Ferry Ocean Colour Observation Systems (FOCOS)

- Deployment
- Data quality
- Download
- Data reduction
- Data analysis

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Satellite Validation International Workshop, Plymouth
June, 2017

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MEOPAR SATLANTIC

Fisheries and Oceans Canada

Mitacs

IRVING

OCEAN NETWORKS CANADA

BCFerries

SALISH SEA MARINE SURVIVAL PROJECT

PACIFIC SALMON FOUNDATION

West Coast of Canada

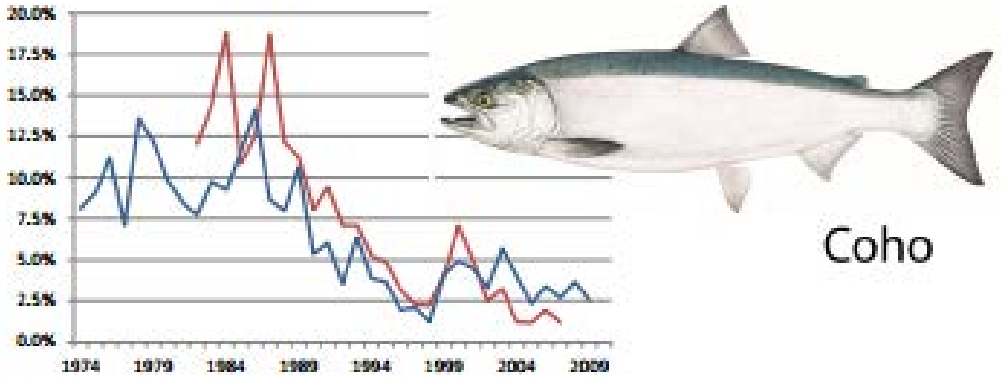
Salish Sea

~17,000 km^2

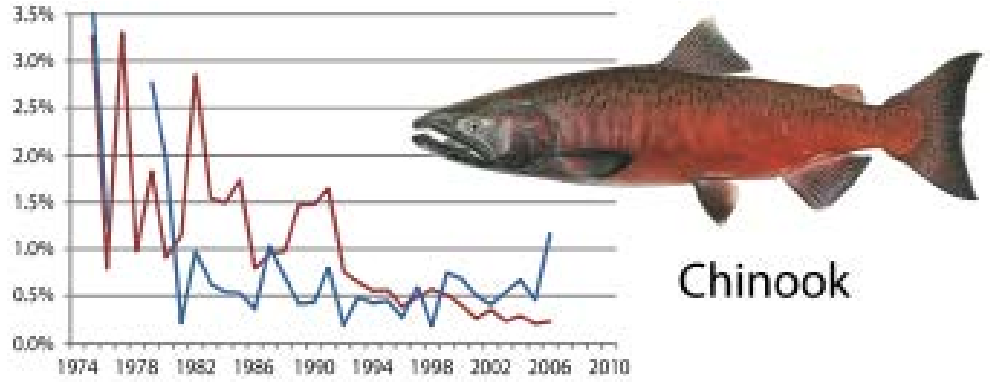
~7,500 km coastline

~ 8 million population

Why do we care?



Coho



Chinook

Marine survival rates

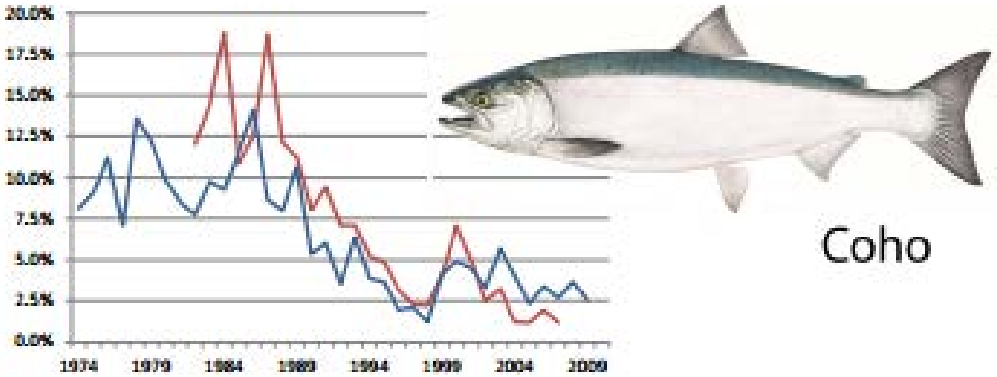
Puget Sound

Strait of Georgia

? Synchrony between primary/secondary phenology and salmon productivity.

Spatial-temporal time series

Why do we care?



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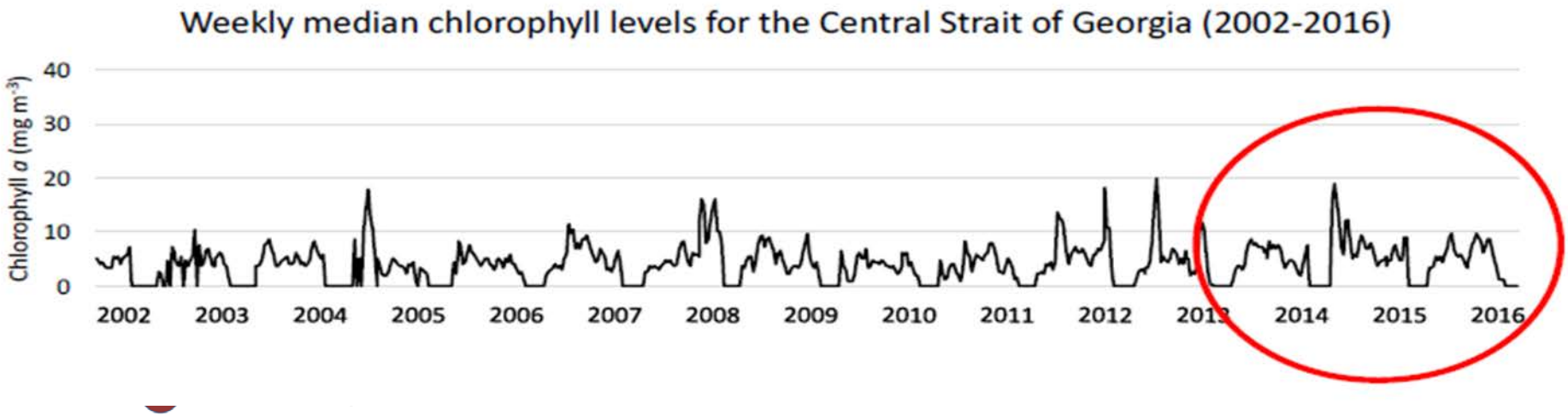
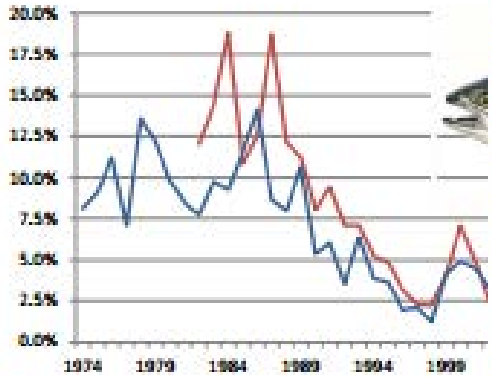
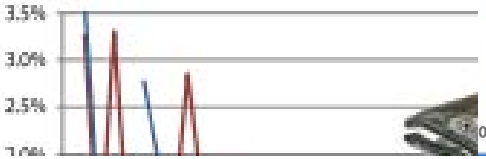
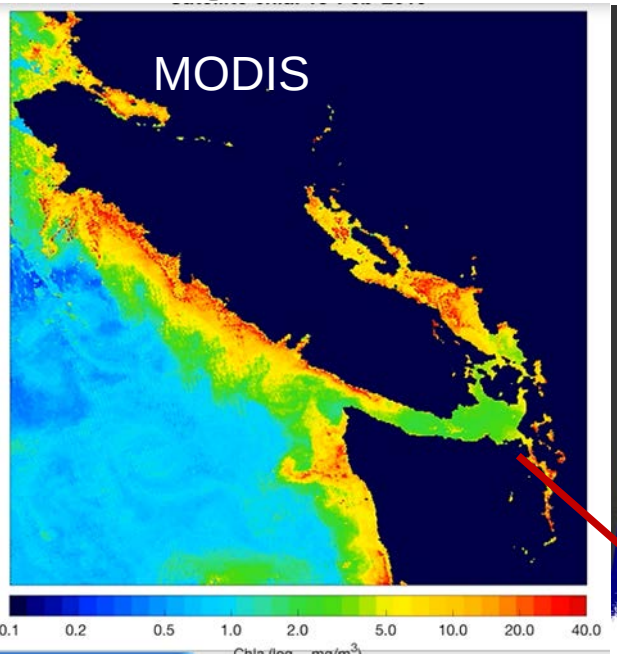
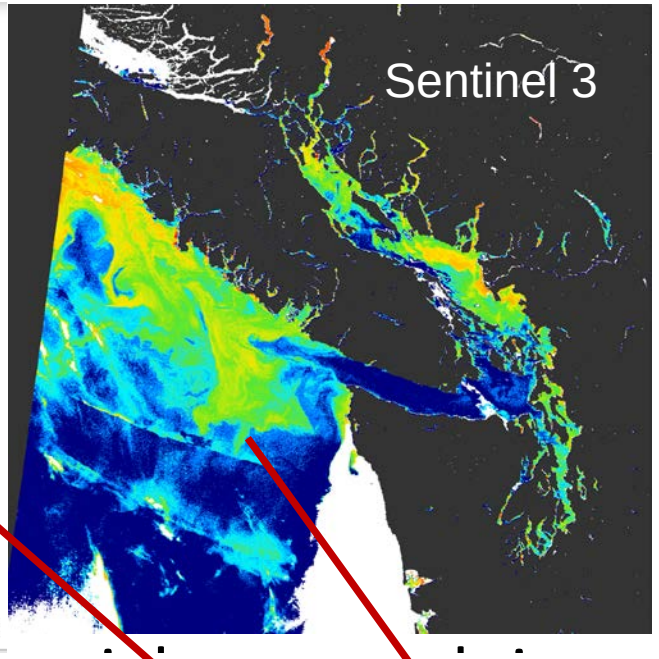


