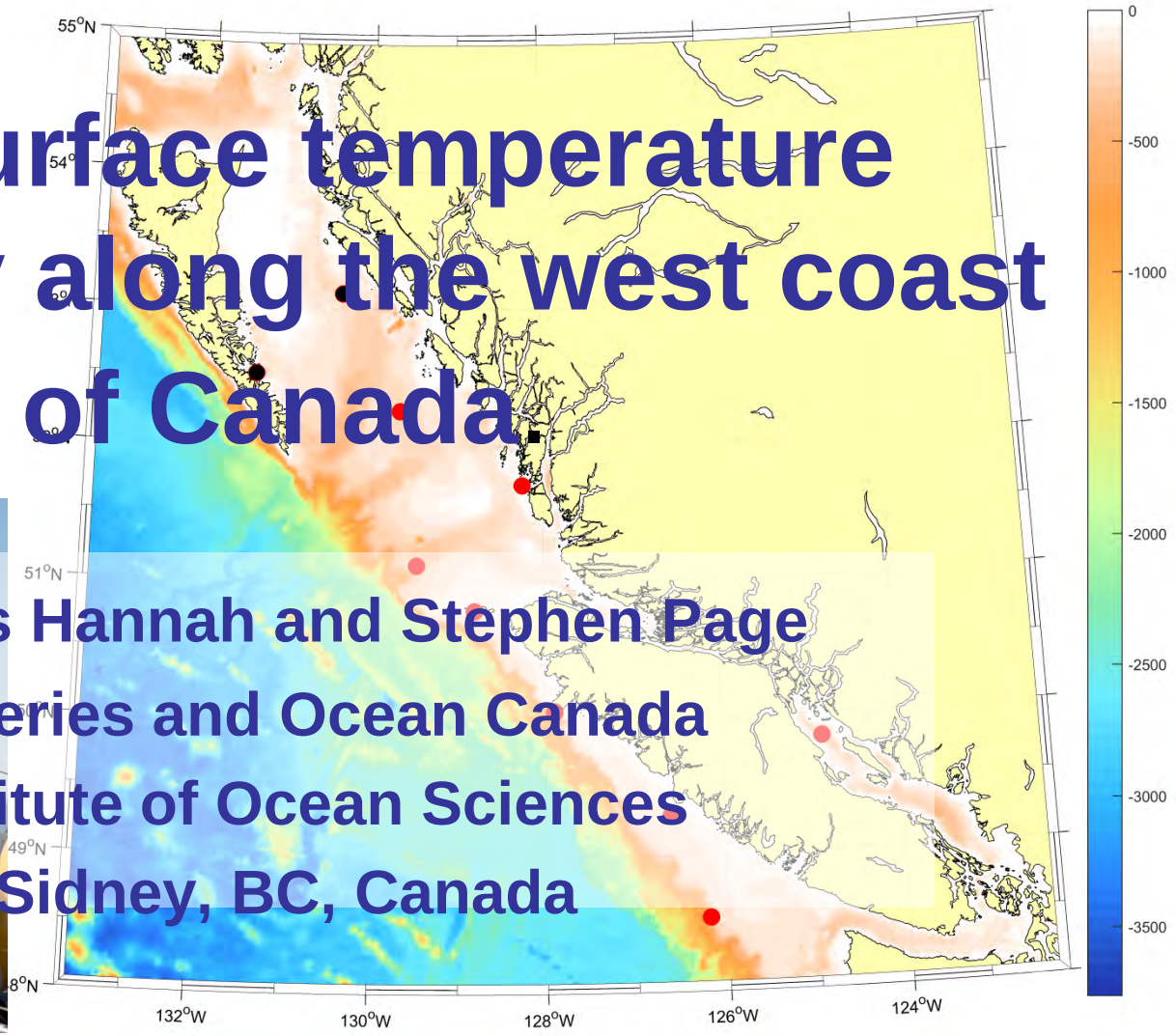
Sub-surface temperature variability along the west coast of Canada

