



FCT

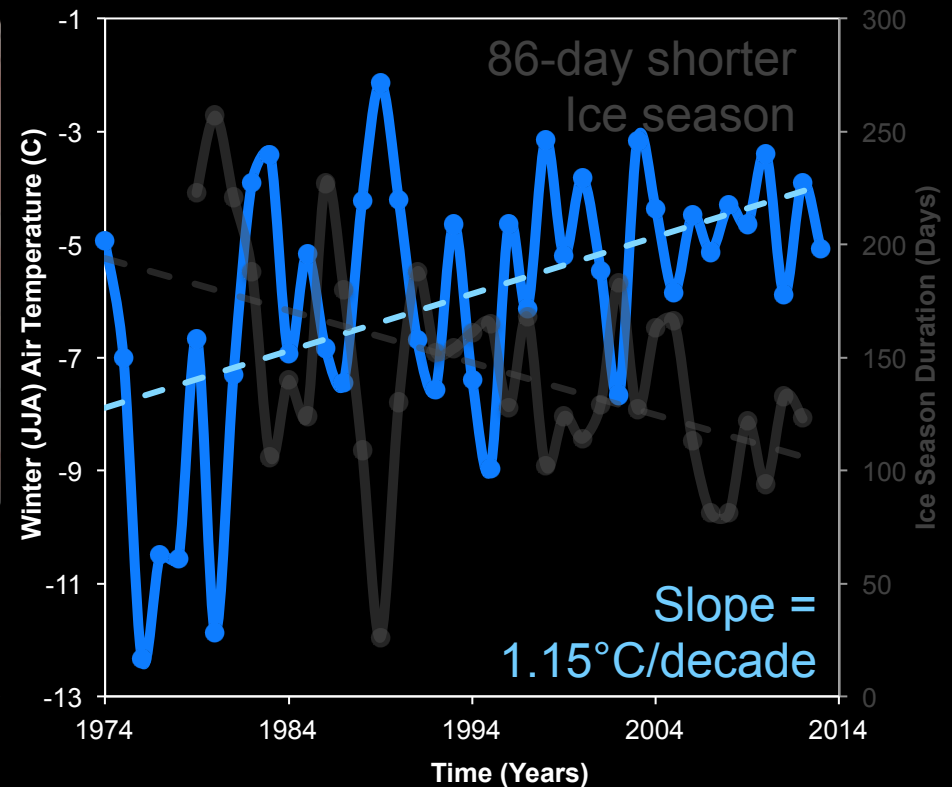
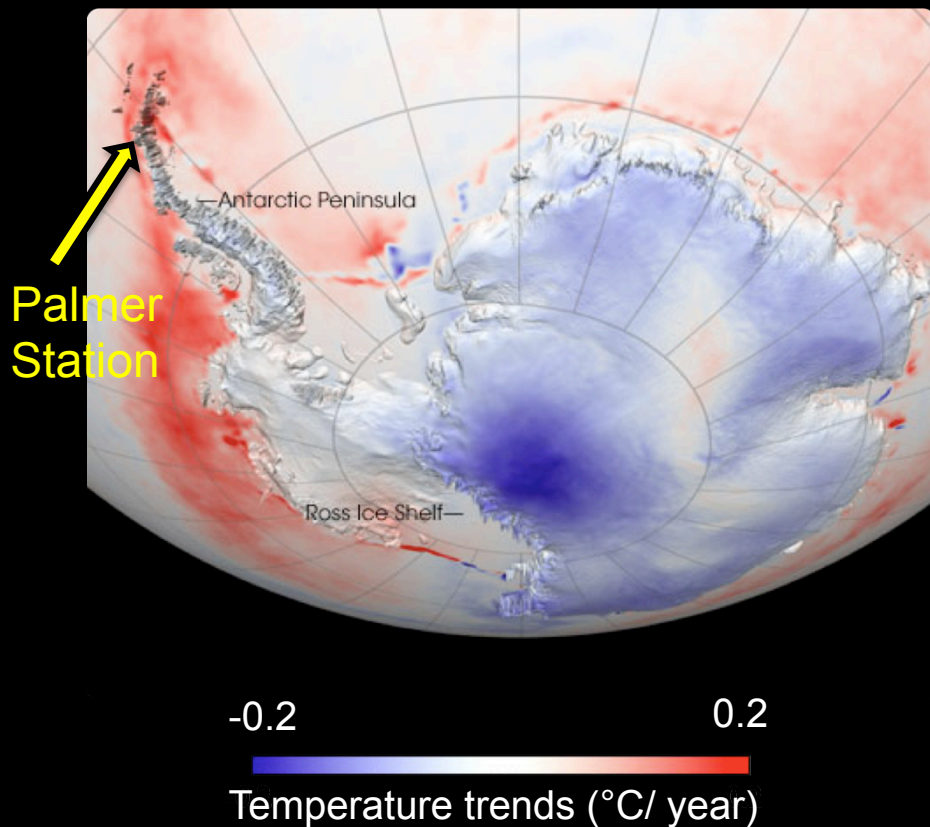
Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

USING AUTONOMOUS UNDERWATER GLIDERS TO STUDY PHYTOPLANKTON DYNAMICS IN THE WEST ANTARCTIC PENINSULA

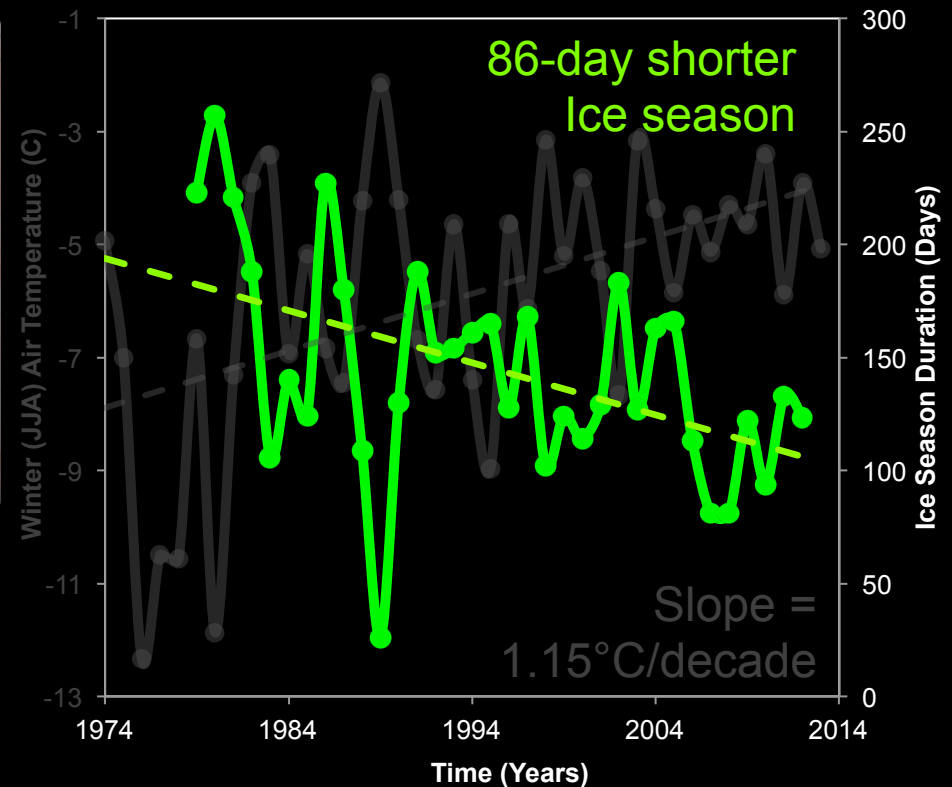
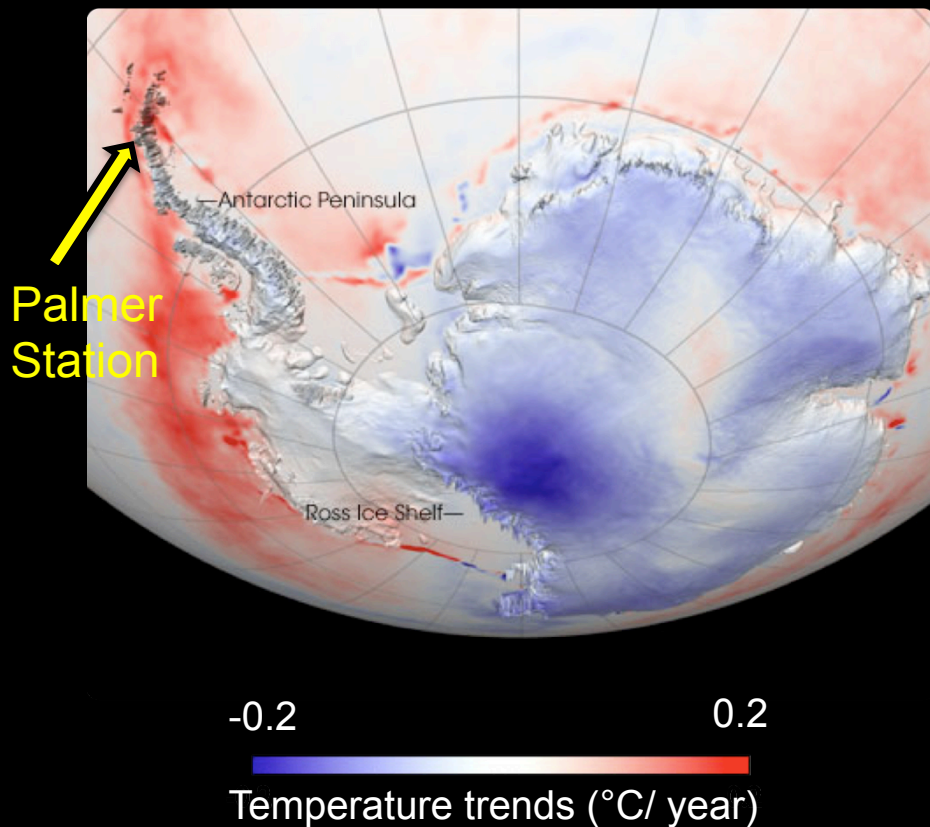