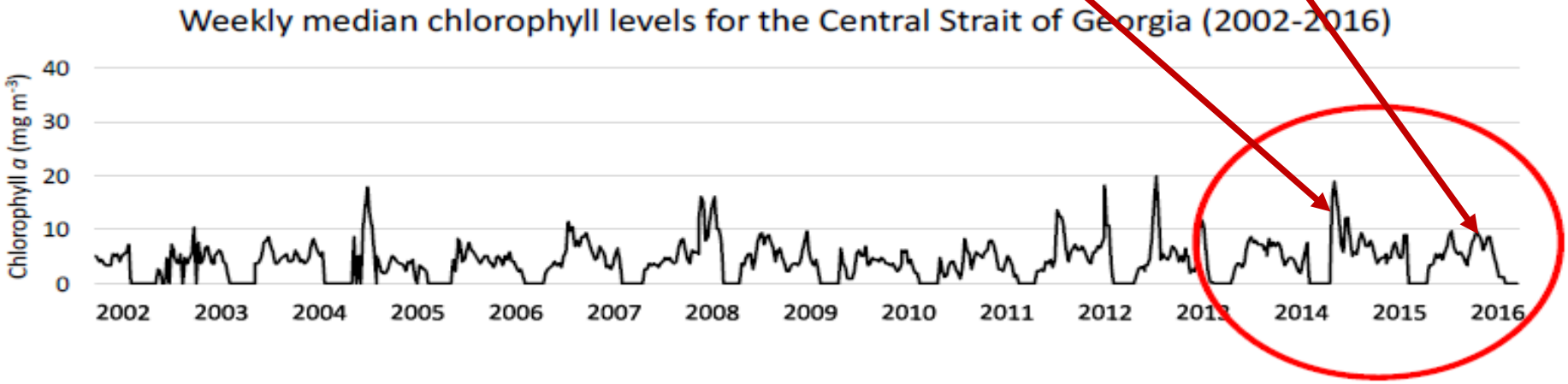
Why do we care?









