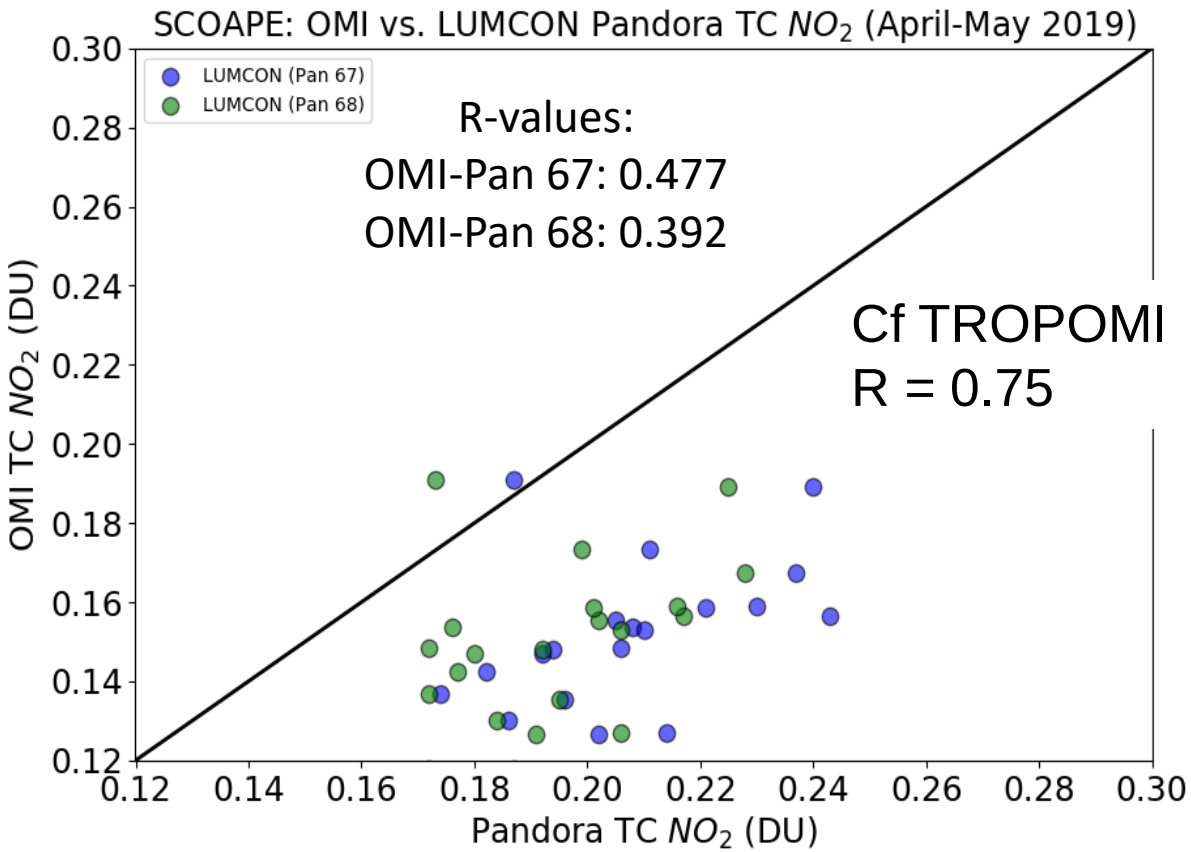


- Pan-satellite offset tends to increase with higher TC NO_2 (cf OWLETS)
- Note: Pan data preliminary, pending field calibration, values may decrease
- Compare TROPOMI-Pan 66, mean agreement ~10%, Pan higher

Correlation of Pans with OMI (TROPOMI)

Left: OMI L2 Std & TROPOMI Std TC NO_2 – Pan 66 on Cruise.
Right: OMI L2 Std & LUMCON Pans 67 & 68 in <u>April and during Cruise</u>

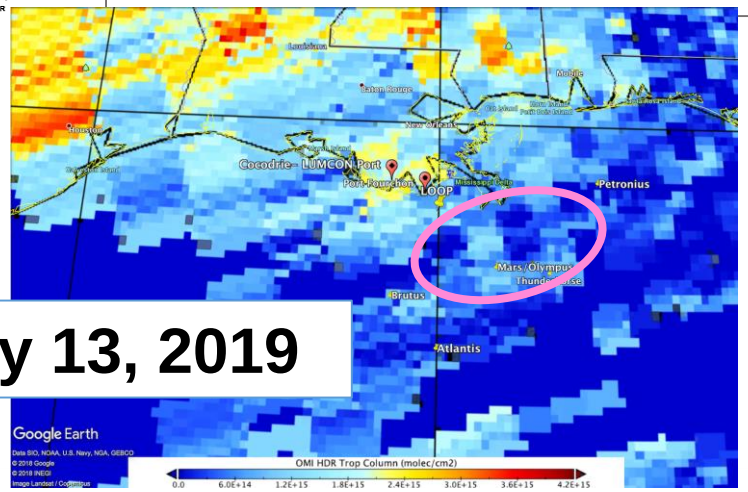




Ship Pan 66 TC NO_2 – high corr, OMI & TROPOMI.

