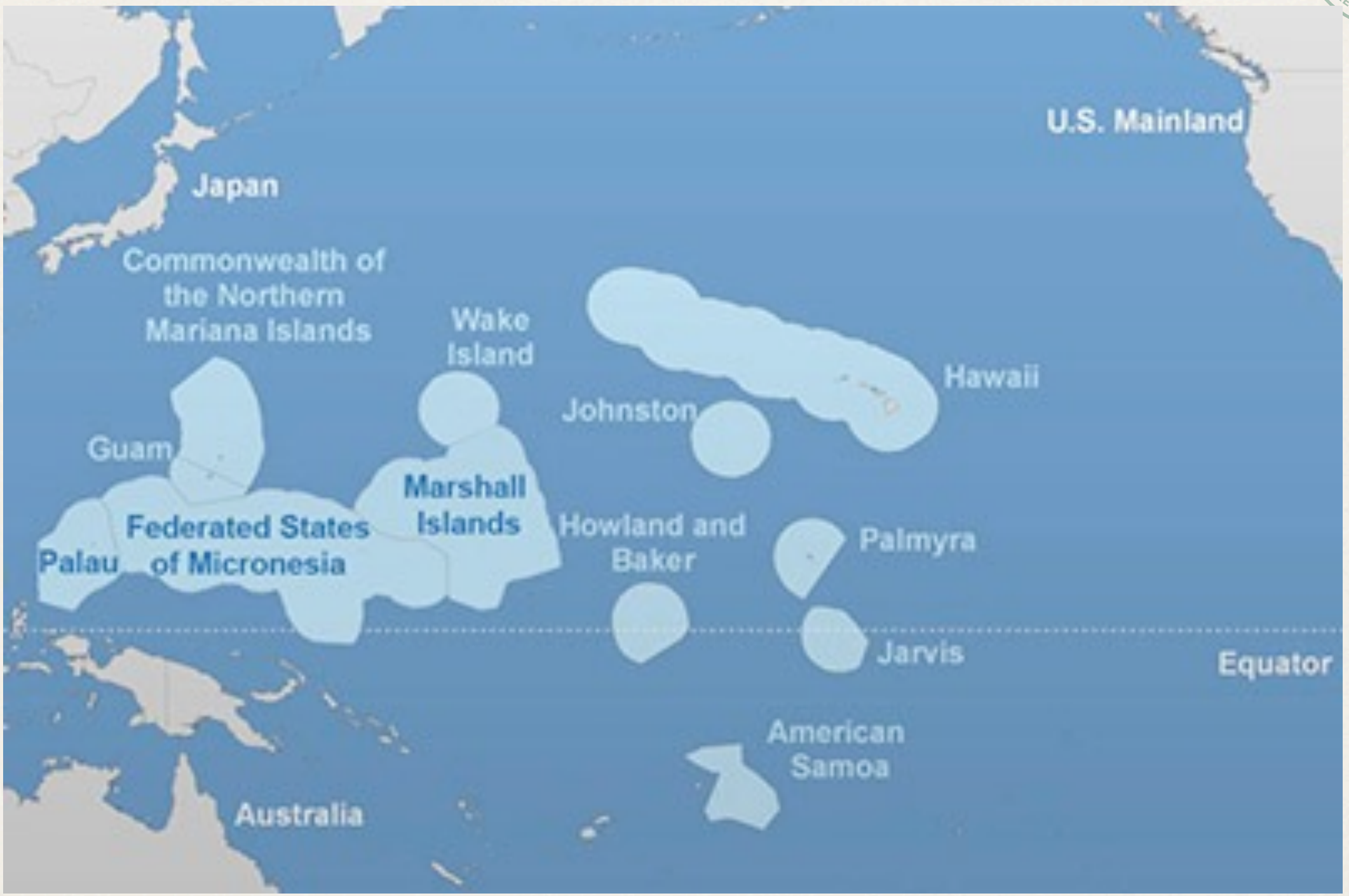
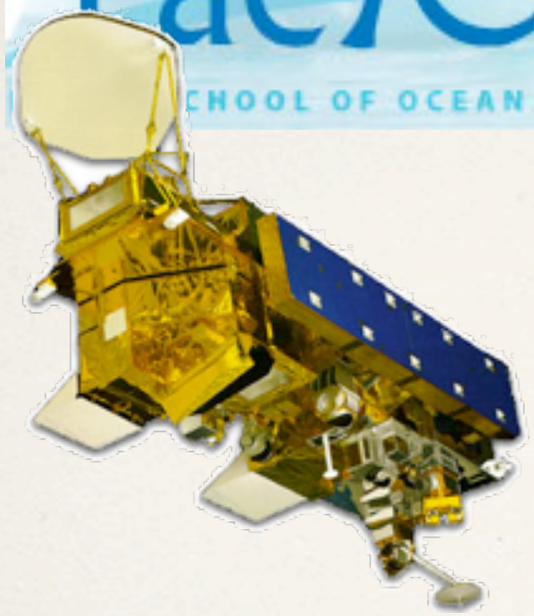
Quantifying Gliders in PacIOOS

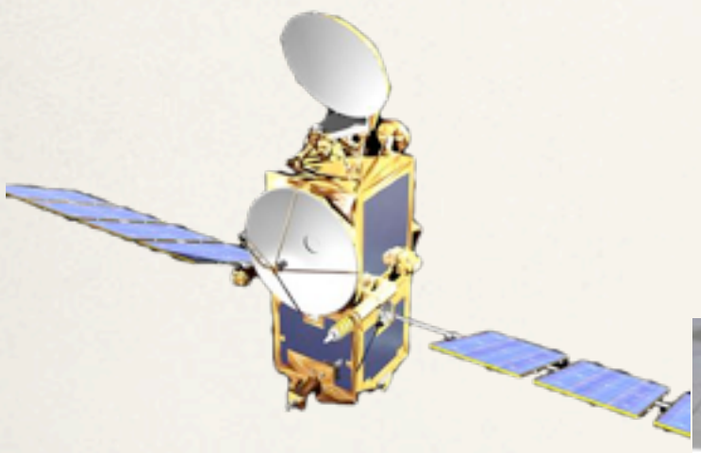
Brian Powell

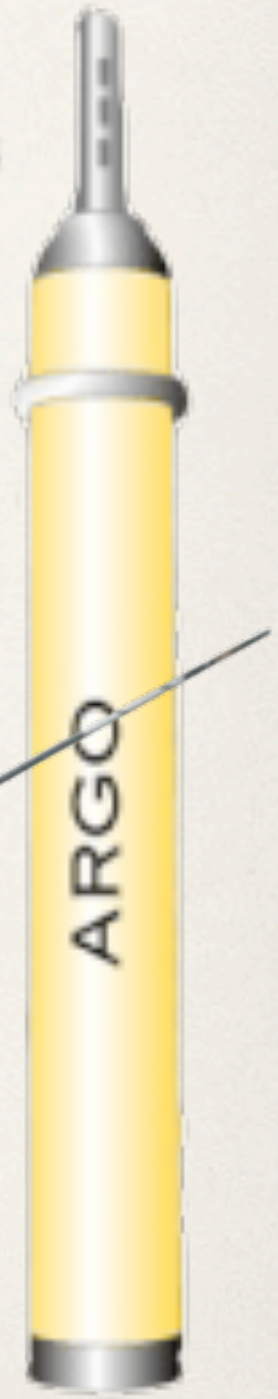

U.S. Mainland
Japan
Commonwealth of
the Northern
Mariana Islands
Wake
Island
Hawaii
Johnston
Guam
Marshall
Islands
Federated States
of Micronesia
Palau
Howland and
Baker
Palmyra
Jarvis
Equator
American
Samoa
Australia

