SAND2017-3728C

# Socorro and Wanaka: Balloon Borne Infrasound Expeditions

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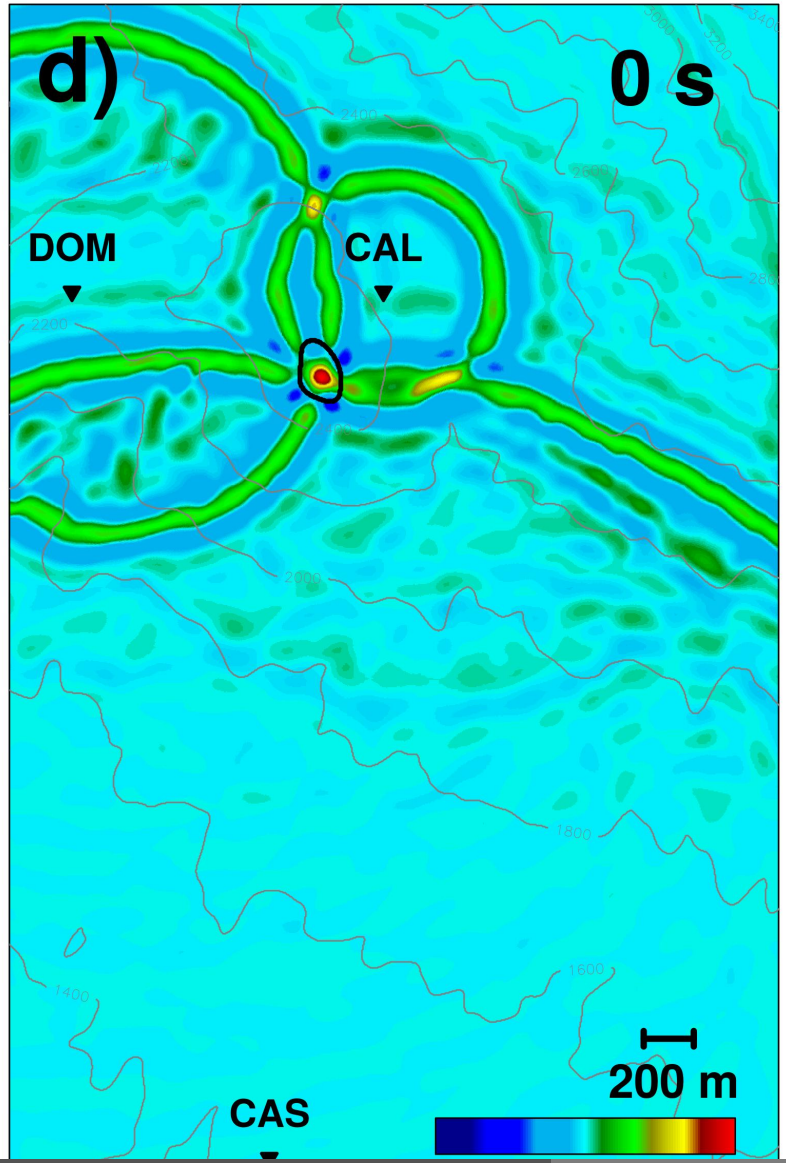
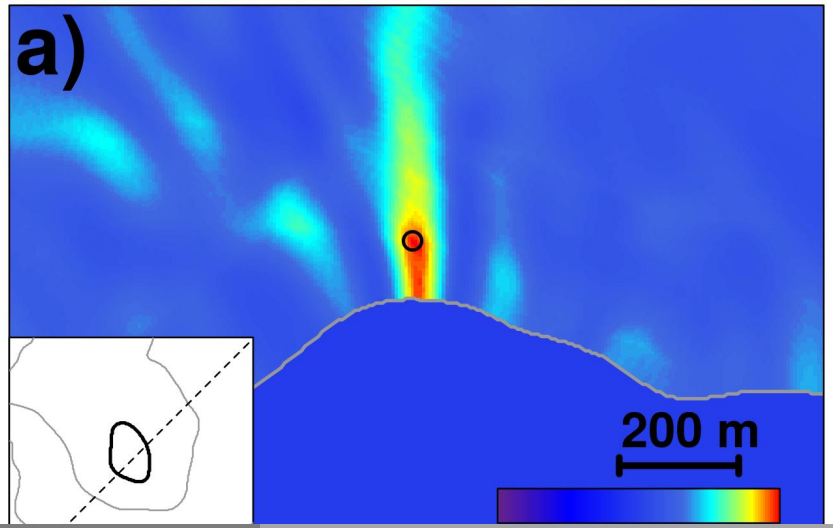
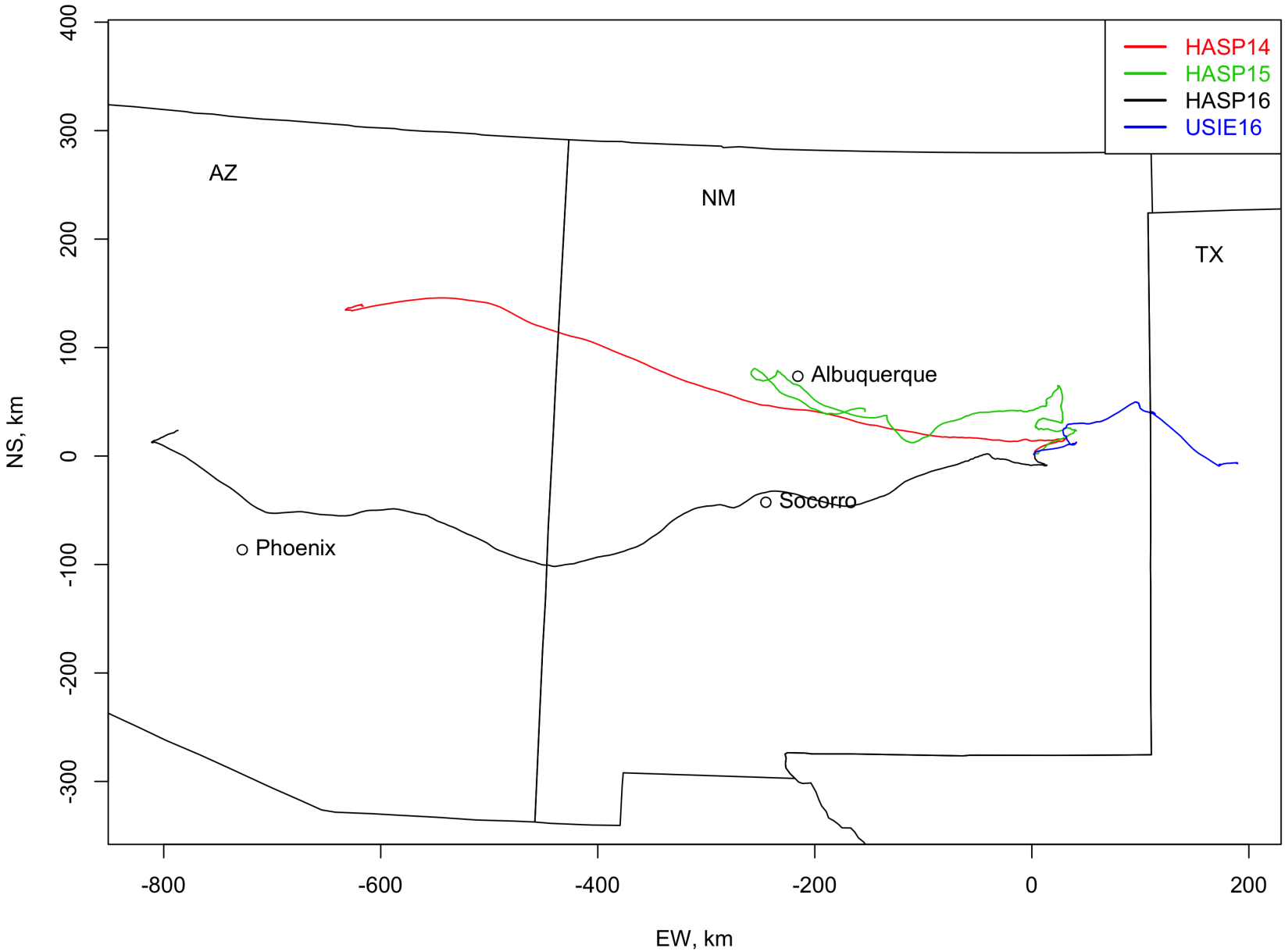
- Intro-motivation
- USIE and HASP flight
- USIE shots - verification of shot-> balloon
- Wanaka circumnav
- WW3 interactions / pdf video
- Micro Barom analysis
- crossing of Andes?
- IMS vs balloon
- statistical analysis of arrivals?

