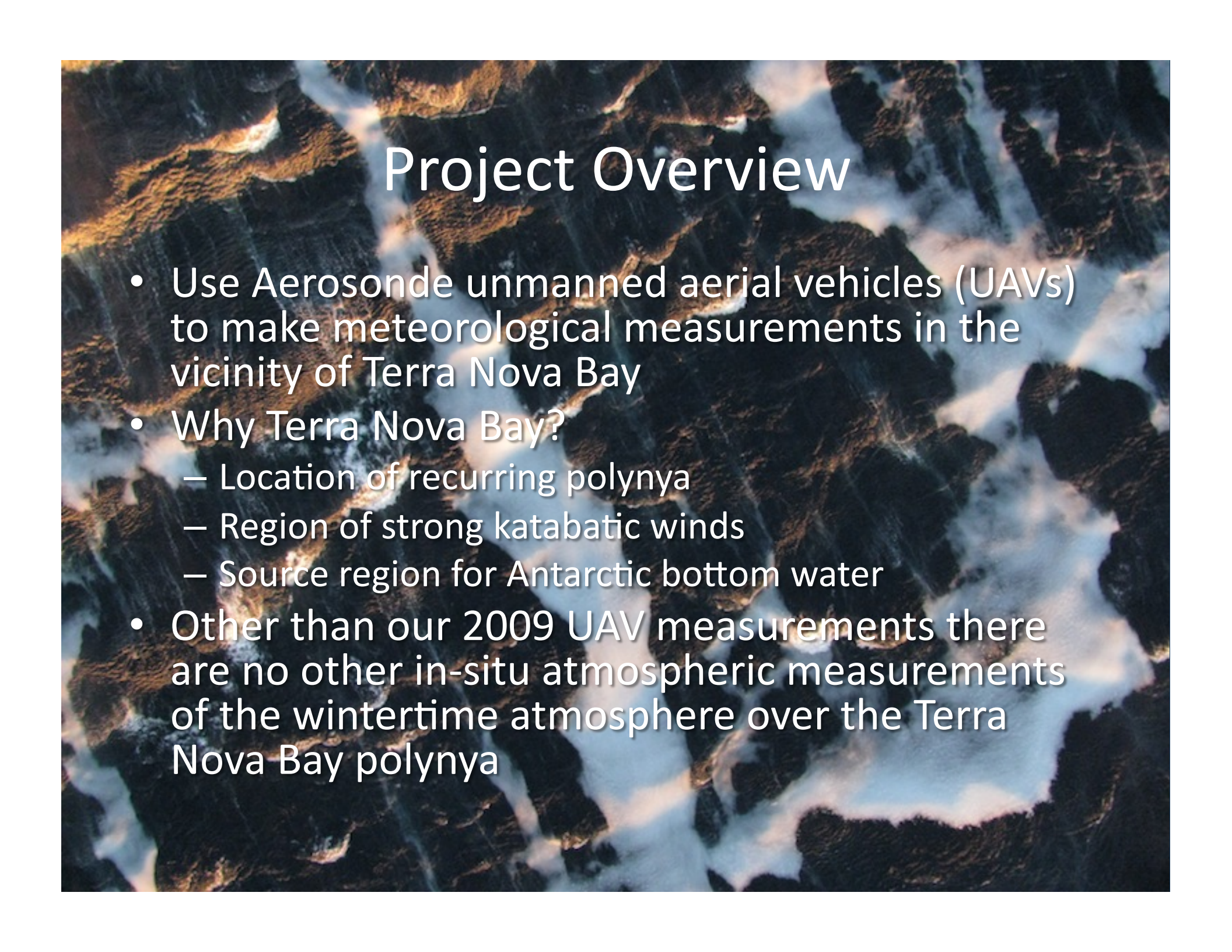


Observations of the Atmosphere Over the Terra Nova Bay Polynya: September 2009 and September 2012



John J. Cassano and Shelley L. Knuth
University of Colorado

The background of the slide is a high-contrast, aerial photograph of a mountainous landscape. The terrain is dark, likely due to shadows or low light, with bright, snow-covered or ice-filled areas highlighting the ridges and valleys. The overall texture is rough and uneven, typical of a high-altitude environment.

Project Overview

- Use Aerosonde unmanned aerial vehicles (UAVs) to make meteorological measurements in the vicinity of Terra Nova Bay
- Why Terra Nova Bay?
 - Location of recurring polynya
 - Region of strong katabatic winds
 - Source region for Antarctic bottom water
- Other than our 2009 UAV measurements there are no other in-situ atmospheric measurements of the wintertime atmosphere over the Terra Nova Bay polynya

Science Questions

- How do changes in the atmospheric state alter the amount of heat and moisture removed from the ocean in the polynya?
- How does the presence of the polynya modify the katabatic airstream as it passes over the polynya?
- What impact does this have on the development of Antarctic bottom water?

Aerosonde UAV



Aerosonde UAV

Wingspan	3.6 meters
Weight	18 - 21 kg
Payload Capacity	2 - 3.5 kg
Endurance	Up to 19 hours
Range	1000+ km
Altitude	100 - 6000 m
Cruise / max speed	42 / 65 kts

Communications via 900 MHz radio and Iridium

Flies in fully autonomous mode with user-controlled capability

Aerosonde Measurements

Wind Speed/Direction

Pitot with GPS

RH/Temp/Pressure

Met Sensors

Ocean /Ice Skin
Temperature

Infrared Thermometer

Ocean/Ice Visible Imagery

Still Digital Camera

Shortwave Radiation

Up and Down-Looking
Pyranometer

Longwave Radiation

Up and Down-Looking
Pyrgeometer

Altitude and Surface
Waves

CULPIS Laser Altimeter

The Challenges

- Cold temperatures
 - Impacted:
 - Engine
 - Parts failure
- Communication failures
- Wind
 - Take-off / landing
 - In flight winds
- Aircraft icing

AMPS 5-km WRF

Fcst. 24 h

Relative humidity (w.r.t. water)

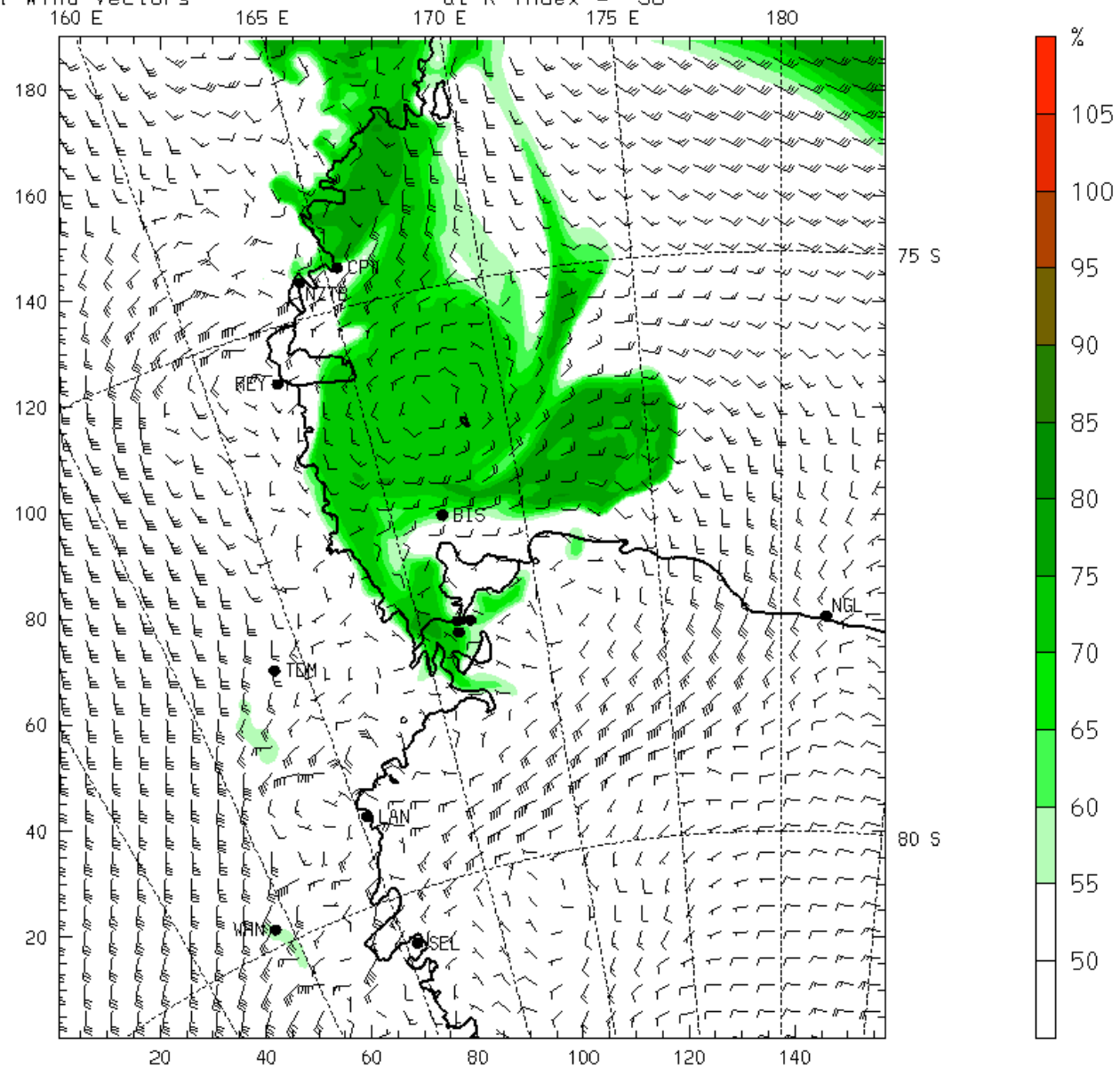
Horizontal wind vectors

at k-index = 38

at k-index = 38

Init: 12 UTC Sat 08 Sep 12

Valid: 12 UTC Sun 09 Sep 12



Model Info: V3.2.1 M No Cu MYJ PBL WSM 5class Noah LSM 5.0 km, 43 levels, 38 sec
SN: Goddard DIFF: simple KM: 2D Smagor