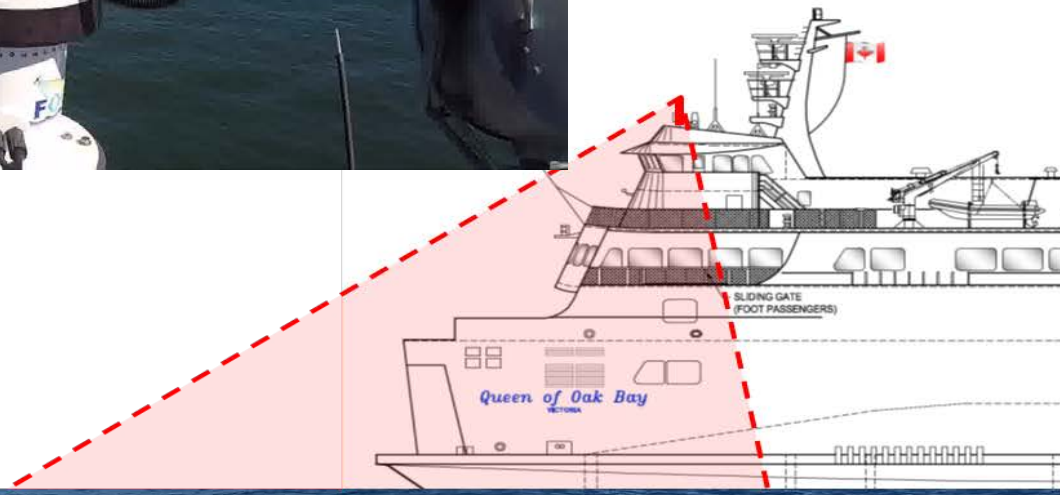


1. Deployment requirements

Instrument – HyperSAS Solar Tracker

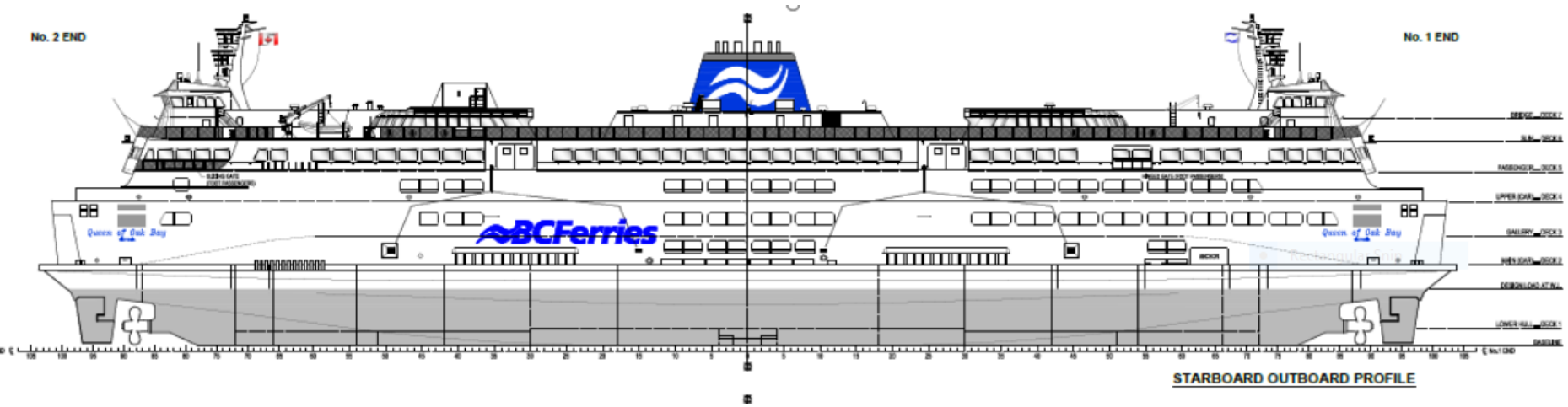
FOCOS

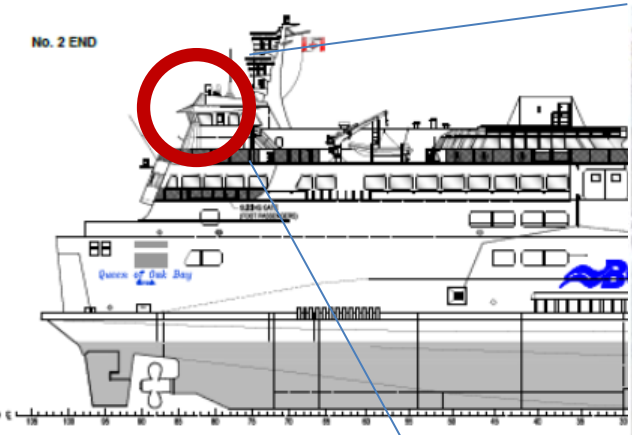
(Ferry Ocean Colour Observation System)