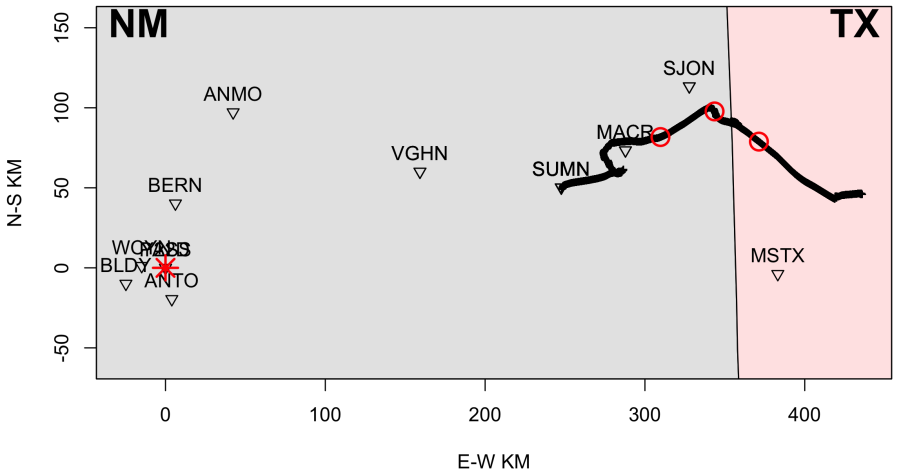
# A Three Dimensional Phenomenon: Part 2

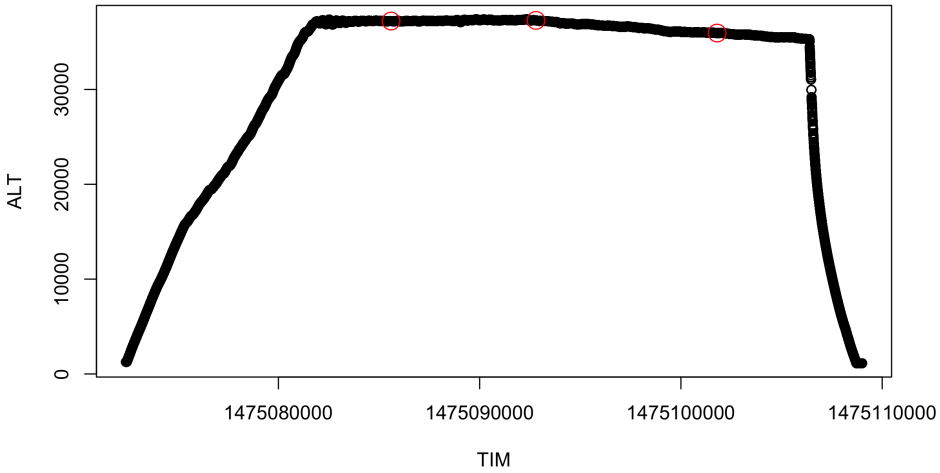
Poor localization of infrasound sources in the vertical direction



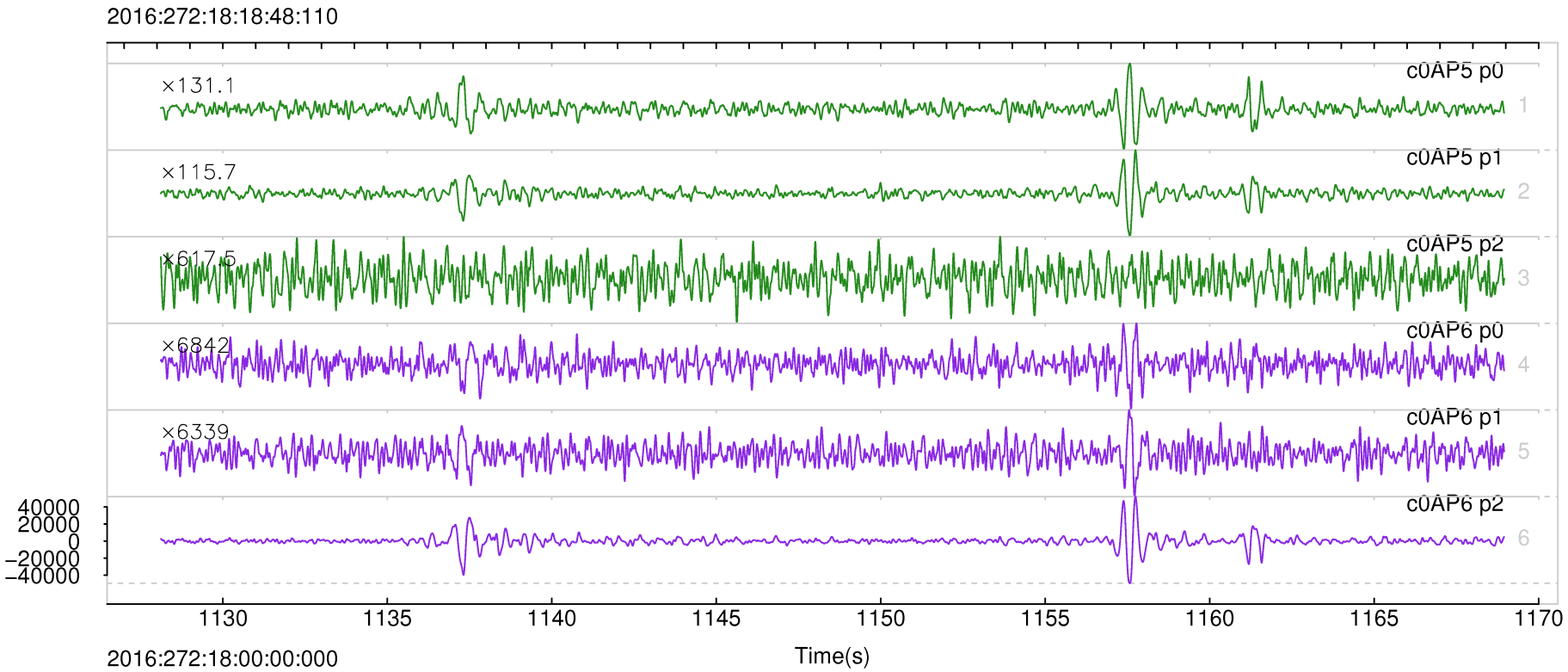

HASP14
HASP15
HASP16
USIE16
AZ
NM
TX
Albuquerque
Socorro
Phoenix
NS, km
EW, km
400
300
200
100
0
-100
-200
-300
-800
-600
-400
-200
0
200