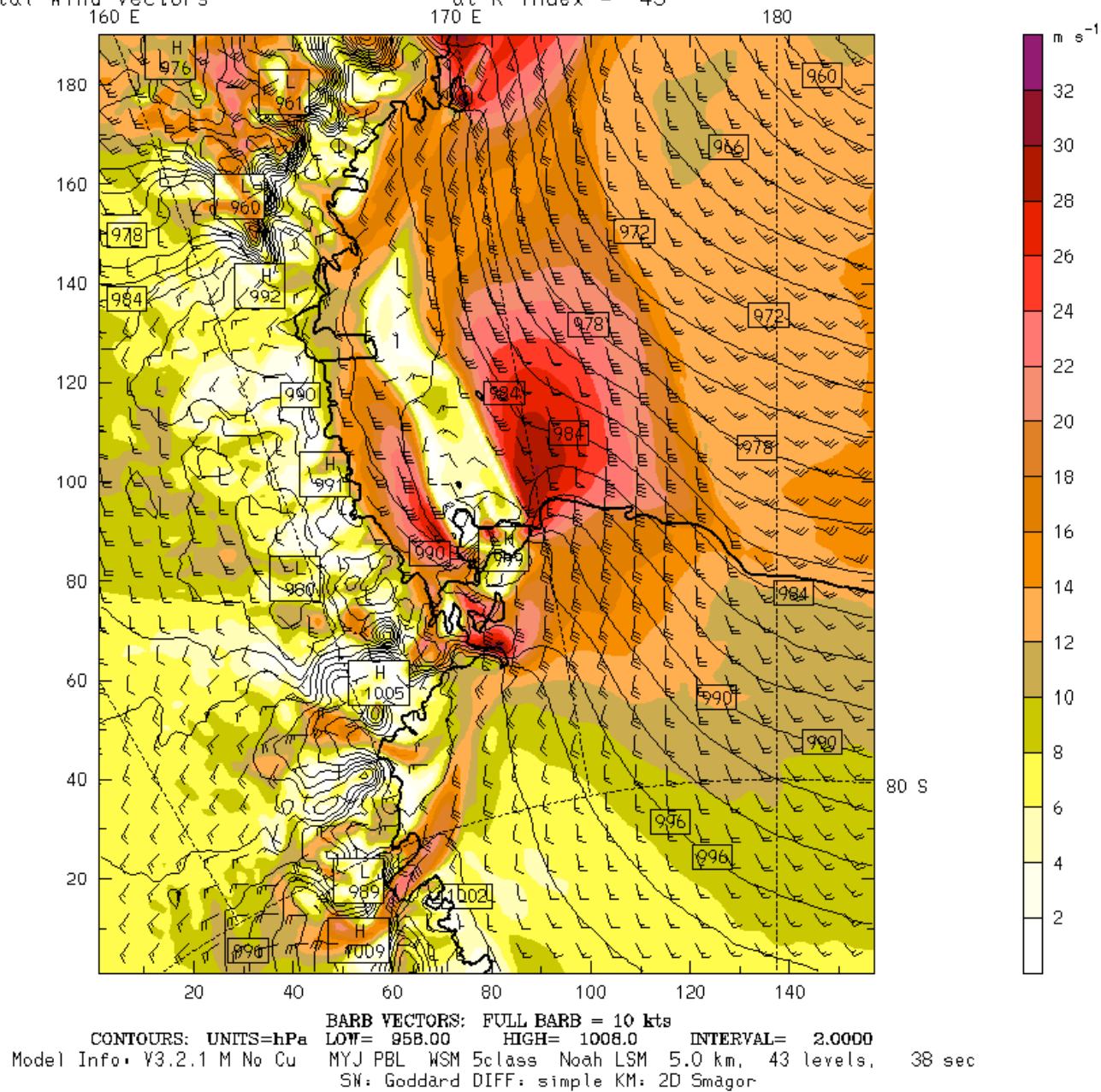
Init. 1200 UTC Sun 09 Sep 12

Valid: 1200 UTC Mon 10 Sep 12

at k-index = 43

Sea-level pressure

```
_at_ k-index = 43
```

$$sm = 1$$


Aerosonde Launch

Pegasus Runway (18 Sept 2012)



Aerosonde Recovery

Pegasus Runway (23 Sept 2012)



2009

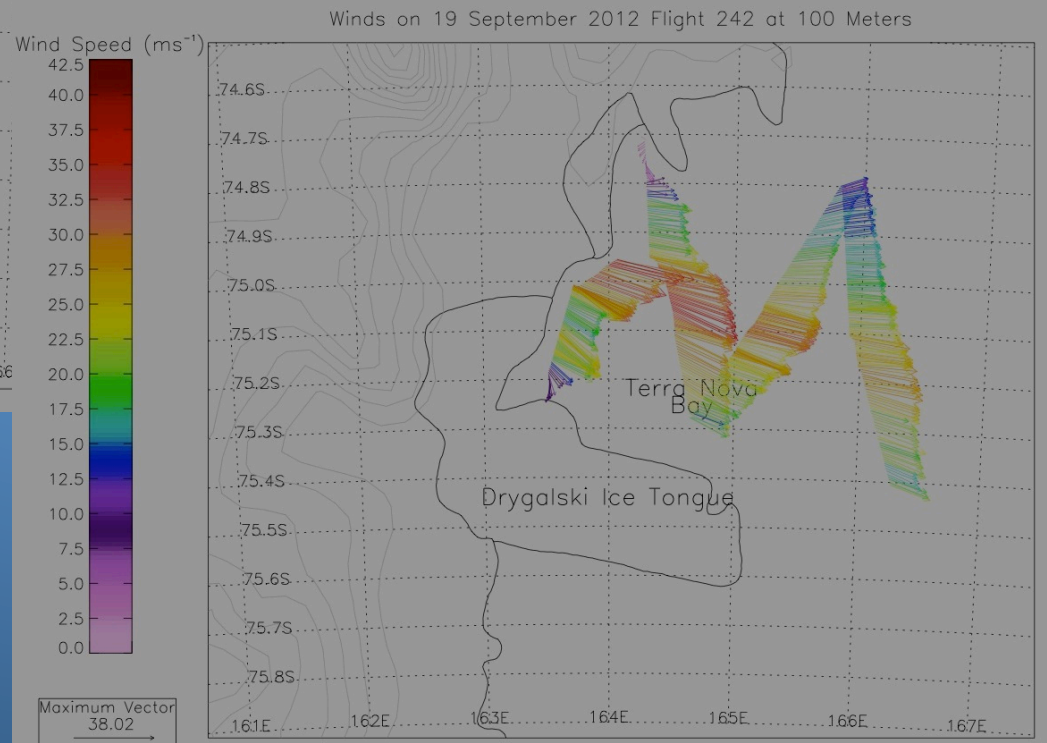
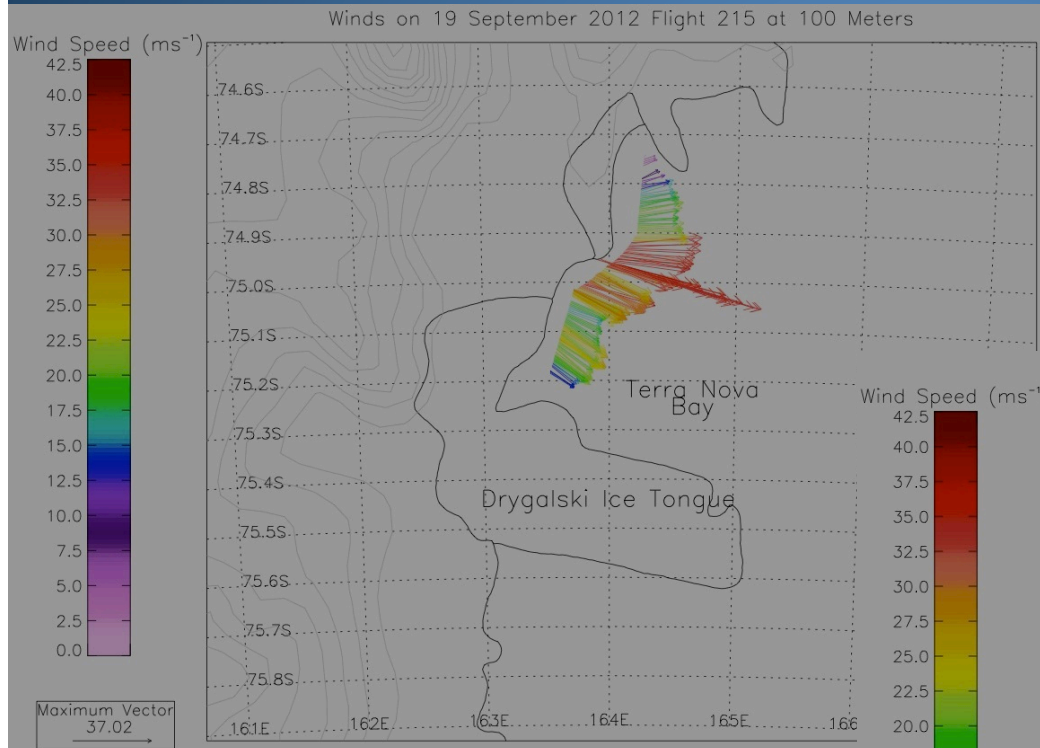
- 16 flights
 - 8 science flights to TNB
- 130 flight hours

2012

- 14 flights
 - 8 science flights to TNB
 - 1 science flight to Ross Sea
- 168 flight hours