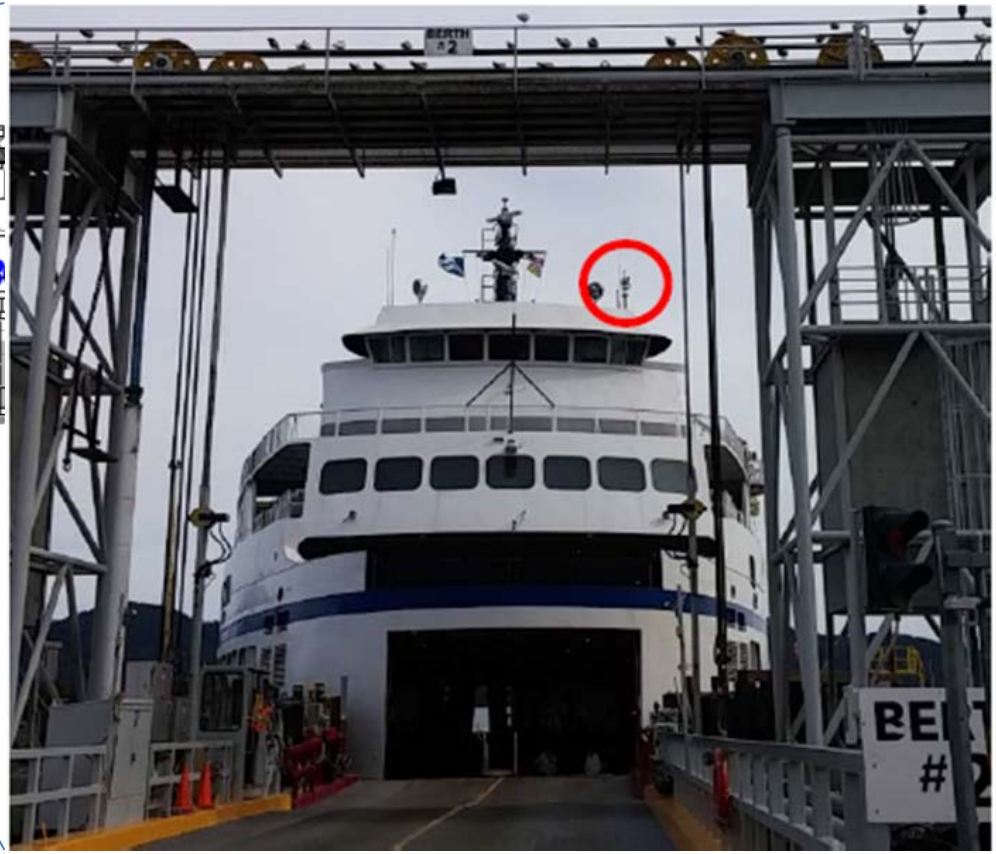


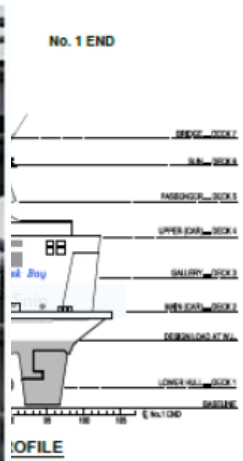
Queen of Oak Bay

Length ~ 140 m

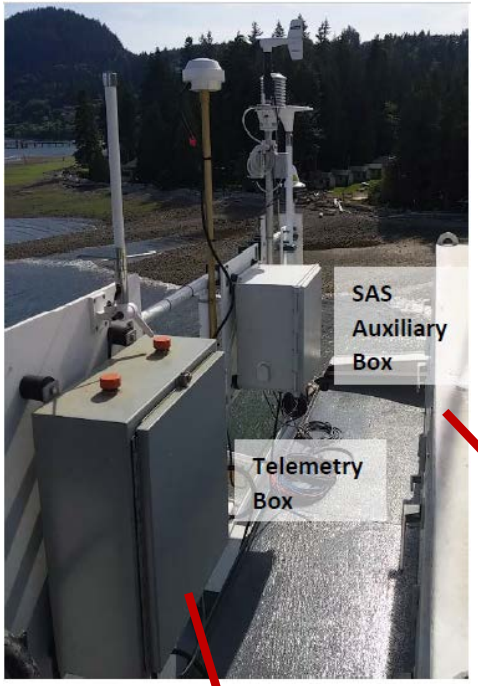



No. 2 END
Queen of Oak Bay


BERTH
#2

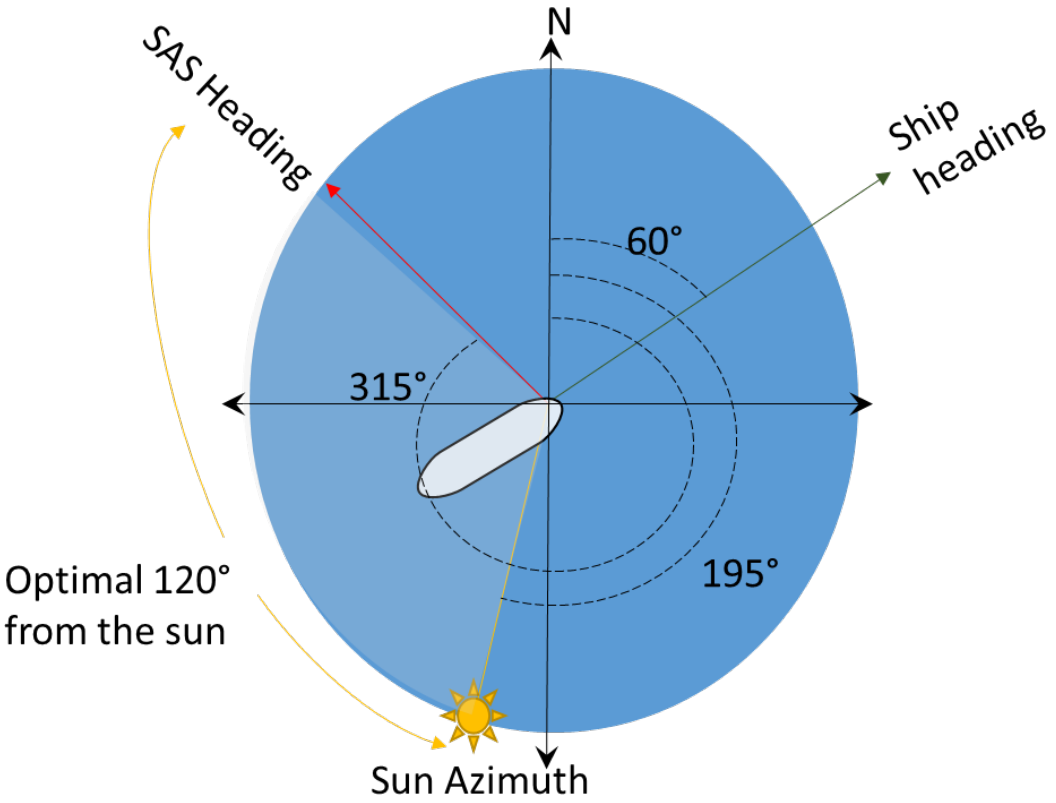

No. 1 END
OFILE

SAS ST mounted on a pedestal

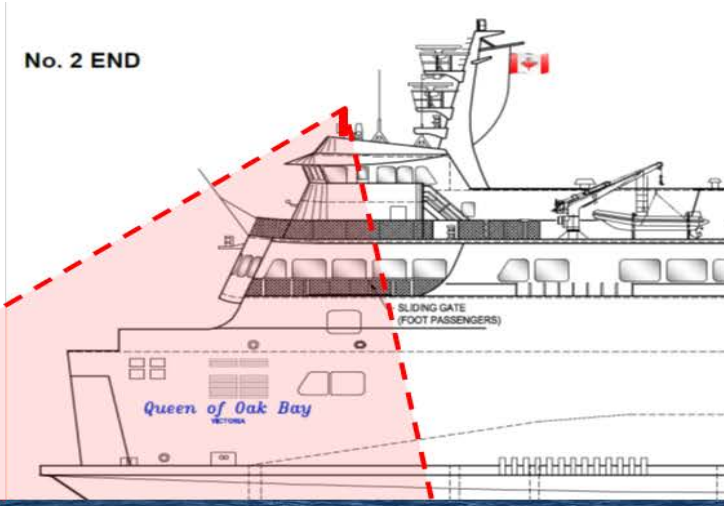


Driver computer: Linux and has Ethernet connectivity

Power supply and SAS deck unit

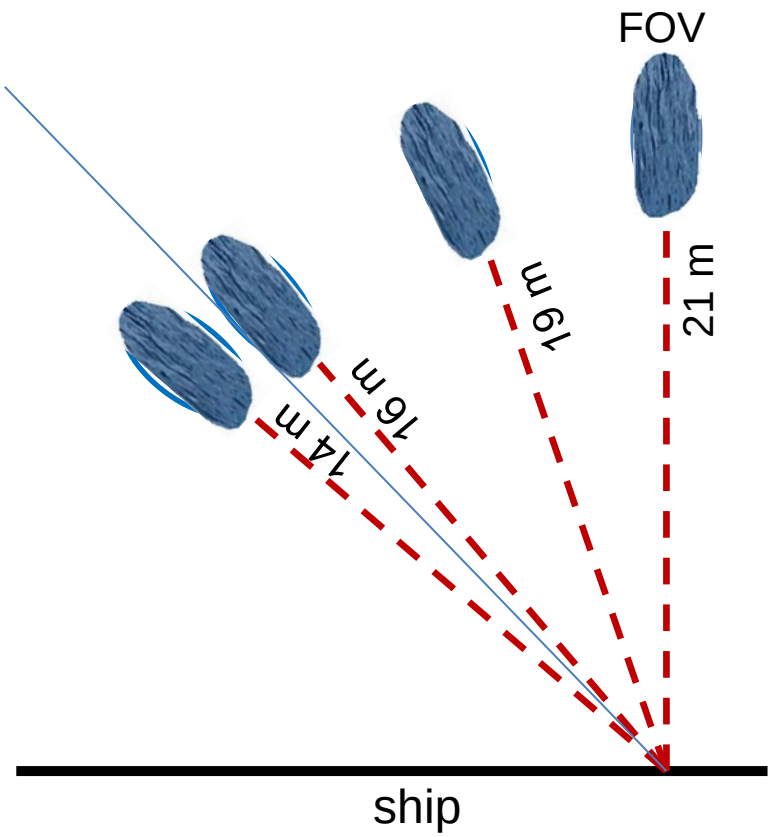


- Avoid ship structure, shadow, wake
- Sun-sensor azimuth
- Distance from ship

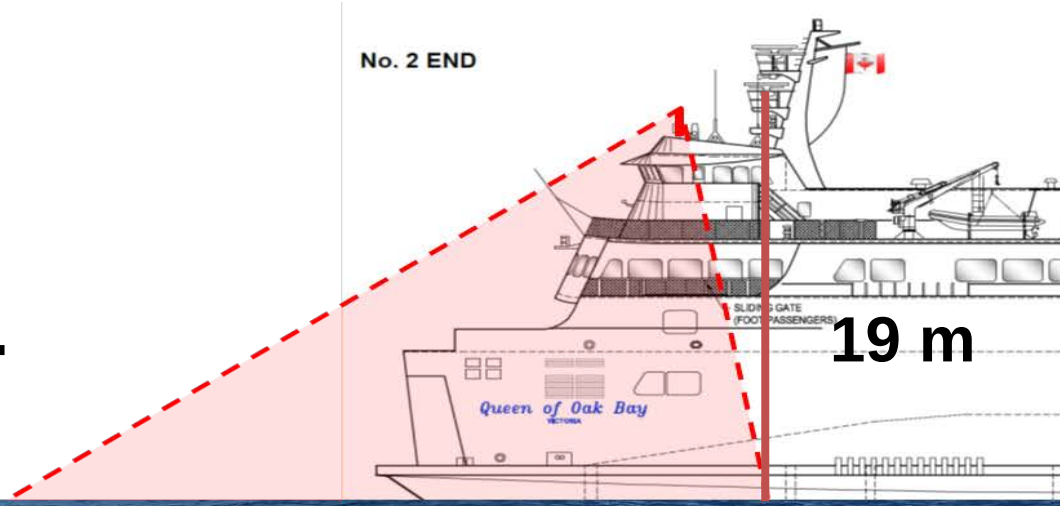


FOCOS

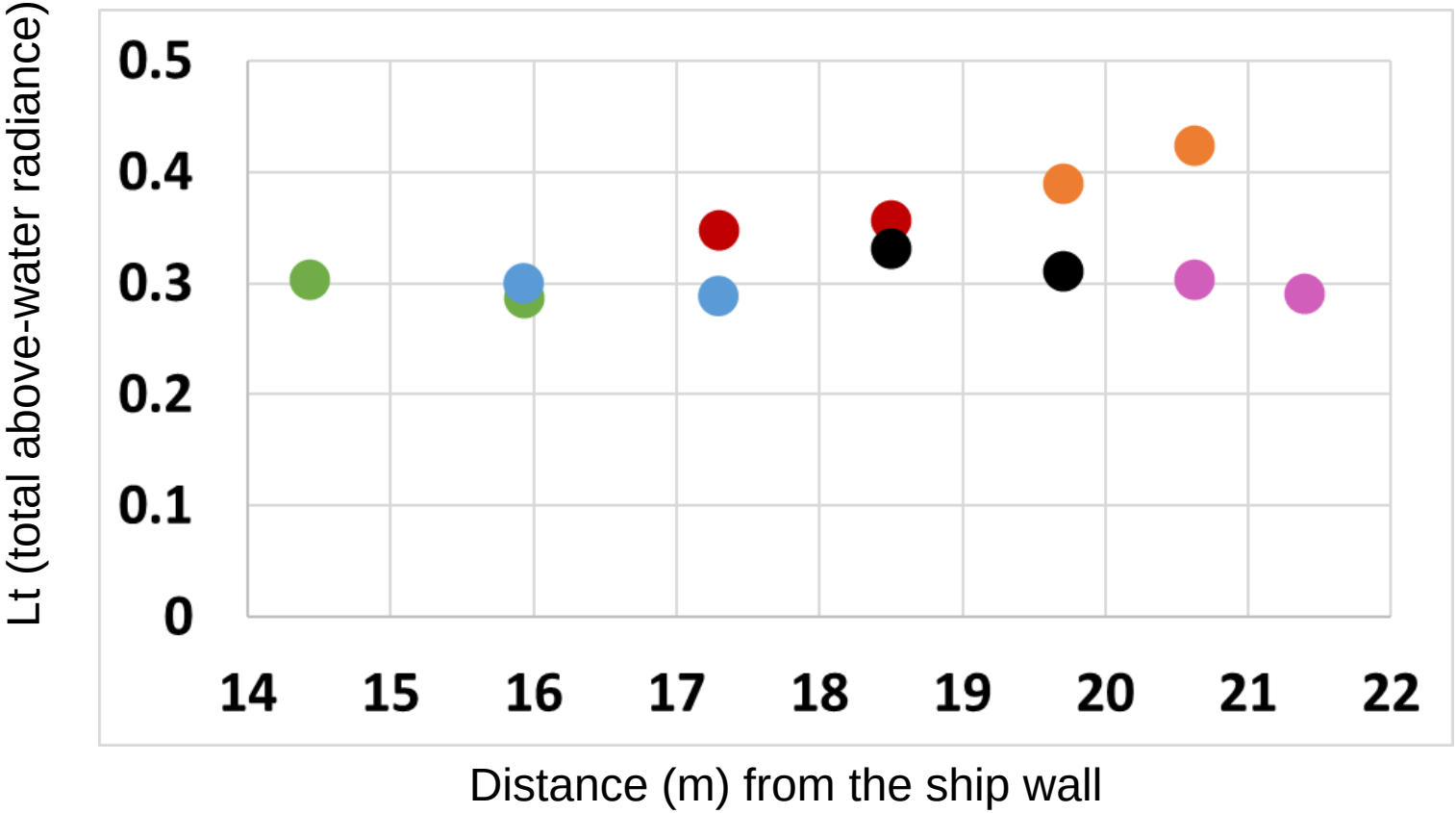
Sensor rotates to optimize sun-sensor azimuth angle



Field of view footprint and distance from the ship:
16-21 m is acceptable