Charles Hannah and Stephen Page

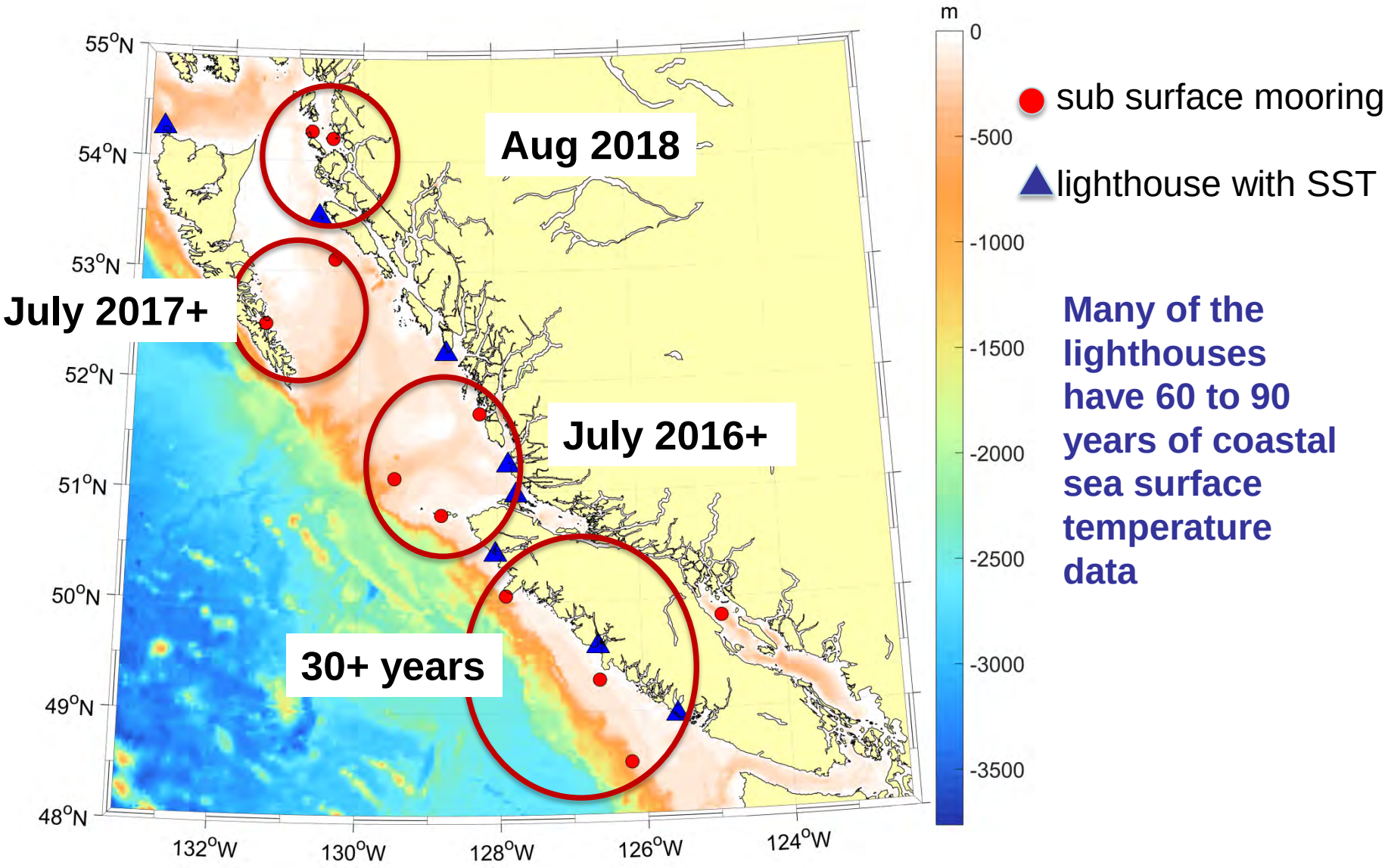
Fisheries and Ocean Canada

Institute of Ocean Sciences

Sidney, BC, Canada

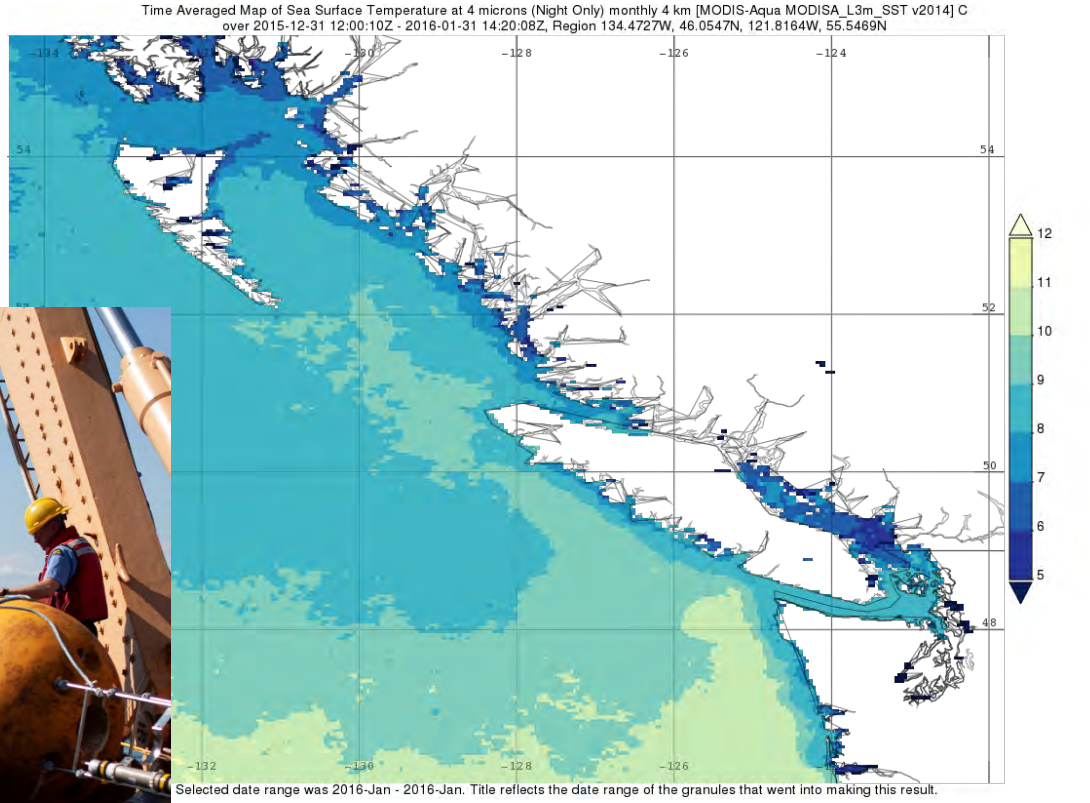


West coast of Canada



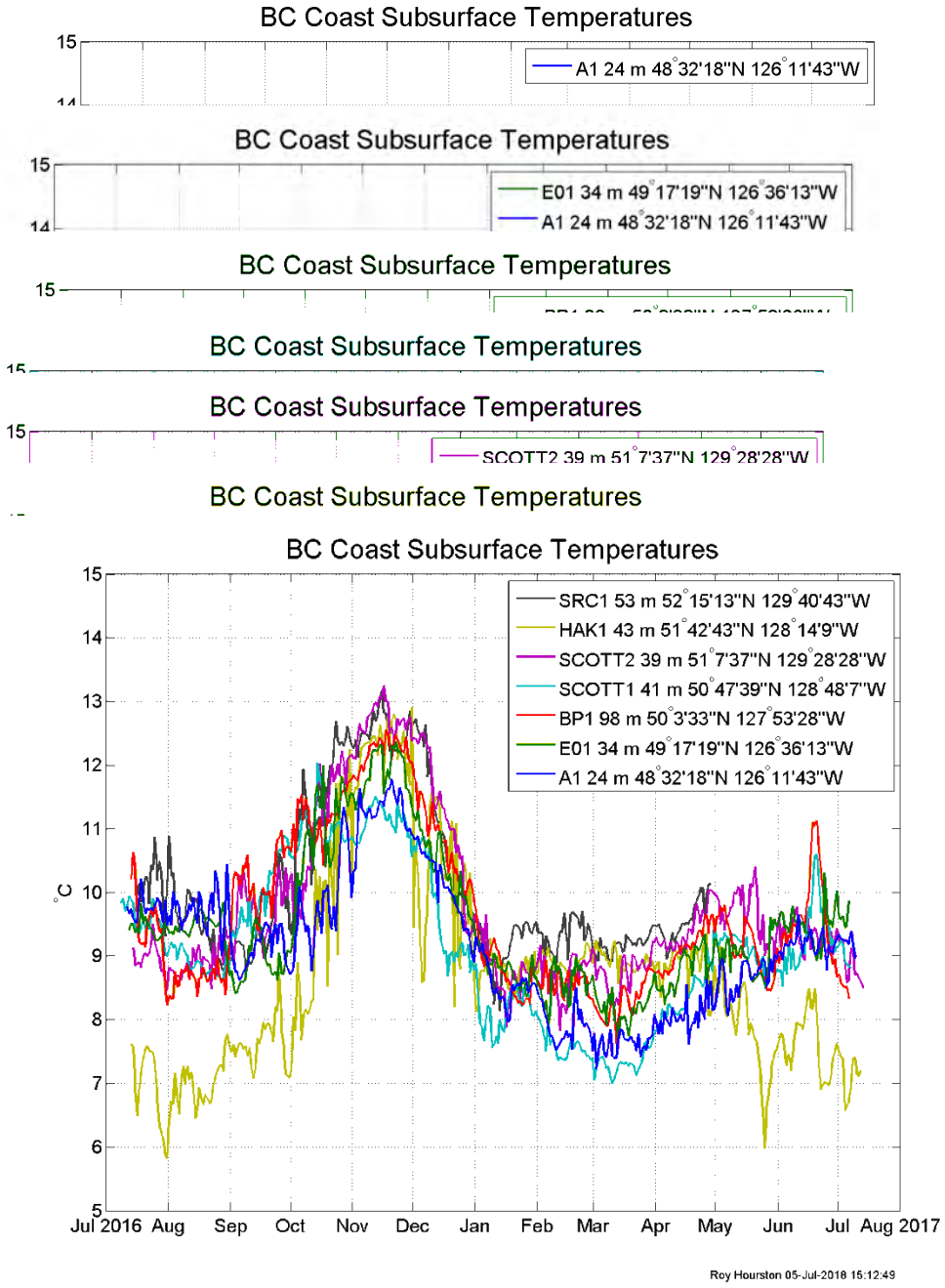
Many of the lighthouses have 60 to 90 years of coastal sea surface temperature data

Can we link the subsurface temperatures that we observe at the moorings with surface temperatures observed from satellites and coastal lighthouses?

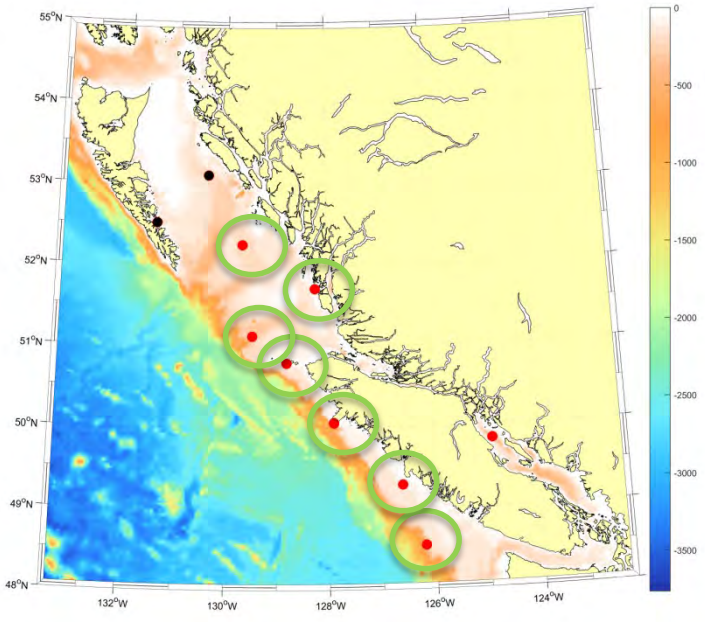


Questions

- Can we use SST to map bottom temperature for some months of the year?
- Can we use coastal SST, measured at lighthouses, as proxy for bottom temperature and infer trends?
  - Some of the lighthouse records go back 80 – 90 years.