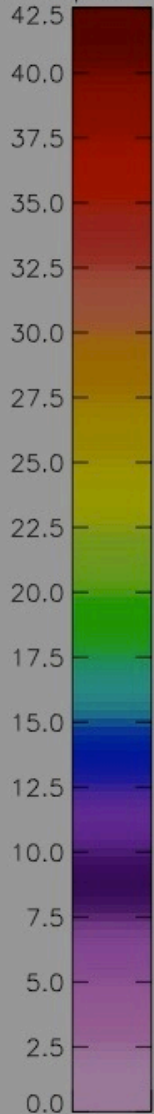


Atmospheric Observations over the Terra Nova Bay Polynya

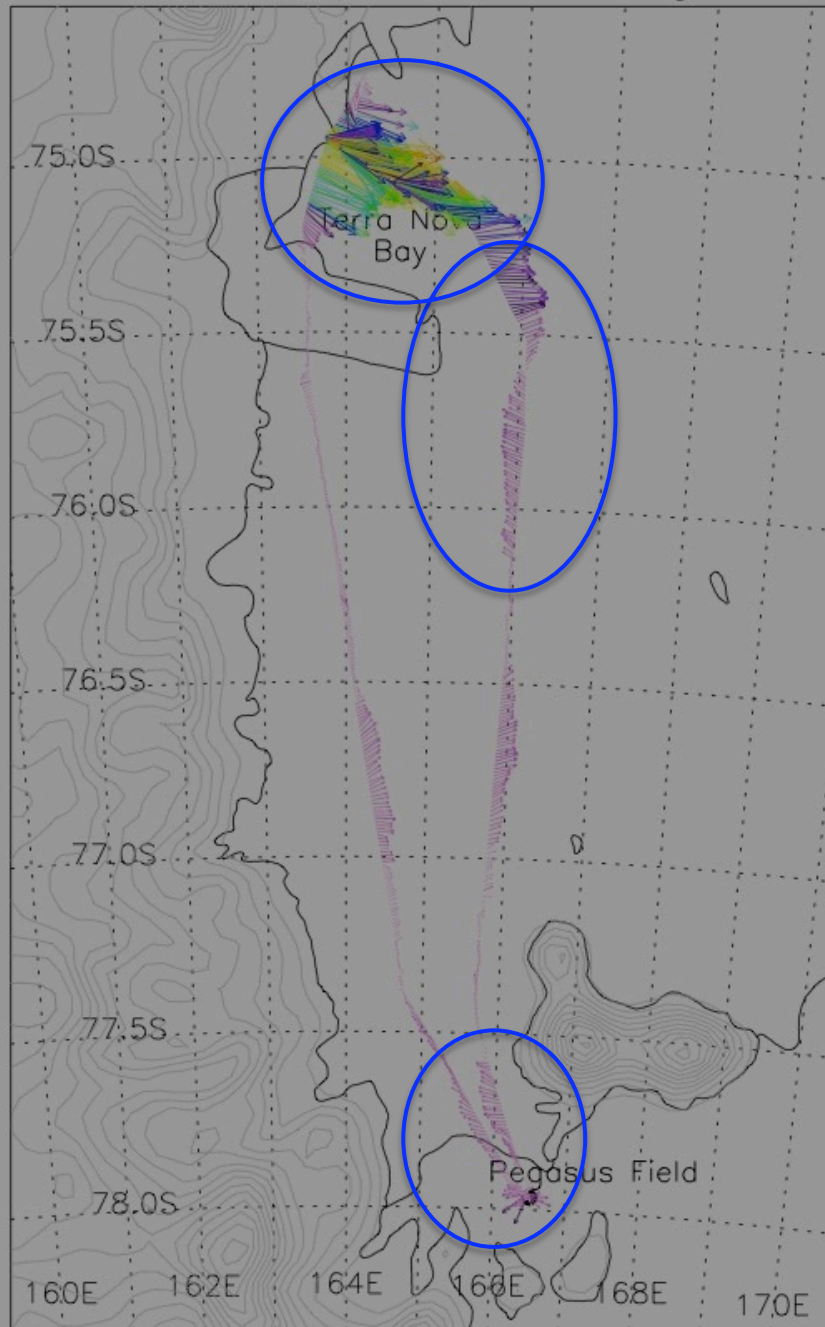


Winds on 18 September 2012 Flight 215

Wind Speed (ms^{-1})



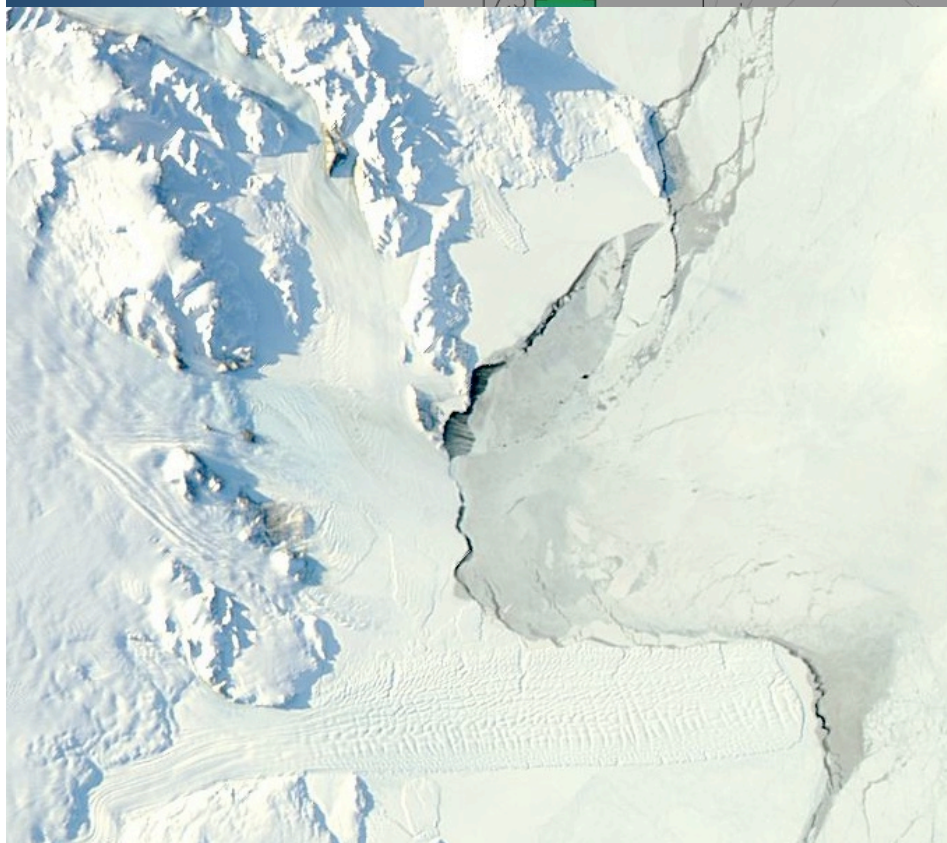
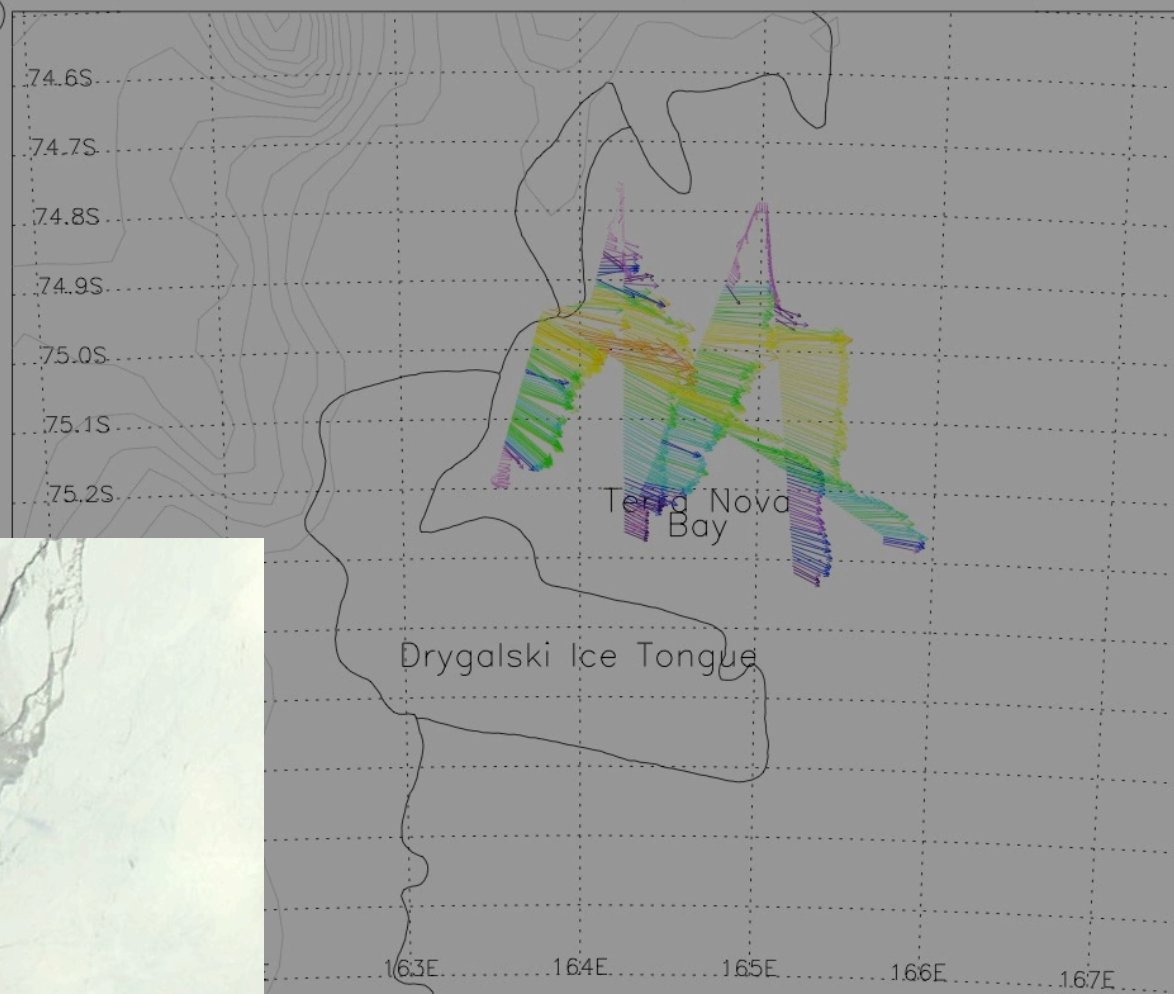
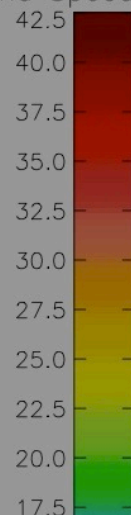
Maximum Vector
30.65
→