Filipa Carvalho, Hugh Ducklow,
Oscar Schofield, Josh Kohut

MEAN WINTER AIR TEMPERATURE IS INCREASING IN THE WEST ANTARCTIC PENINSULA (WAP)

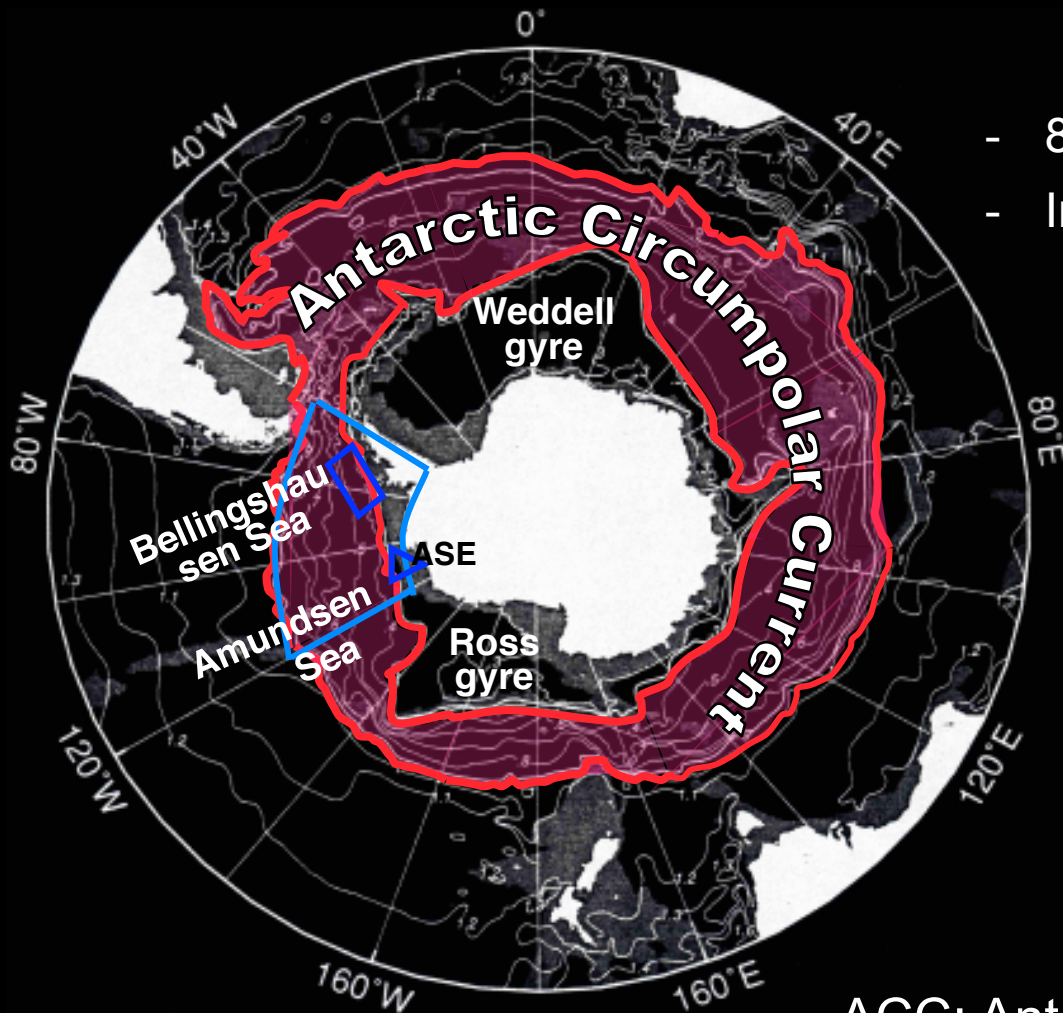


ICE SEASON DURATION IS DECREASING IN THE WEST ANTARCTIC PENINSULA (WAP)



UCDW INTRUSION ONTO THE SHELF

WARMING OF SHELF WATER



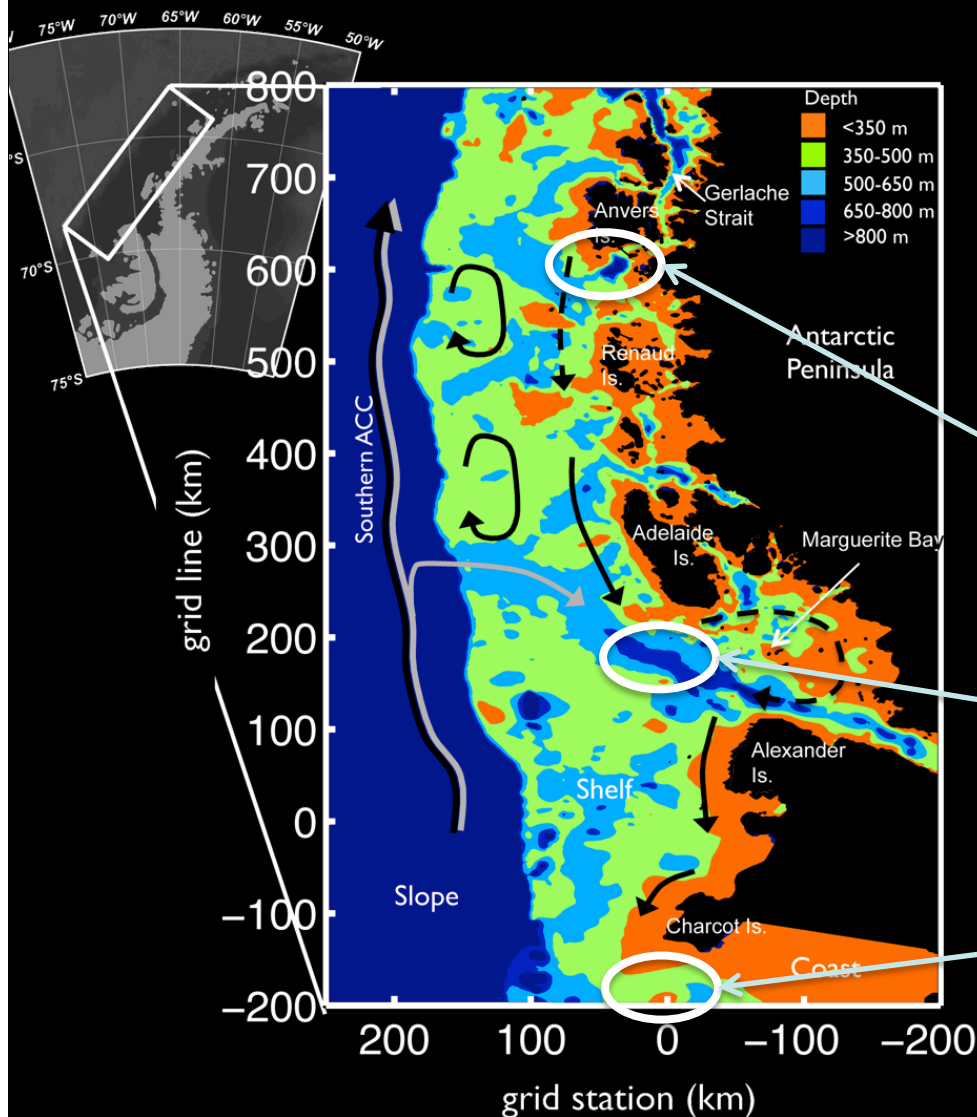
- 87% of glaciers are in retreat
- Increase in the ocean heat content

UCDW: Upper
Circumpolar Deep Water

ACC based on climatological dynamic topography
of Orsi *et al.*, DSR, 1995

ACC: Antarctic Circumpolar Current
WAP: West Antarctic Peninsula

WAP CANYONS: “*BIOLOGICAL HOTSPOTS*”