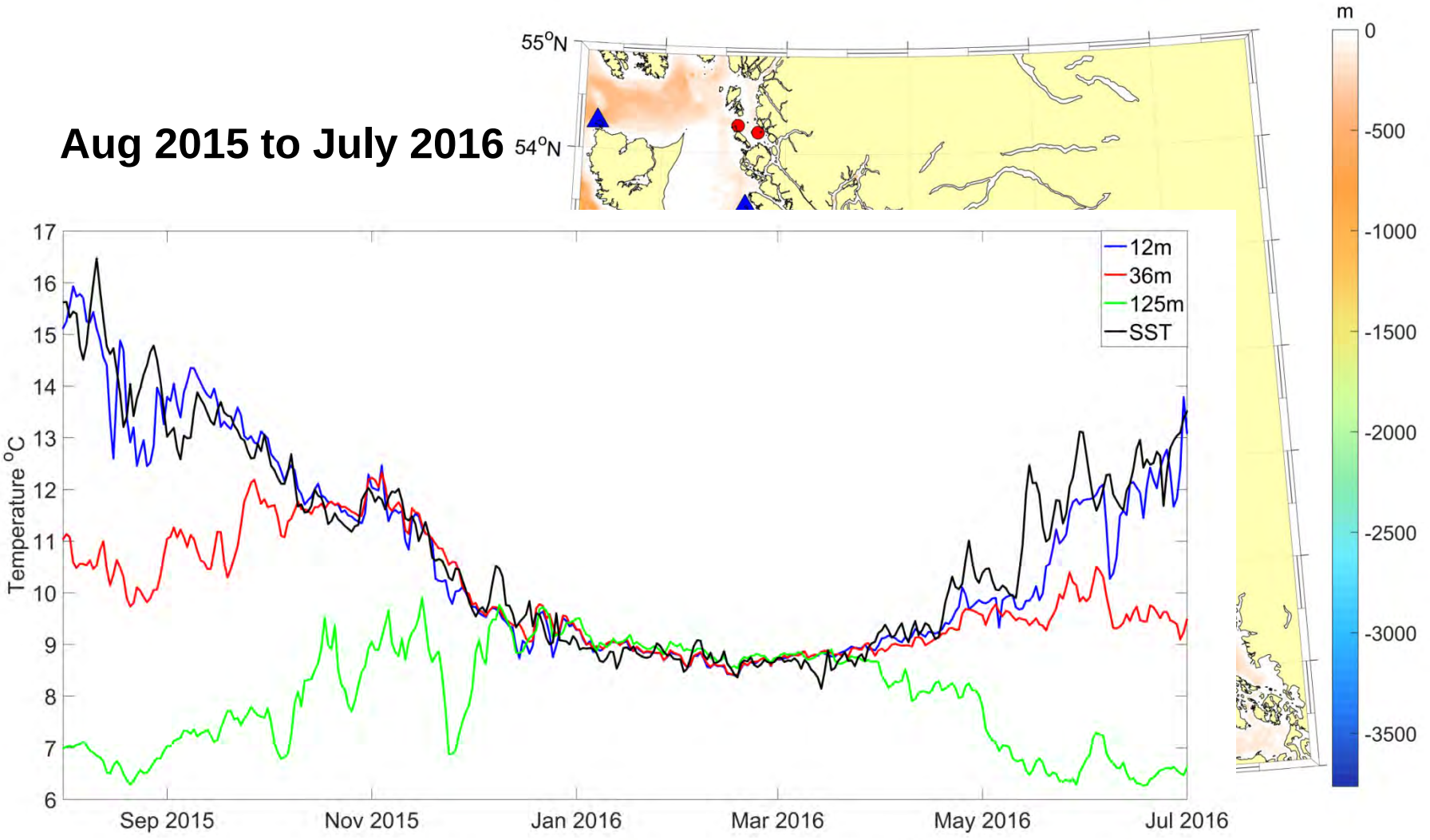


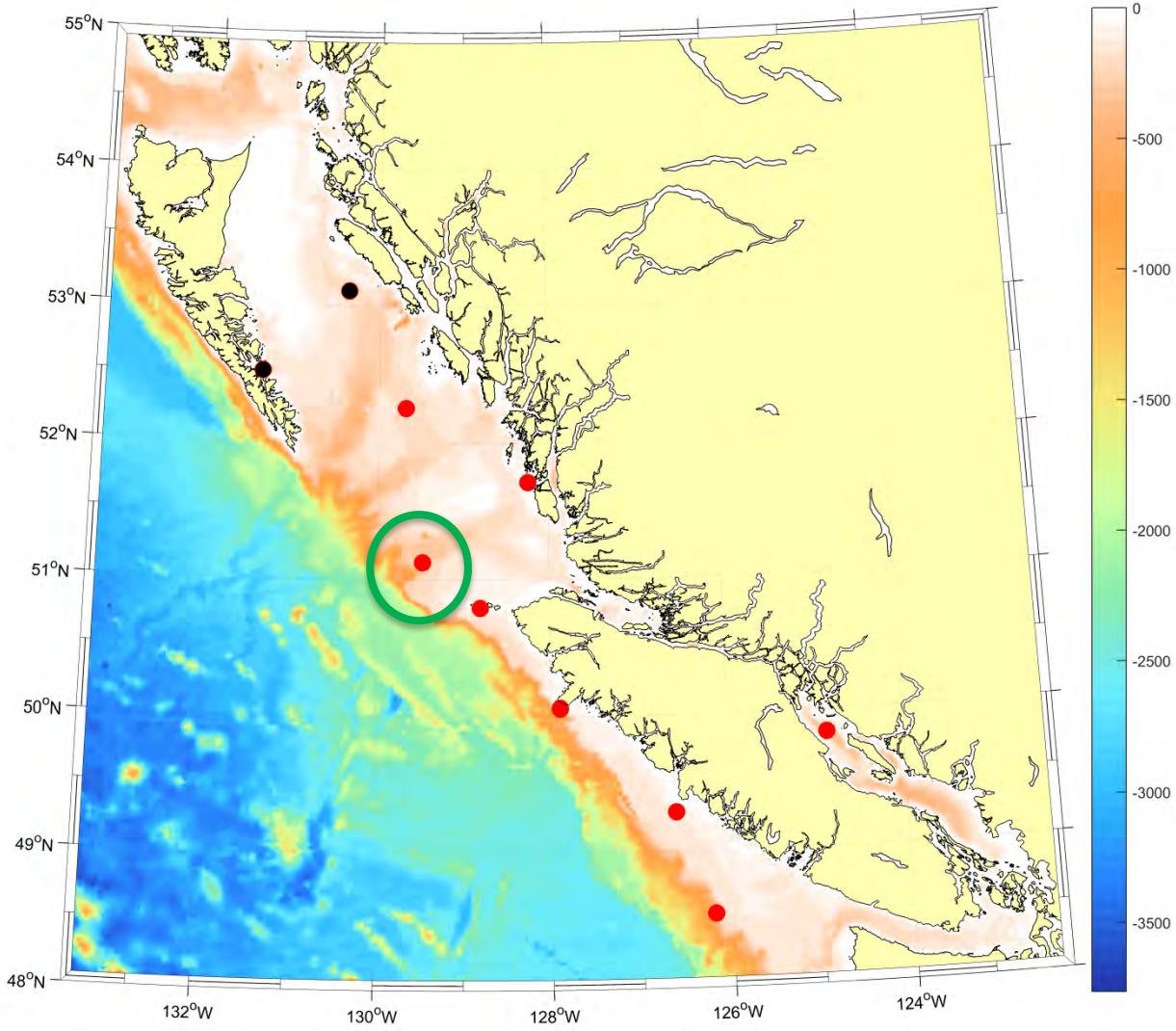
Temperatures between 35 and 100 m from July 2016 to July 2017