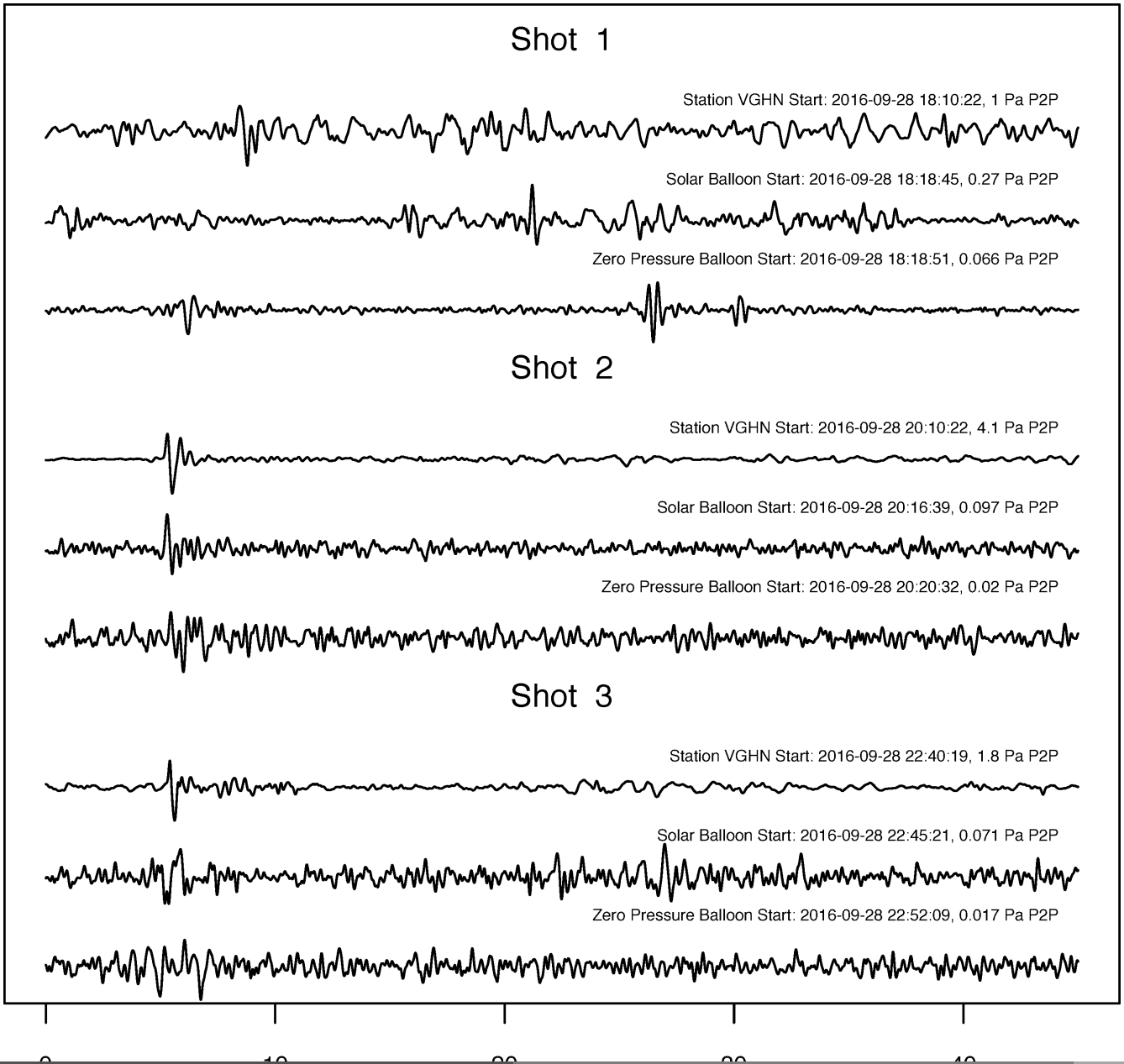

- 2400 lbs TNT (about 1 metric ton)