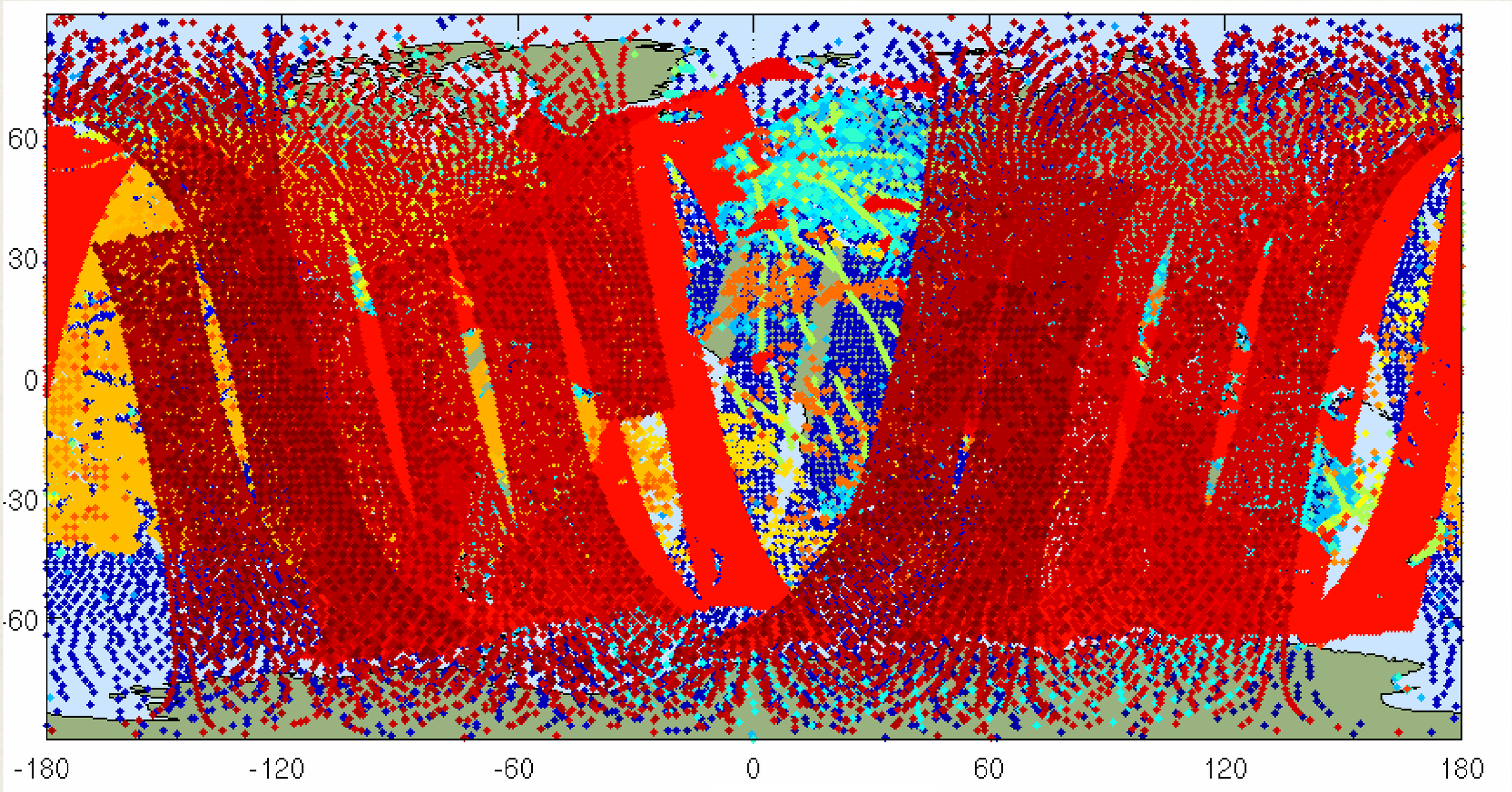
PacIOOS Pacific Islands Ocean Observing System