Effect of distance from the ship wall on Lt (412nm)



Same colour represents measurements made less than 1 minute apart, but the rotator changed azimuth angle. Note Lt is very similar for consecutive distances from the ship wall.

2. Data quality:

bi-weekly cleaning of instrument lens;

8 months deployment and re-calibration

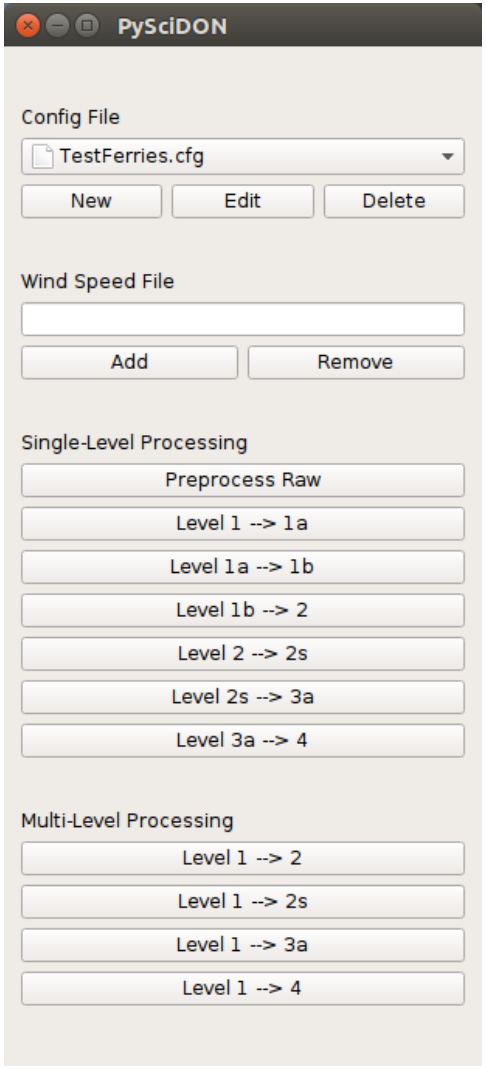
SAS Solar Tracker - cleaning

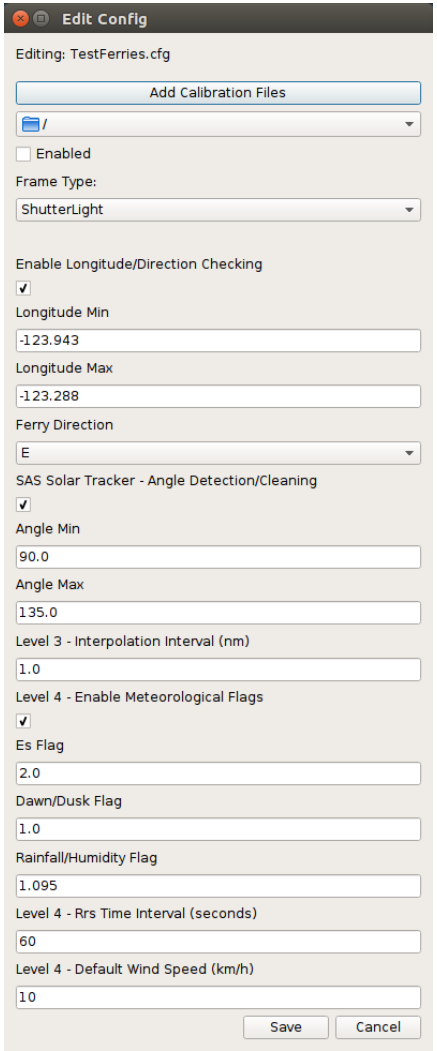
Ferrybox, cleaning

FOCOS

3. Download: near-real time – Ocean 2.0

4. Data Reduction: PySciDON (based on Python)





- Sensors calibration
- Time interpolation
- Wavelength interpolation
- Filters:

Direction checking
Lat/long threshold
Angle threshold
Pitch/roll
Remove data with artifacts (ship)