# shot 1

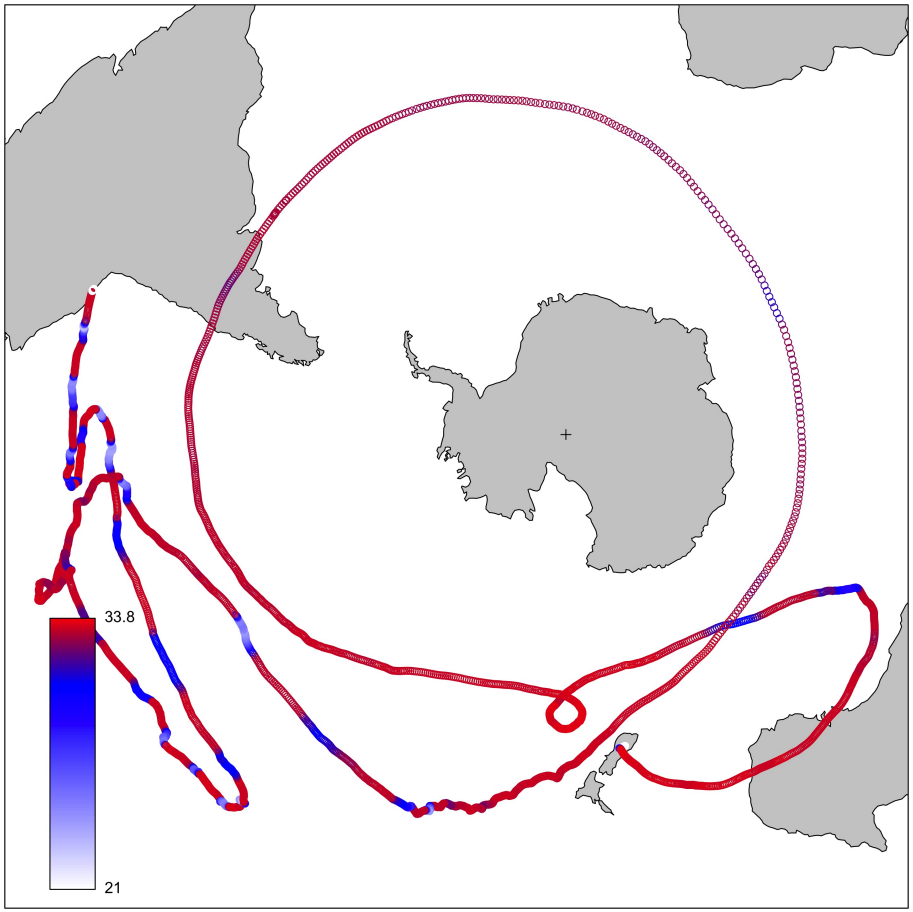



BP FILTER 1 Hz to 10 Hz

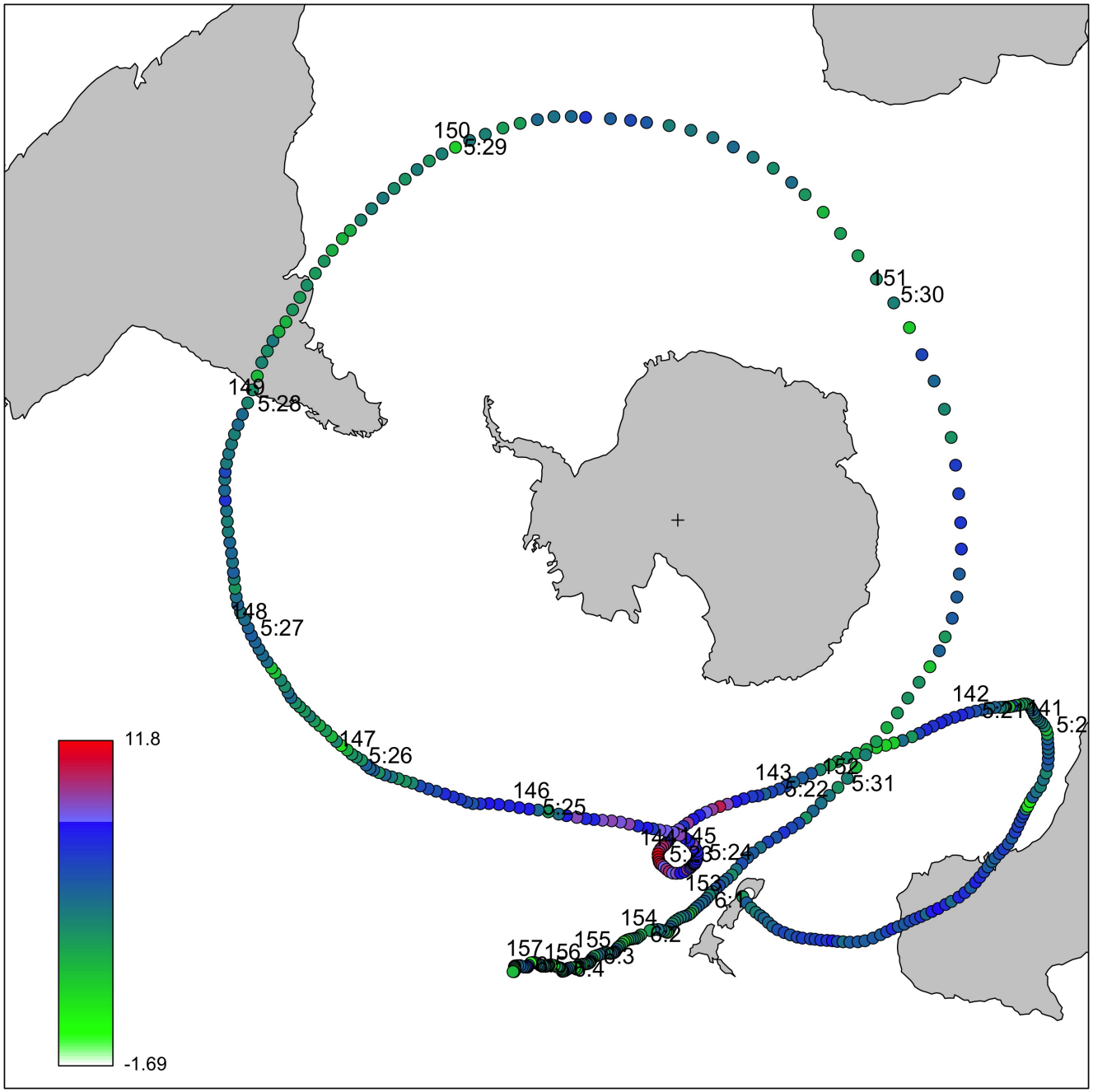
# USIE 3-Shots


Shot 1
Station VGHN Start: 2016-09-28 18:10:22, 1 Pa P2P
Solar Balloon Start: 2016-09-28 18:18:45, 0.27 Pa P2P
Zero Pressure Balloon Start: 2016-09-28 18:18:51, 0.066 Pa P2P
Shot 2
Station VGHN Start: 2016-09-28 20:10:22, 4.1 Pa P2P
Solar Balloon Start: 2016-09-28 20:16:39, 0.097 Pa P2P
Zero Pressure Balloon Start: 2016-09-28 20:20:32, 0.02 Pa P2P
Shot 3
Station VGHN Start: 2016-09-28 22:40:19, 1.8 Pa P2P
Solar Balloon Start: 2016-09-28 22:45:21, 0.071 Pa P2P
Zero Pressure Balloon Start: 2016-09-28 22:52:09, 0.017 Pa P2P


PRIMARY
UP




- Launch Wanaka, NZ
- Launch May 7, 2016
- Battery stopped: June 6, 2016
- Top float altitude 33.8km


150
5:29
151
5:30
149
5:28
148
5:27
147
5:26
146
5:25
145
5:24
142
143
5:22
5:31
154
157
156
155
11.8
-1.69