CHOOL OF OCEAN AND EARTH SCIENCE AND OLOGY AT I AT MĀNOA



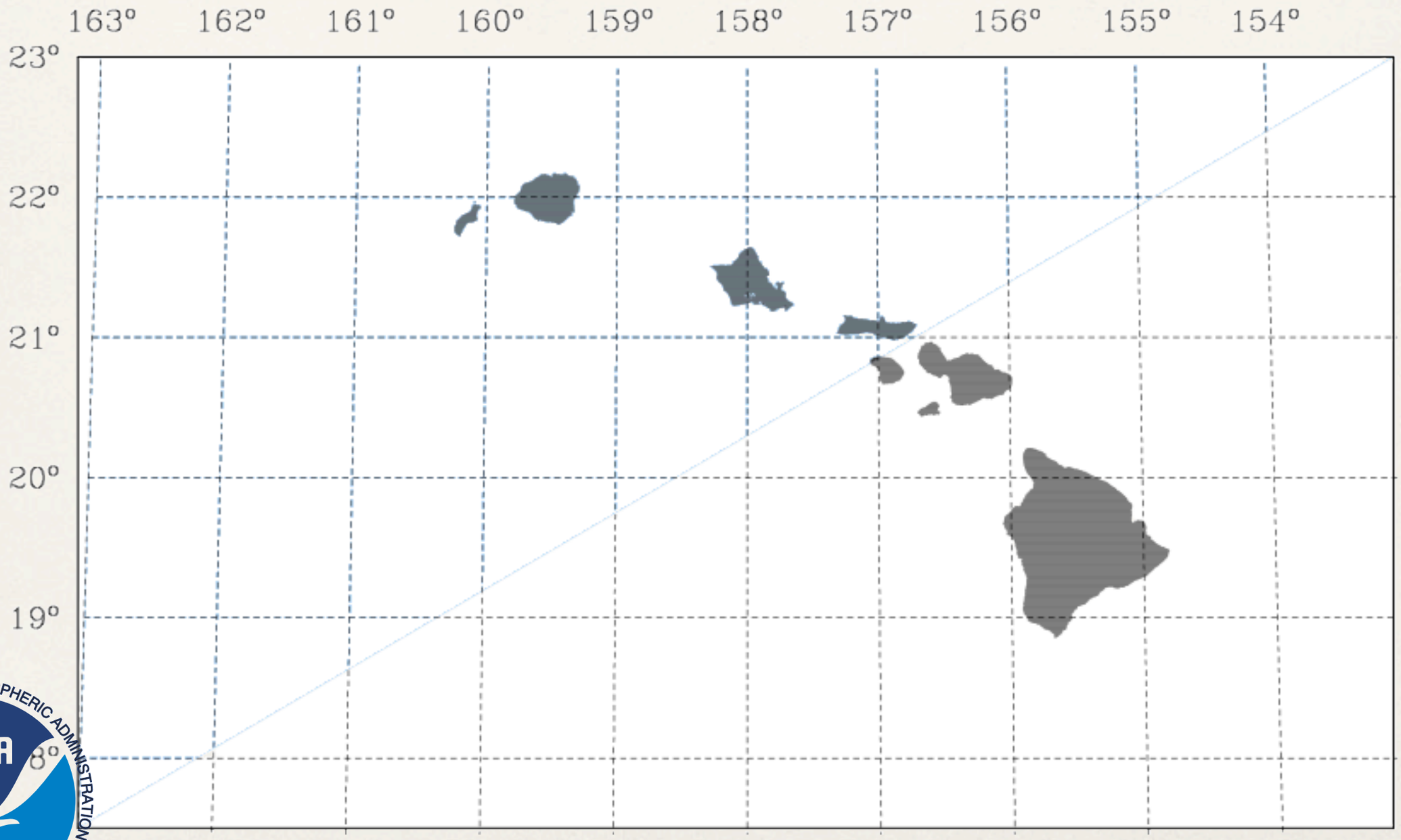




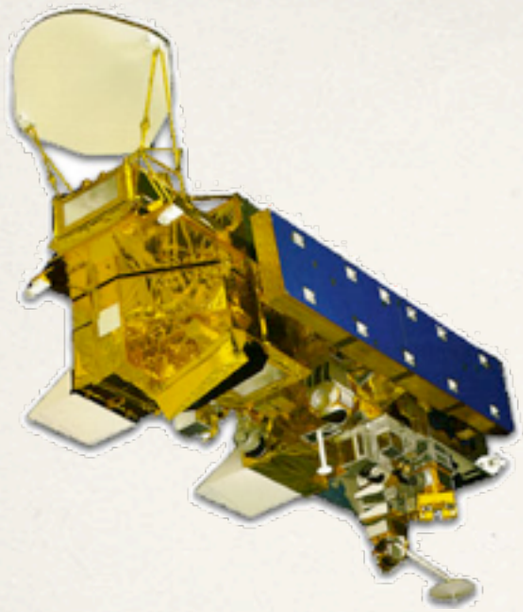

60
30
0
-30
-60
-180
-120
-60
0
60
120
180

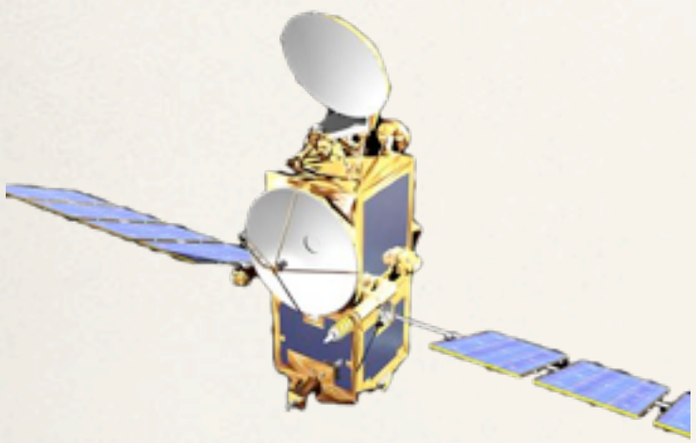
PacIOOS Pacific Islands Ocean Observing System

IN THE SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY AT THE UNIVERSITY OF HAWAI'I AT MĀNOA

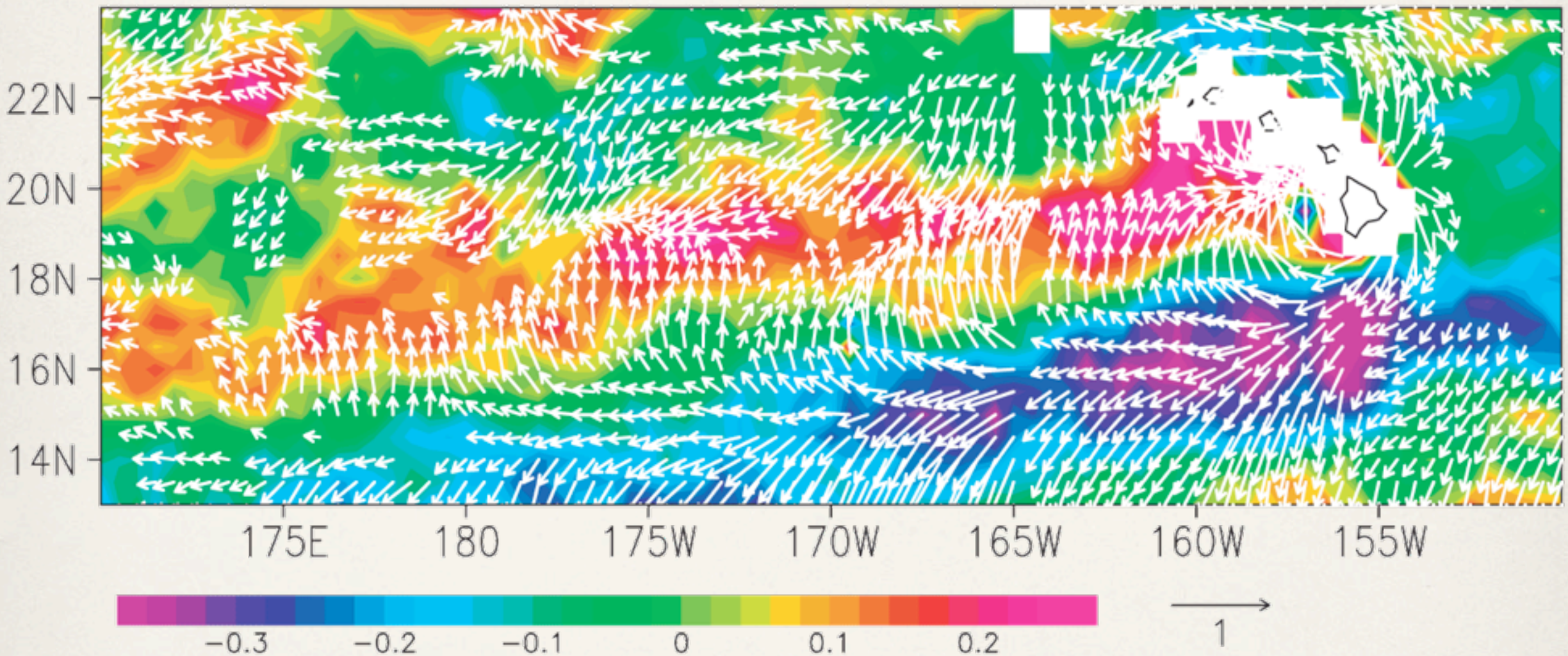


Observation	Count	Percent
HOT Temperature	4,982	0.02%
HOT Salt	4,982	0.02%
Argo Temp	15,212	0.06%
Argo Salt	15,212	0.06%
Seaglider Temperature	220,266	0.83%
Seaglider Salt	220,266	0.83%
SST	25,201,519	94.50%
SSH	985,731	3.70%
Total	26,668,170	





ARGO



S.-P. Xie, W. Liu, Q. Liu, and M. Nonaka. Far-Reaching Effects of the Hawaiian Islands on the Pacific Ocean-Atmosphere System. Science, 292(5524):2057–2060, 2001.

- The model and observations are combined via:

$$\mathbf{x}_a = \mathbf{x}_b + \mathbf{K}\left(\mathbf{y} - \mathbf{H}\mathbf{x}_b\right)$$

- Any measure of the ocean (EKE, transport, etc.):

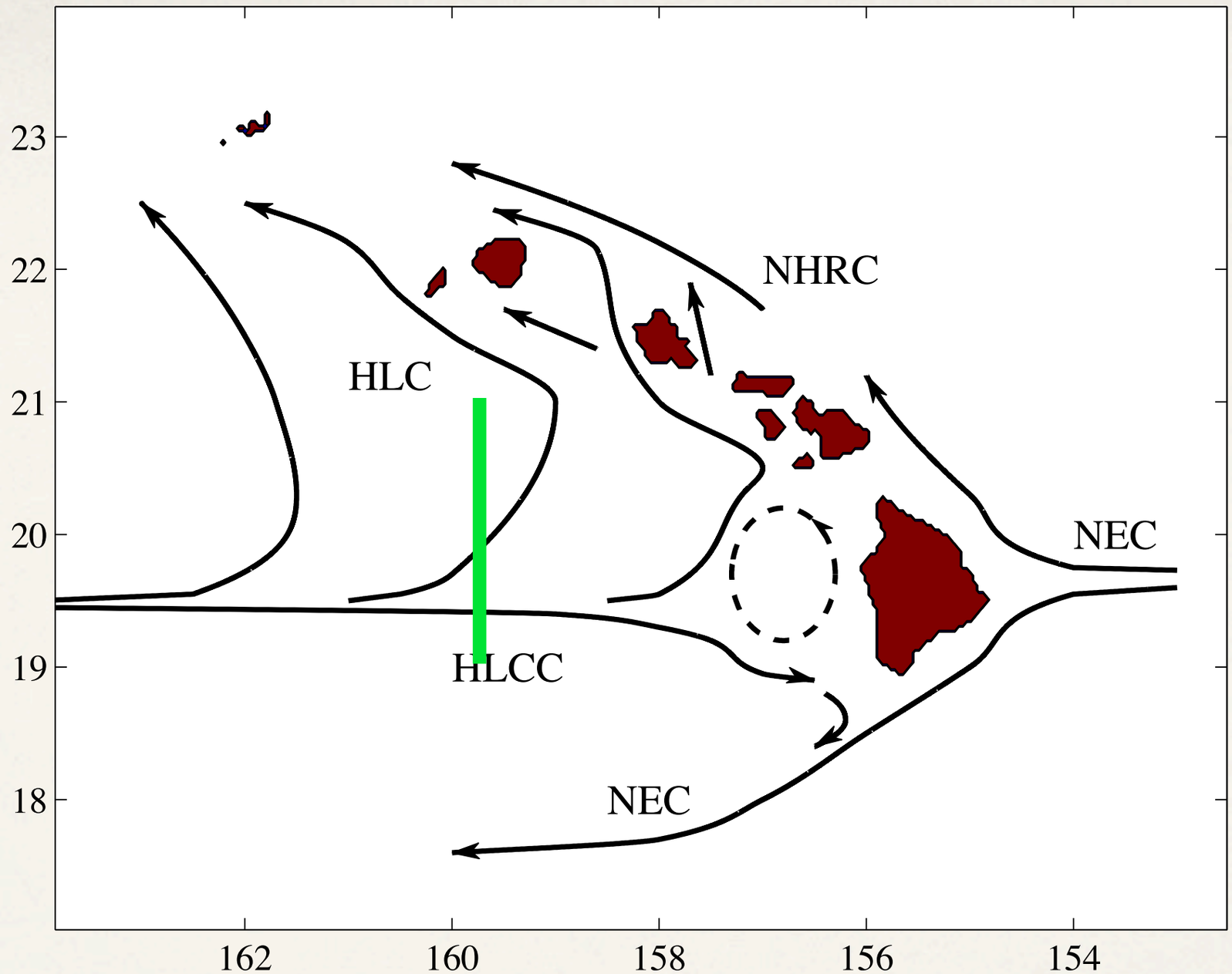
$$\mathcal{J} = f\left(\mathbf{x}_b + \delta\mathbf{x}_a\right)$$