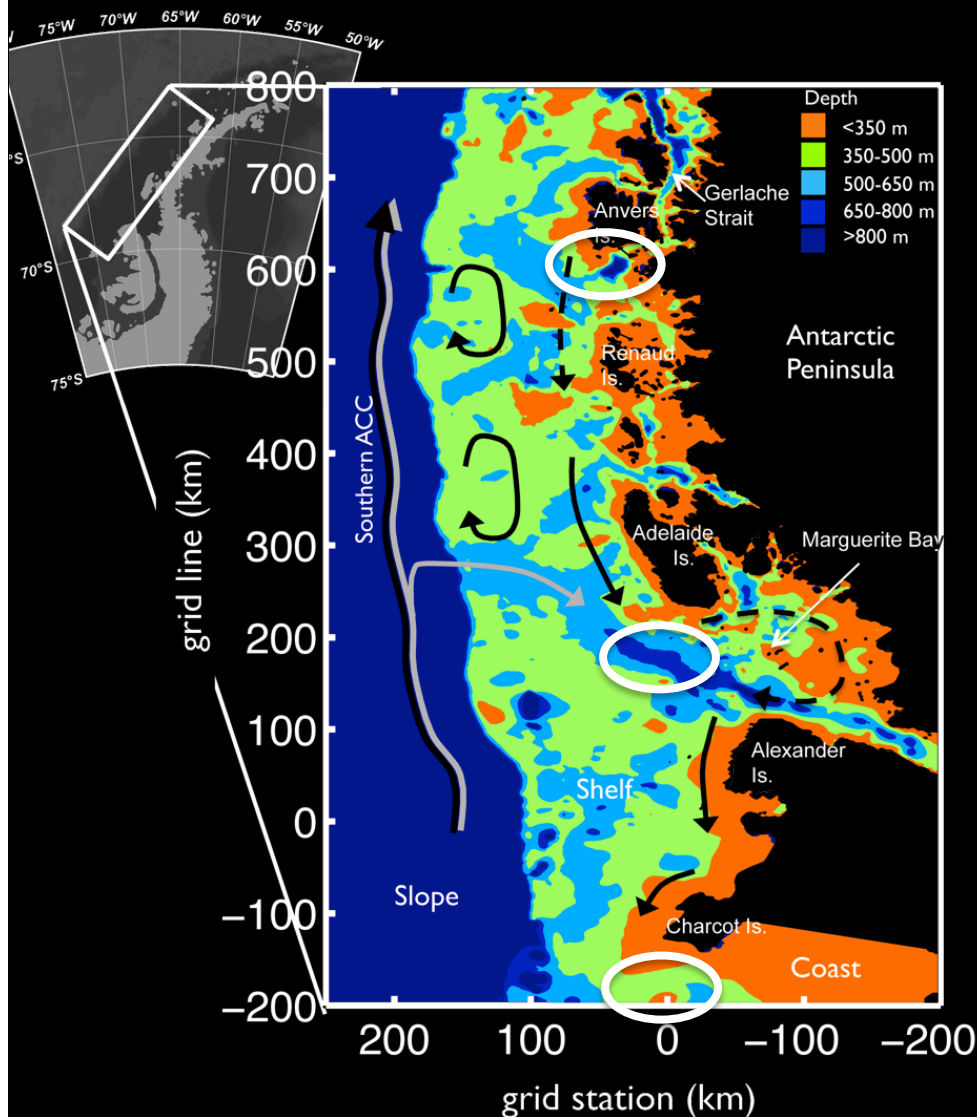
- “Biological Hotspots” along the Peninsula associated with **deep undersea canyons**.

Palmer Deep Canyon
(near Anvers Island)

Margarite Trough
(near Avian Island)

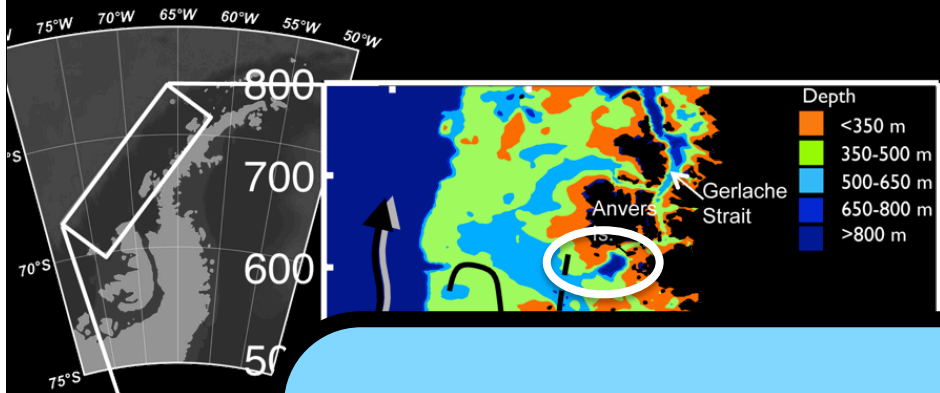
newly discovered canyon
(near Charcot Island)

WAP CANYONS: “BIOLOGICAL HOTSPOTS”



- Penguin Colonies at costal termini of cross-shelf canyons/troughs
- Predictable /elevated food availability;
- Phytoplankton growth in canyon heads;
- Blooms variable in time and space

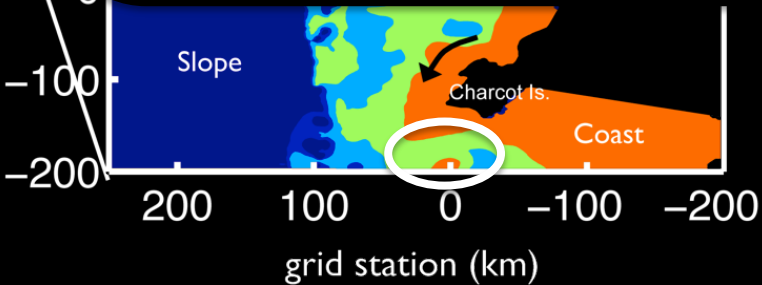
WAP CANYONS: "BIOLOGICAL HOTSPOTS"



- Penguin Colonies at costal shelf

BUT WHAT IS ACTUALLY DRIVING THIS INCREASED PRODUCTIVITY?

grid line (km)



canyon heads;

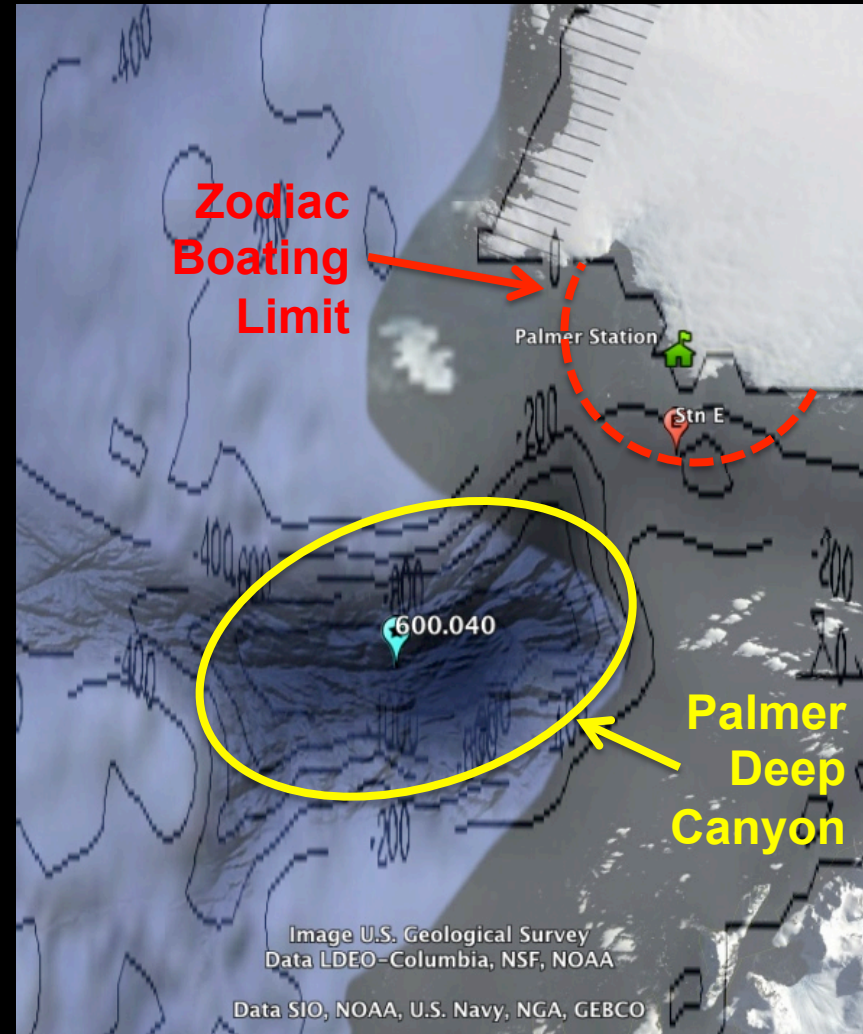
food

th in

SAMPLING METHODS: ZODIACS



- Slow speed, labor intensive
- Small number of profiles
- Limited range
- Daytime sampling only
- Weather dependent