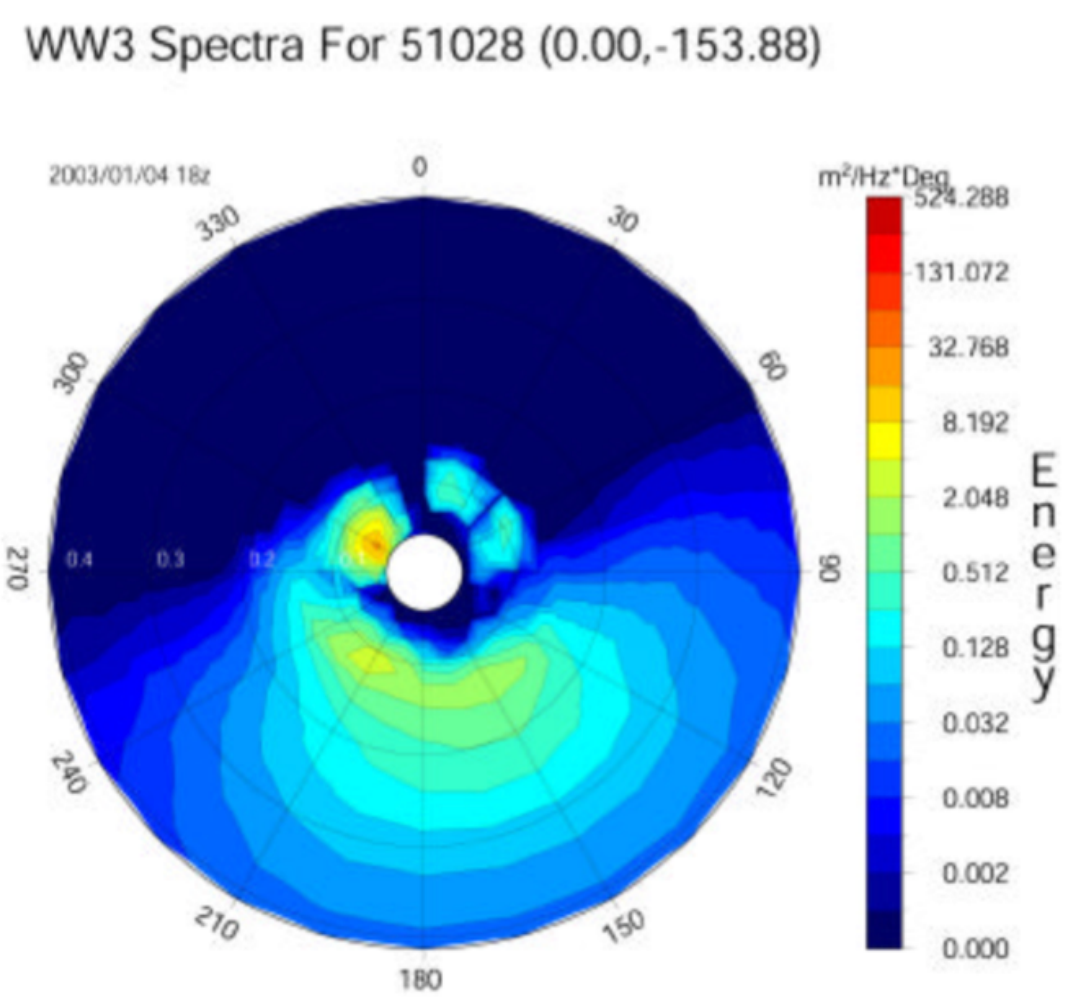
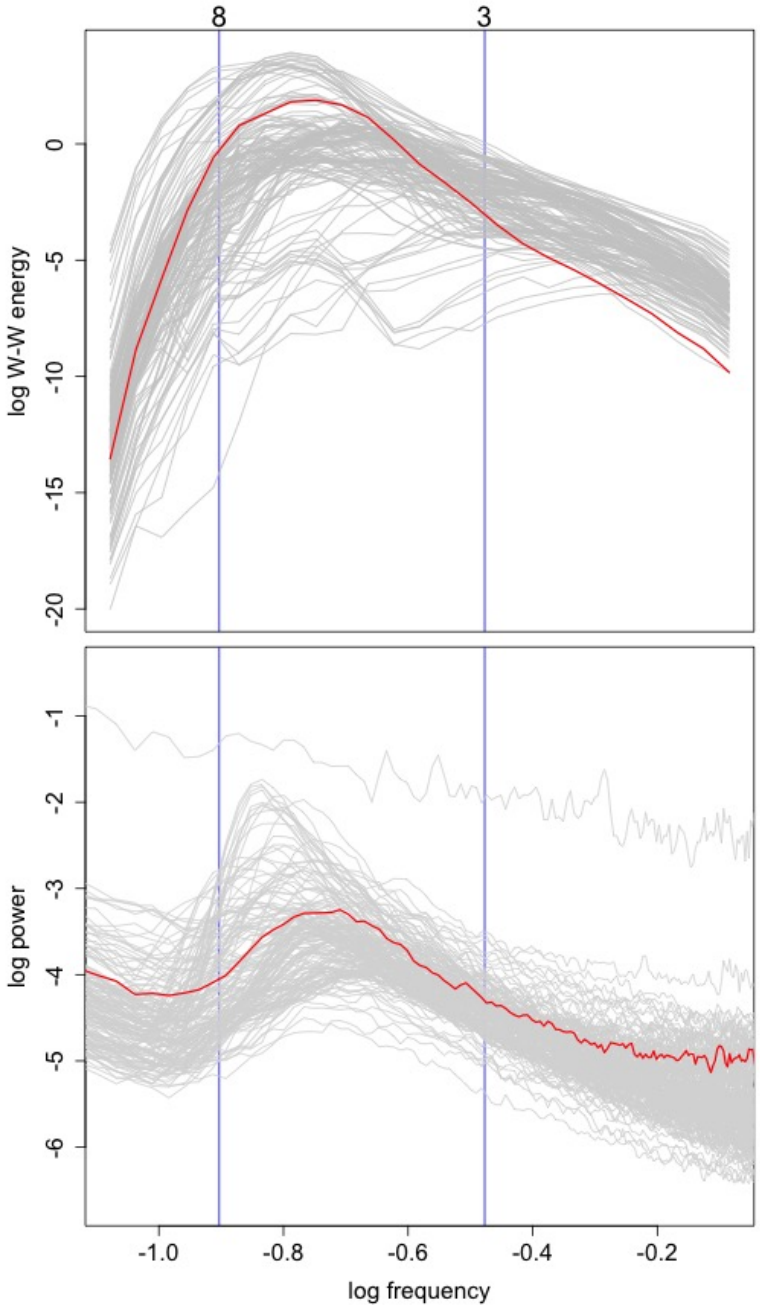
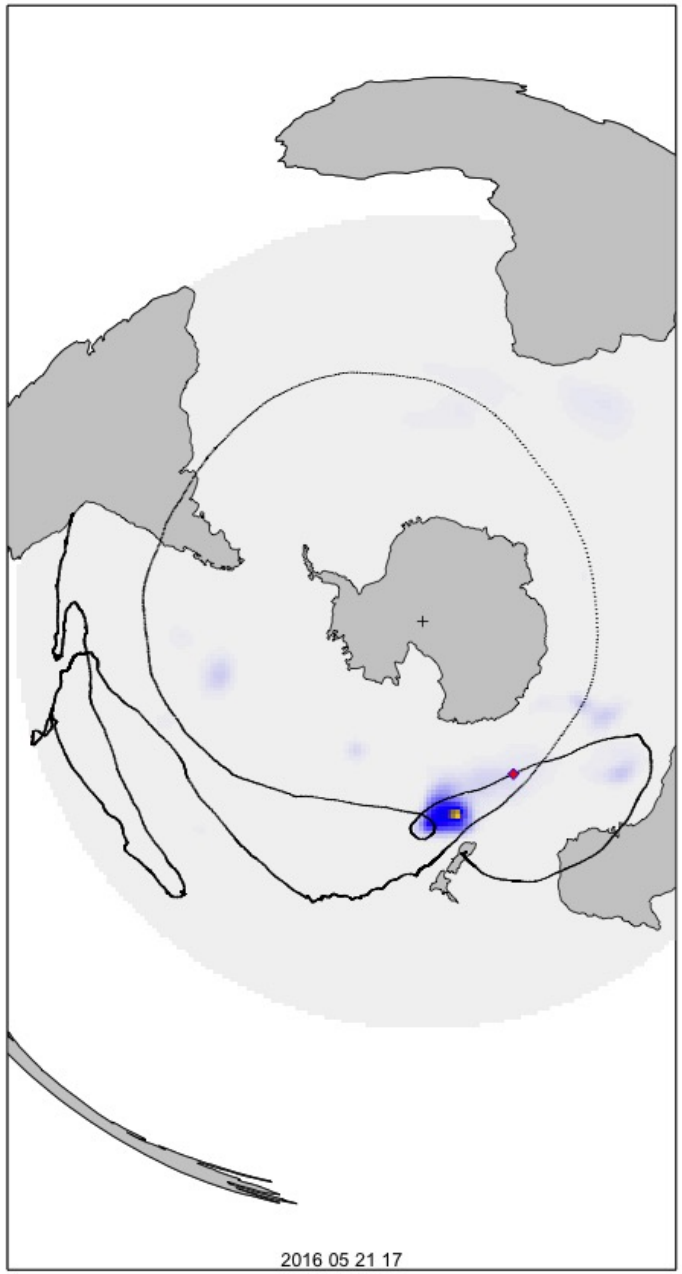
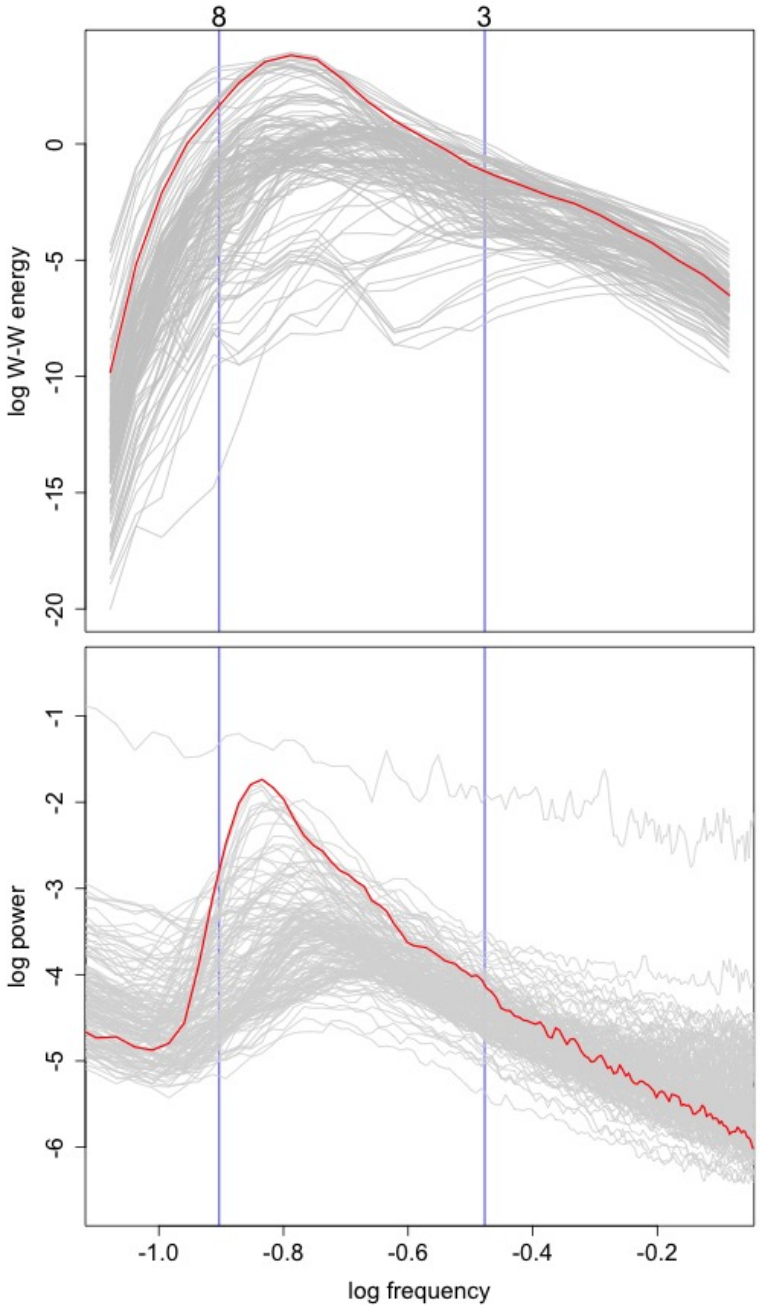