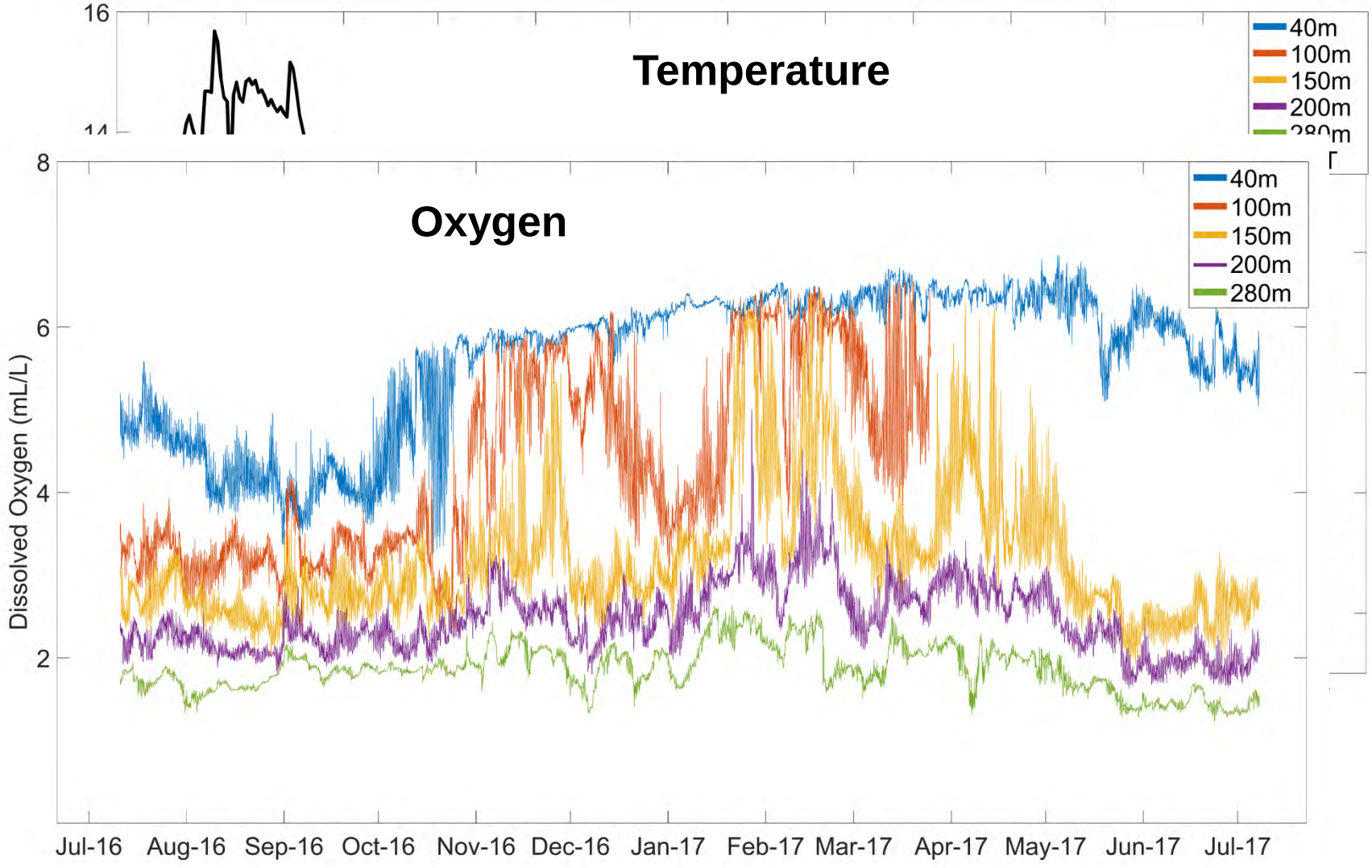
Subsurface Temperature

Aug 2015 to July 2016



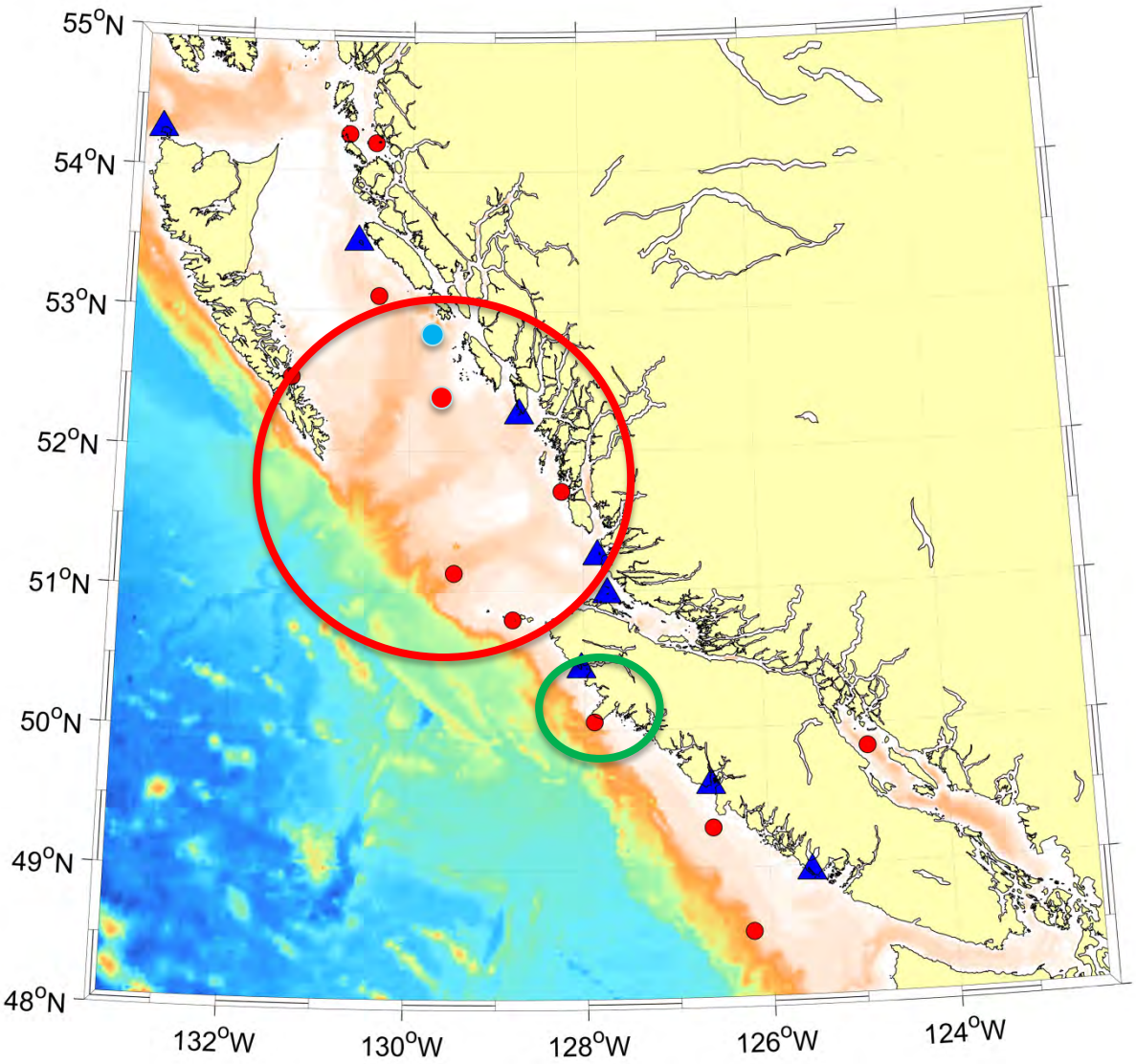

55°N
54°N
53°N
52°N
51°N
50°N
49°N
48°N
132°W
130°W
128°W
126°W
124°W
0
-500
-1000
-1500
-2000
-2500
-3000
-3500

Scott 2 mooring, 300 m water depth

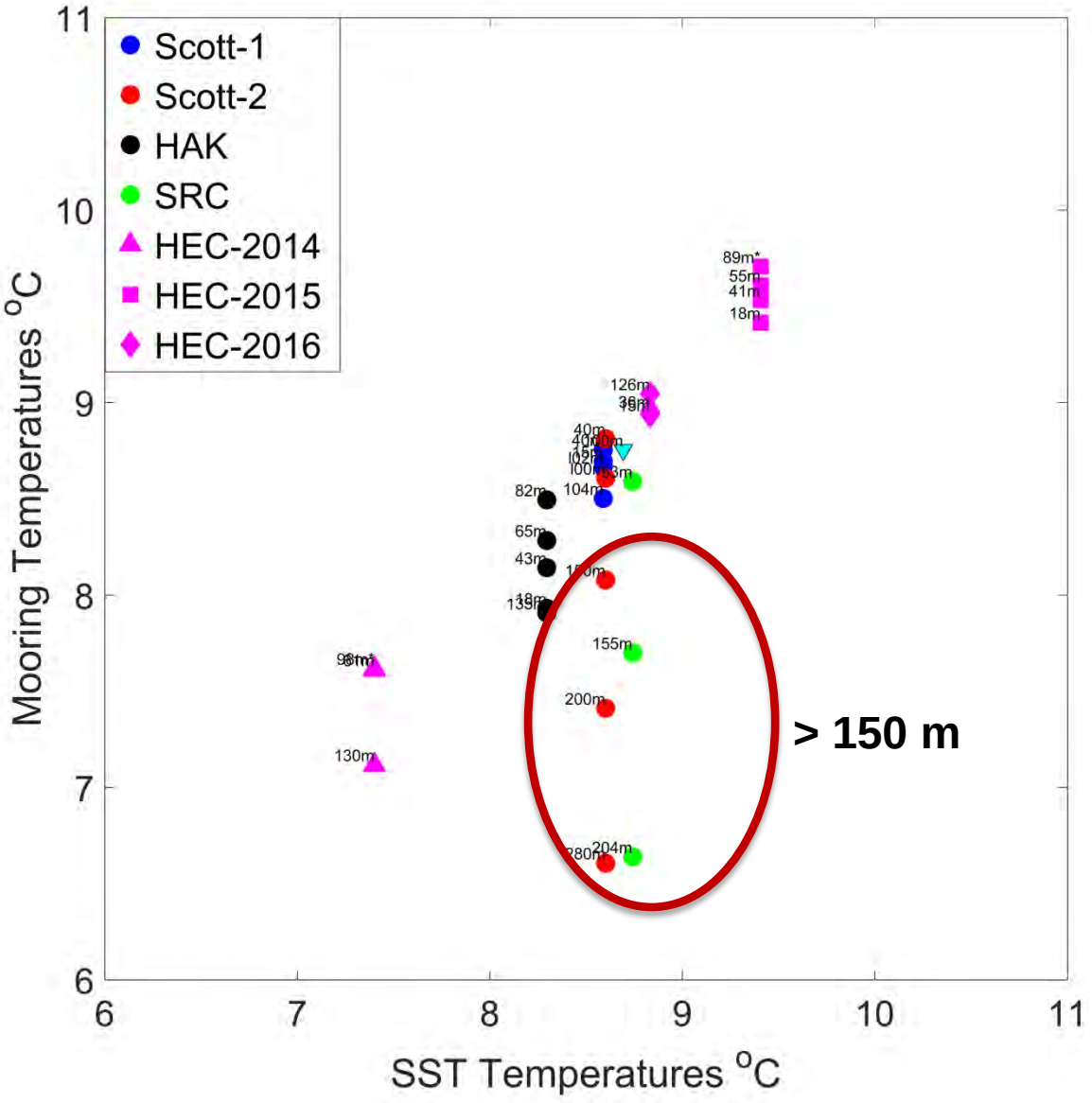


Mooring locations

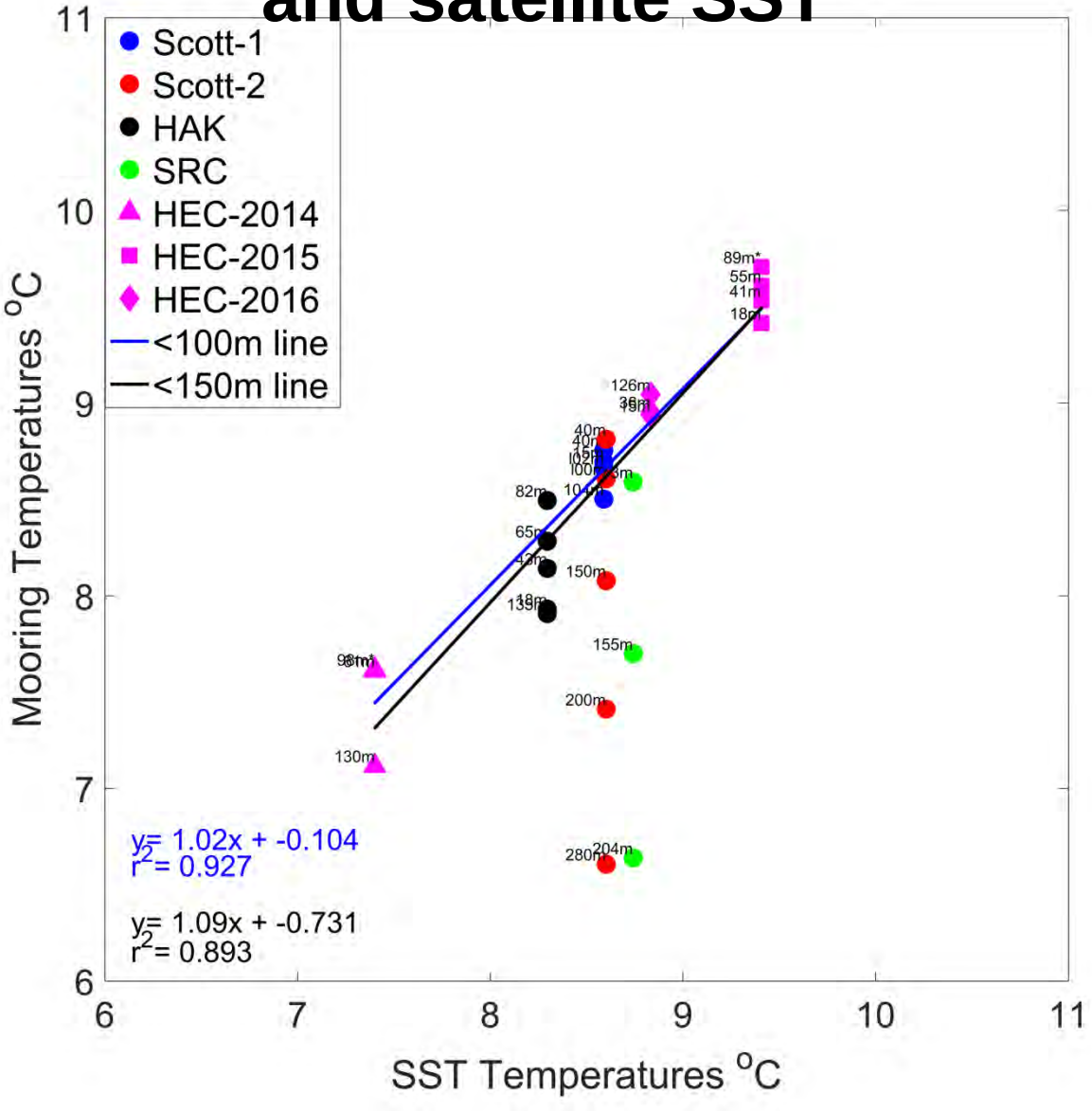
Blue : 3 Years 2013-2016
Red : 1 Year 2016-2017