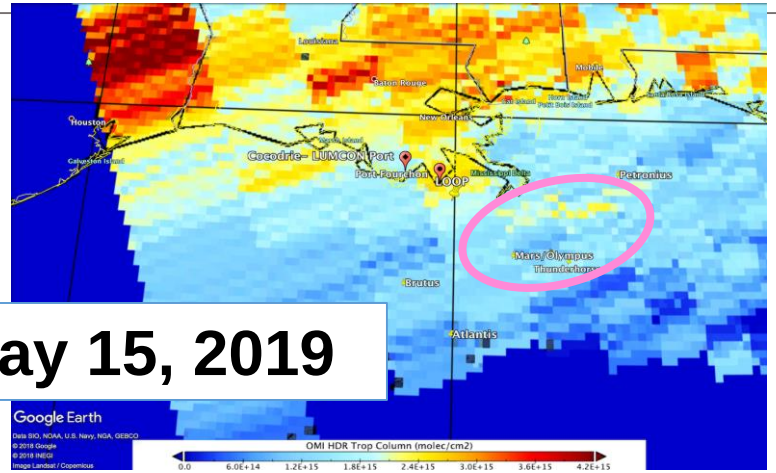
LUMCON Pans less well correl, OMI & TROPOMI

Compare Tropo. Column NO_2 from Pan 66 to OMI High Resolution Daily (HRD, 0.1°x0.1°) v3 NO_2 Data