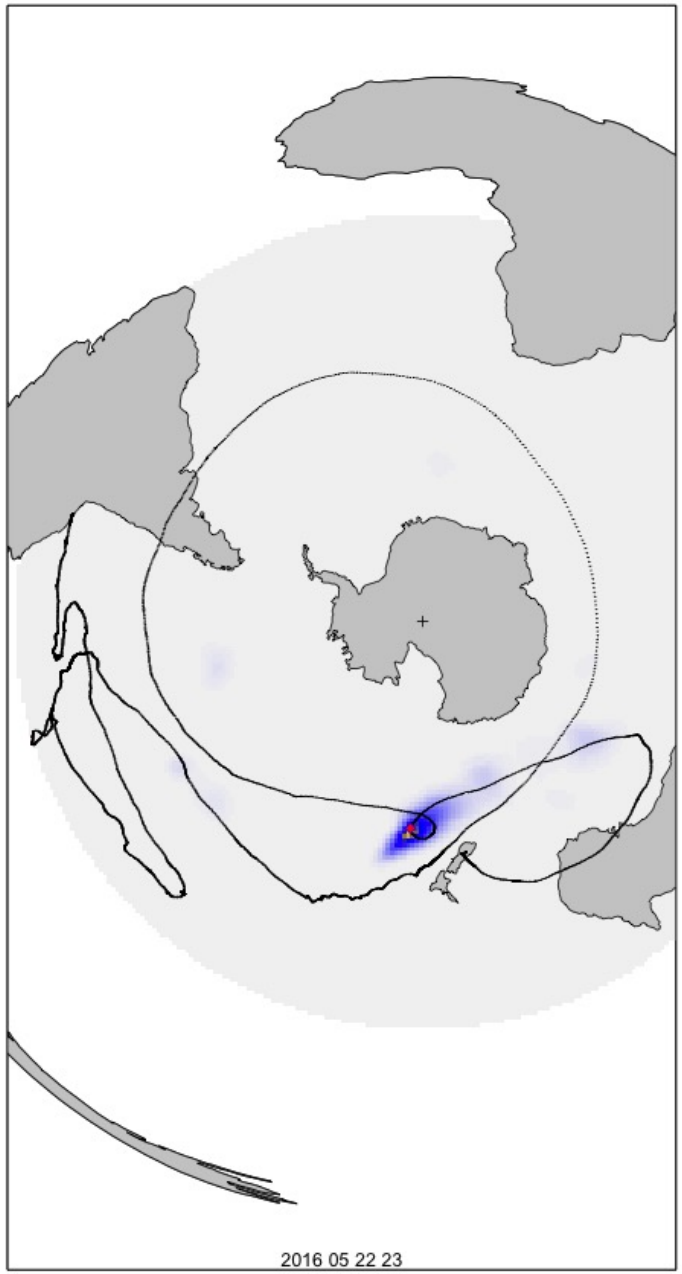

**Fig. 6.** Frequency, directional ocean wave spectrum for Central Pacific location 0.00N, 153.88W on January 4, 2003 18Z. Frequency (Hz) decreases towards the center, wave energy scale (m²/Hz*Deg) on the right hand side.

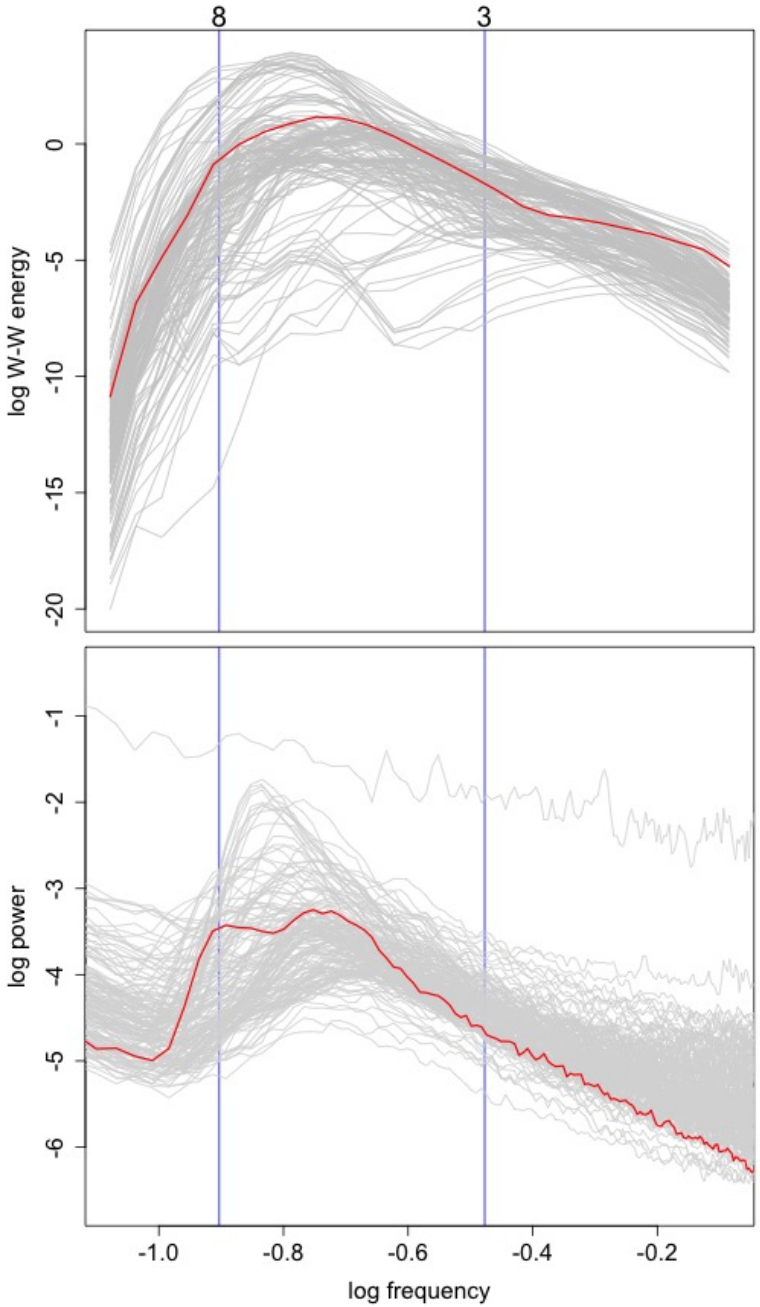
Adapted from Willis et al.

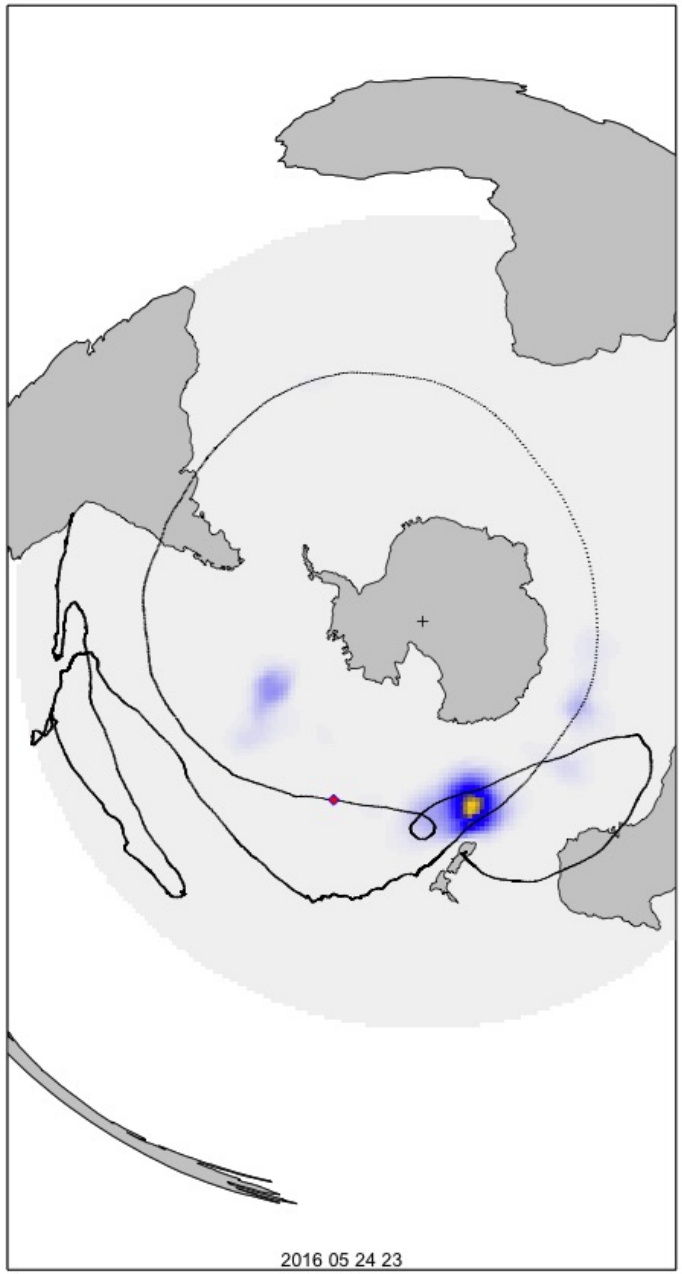

8
3
log W-W energy
0
-5
-10
-15
-20
log power
-1
-2
-3
-4
-5
-6
-1.0
-0.8
-0.6
-0.4
-0.2
log frequency