- Features:
 - Strong winds in Terra Nova Bay
 - Shear vortex south of TNB
 - Easterly flow over Hut Point peninsula

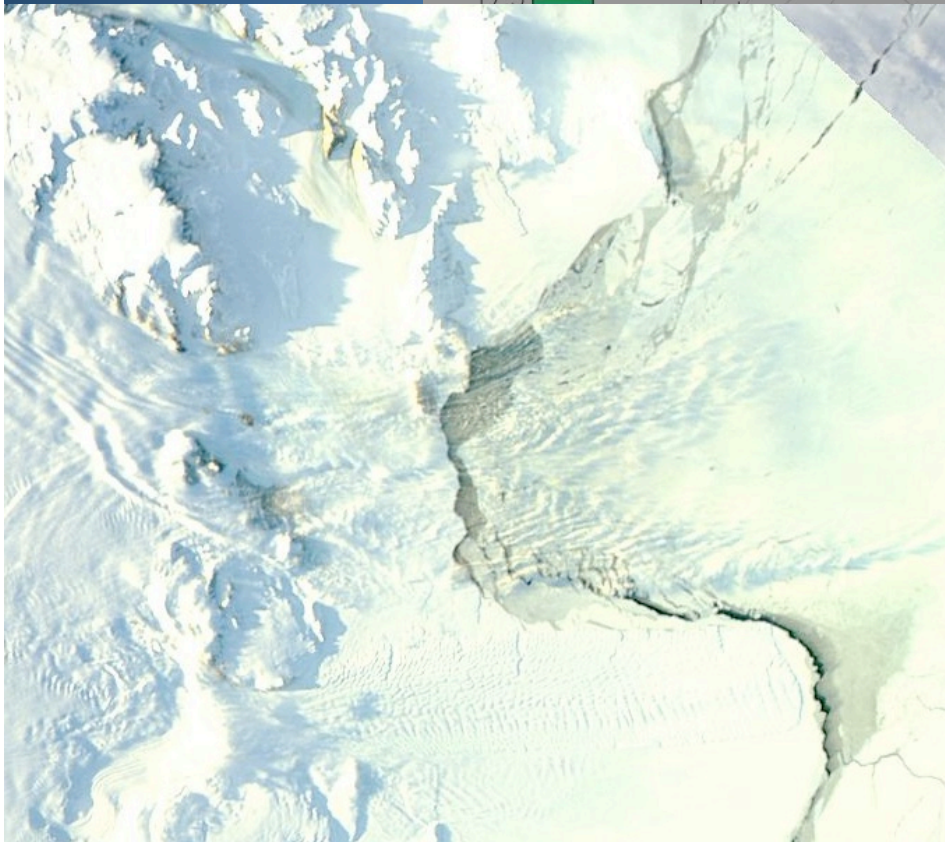
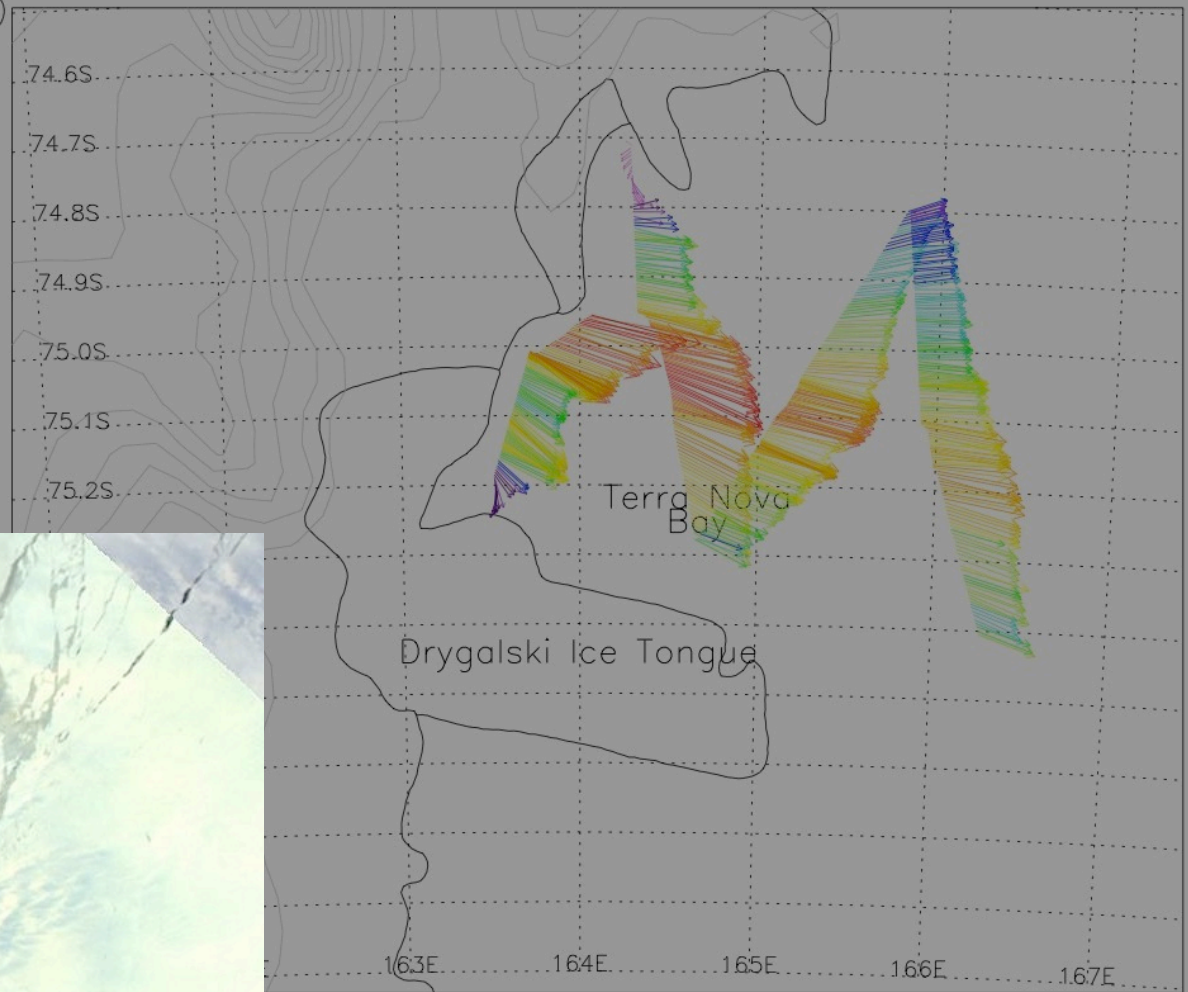
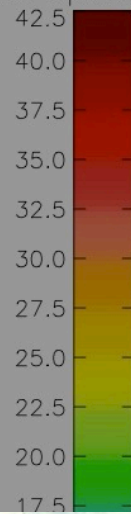
Winds on 18 September 2012 Flight 230 at 100 Meters

Wind Speed (ms^{-1})