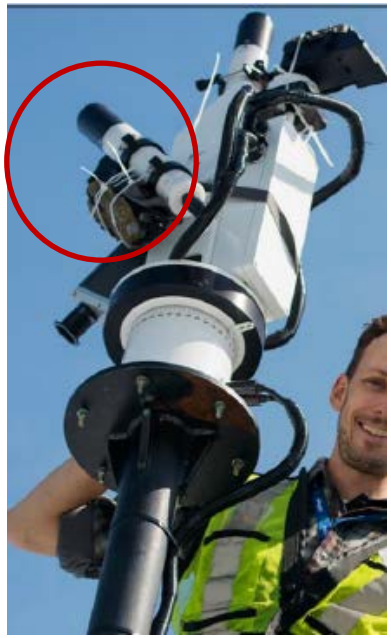
- Meteorological flags
  - Es magnitude
  - Dawn/dusk
  - Rain/high humidity/cloud
- Wind Speed – Rrs
- Time binning
- Satellite Response Function

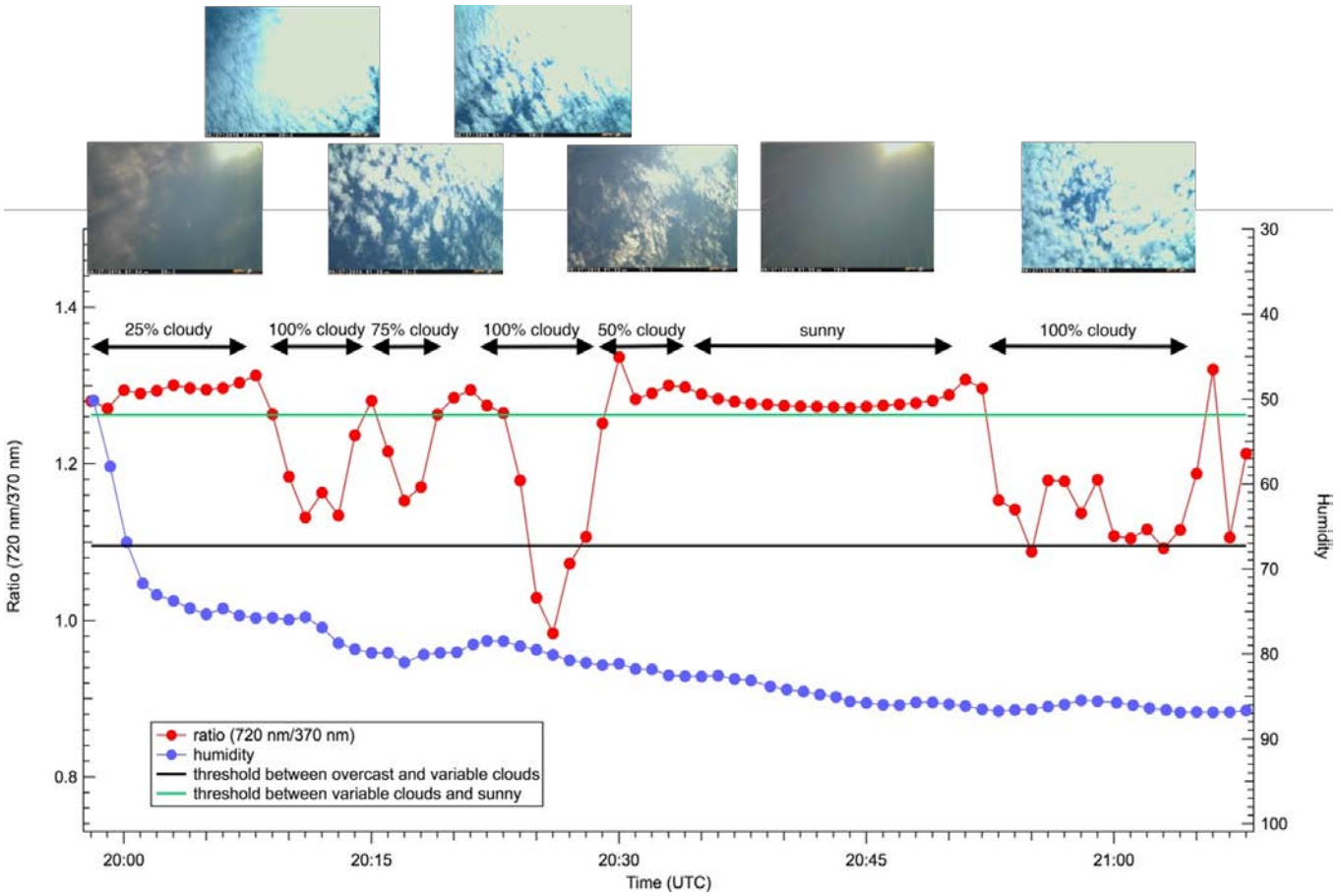
Sentinel-3, MODIS, VIIRS

FOCOS

Meteorological Flags

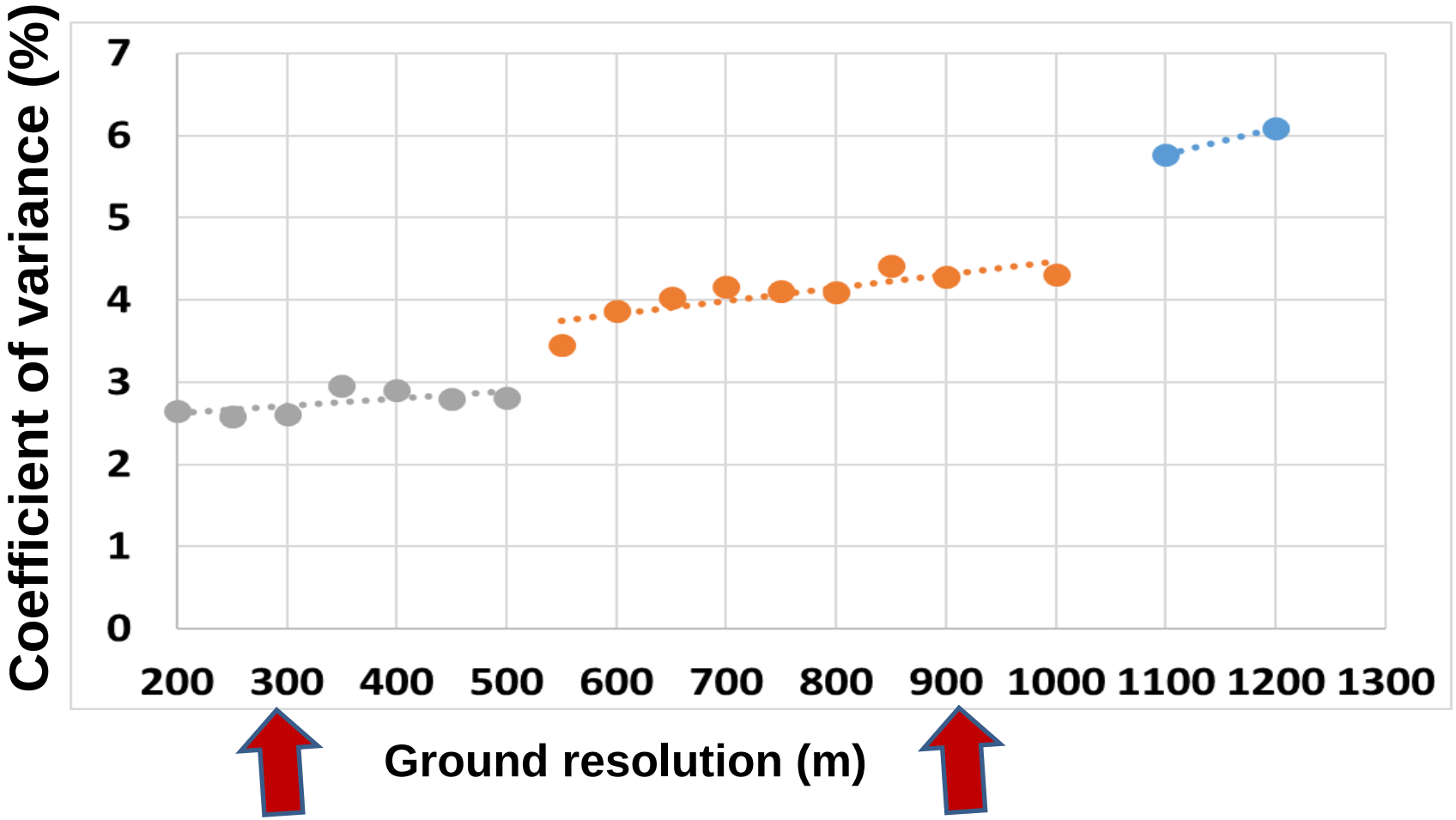
N=35,000 in situ spectra





FOCOS