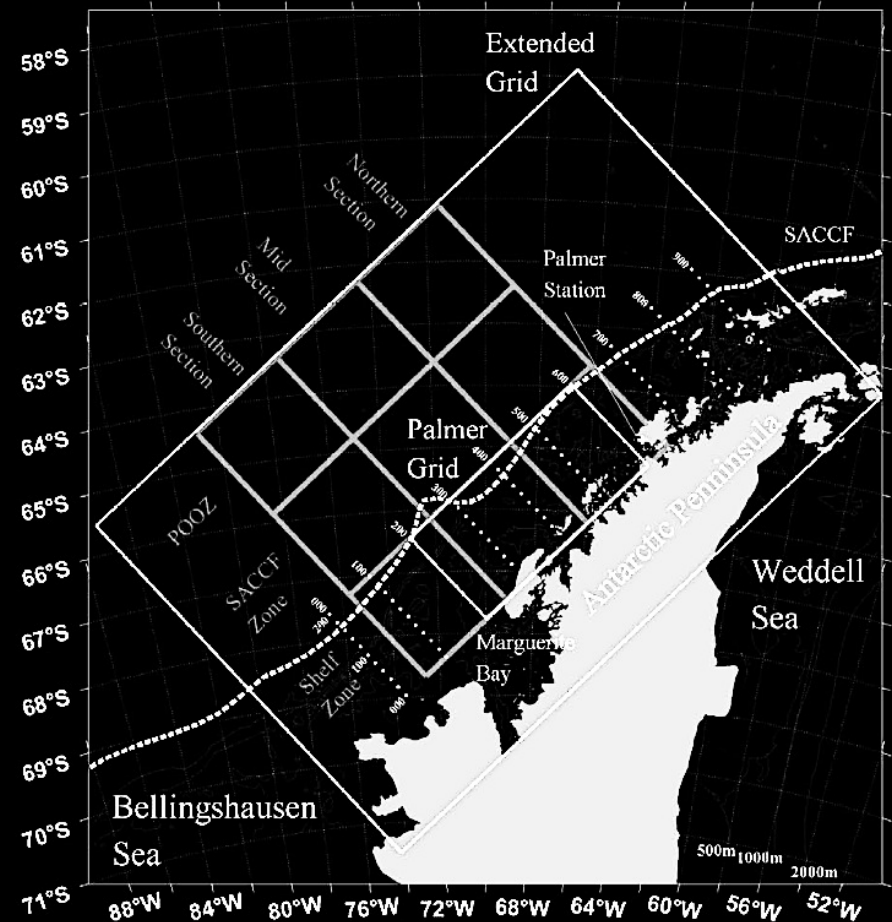
**THE CHALLENGE: WE DO NOT SAMPLE THE
RELEVANT SCALES IN TIME AND SPACE**



SAMPLING METHODS: SHIP SURVEY (ARSV LAURENCE M. GOULD)



- More specific sampling
- Limited to annual cruise
- High cost
- High area to cover
- Labor intensive



THE CHALLENGE: SAMPLING HINDERED BY EXTREME CONDITIONS



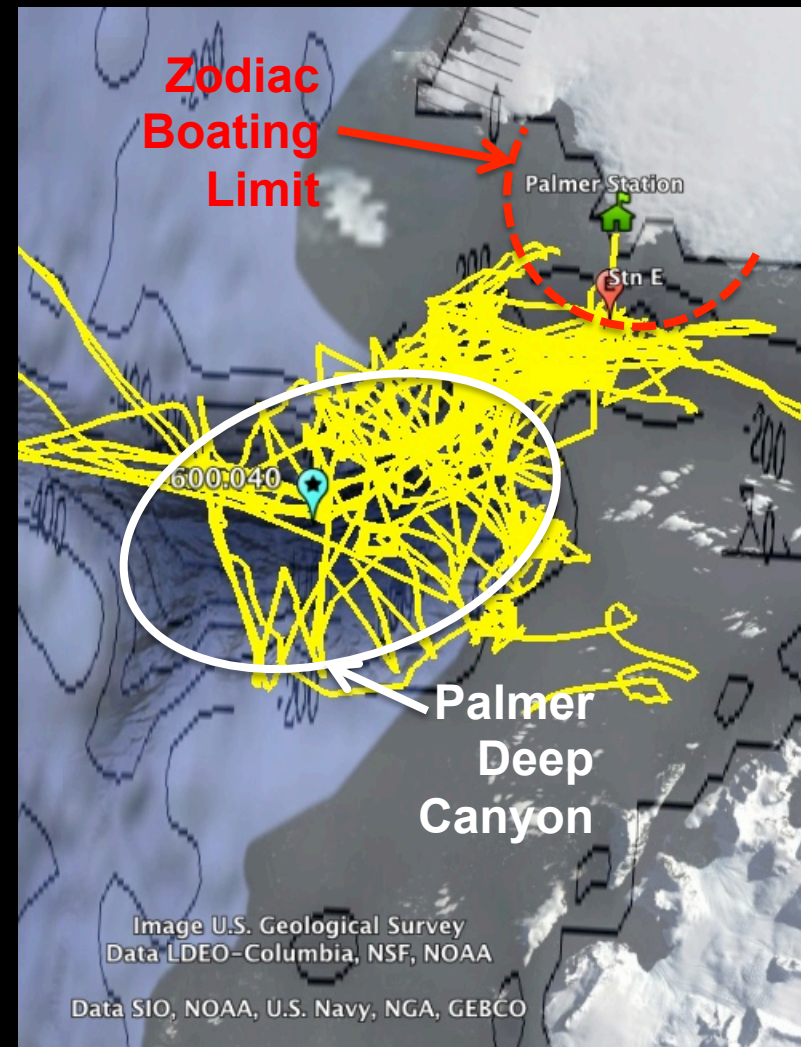
THE CHALLENGE: SAMPLING HINDERED BY EXTREME CONDITIONS



SAMPLING METHODS: GLIDERS

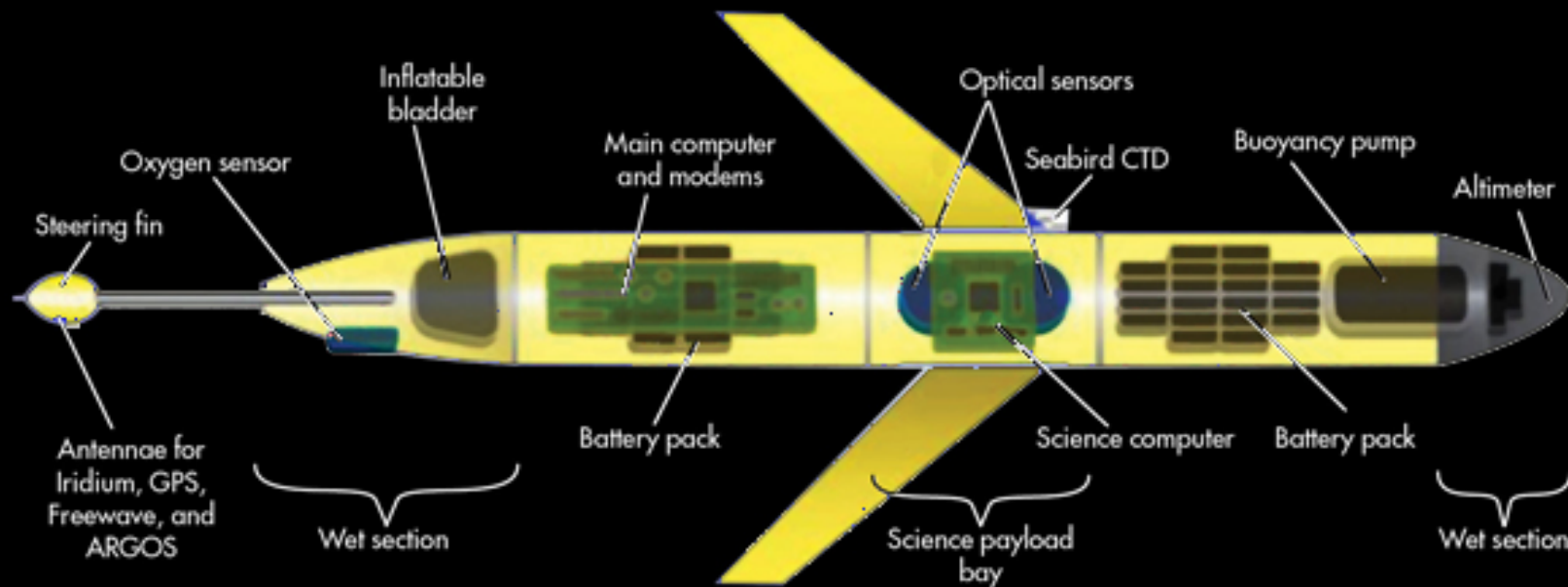
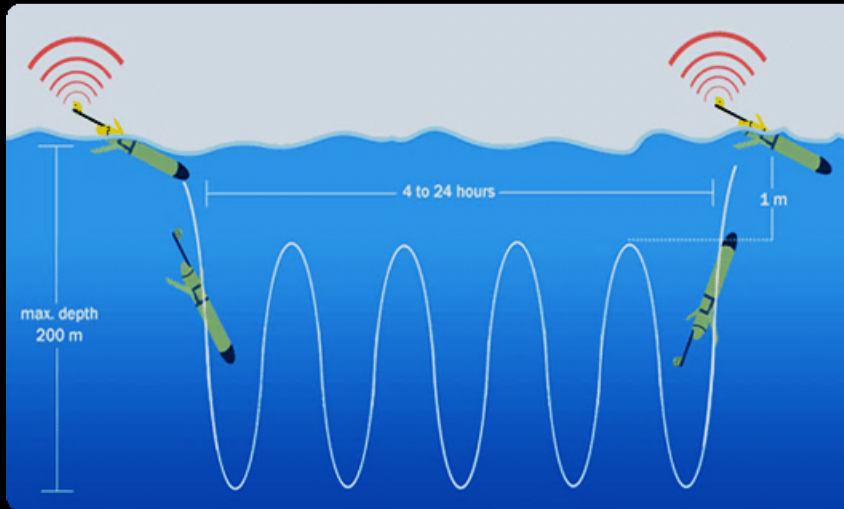


- Autonomous
- Weather independent
- High resolution profiles
- Elevated number of profiles
- “Reusable”!