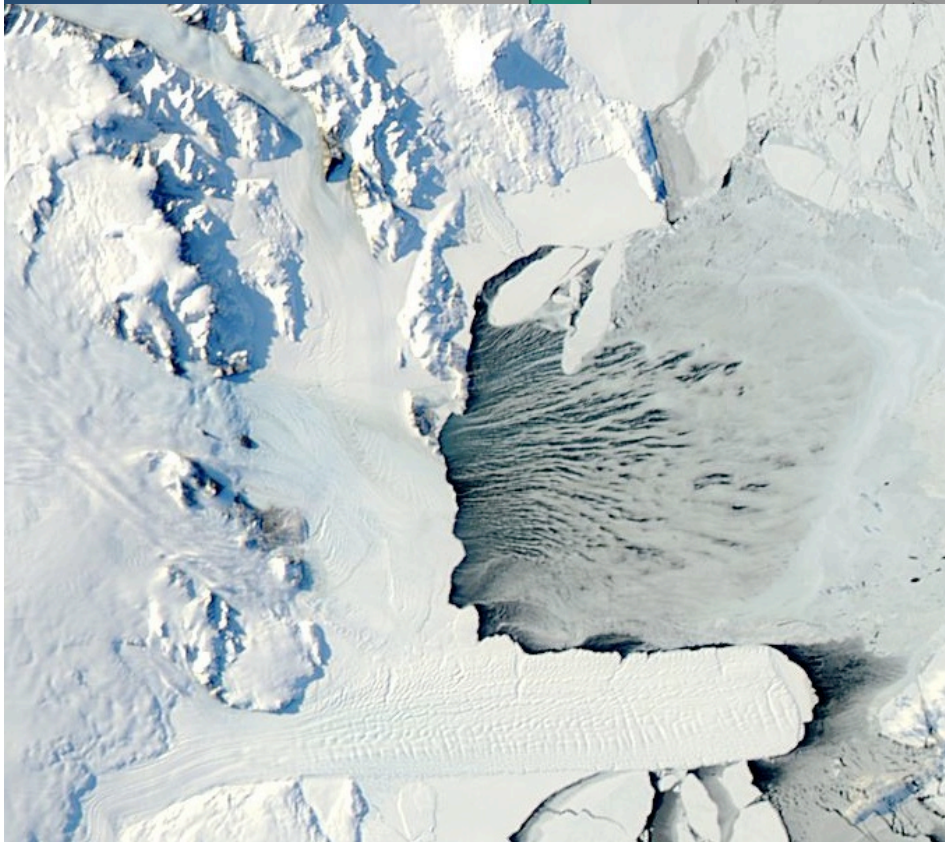
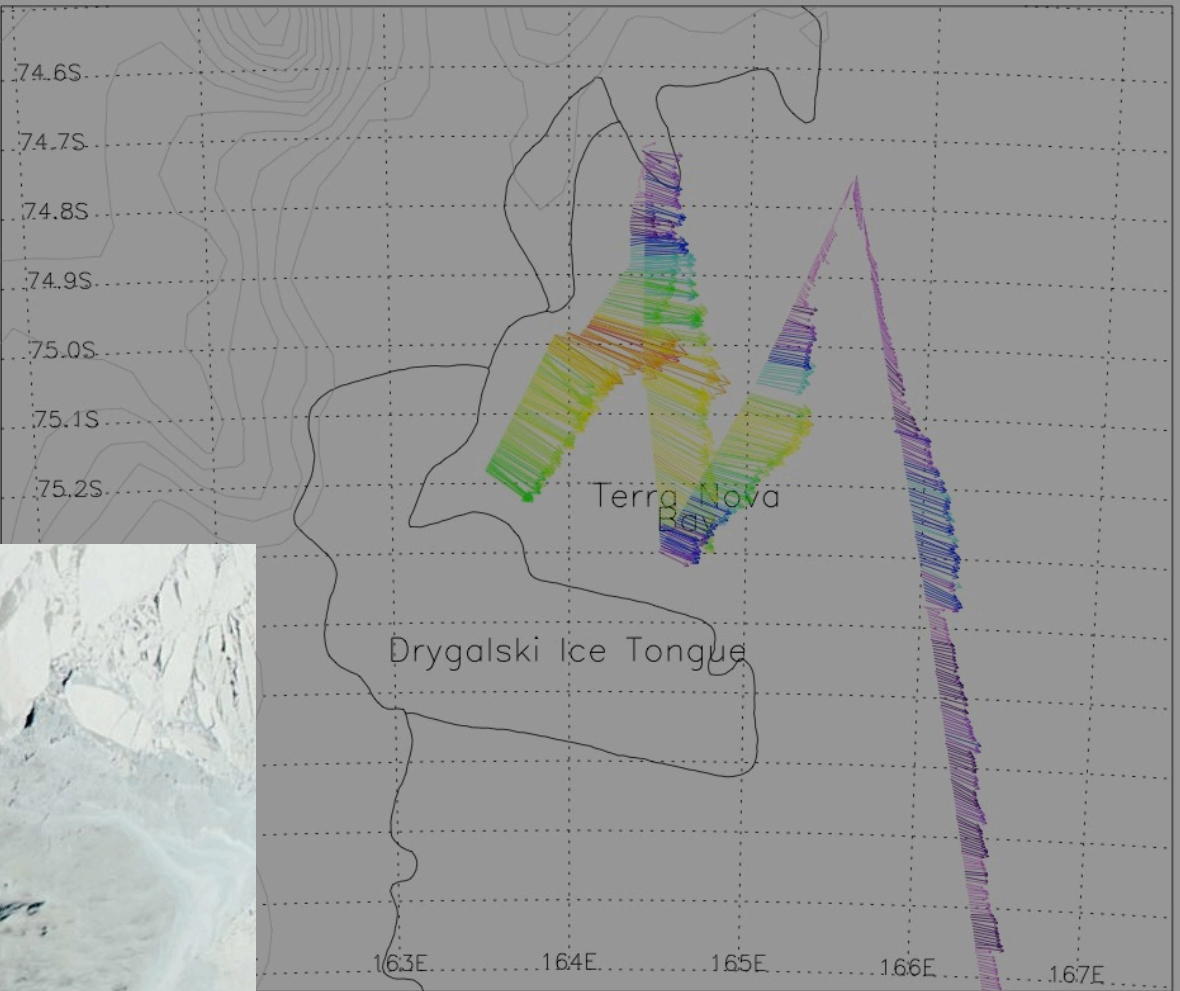
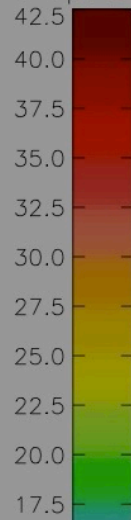
Winds on 19 September 2012 Flight 242 at 100 Meters

Wind Speed (ms^{-1})



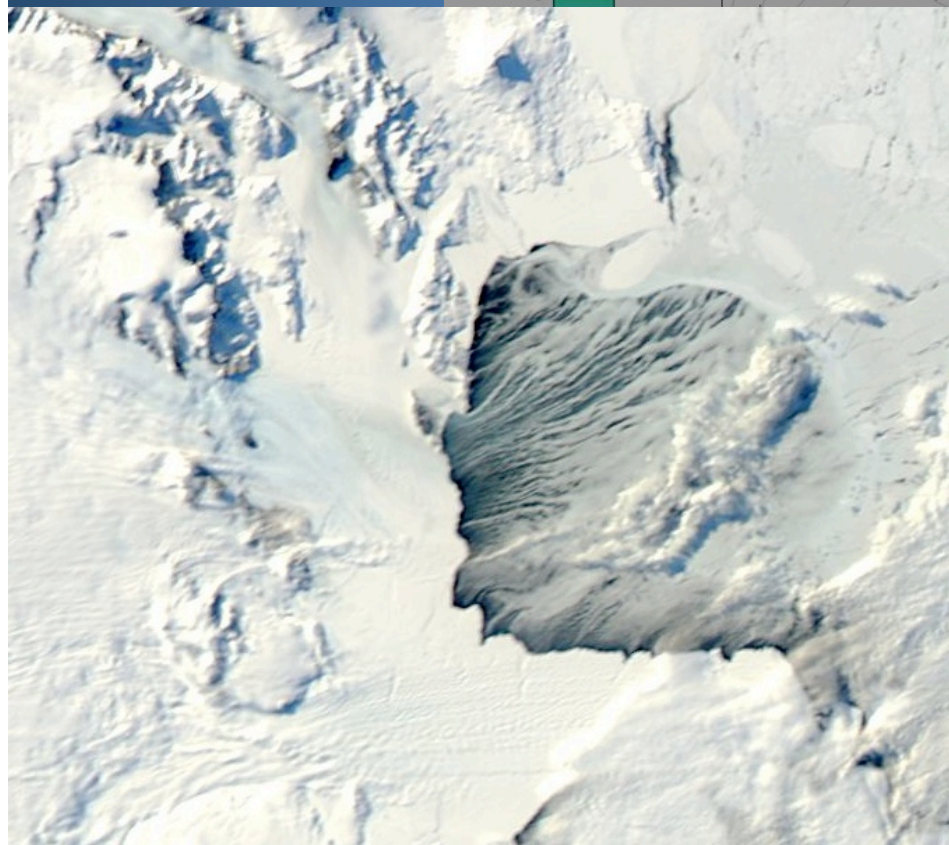
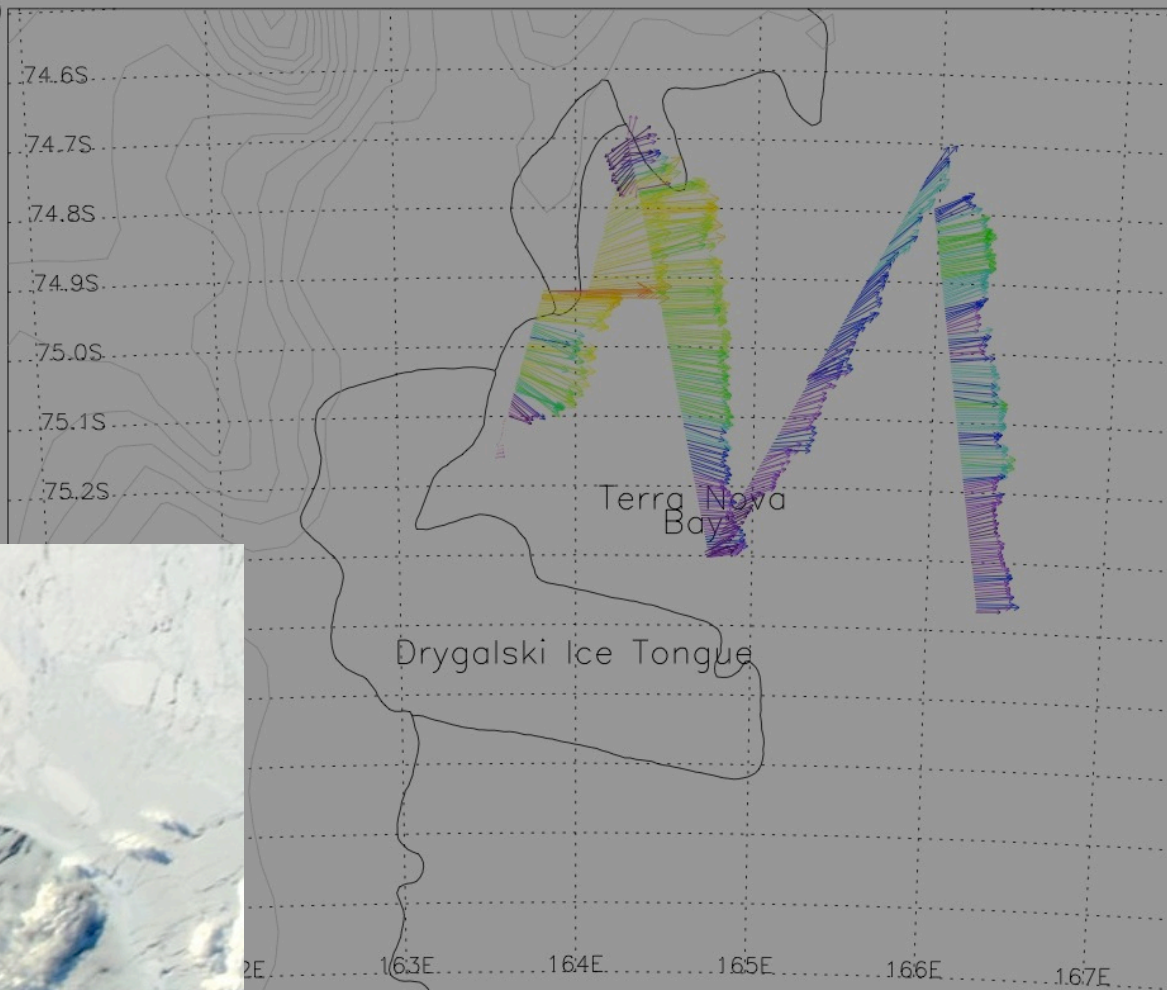
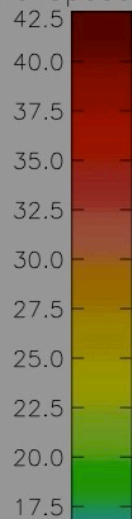
Winds on 22 September 2012 Flight 230 at 100 Meters