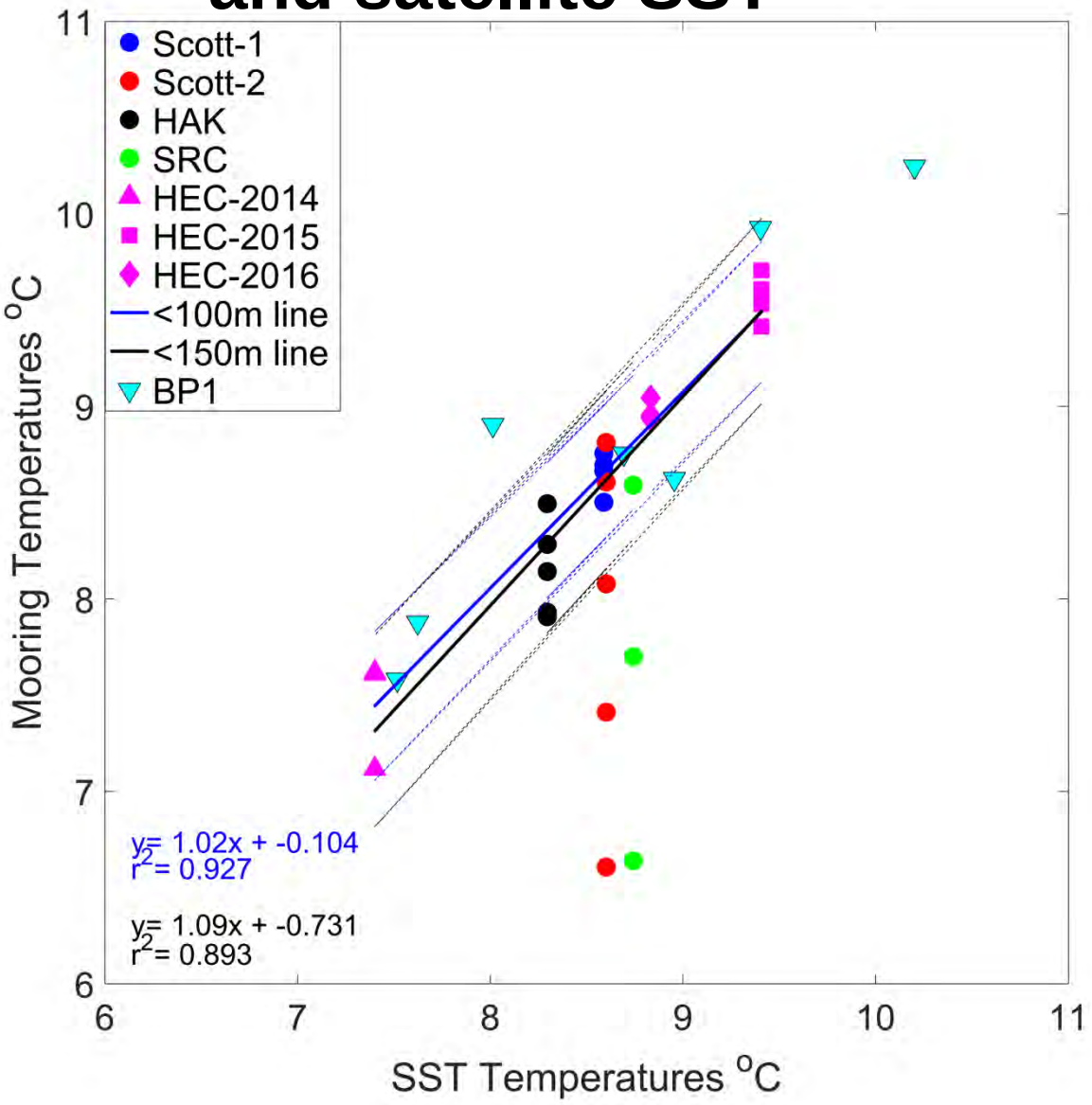
January Mooring Temperature vs Satellite SST