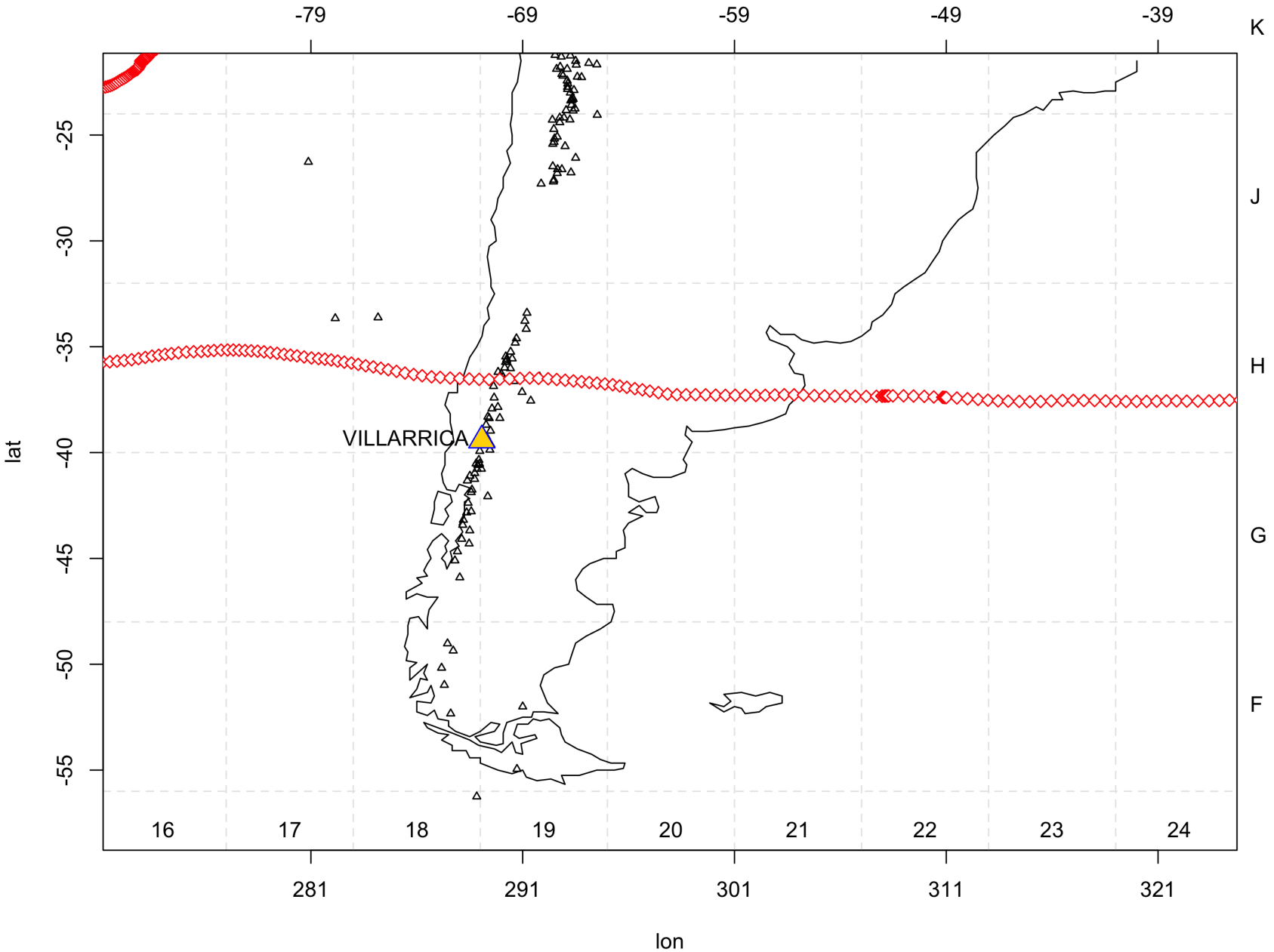

2016 05 21 17

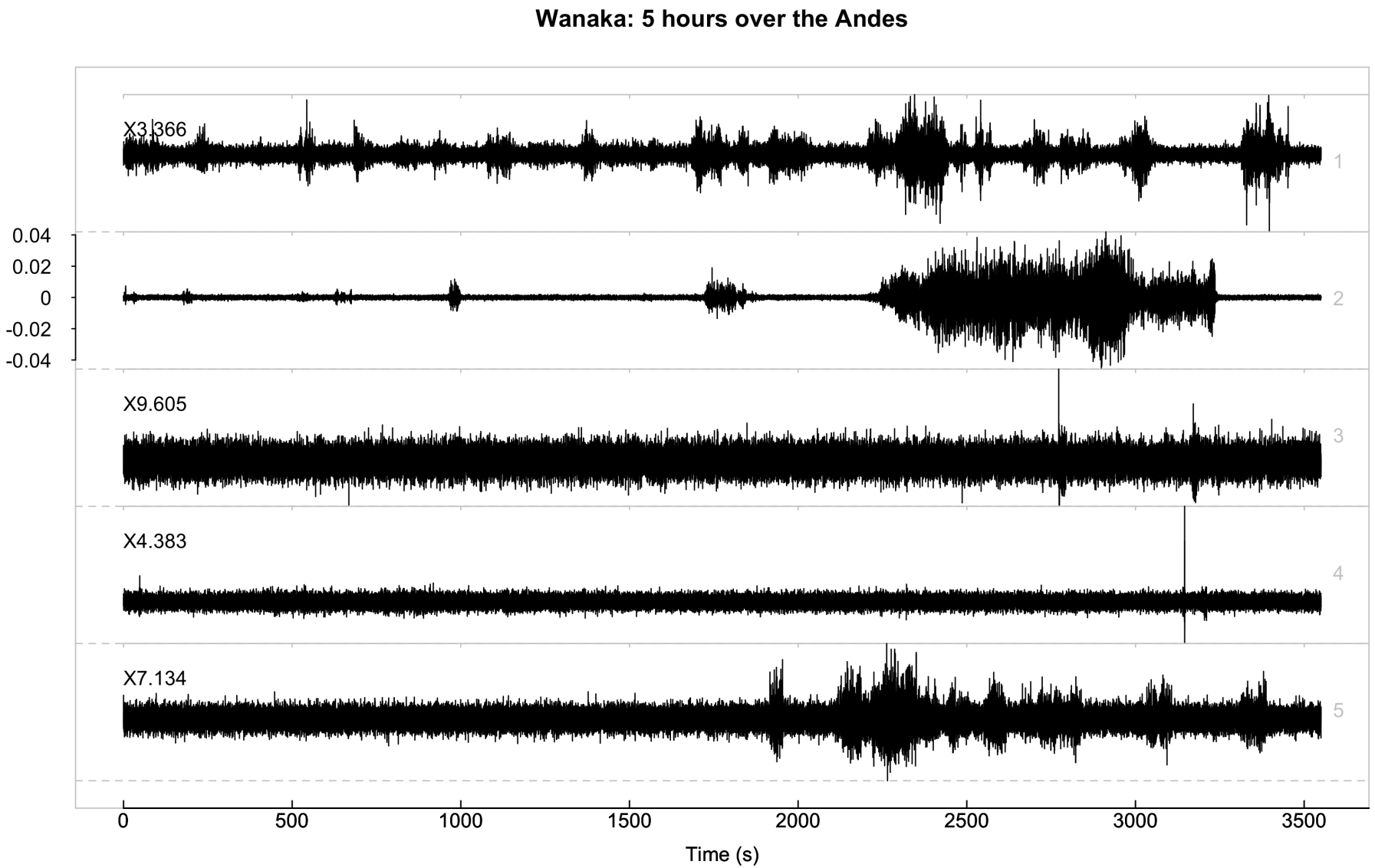

8
3
log W-W energy
0
-5
-10
-15
-20
log power
-1
-2
-3
-4
-5
-6
-1.0
-0.8
-0.6
-0.4
-0.2
log frequency