Wind Speed (ms^{-1})

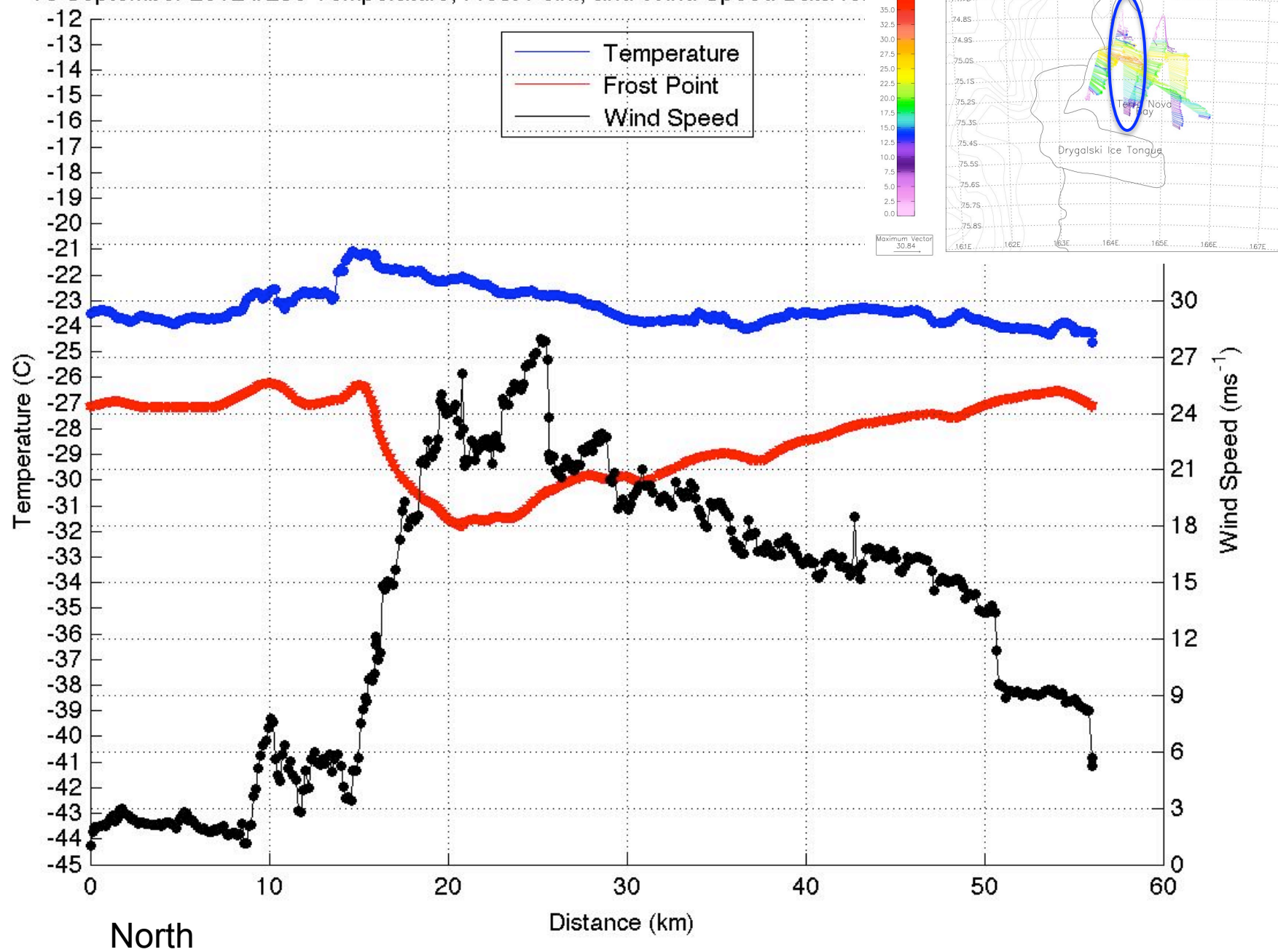


Winds on 25 September 2012 Flight 230 at 100 m

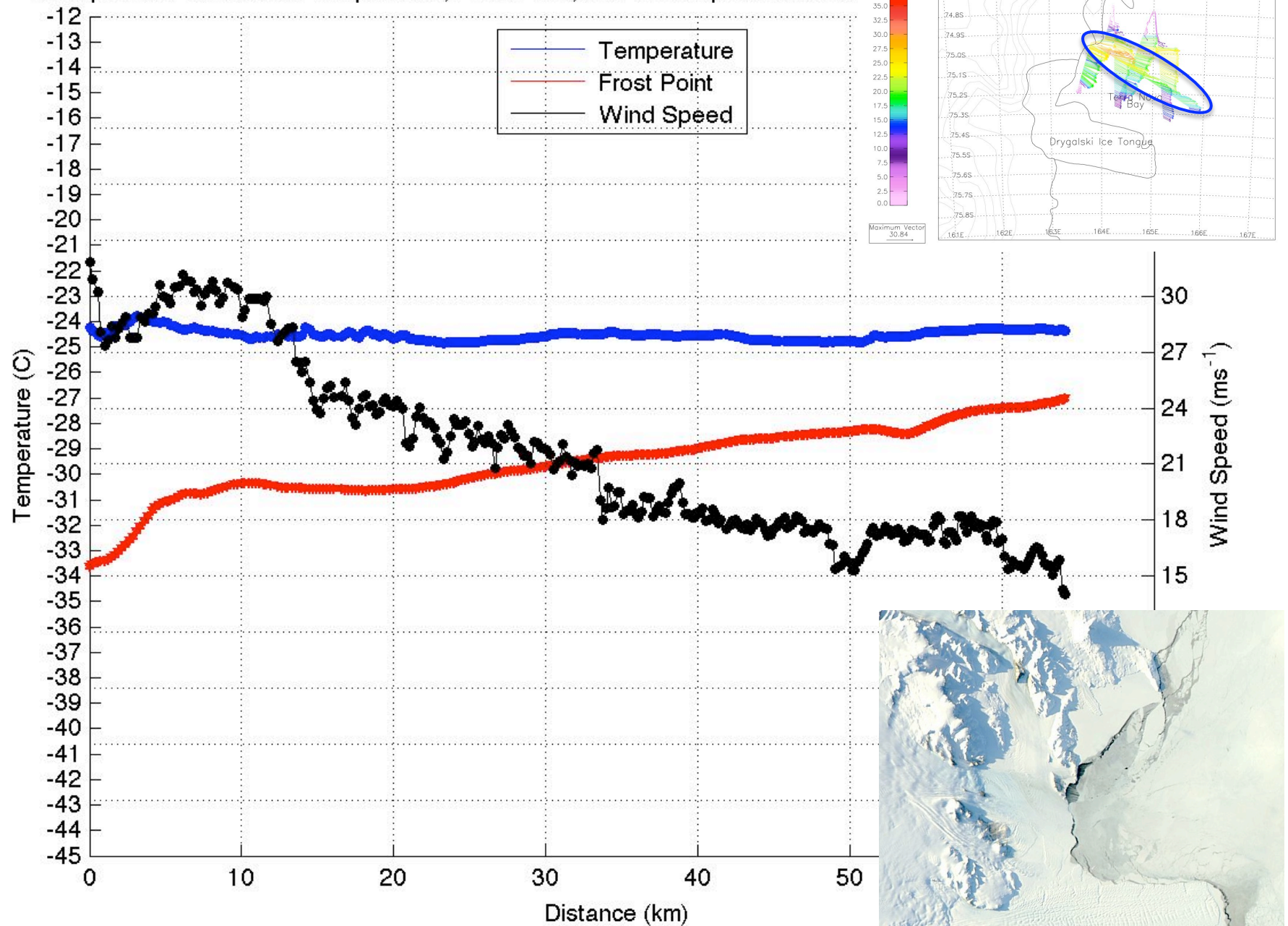
Wind Speed (ms^{-1})