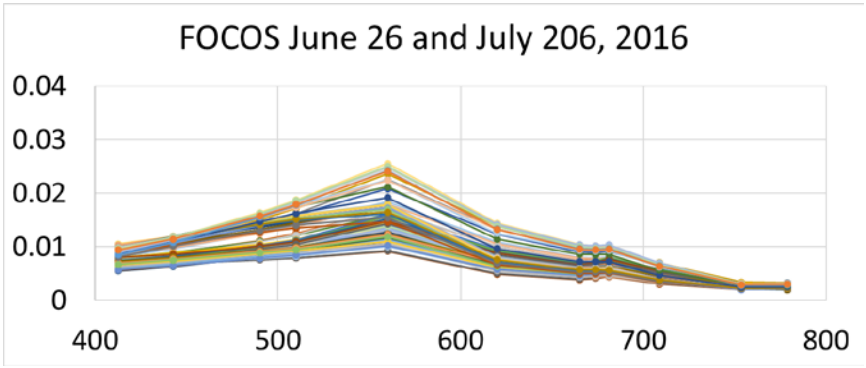
Time binning: Effect of ground resolution on Lt variability (560 nm)



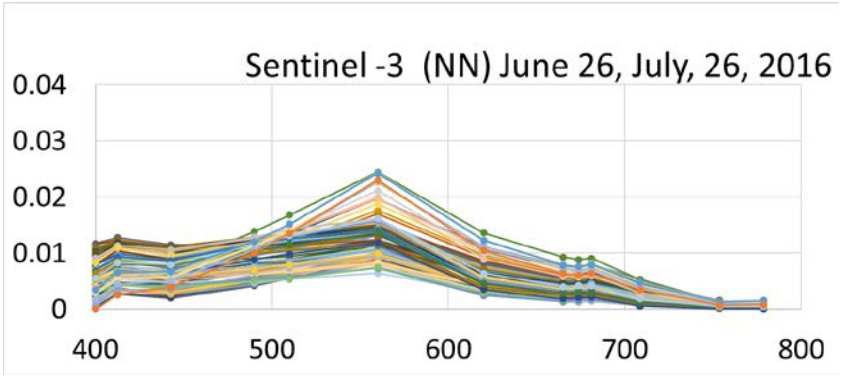
5. Data Analysis: Sentinel 3 validation (June, July, Aug N~220)

(Mobley, 1999 – rho)
(Lowest 5%)

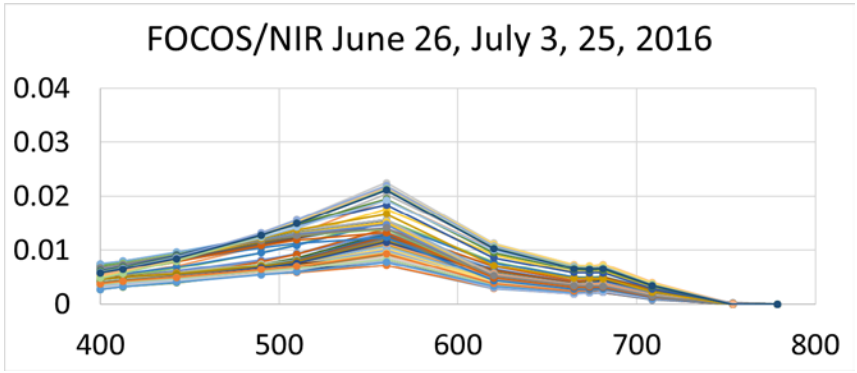
In situ



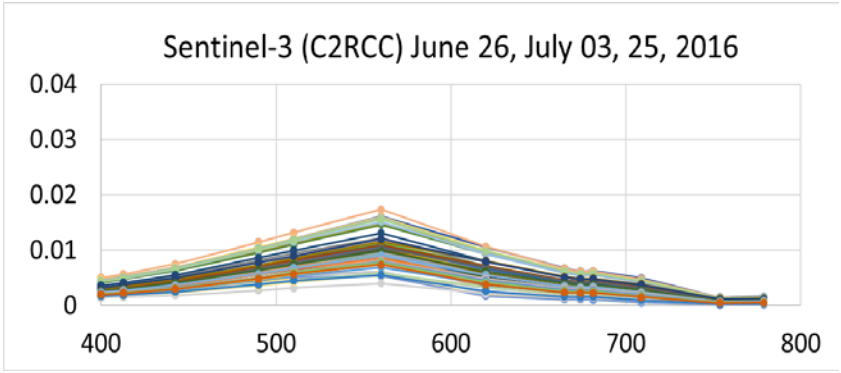
Sentinel 3 (Level 2)