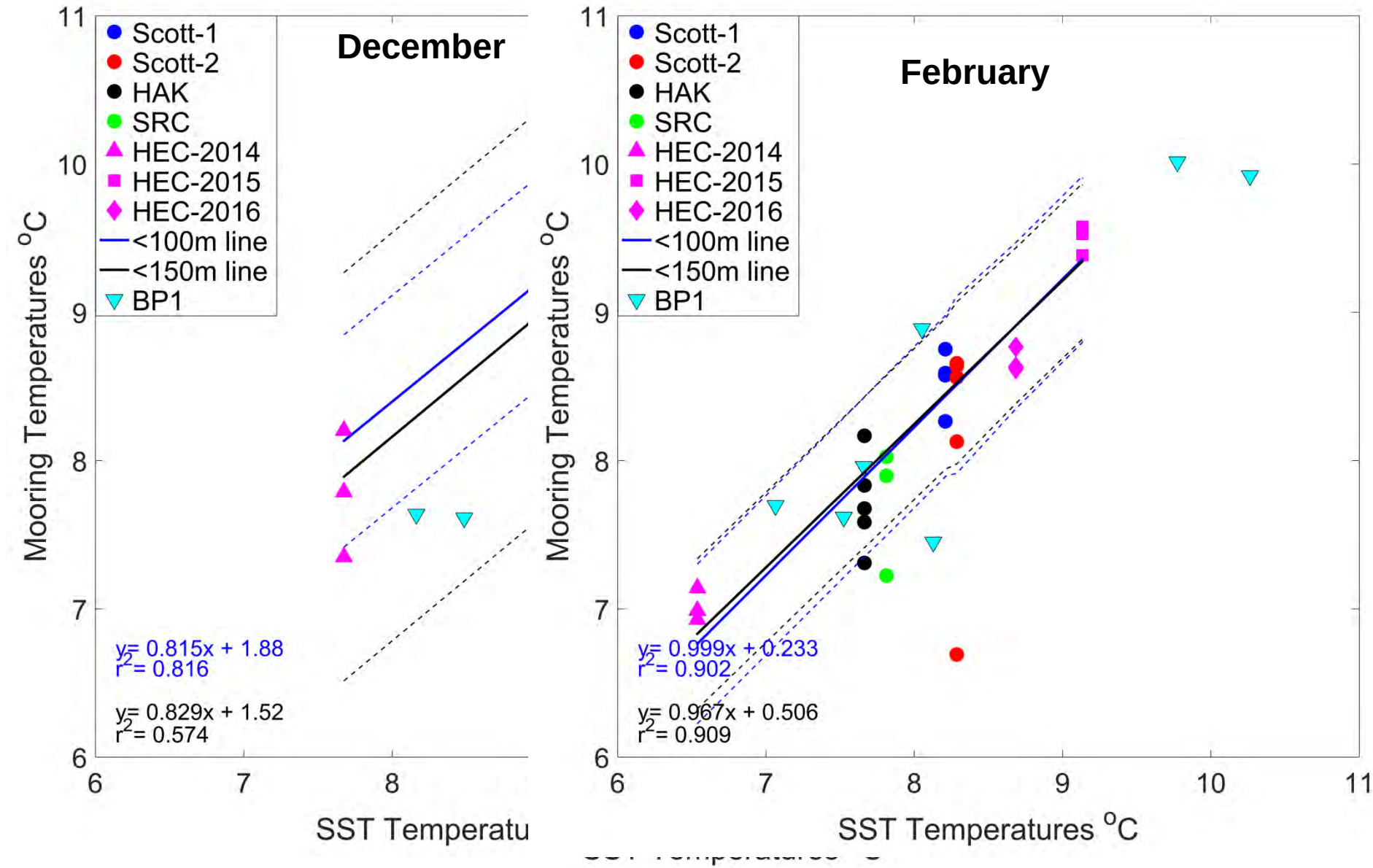


Relationship between subsurface temperature and satellite SST

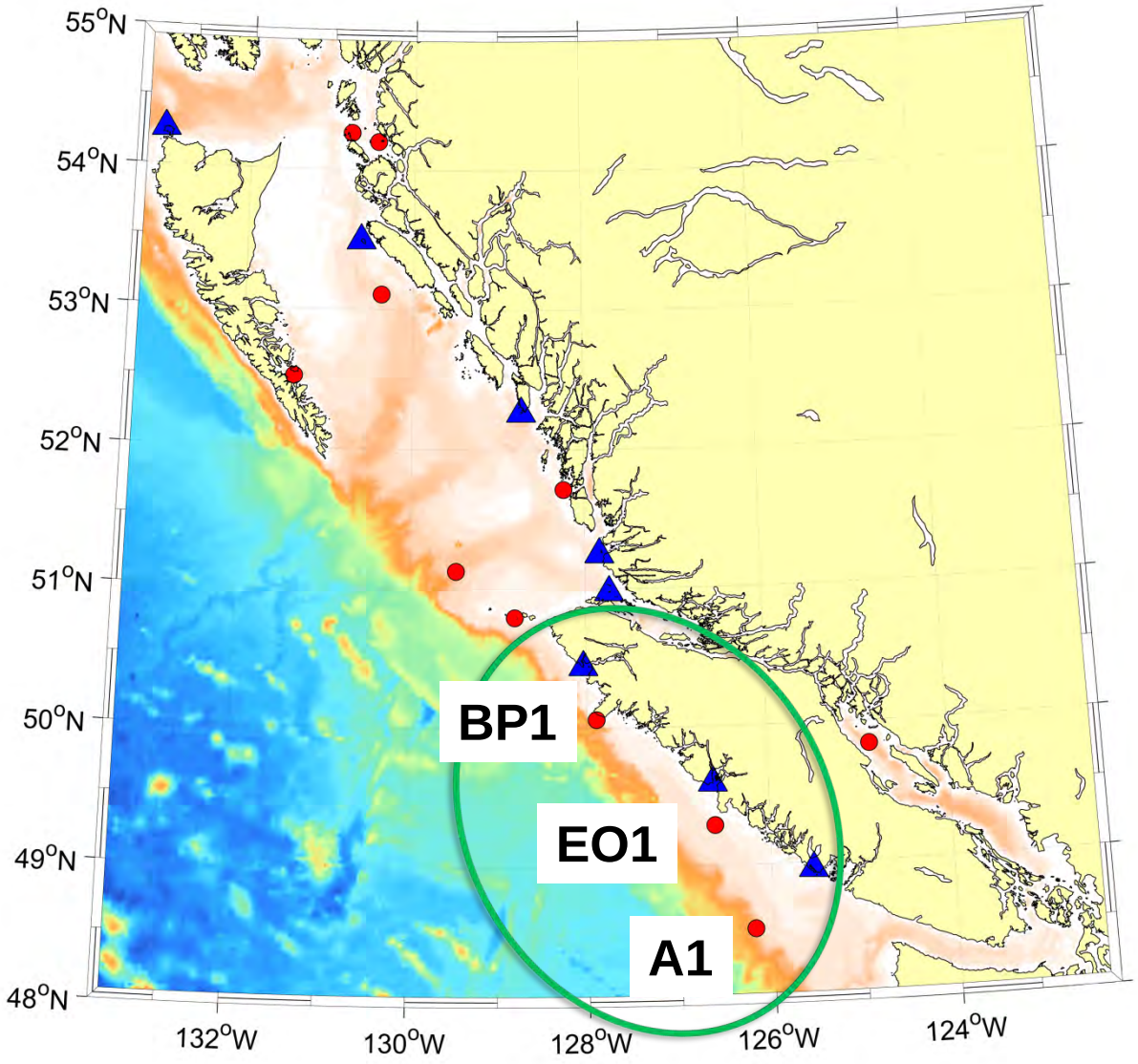


Relationship between subsurface temperature and satellite SST



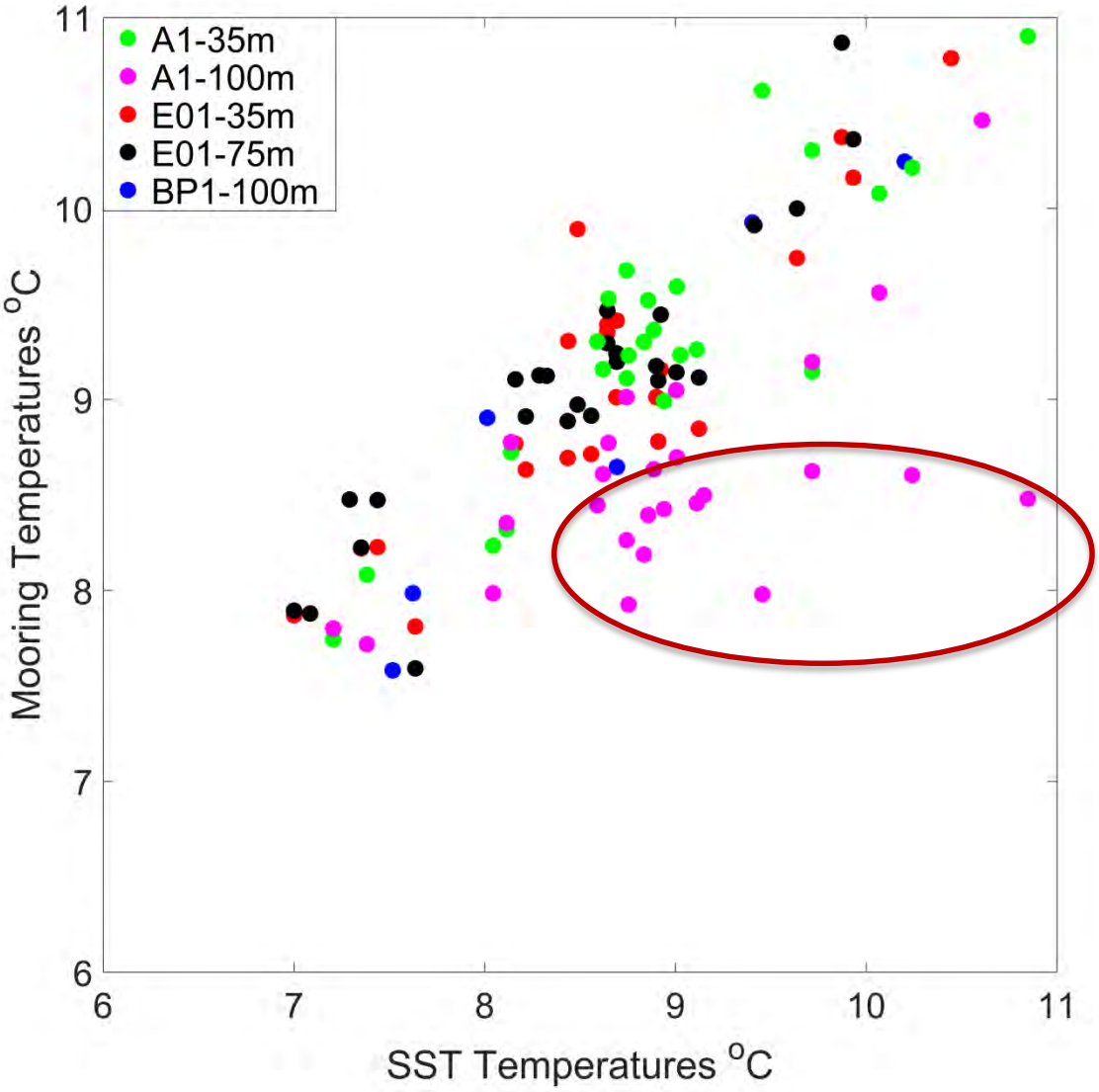

December
Scott-1
Scott-2
HAK
SRC
HEC-2014
HEC-2015
HEC-2016
<100m line
<150m line
BP1
y= 0.815x + 1.88
r2= 0.816
y= 0.829x + 1.52
r2= 0.574
Mooring Temperatures °C
SST Temperatu
February
Scott-1
Scott-2
HAK
SRC
HEC-2014
HEC-2015
HEC-2016
<100m line
<150m line
BP1
y= 0.999x + 0.233
r2= 0.902
y= 0.967x + 0.506
r2= 0.909
Mooring Temperatures °C
SST Temperatures °C

West coast of Vancouver Island



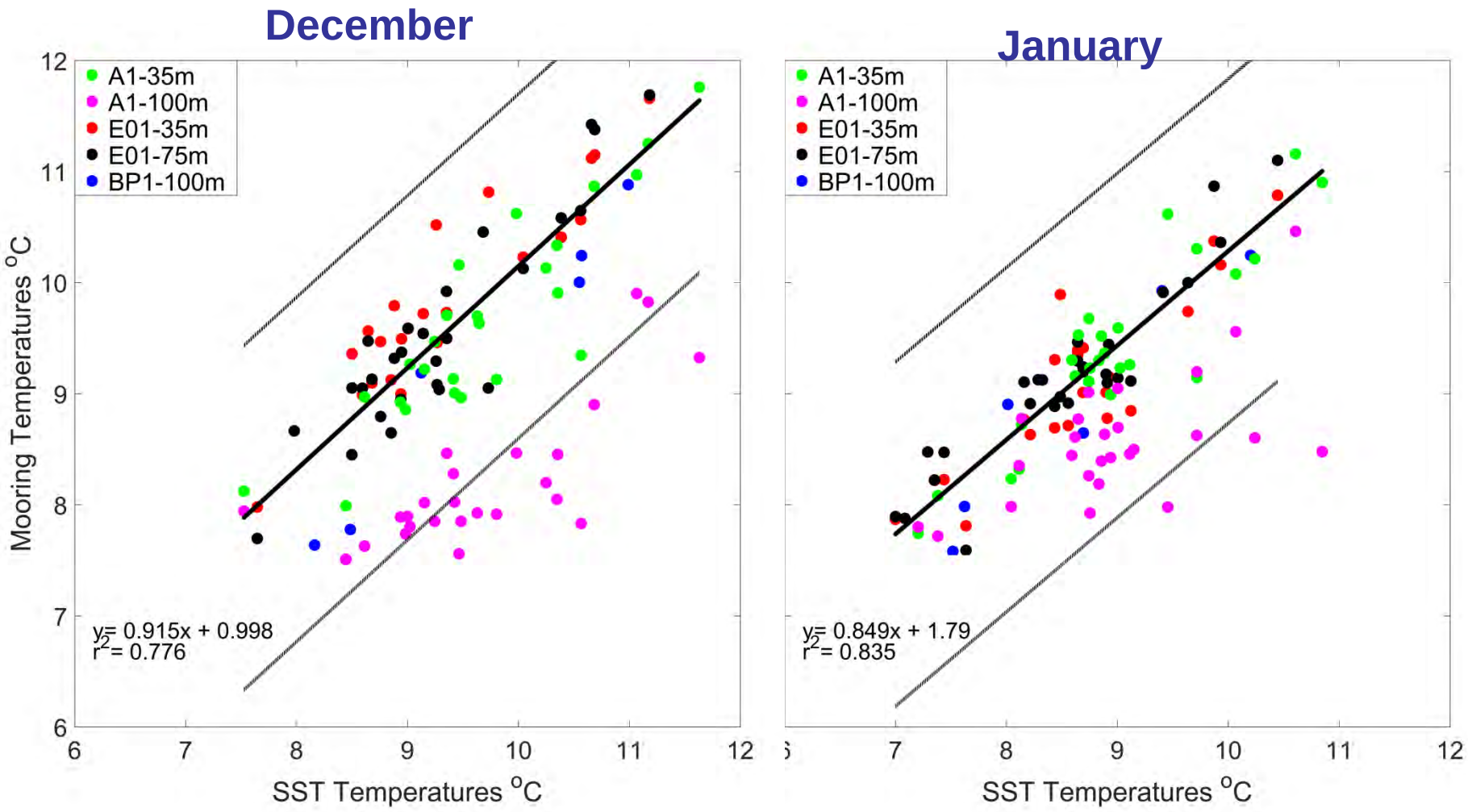
Records are about 30+ years long. Test whether previous results were coincidence.