- The difference between the model guess and assim:

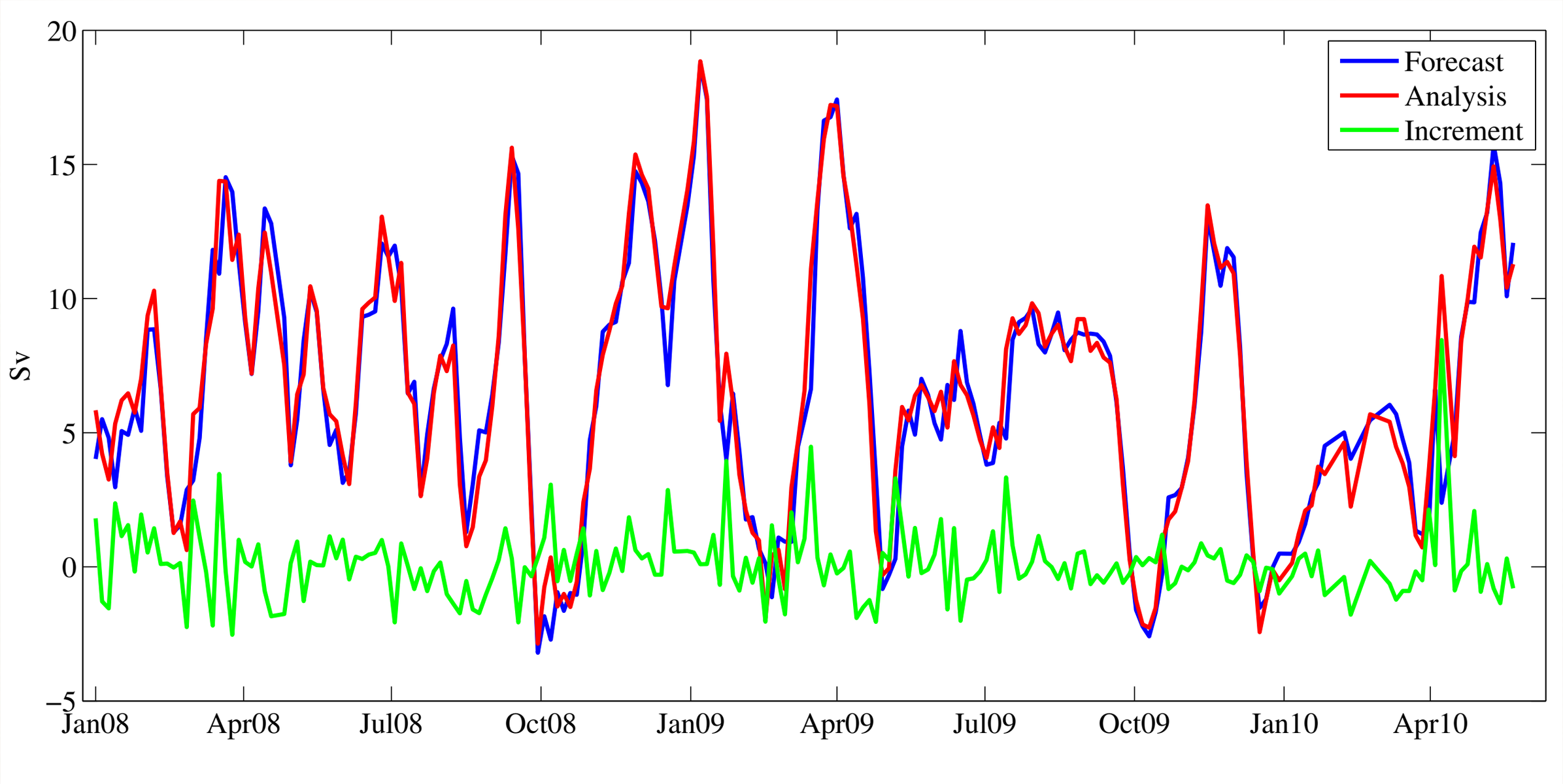
$$\Delta\mathcal{J} = 2\left(\mathbf{y} - \mathbf{H}\mathbf{x}_b\right)^T \mathbf{K}^T \mathbf{M}_b^T \frac{\partial \mathcal{J}}{\partial \mathbf{x}_b}$$