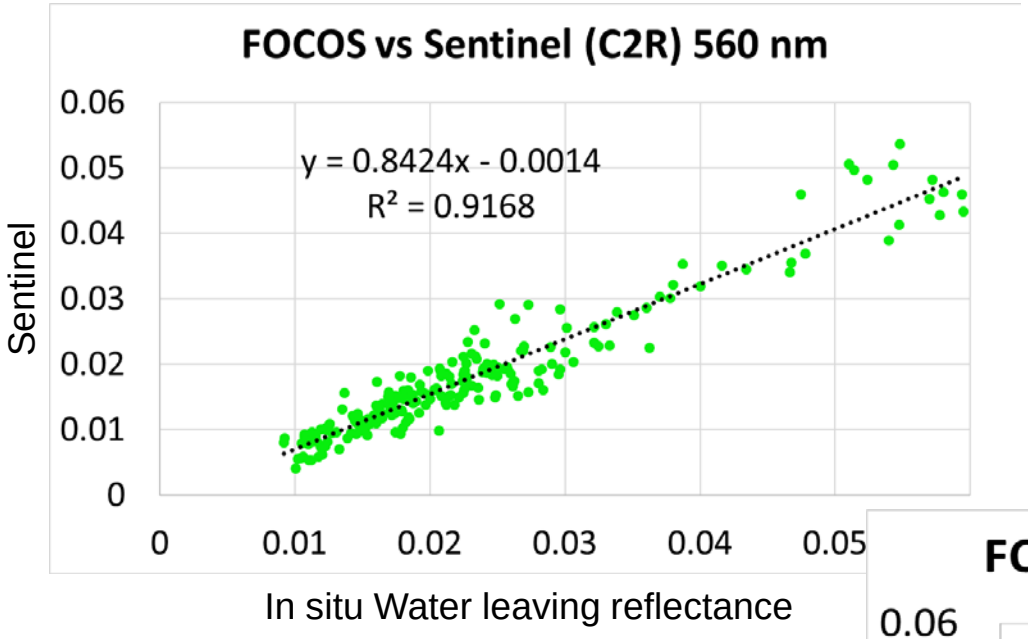
In situ corrected to 780nm

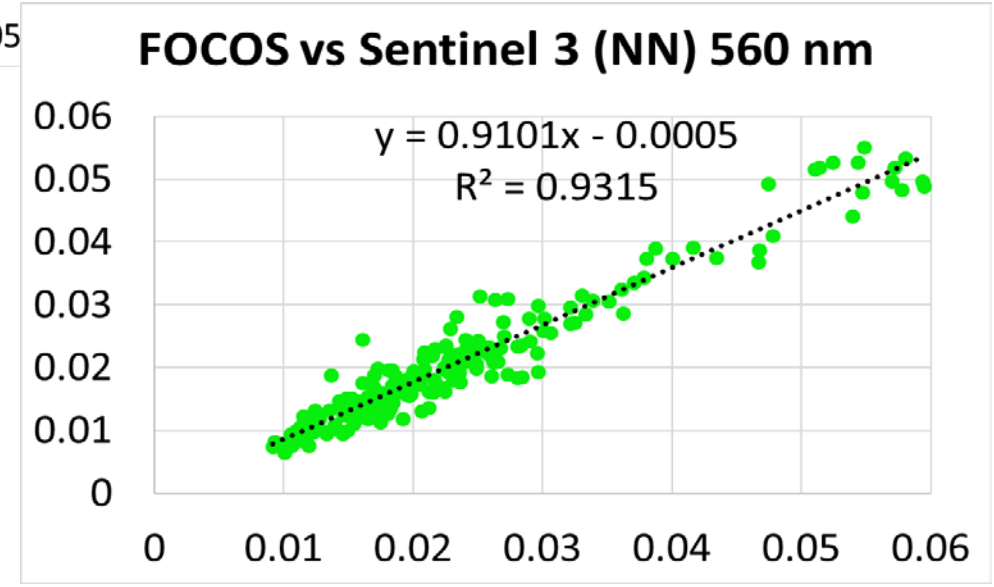


Sentinel 3 (C2RCC)



5. Data Analysis: Sentinel 3 validation





5. Data Analysis: Sentinel 3 validation

Sentinel (Level 2) vs in situ

N=220	PD%	R^2
400	-27	0.5
412	-11	0.56
442	-21	0.75
490	-16	0.9
510	-13	0.92
560	-9	0.94
620	-23	0.84
665	-33	0.78
681	-29	0.7
709	-44	0.6

Sentinel (C2R) vs in situ

N=220	PD%	R^2
400	-45	0.8
412	-42	0.8
442	-32	0.9
490	-18	0.9
510	-16	0.9
560	-20	0.9
620	-23	0.9
665	-35	0.9
681	-43	0.8
709	-42	0.8

5. Data Analysis: Sentinel 3 validation

Sentinel (Level 2) vs in situ (NIR corr)

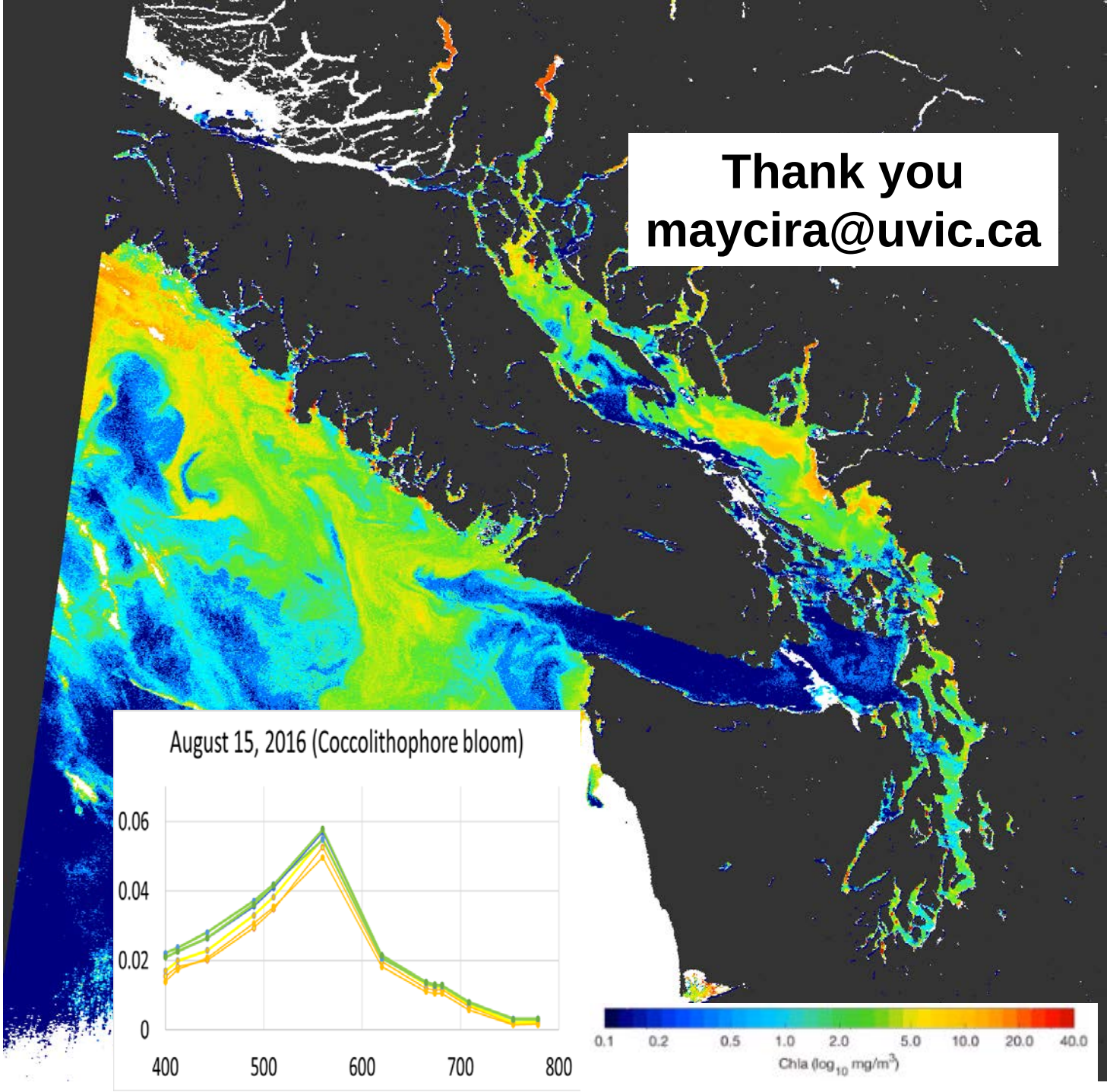
N=220	PD%	R^2
400	1.2	0.52
412	21.2	0.62
442	0.7	0.77
490	2.2	0.94
510	2.9	0.93
560	2.8	0.93
620	1.8	0.86
665	2.9	0.77
681	3.4	0.76
708	5.1	0.67
709	10.8	0.33

Sentinel (C2R) vs in situ (NIR corr

N=220	PD%	R^2
400	-24.5	0.81
412	-21.8	0.85
442	-12.6	0.91
490	1.6	0.94
510	1.3	0.93
560	-8	0.93
620	5.1	0.89
665	1.65	0.86
681	-13.1	0.84
709	19.2	0.8

summary

- It is a lot of work! I will try my best to calculate uncertainties
- It is important to understand your instrument, specially if it is autonomous – filter data with artifacts!
- Geometry is key
- Large data sets requirements: filter, flags, processing!
- Sentinel-3 …..looking forward the new calibrated data


Thank you
maycira@uvic.ca
August 15, 2016 (Coccolithophore bloom)
0.06
0.04
0.02
0
400
500
600
700
800
0.1
0.2
0.5
1.0
2.0
5.0
10.0
20.0
40.0
Chla (log10 mg/m3)