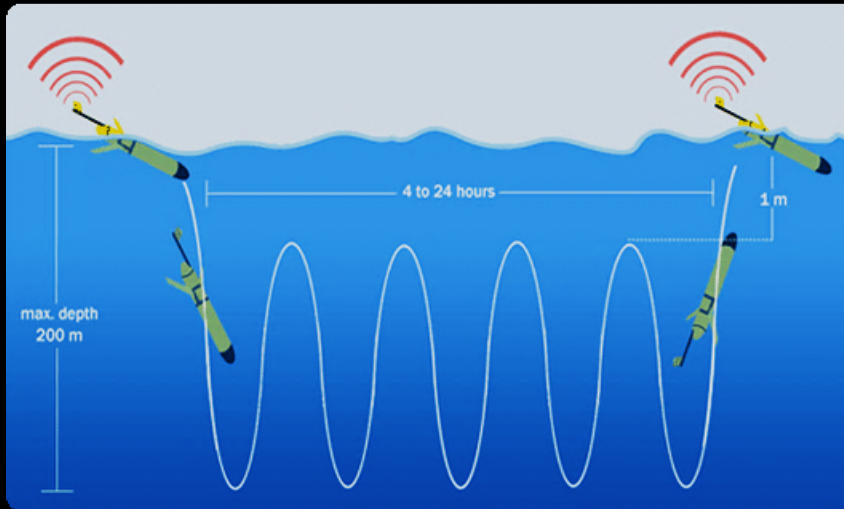


SAMPLING METHOD: SLOCUM GLIDERS

- AUV
- 1.5 meter; ~ 60 Kg
- Buoyancy driven (saw-tooth pattern)

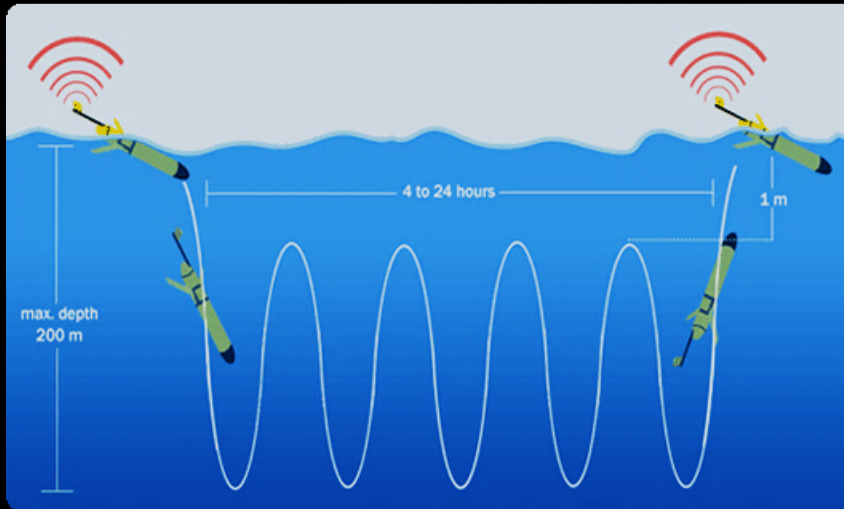


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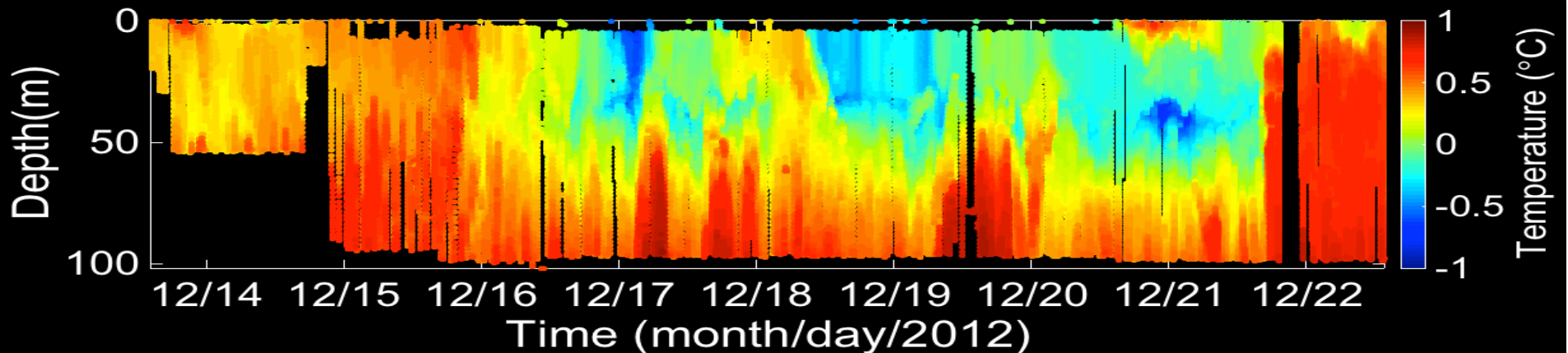


- AUV
- 1.5 meter; ~ 60 Kg
- Buoyancy driven (saw-tooth pattern)
- Communications: Iridium (RUDICS), Argos, Freewave

SAMPLING METHOD: SLOCUM GLIDERS

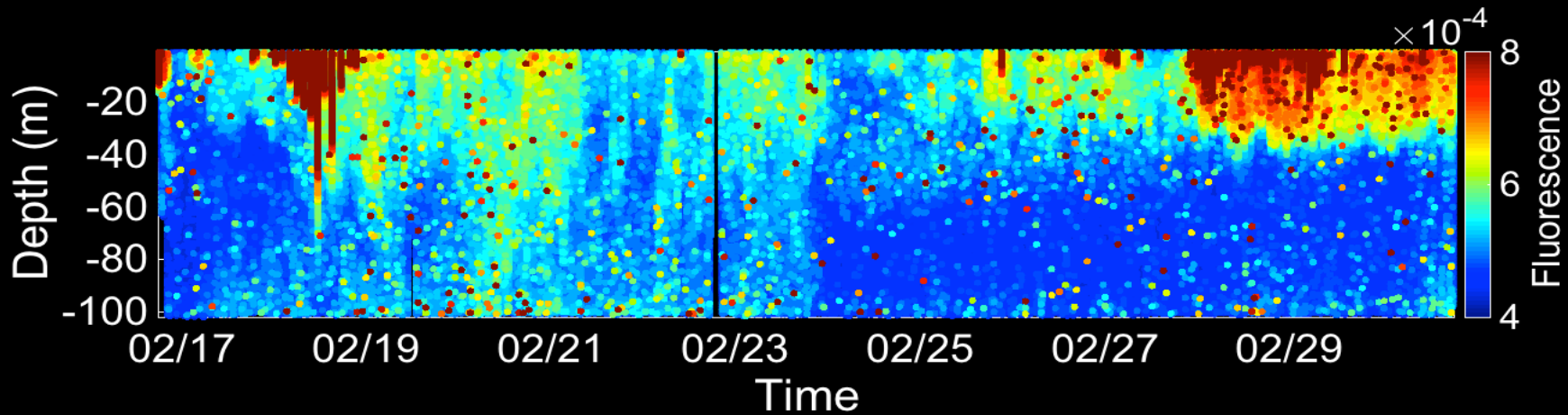
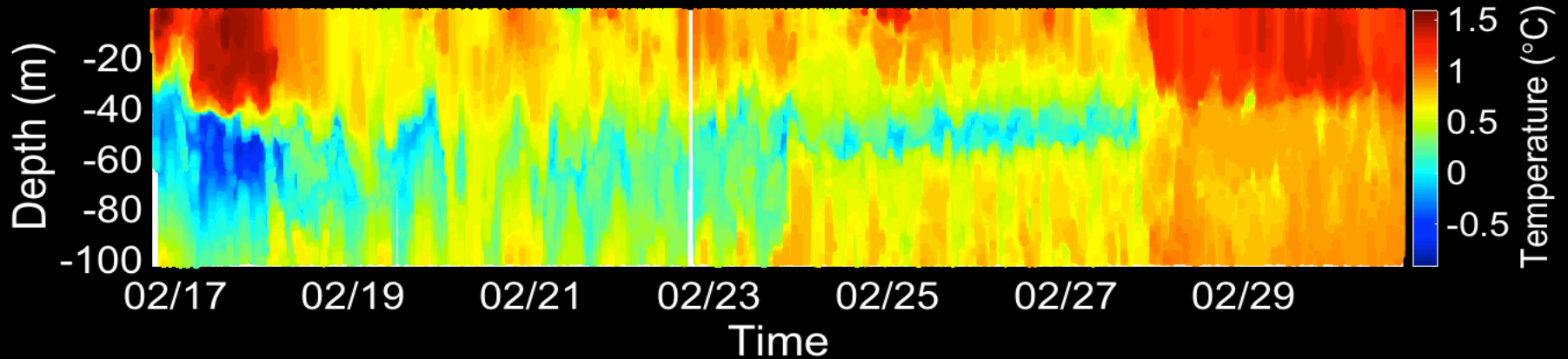
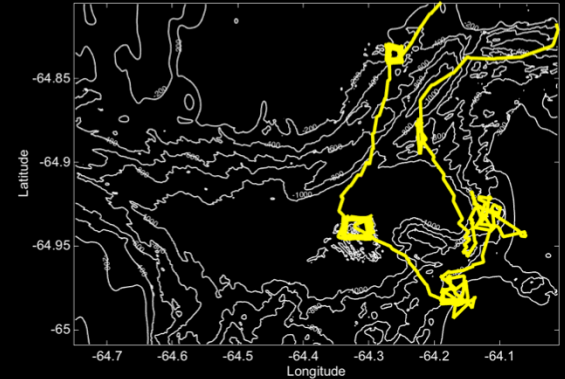