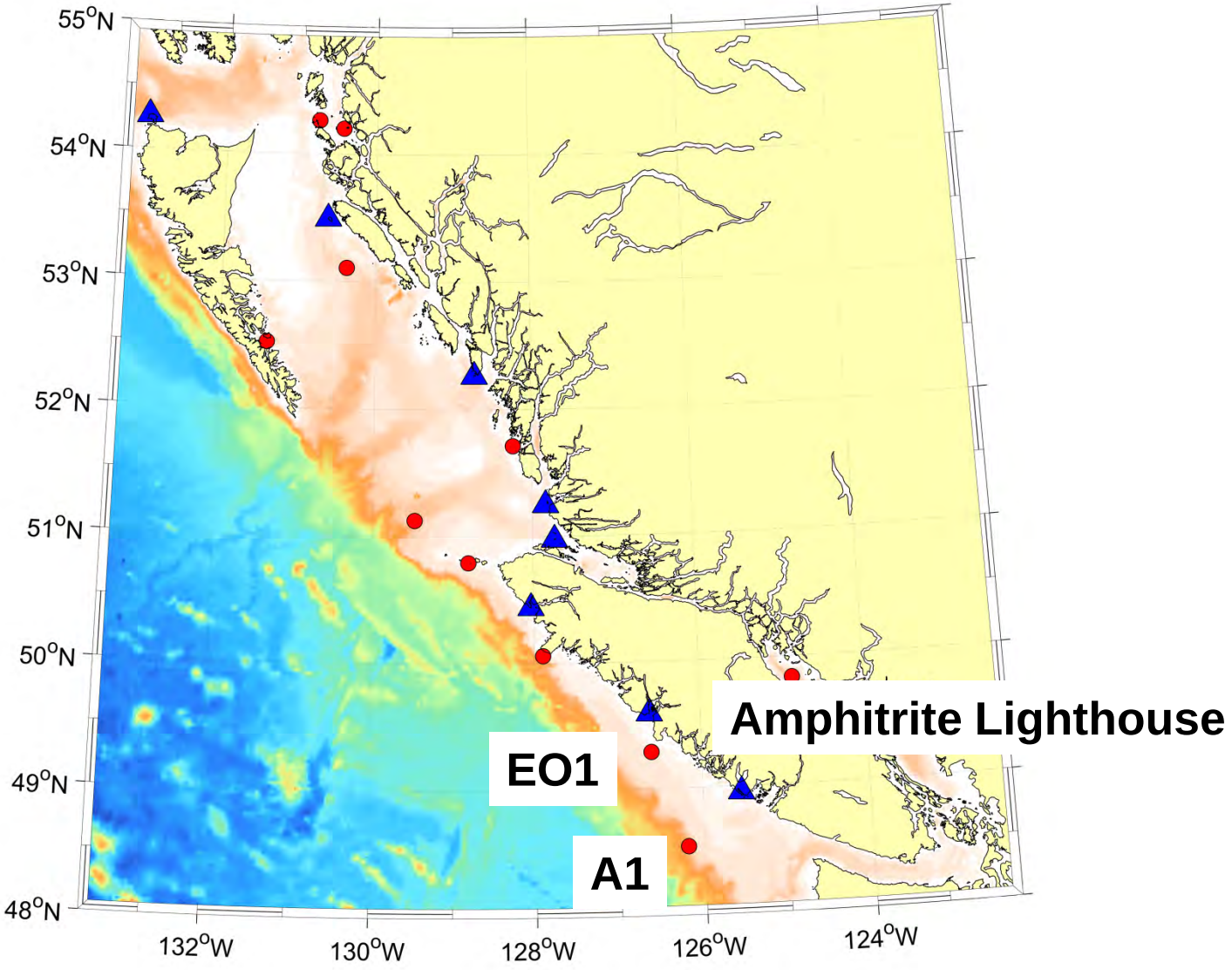
A1, EO1, BP



A1- 100 m

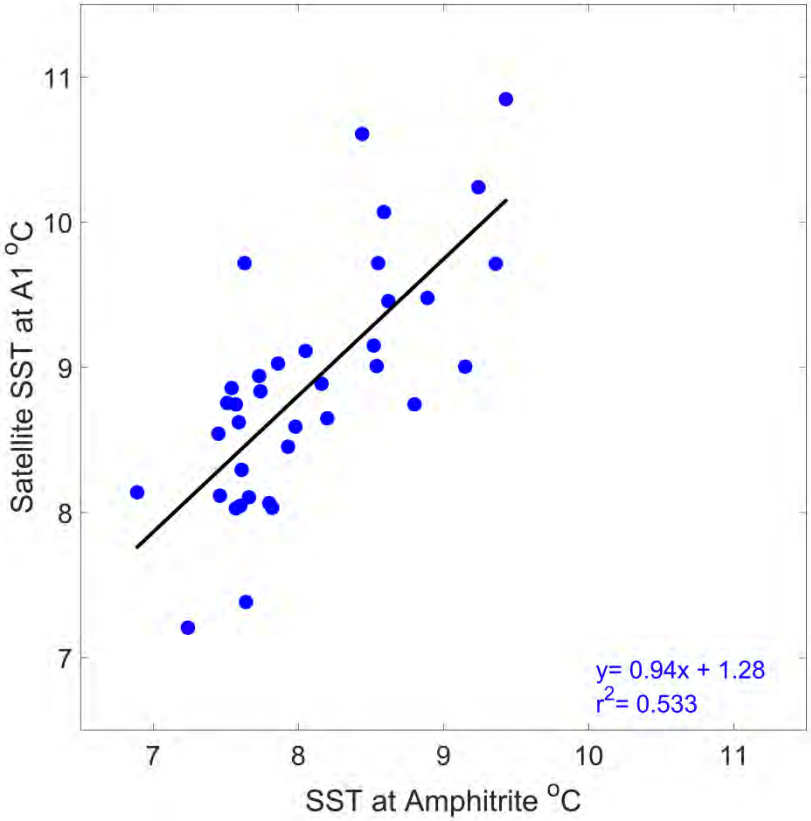
Mooring T vs satellite SST
regressions without A1 -100 m



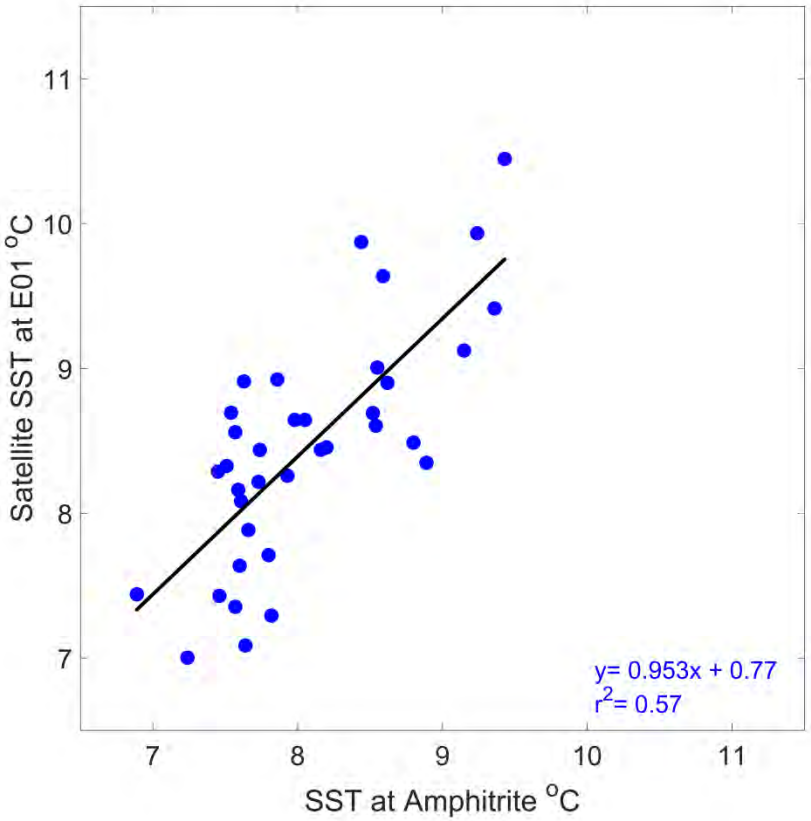

55°N
54°N
53°N
52°N
51°N
50°N
49°N
48°N
132°W
130°W
128°W
126°W
124°W
Amphitrite Lighthouse
EO1
A1