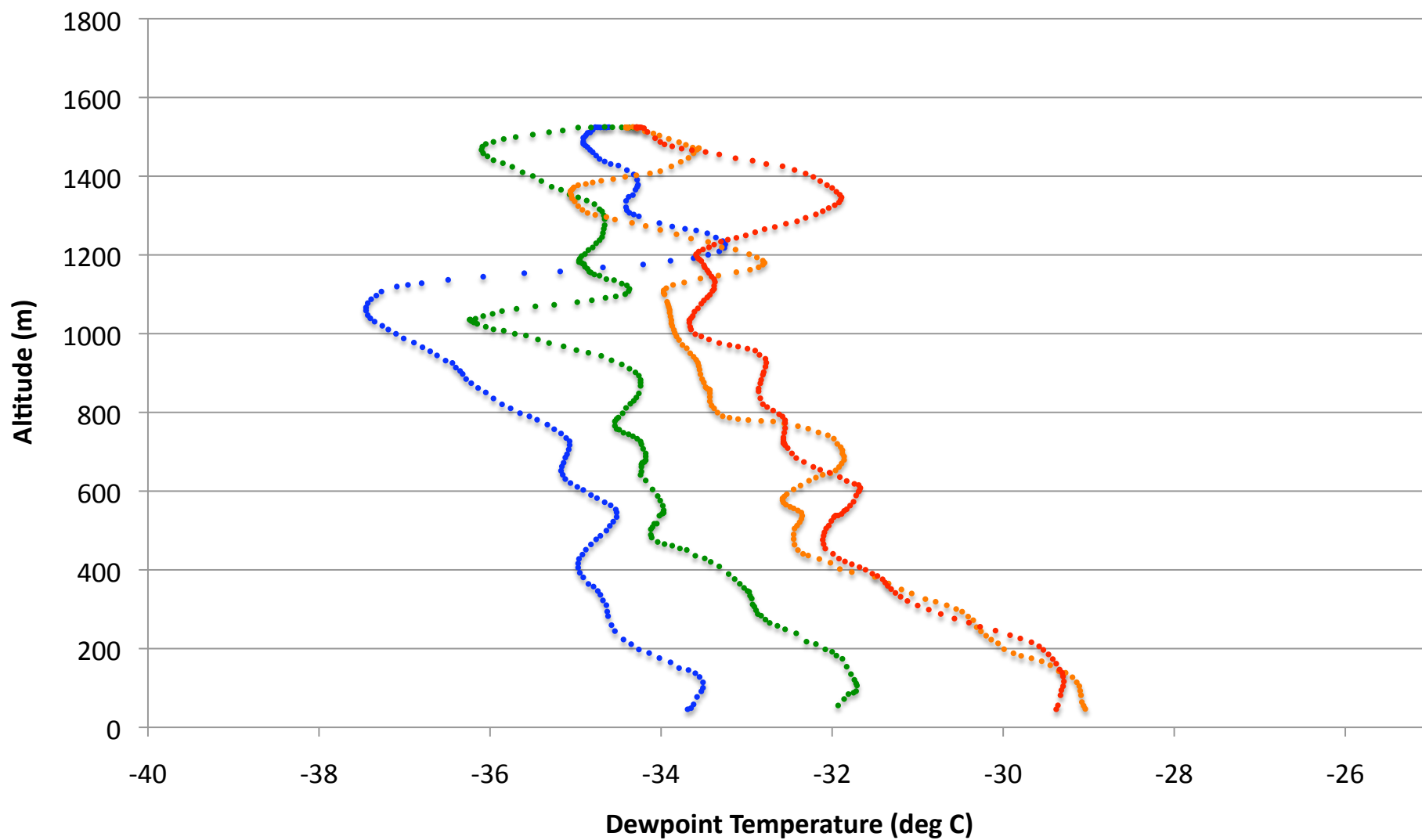


18 September 2012 #230 Temperature, Frost Point, and Wind Speed Data for



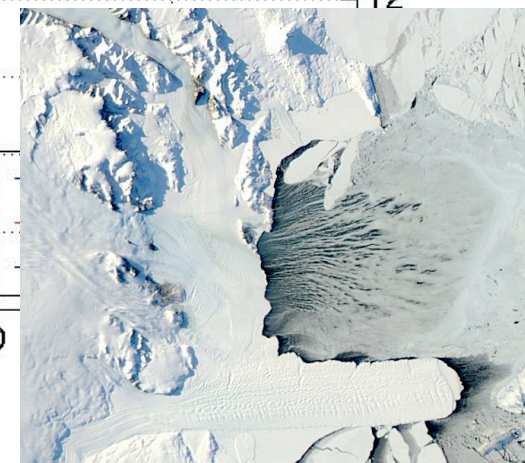
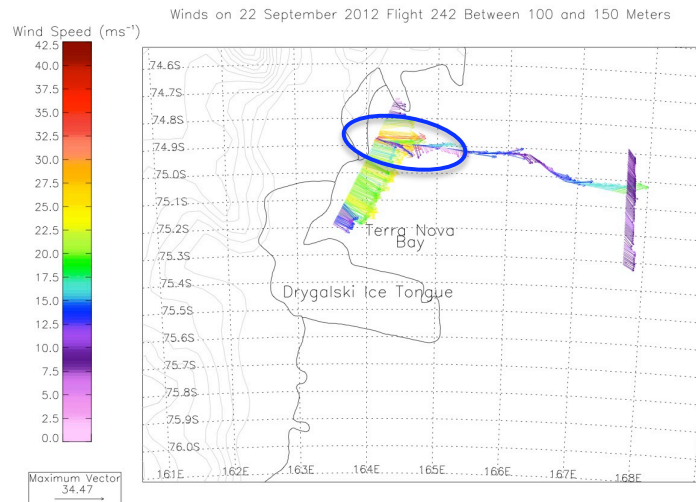
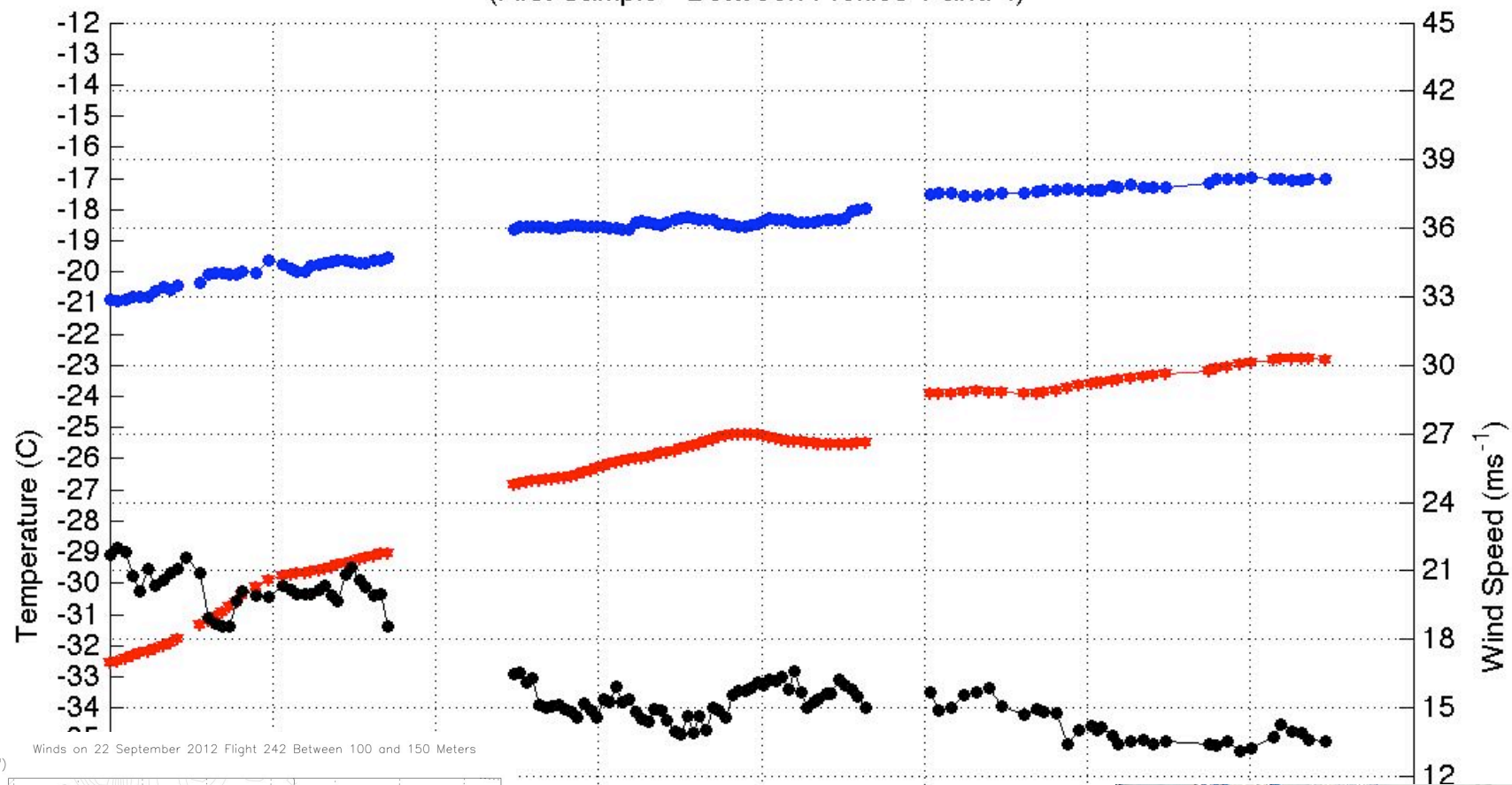
18 September 2012 #230 Temperature, Frost Point, and Wind Speed Data for