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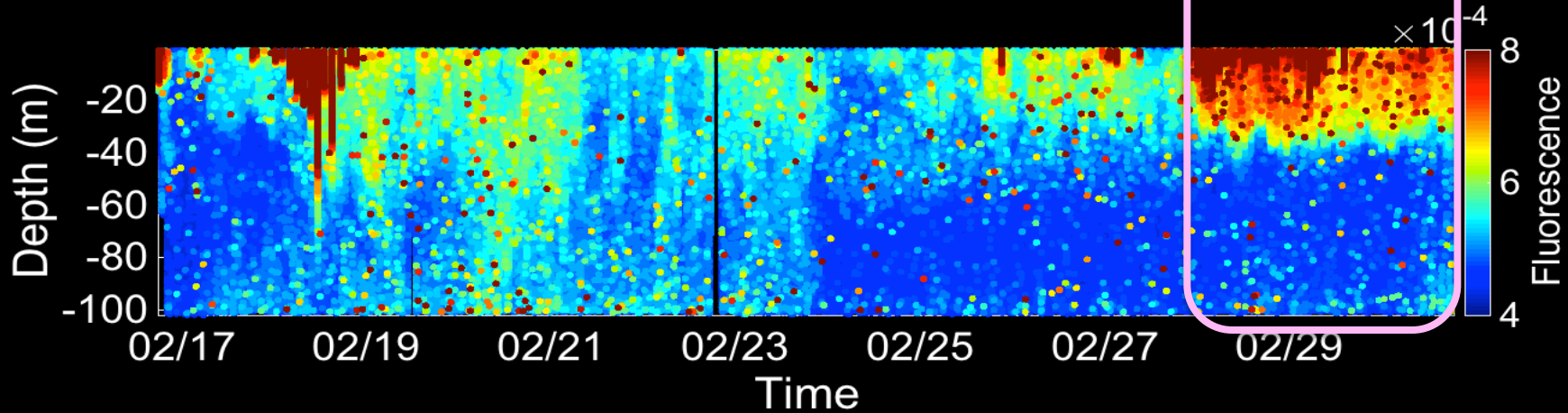
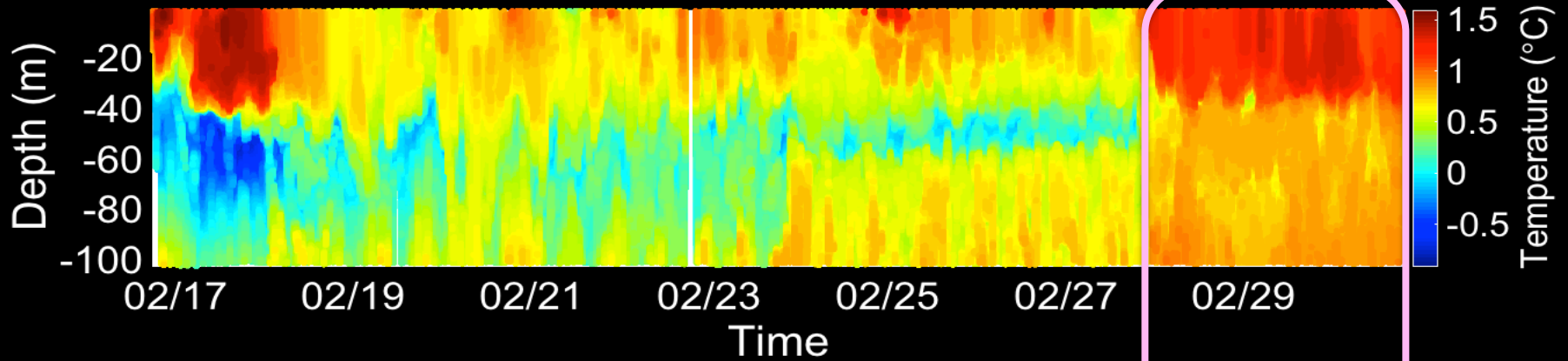
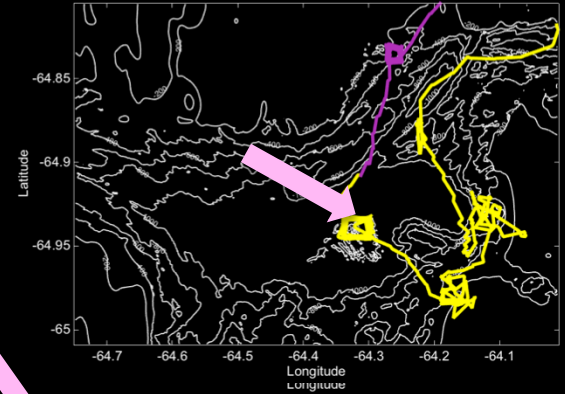


Sensors: CTD (Temperature, Salinity, Depth), Fluorescence, FRe & PAR, Backscatter, Oxygen, ADCP

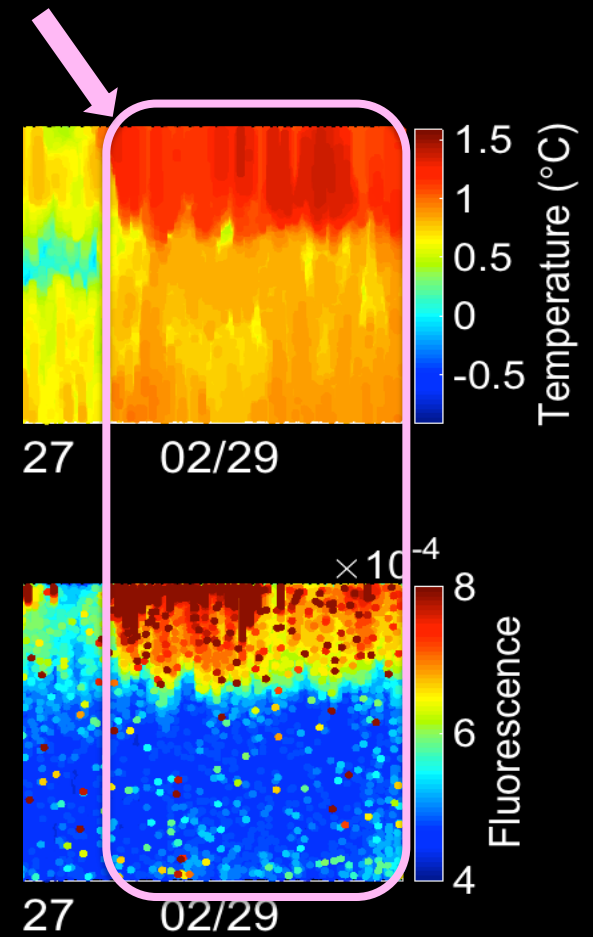
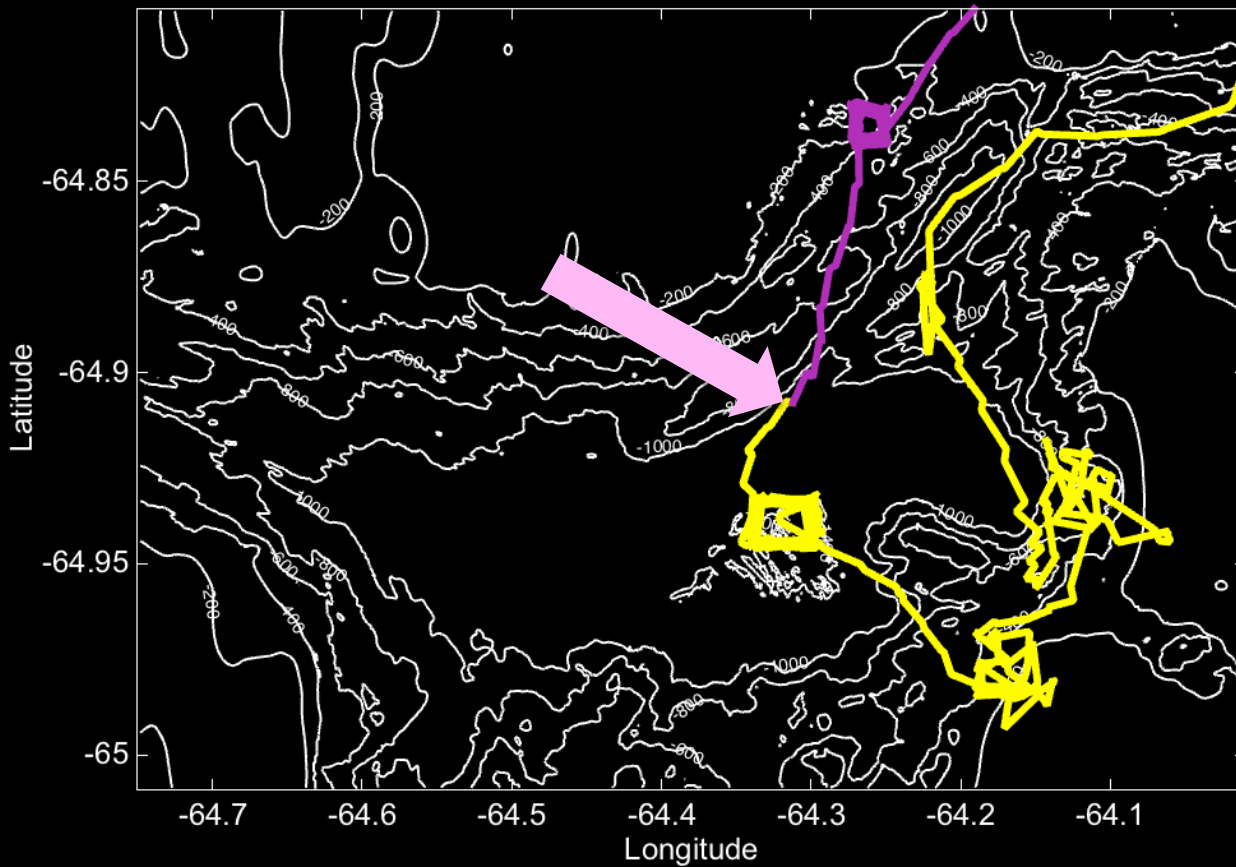
GLIDER ANALYSIS – RU05-276 (WARM WATER SHOALING)