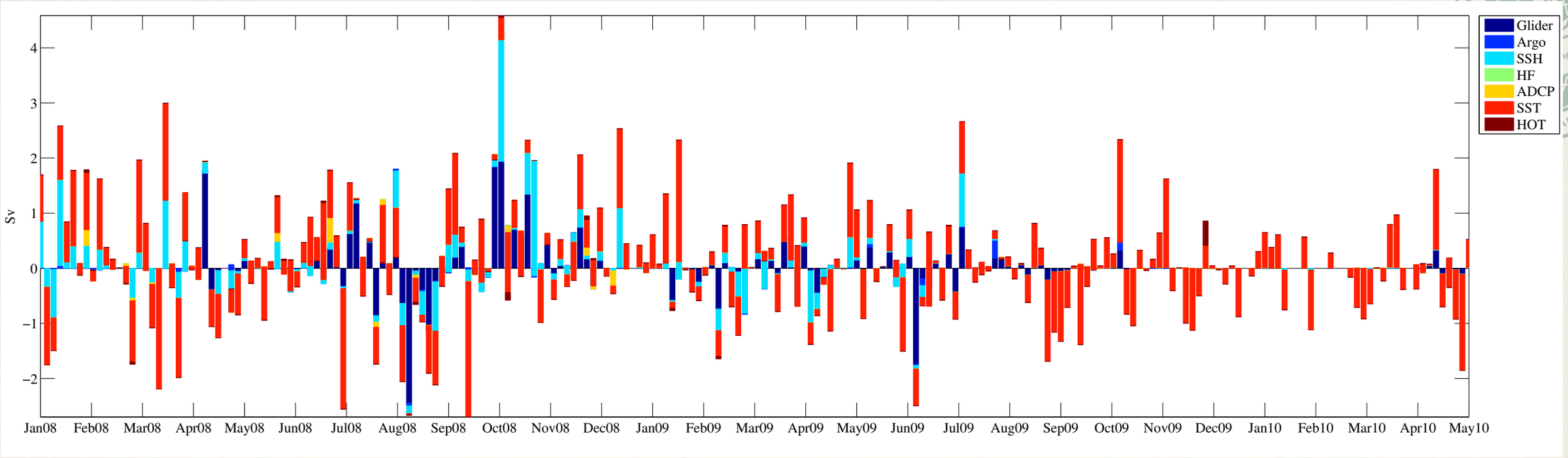
- where,

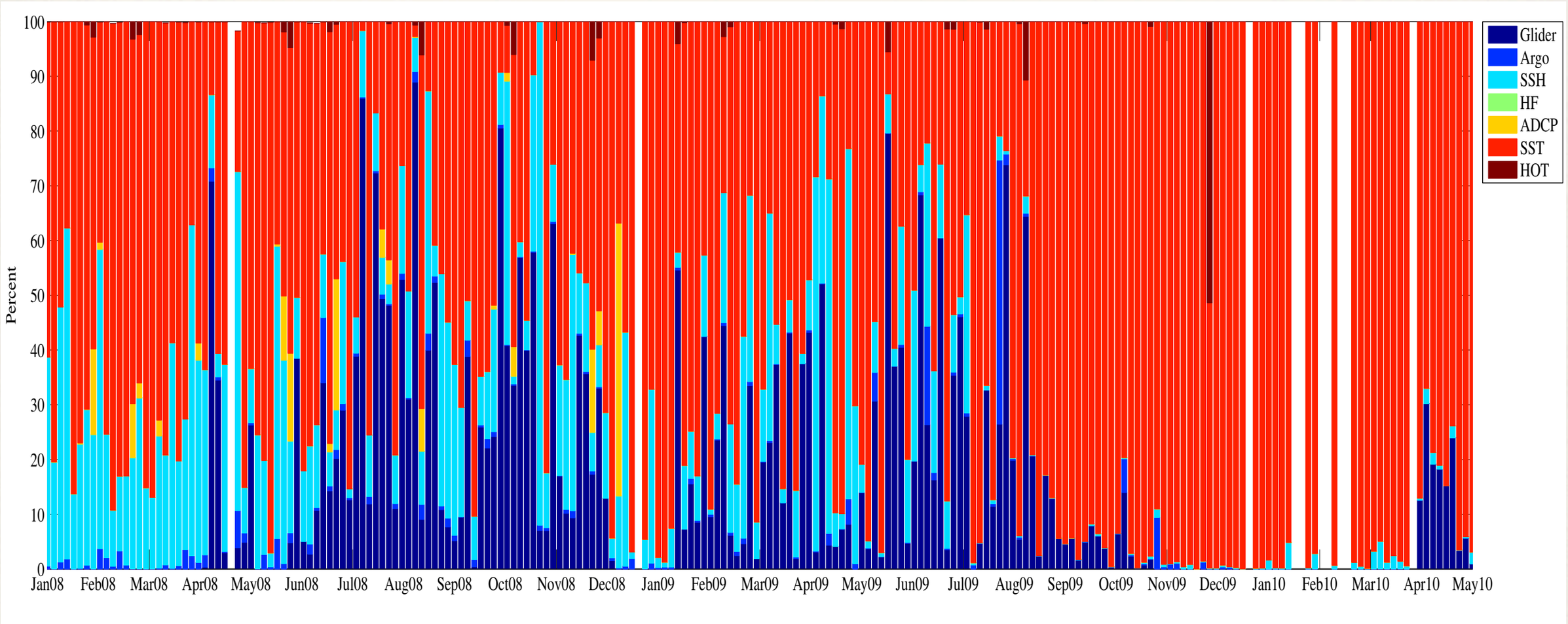
$$\frac{\partial x_a}{\partial y} = \mathbf{K}^T$$