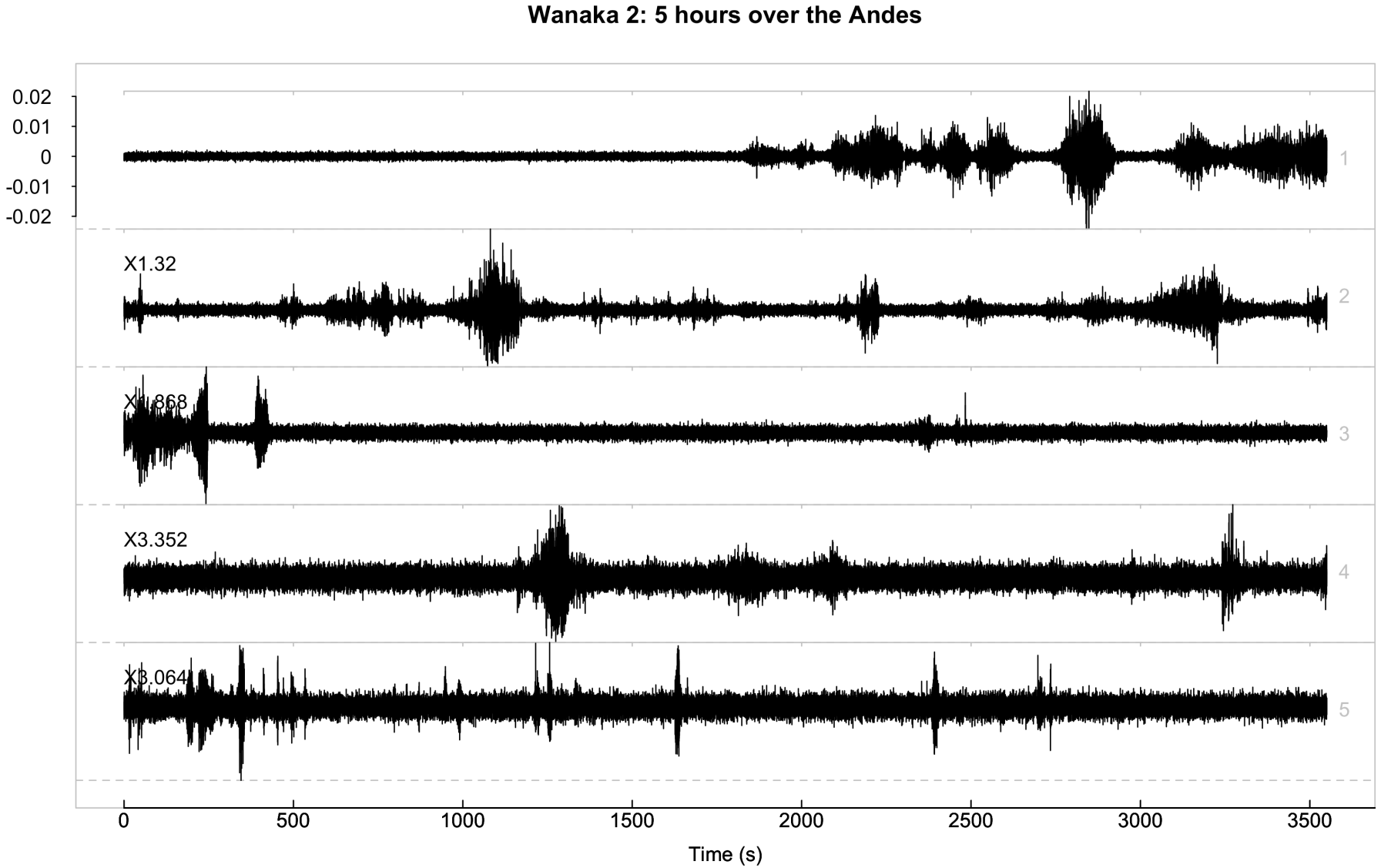

2016 05 22 23

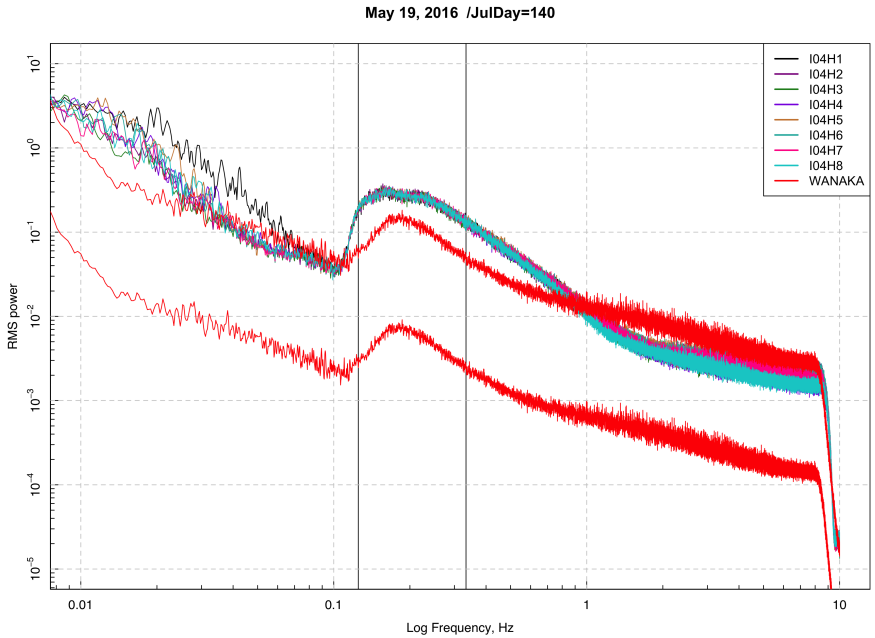

8
3
log W-W energy
0
-5
-10
-15
-20
log power
-1
-2
-3
-4
-5
-6
-1.0
-0.8
-0.6
-0.4
-0.2
log frequency

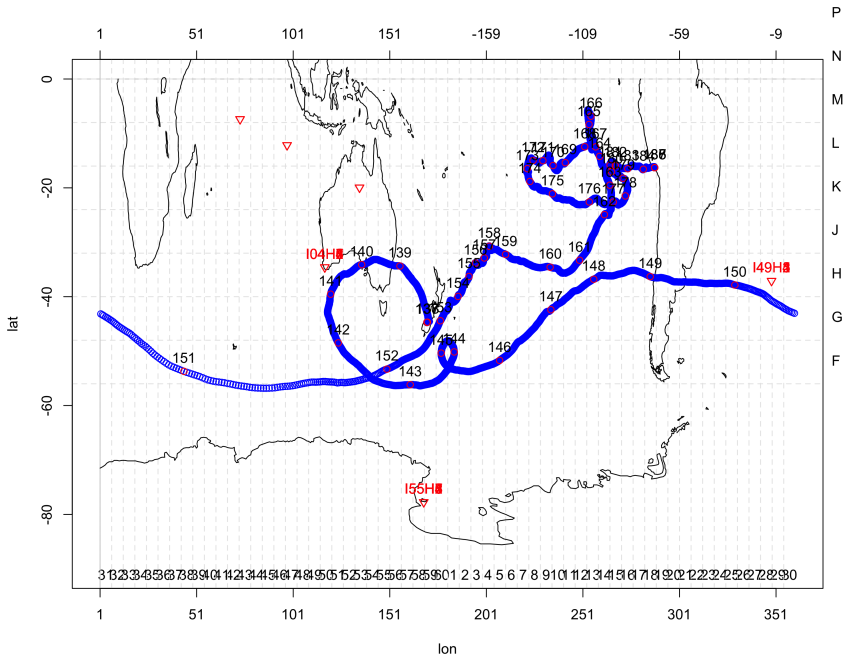

2016 05 24 23


-79
-69
-59
-49
-39
K
J
H
G
F
-25
-30
-35
-40
-45
-50
-55
lat
VILLARRICA
16
17
18
19
20
21
22
23
24
281
291
301
311
321
lon


Wanaka: 5 hours over the Andes
X3.366
X9.605
X4.383
X7.134
1
2
3
4
5
0.04
0.02
0
-0.02
-0.04
0
500
1000
1500
2000
2500
3000
3500
Time (s)


Wanaka 2: 5 hours over the Andes
0.02
0.01
0
-0.01
-0.02
1
X1.32
2
X1.868
3
X3.352
4
X3.064
5
0
500
1000
1500
2000
2500
3000
3500
Time (s)




- Compare with IMS stations
- Power is adjusted for stratosphere
- Power spectra multiplied by $\times 20$

The End

# Wavewatch3 (WW3)

- WW3 = ocean wave model (v1.18)
- Driven by NOGAPS 10m surface winds and global ice concentration values
- Used to produce realistic ocean wave spectra values on a global 1-degree grid
- Initialized at least 6 days ahead of noteworthy events to allow for proper growth and dispersion
- WW3 outputs spectra at every grid point in the form of wave energy densities in 24 directional and 25 frequency bins
- Wave spectra are used to calculate acoustic source pressure by summing the products of directly opposing wave trains at each frequency

- Fritts (2000)
- Wavewatch3 (WW3) : NOGAPS 10 m surface winds
- Tolman (1999)
- Garces et al. 2003