Satellite SST and lighthouse SST

A1 mooring at shelf edge



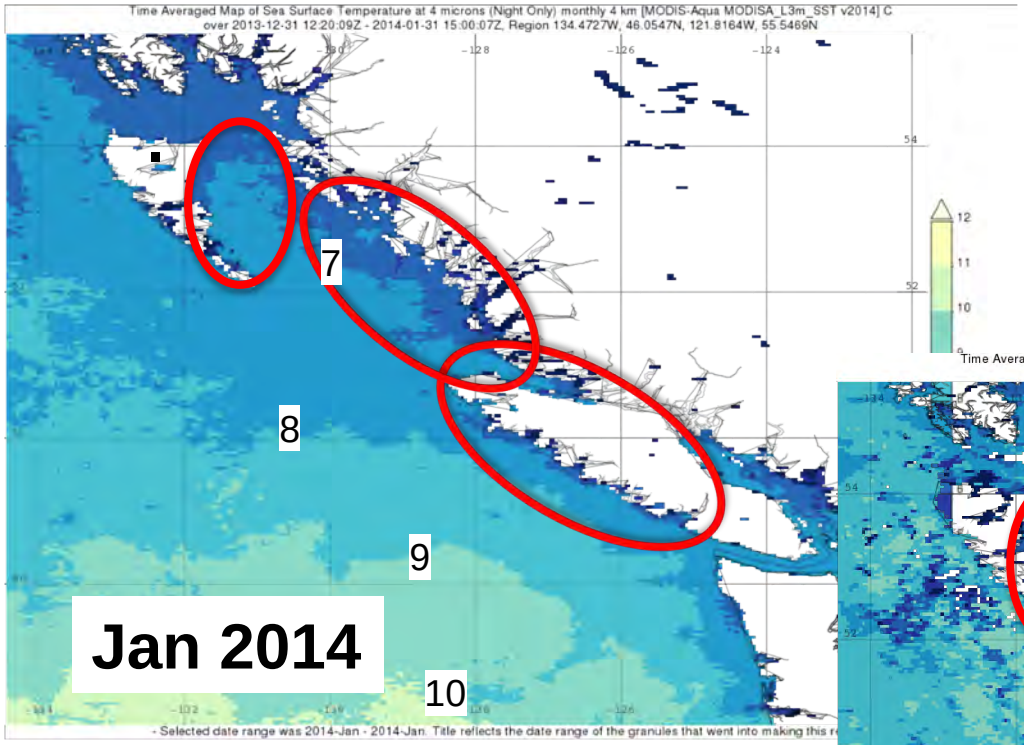
EO1 mooring near Vancouver Island

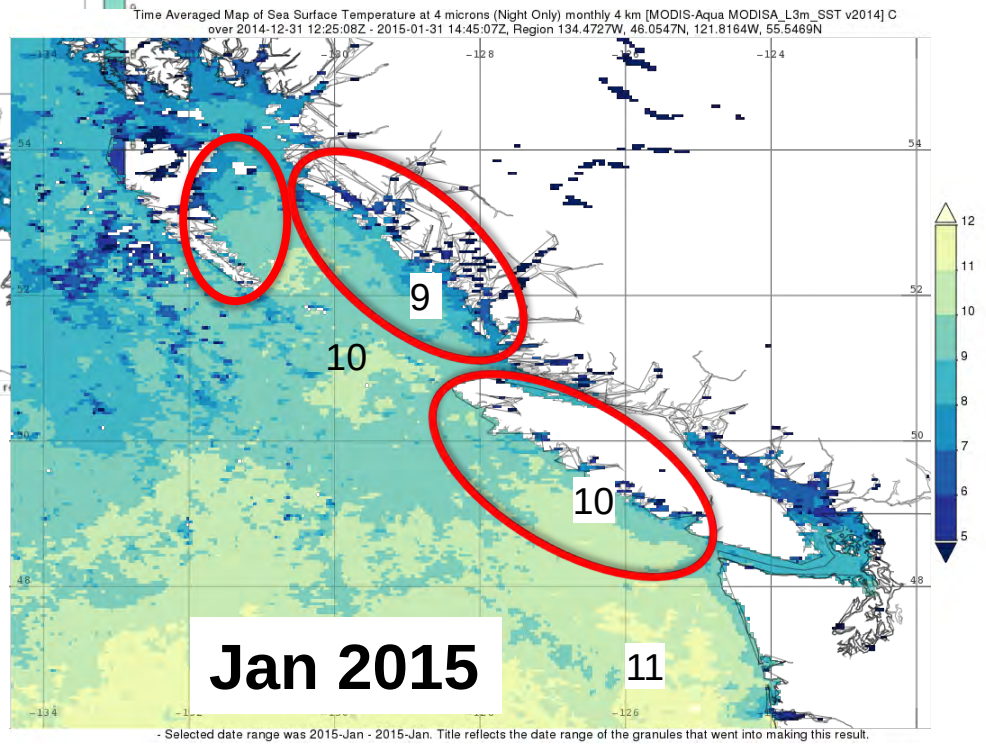


Conclusion 1

- **Can we use satellite sea surface temperature as a proxy for temperature down to 100 or 150 m in January and February?**
- **Probably – down to 100 m**
  - **Errors in the range 0.5 to 1 C**
  - **Need longer time series for the north coast.**
- **Maybe down to 150 m**
  - **Likely that the mixed layer depth does not reach 150 m every year at every location**
- **Time series of estimates of winter mixed layer depth would be useful**

Satellite SST

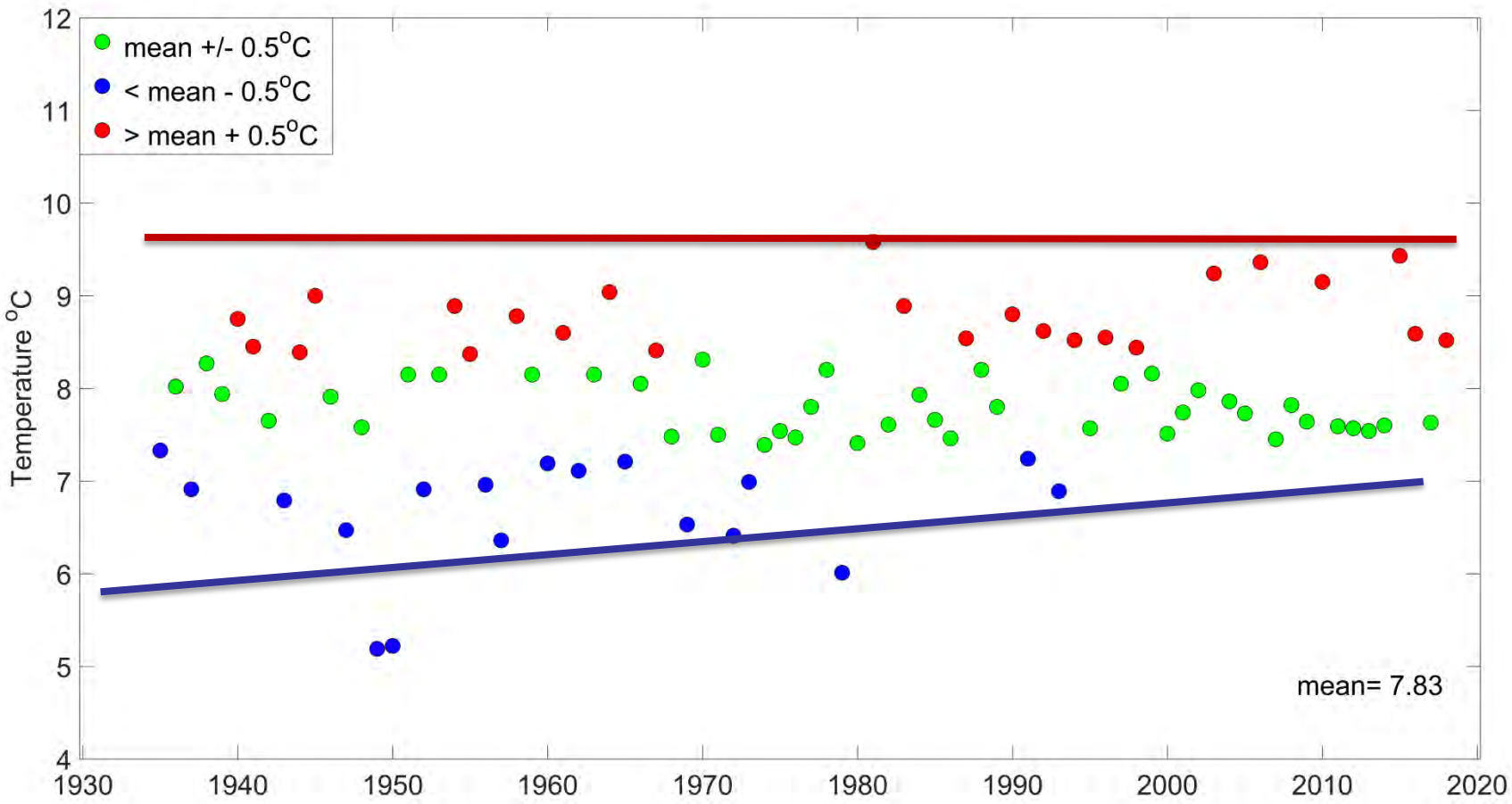


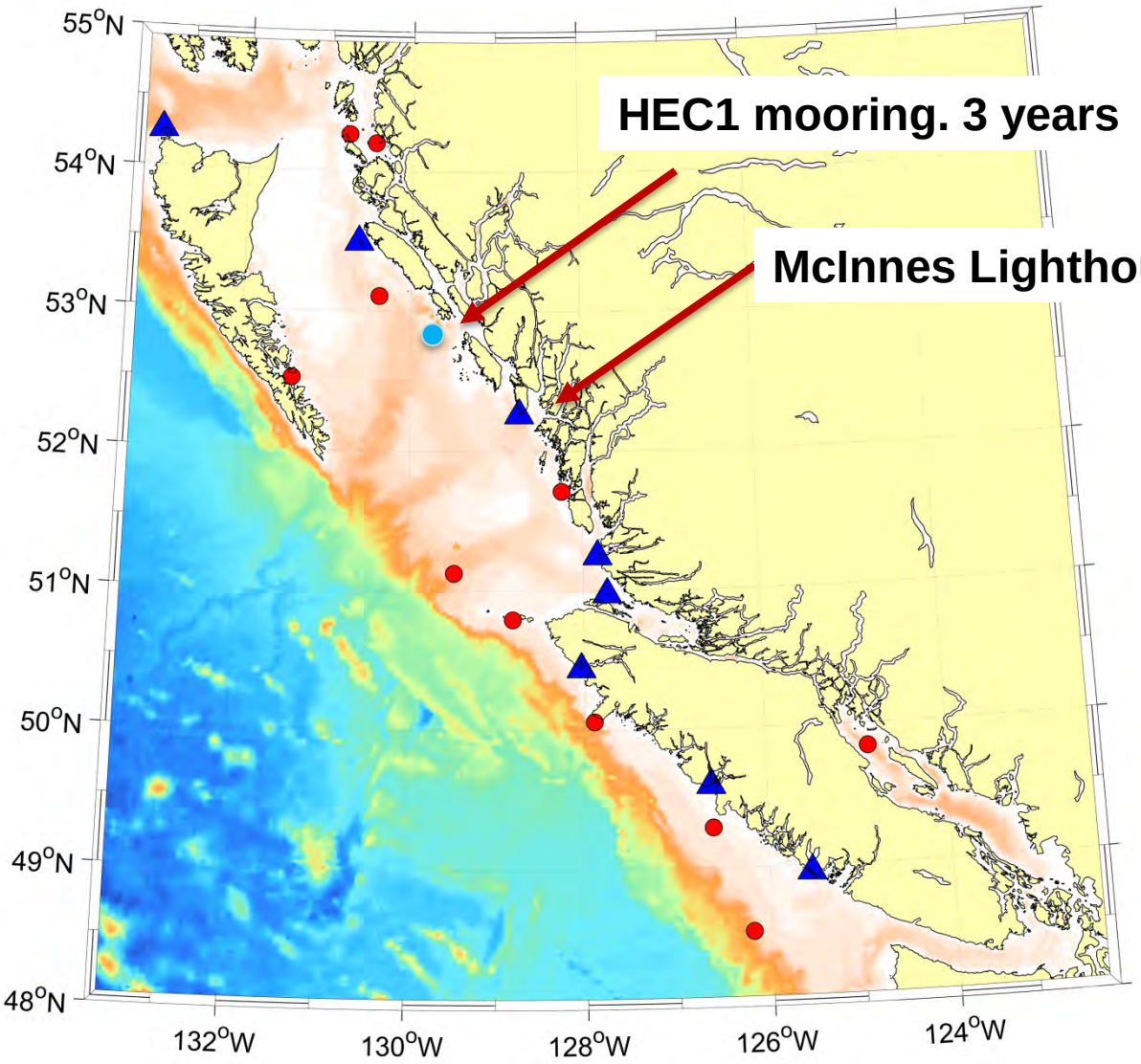


Conclusion 2

- **Is it feasible to use long records of coastal SST as a proxy for satellite SST and thus bottom temperature in January and February?**
- **Yes**
  - **A 3 level classification scheme seems reasonable: low, average, high**

January temperature at Amphitrite lighthouse




HEC1 mooring. 3 years
McInnes Lighthouse. 1955 to present
55°N
54°N
53°N
52°N
51°N
50°N
49°N
48°N
132°W
130°W
128°W
126°W
124°W

January Temperature
at McInness Lighthouse and HEC1 mooring