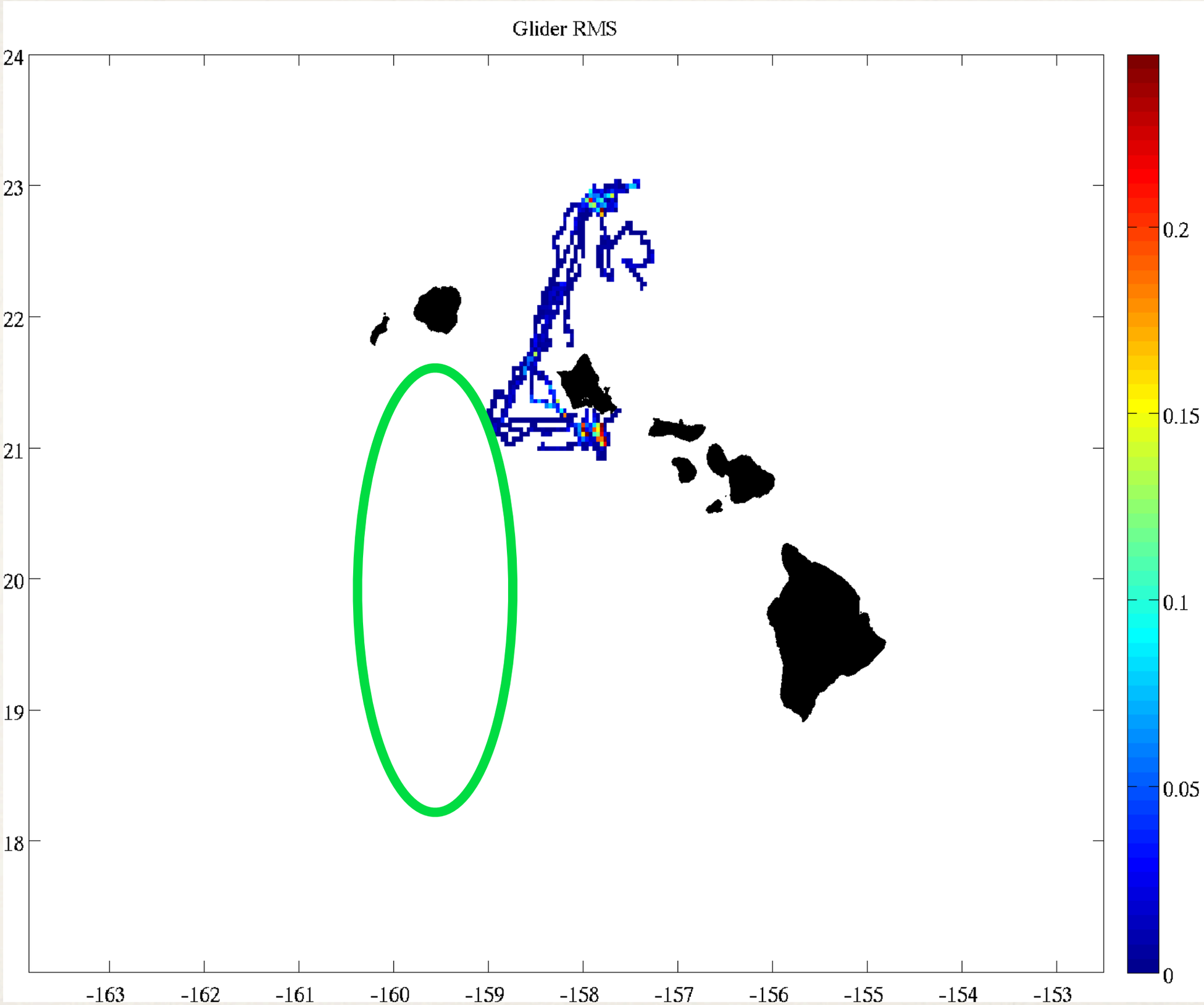


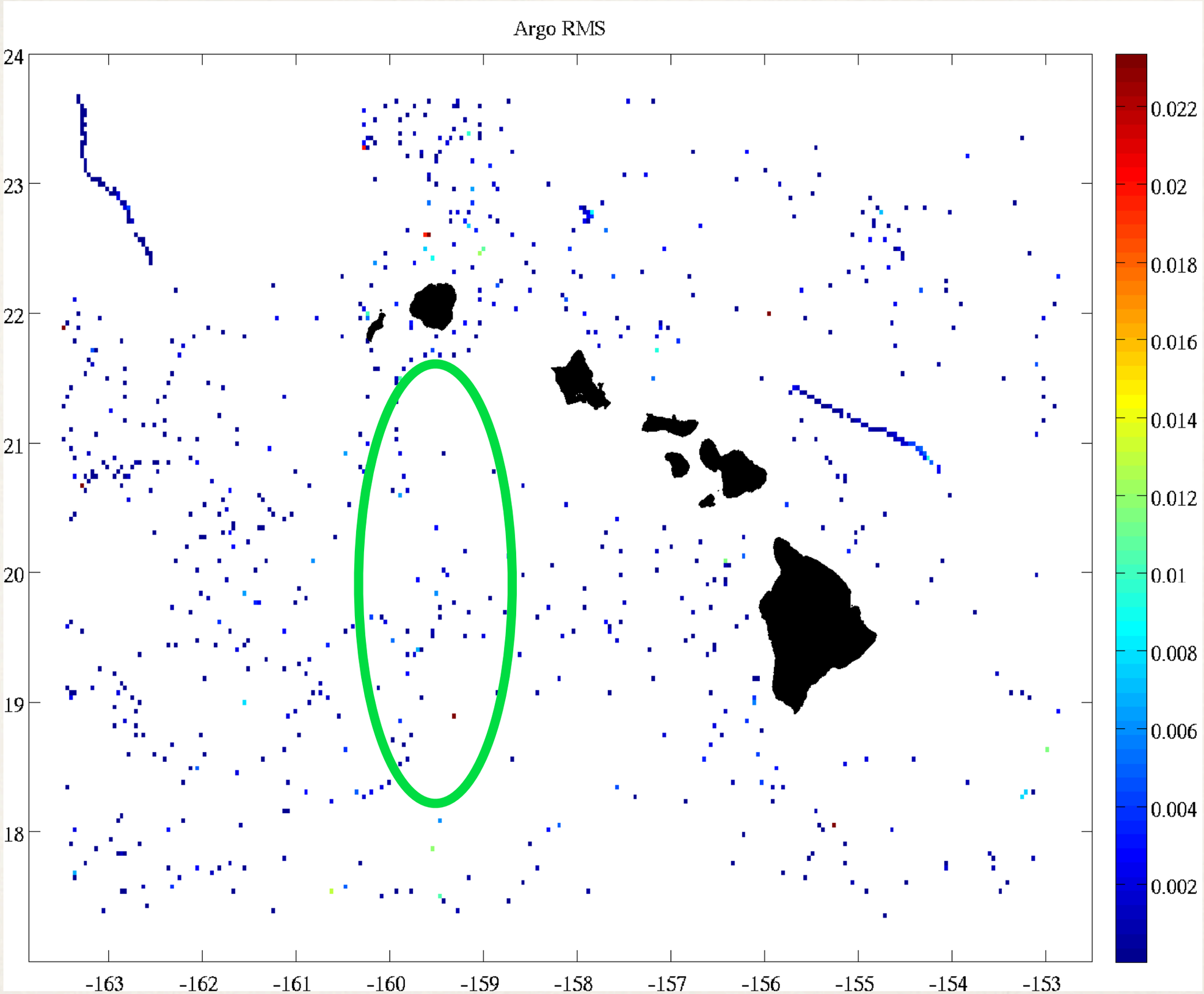
$$\mathcal{J} = \frac{1}{T \cdot 10^6} \int_T \int_S \int_{-Z}^{0} u \Delta y \mathrm{d}z \mathrm{d}s \mathrm{d}t$$

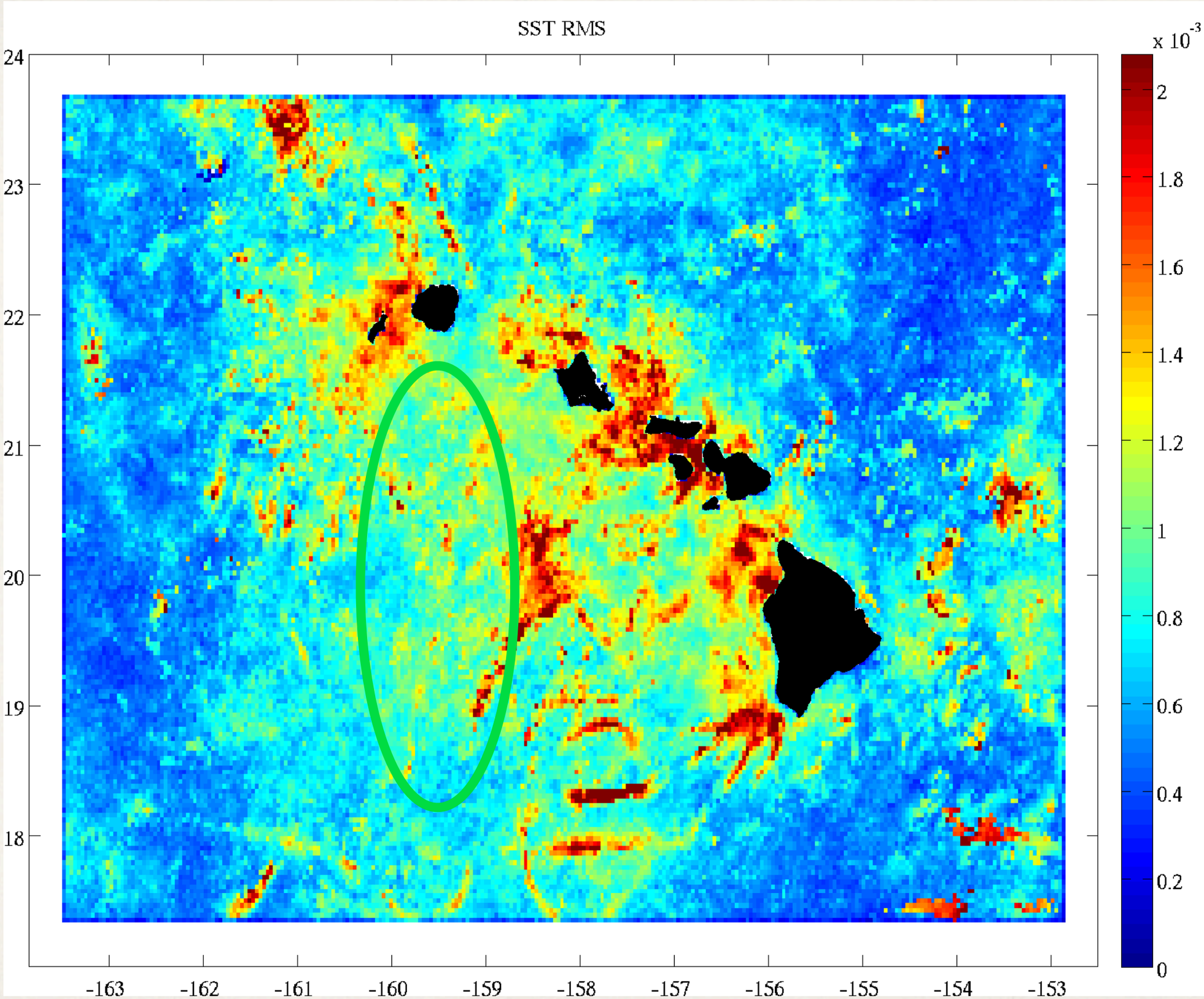

Forecast
Analysis
Increment
Sv
20
15
10
5
0
−5
Jan08
Apr08
Jul08
Oct08
Jan09
Apr09
Jul09
Oct09
Jan10
Apr10