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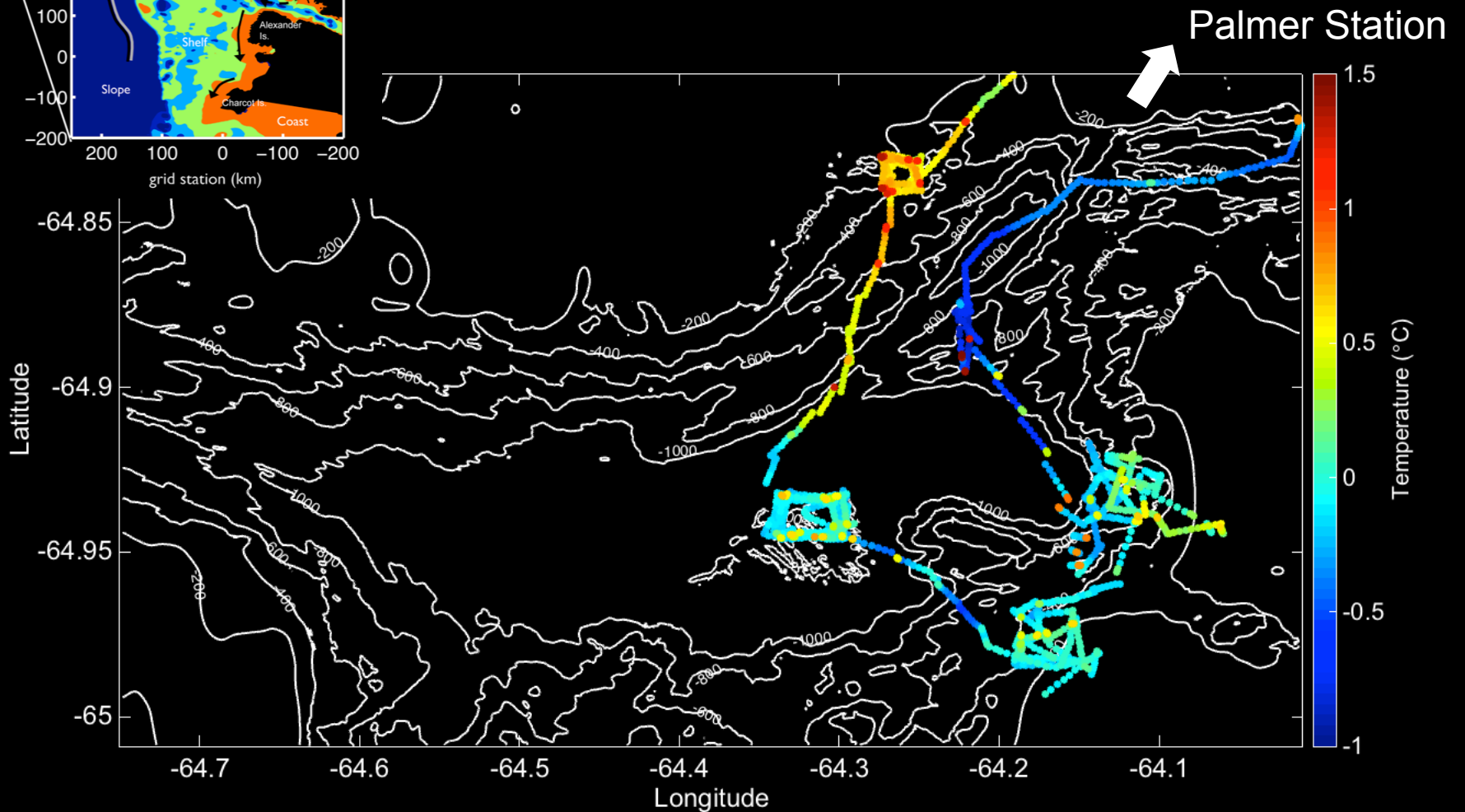
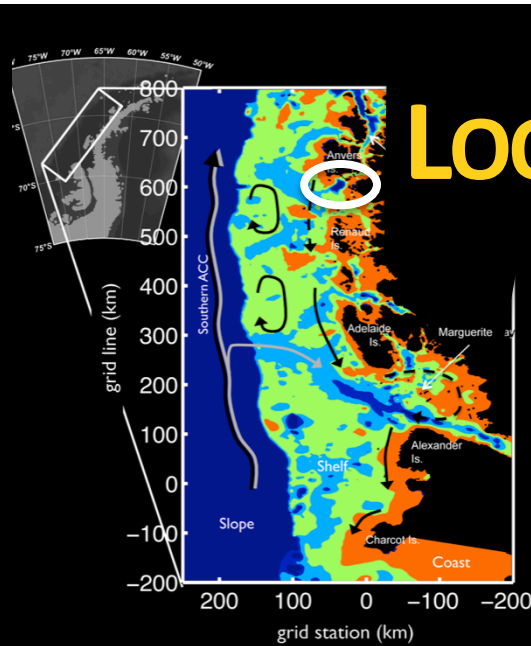


GLIDER ANALYSIS – RU05-276 (WARM WATER SHOALING)

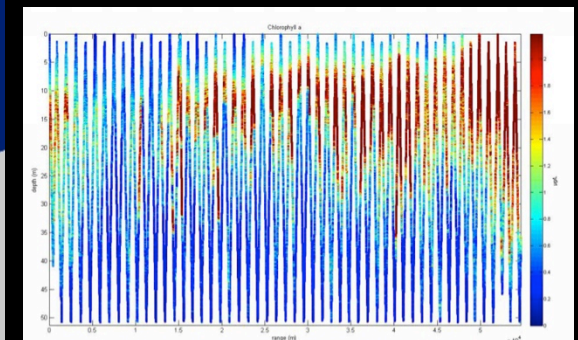
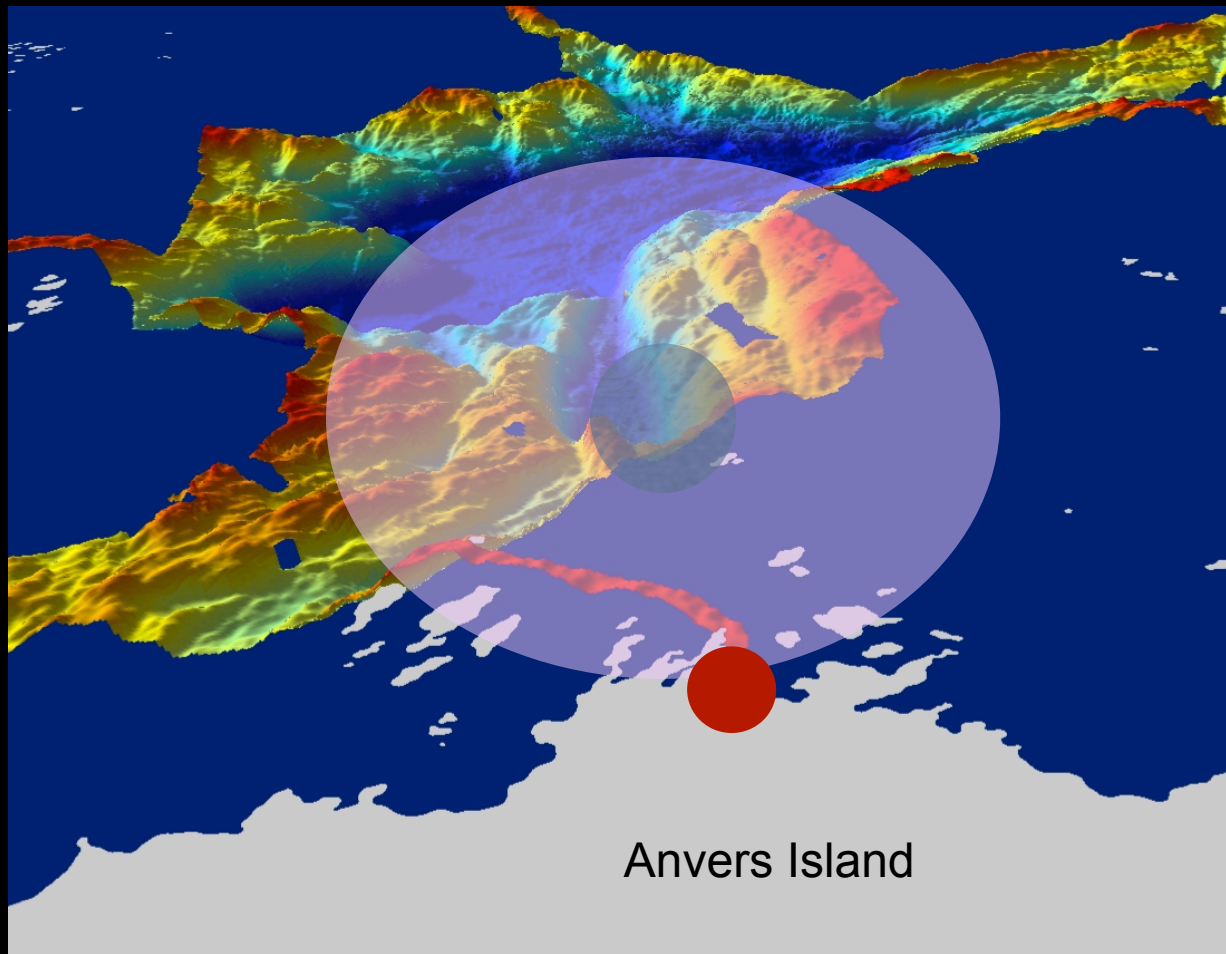