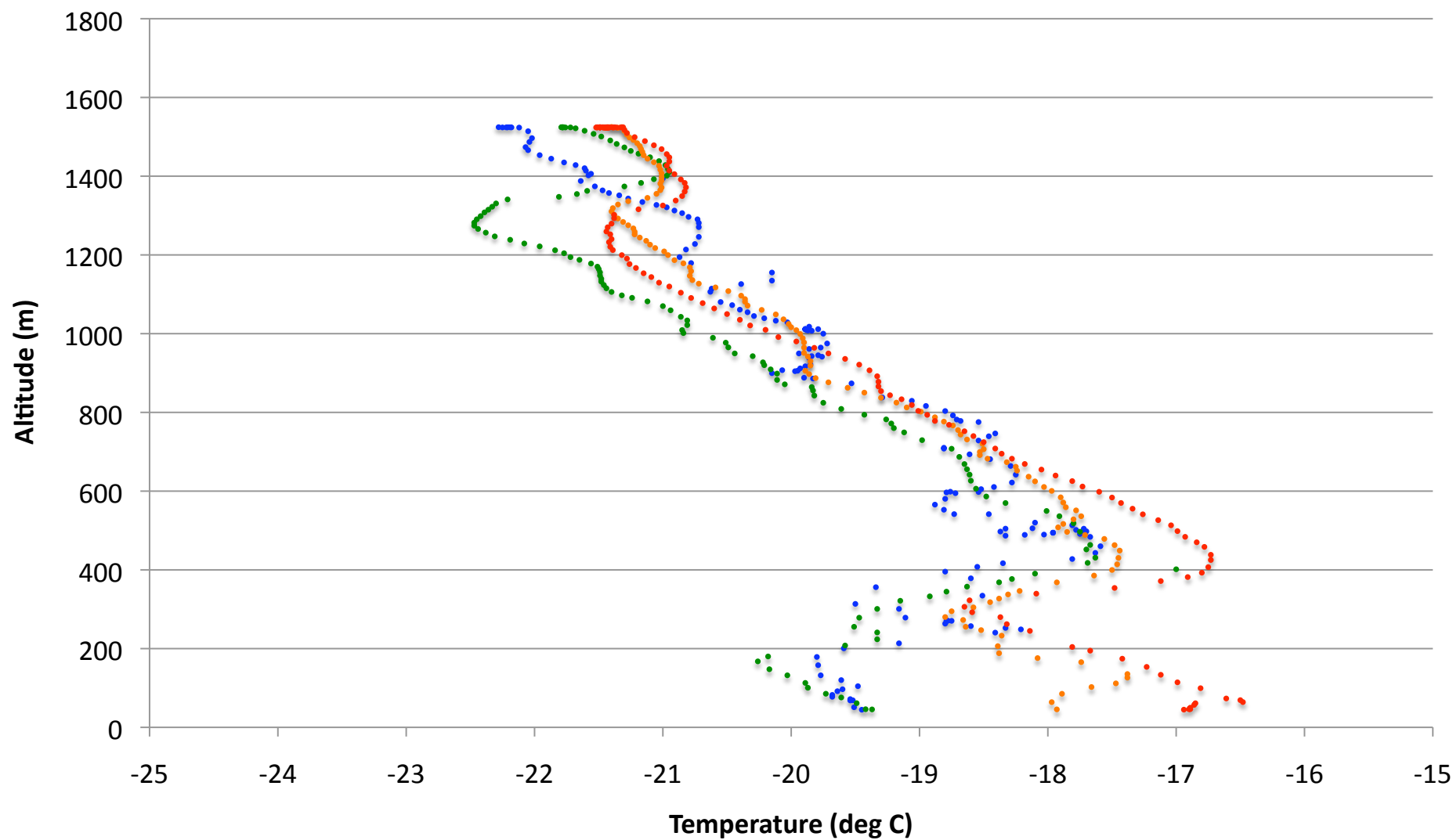




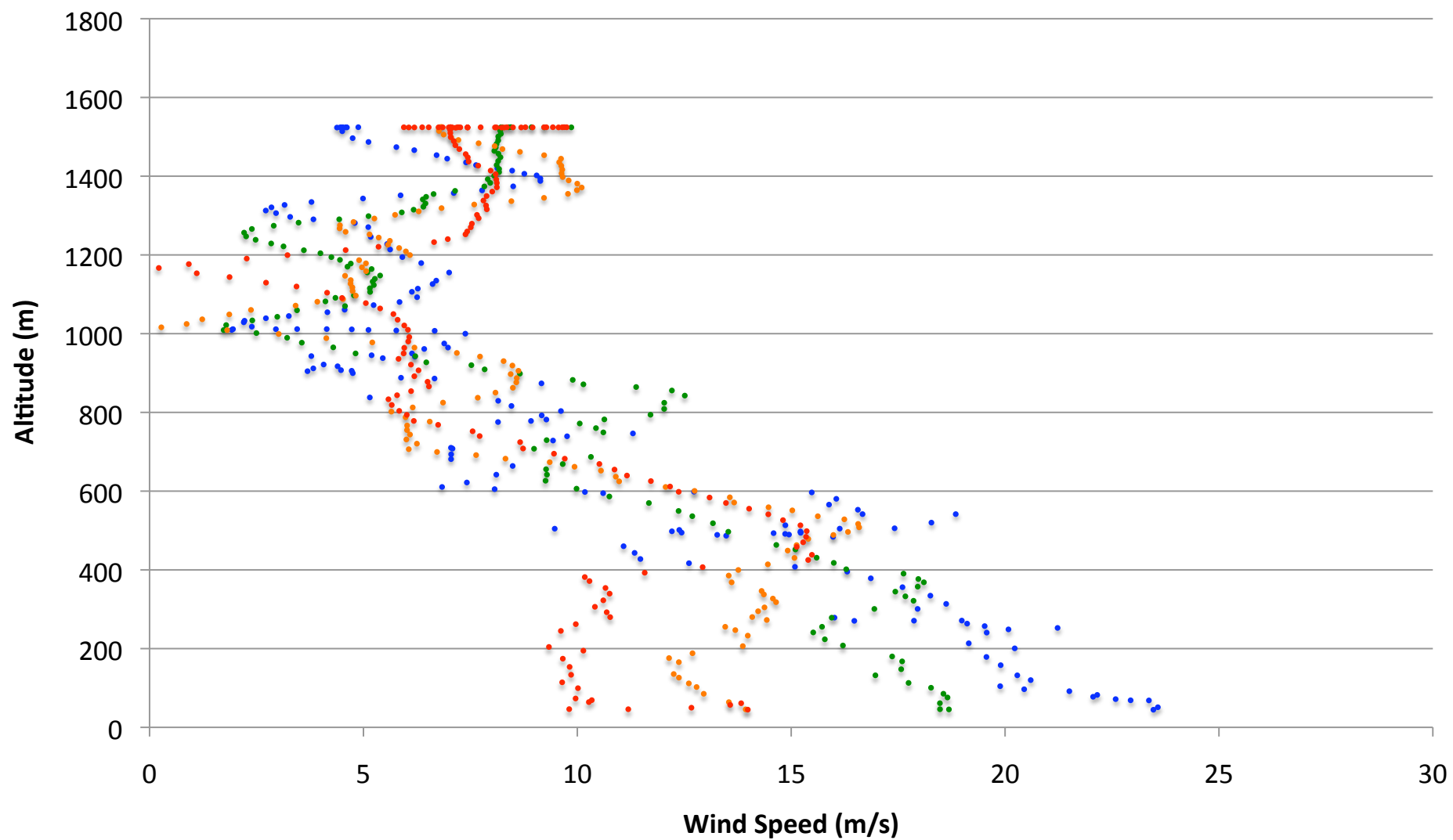
• Profile 1 (ascent) • Profile 2 (ascent) • Profile 3 (ascent) • Profile 4 (ascent)

22 September 2012 #242 Temperature, Frost Point, and Wind Speed Data for Horizontal Transect Downwind
(First Sample - Between Profiles 1 and 4)





• Profile 1 (ascent) • Profile 2 (ascent) • Profile 3 (ascent) • Profile 4 (ascent)



• Profile 1 (ascent) • Profile 2 (ascent) • Profile 3 (ascent) • Profile 4 (ascent)

Aerial Photographs

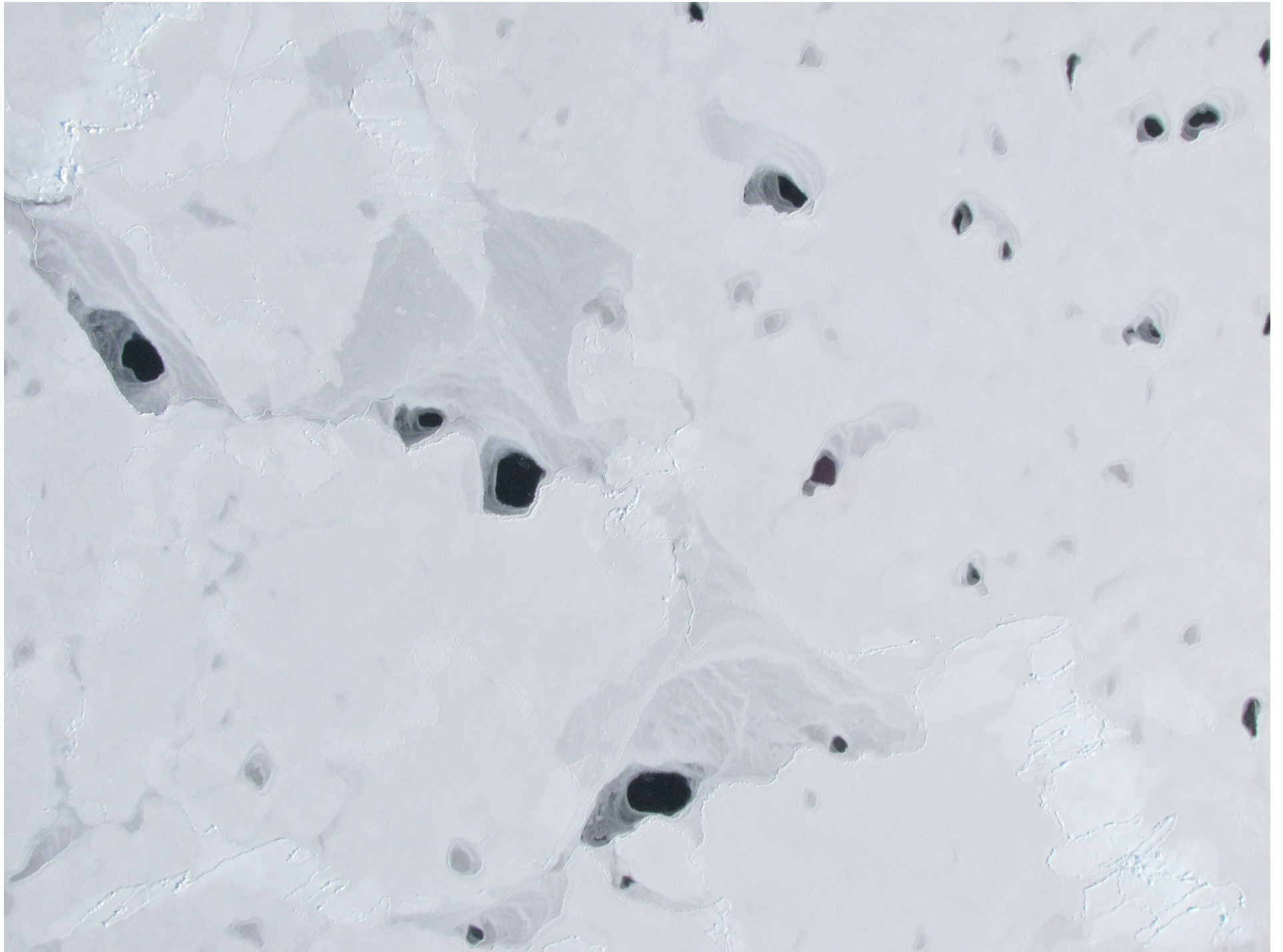












Questions?