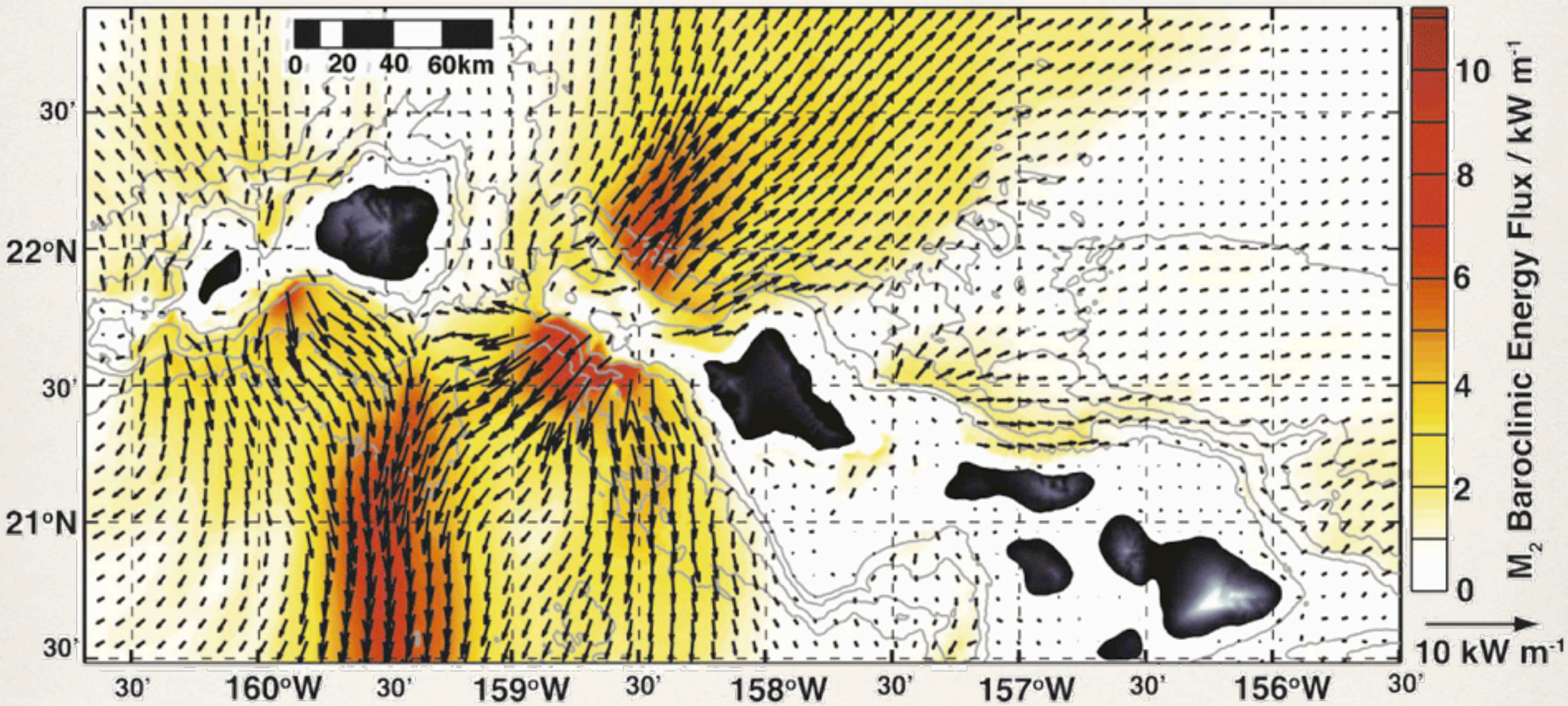

Sv
4
3
2
1
0
−1
−2
Jan08 Feb08 Mar08 Apr08 May08 Jun08 Jul08 Aug08 Sep08 Oct08 Nov08 Dec08 Jan09 Feb09 Mar09 Apr09 May09 Jun09 Jul09 Aug09 Sep09 Oct09 Nov09 Dec09 Jan10 Feb10 Mar10 Apr10 May10
Glider
Argo
SSH
HF
ADCP
SST
HOT


Percent
100
90
80
70
60
50
40
30
20
10
0
Jan08 Feb08 Mar08 Apr08 May08 Jun08 Jul08 Aug08 Sep08 Oct08 Nov08 Dec08 Jan09 Feb09 Mar09 Apr09 May09 Jun09 Jul09 Aug09 Sep09 Oct09 Nov09 Dec09 Jan10 Feb10 Mar10 Apr10 May10
Glider
Argo
SSH
HF
ADCP
SST
HOT

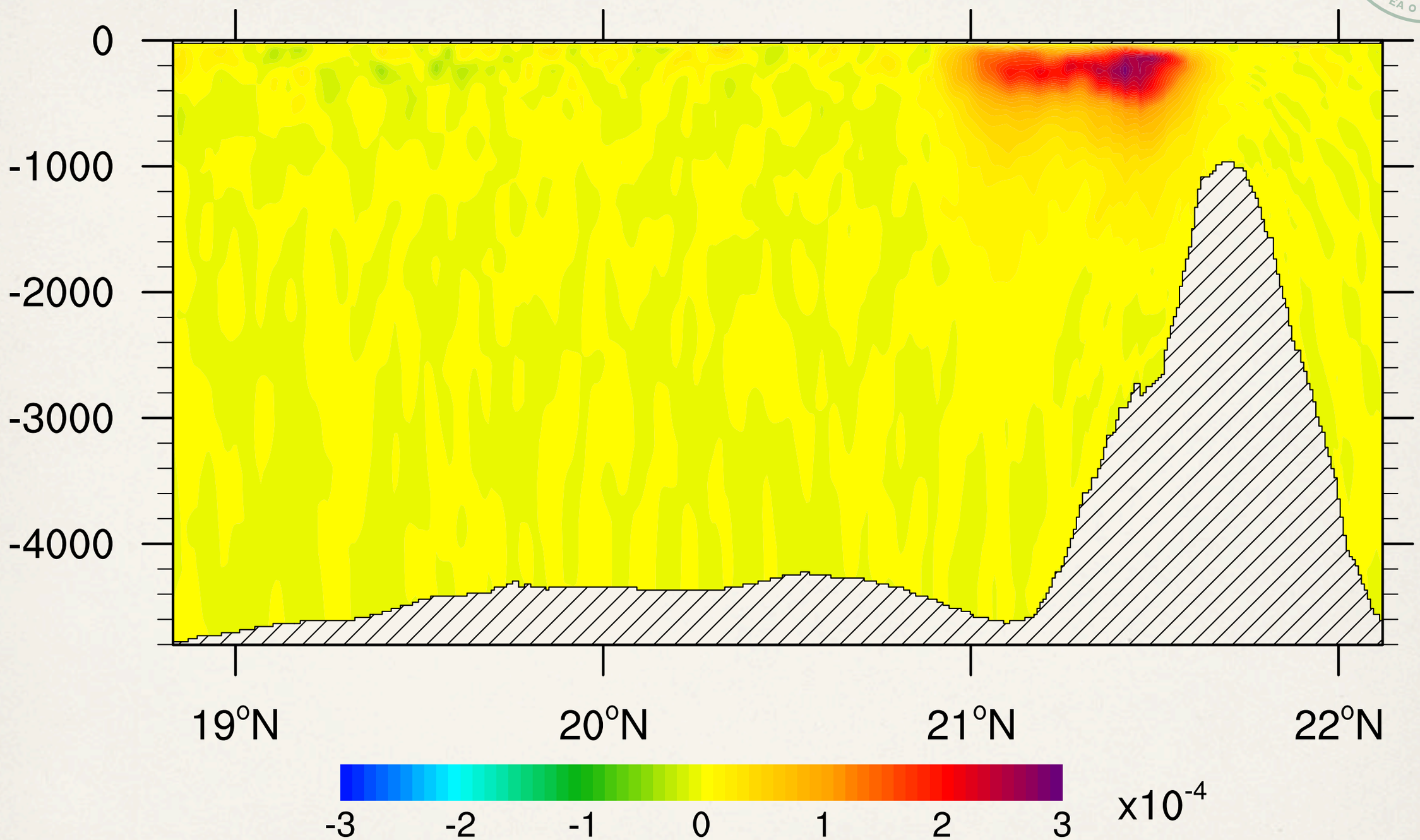

Glider RMS
24
23
22
21
20
19
18
-163
-162
-161
-160
-159
-158
-157
-156
-155
-154
-153
0.2
0.15
0.1
0.05
0