LOOKING FOR SPECIFIC WATER MASSES

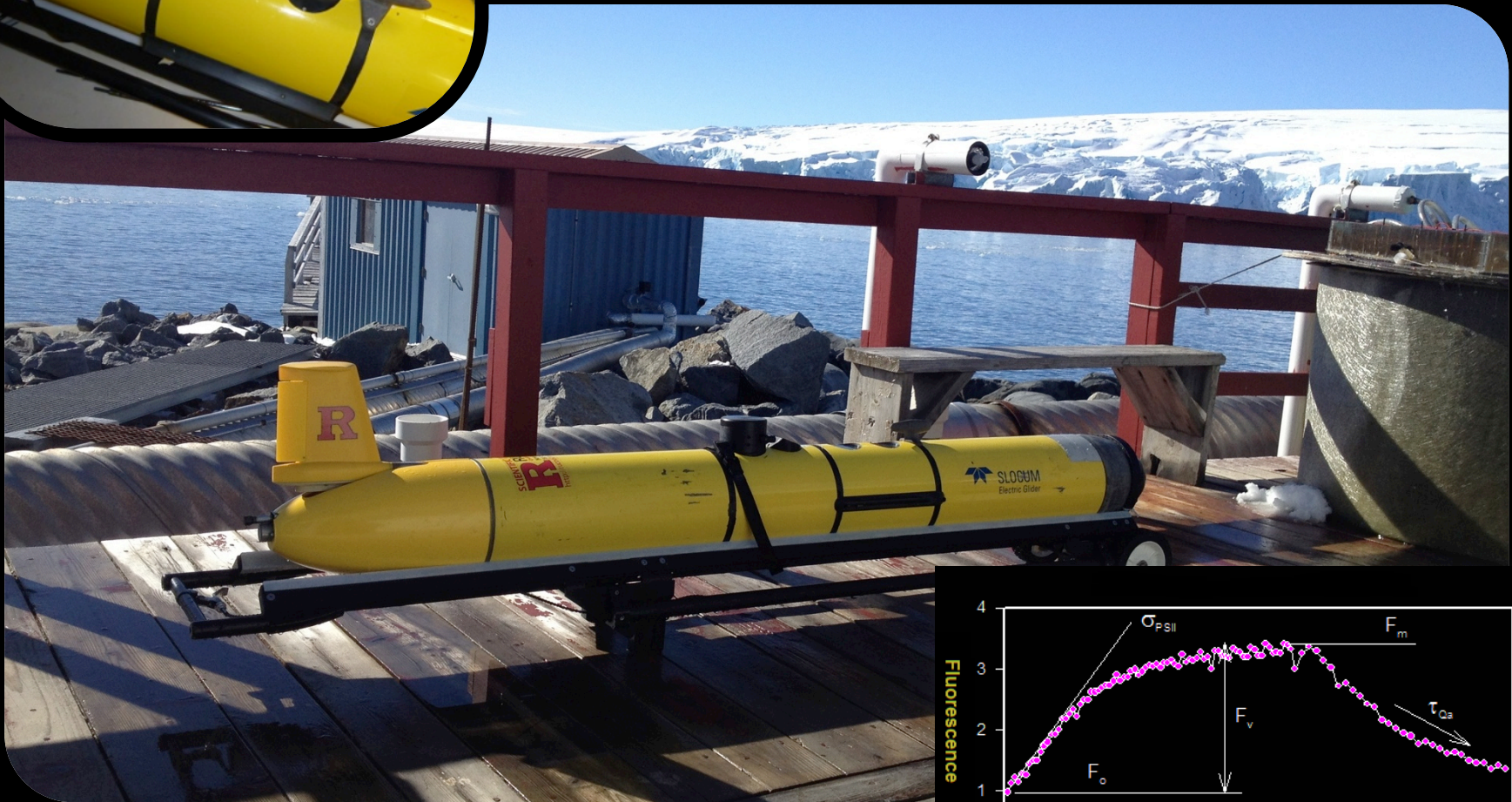
WINTER WATER (TEMP < -1°C)



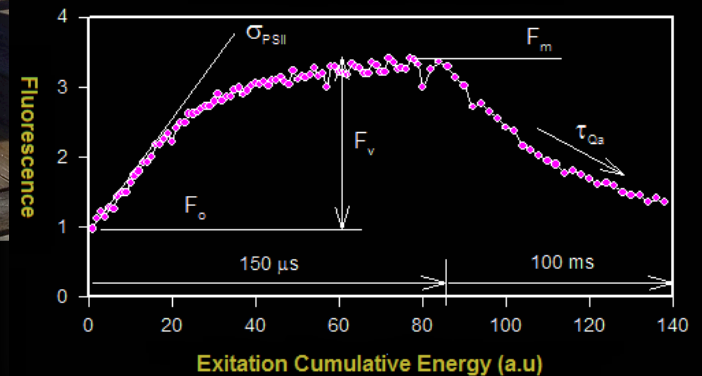
ADAPTIVE SAMPLING OF PENGUIN FORAGING



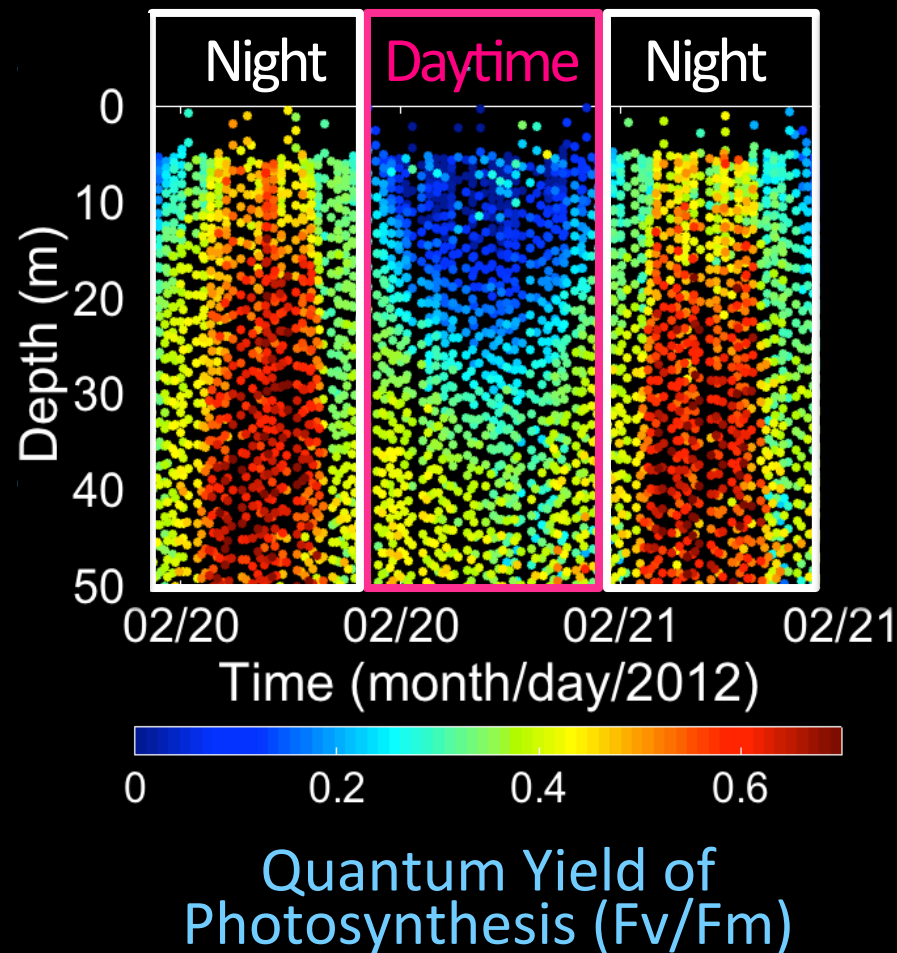
FIRE GLIDER – LOOKING AT PHOTOSYNTHETIC EFFICIENCY



(FIRE=FLUORESCENCE INDUCTION AND RELAXATION SYSTEM)



DAYTIME AFFECTS PHOTOSYNTHETIC EFFICIENCY (NON-PHOTOCHEMICAL QUENCHING)



CONCLUSIONS

- Annual presence – study overall trends and unique events
- Hotspots with small spatial scale and highly variable in time
- Gliders allow to sample at these scales
- Ocean robots will be used to sample the oceans as never before



NEW VIEW...NEW FRONTIER