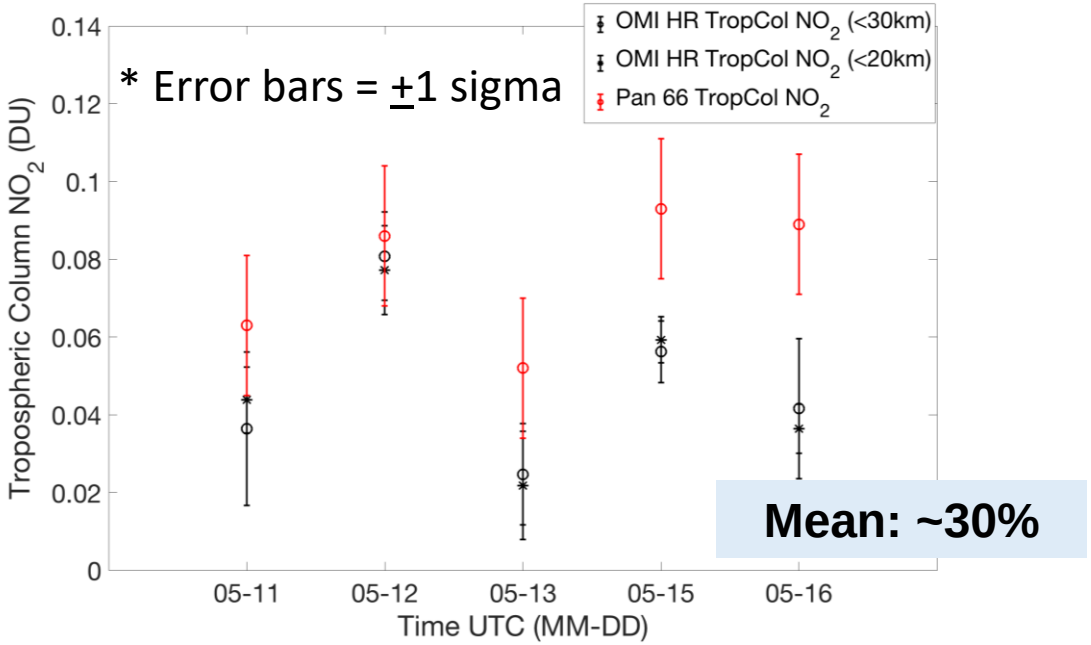
May 13, 2019

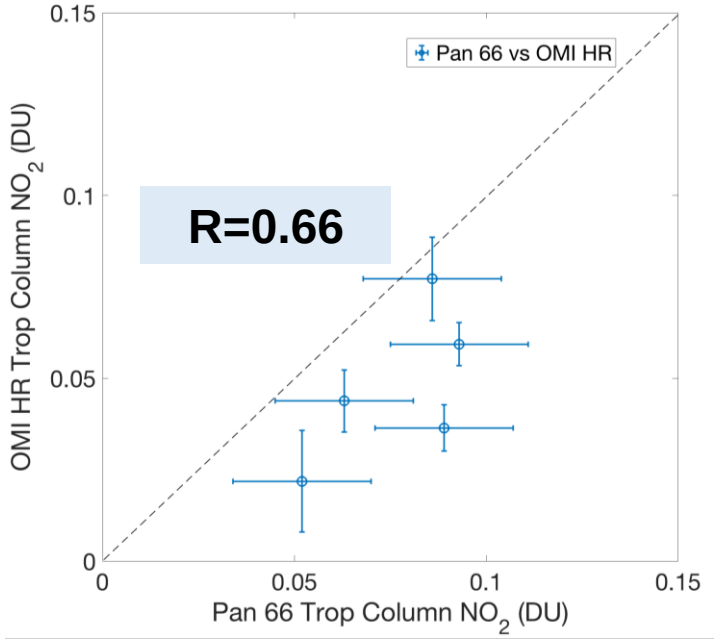
Transition, May 14



May 15, 2019

OMI HDR v3 Tropo. Column NO_2 View of 2 Phases





Pan Tropo. Column NO_2 estimated by subtracting mean strat. Col. NO_2 over Cruise from TC NO_2

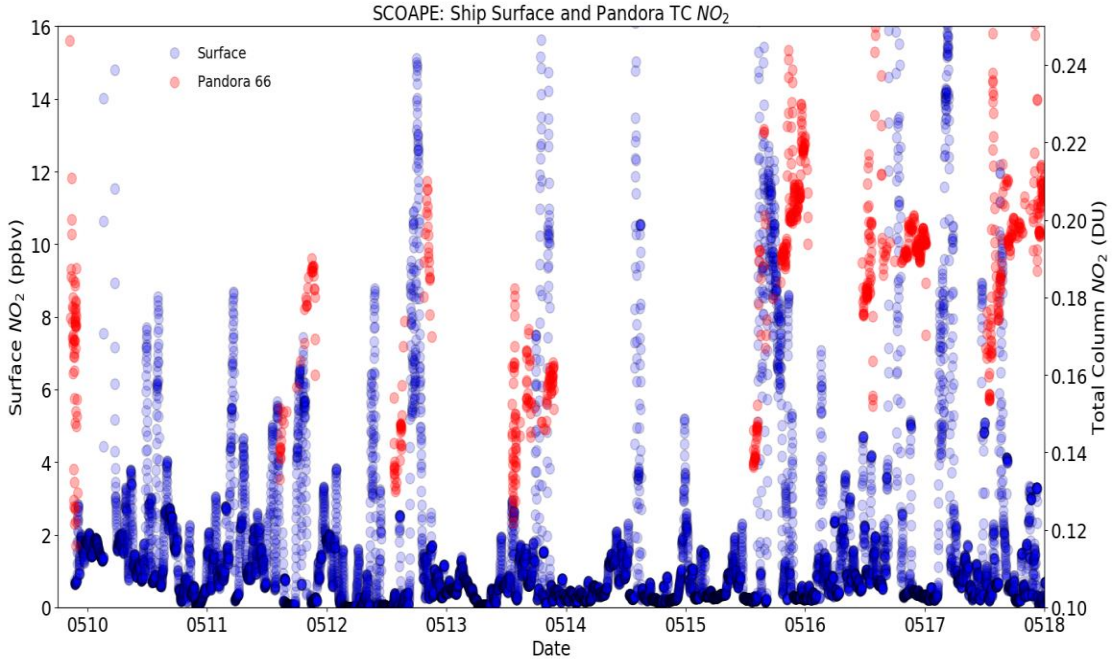
SUMMARY & LOOKING AHEAD

- **Yes! Satellite Data is useful for BOEM,** especially TC NO_2 & Trop. Column NO_2 from OMI, TROPOMI, upcoming TEMPO

- **SCOAPE Total & Trop. Column NO_2**
  - Ship & LUMCON Pans agree well (20-25%) with Std L2 OMI TC NO_2 and (30%) with HRD (v 3) OMI Trop. Column NO_2
  - Satellite-Pan offsets increase with higher NO_2

- **What is Next?**
  - Refine OMI comparisons (& new HRD v4) with field-calibrated Pan data
  - Compare Pan TC & trop. column NO_2 TROPOMI
  - Compare Pan, OMI and <u>surface</u> NO_2 **(Right)**

Ship surface NO_2 vs **Pan TC NO_2**



Date in Cruise

Need to understand satellite-Pan-surface NO_2 relationships for TEMPO

Thank You for Attention!
Acknowledgments

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- OMINO2: https://disc.gsfc.nasa.gov/Aura/data-holdings/OMI; OMINO2D_HR is at avdc.nasa.gov.