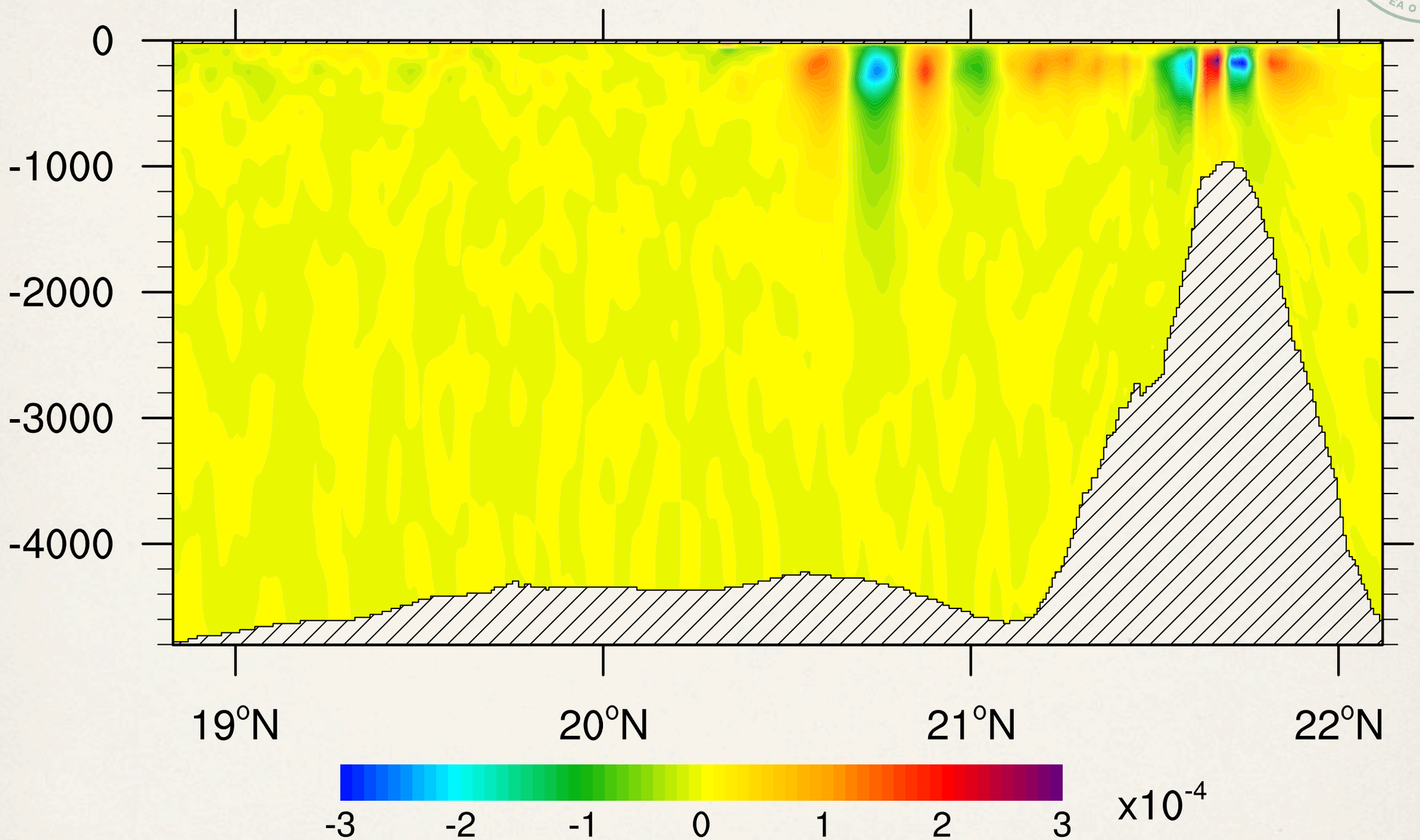

Argo RMS
24
23
22
21
20
19
18
-163
-162
-161
-160
-159
-158
-157
-156
-155
-154
-153
0.022
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002

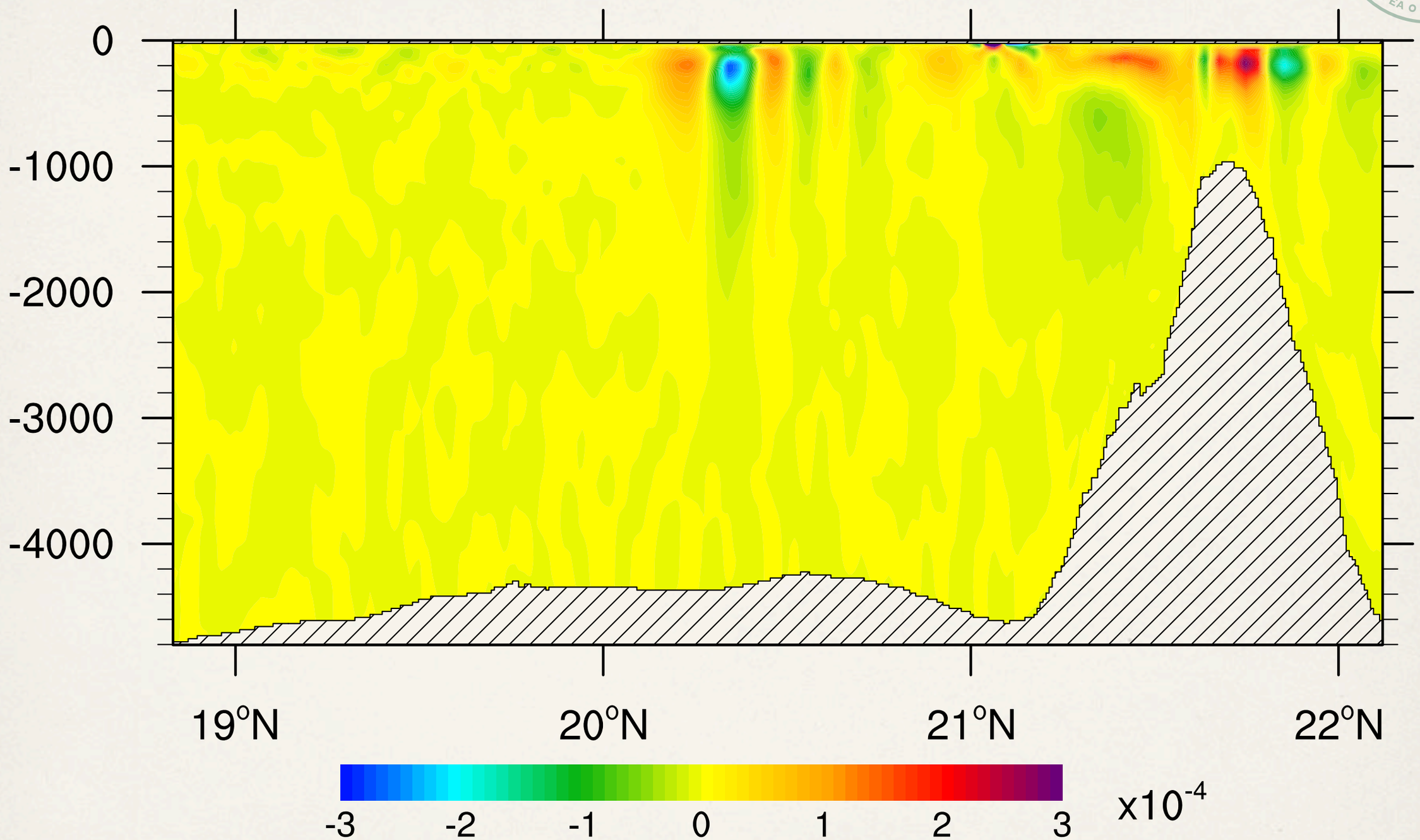

SST RMS
x 10^-3
24
23
22
21
20
19
18
-163
-162
-161
-160
-159
-158
-157
-156
-155
-154
-153
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0

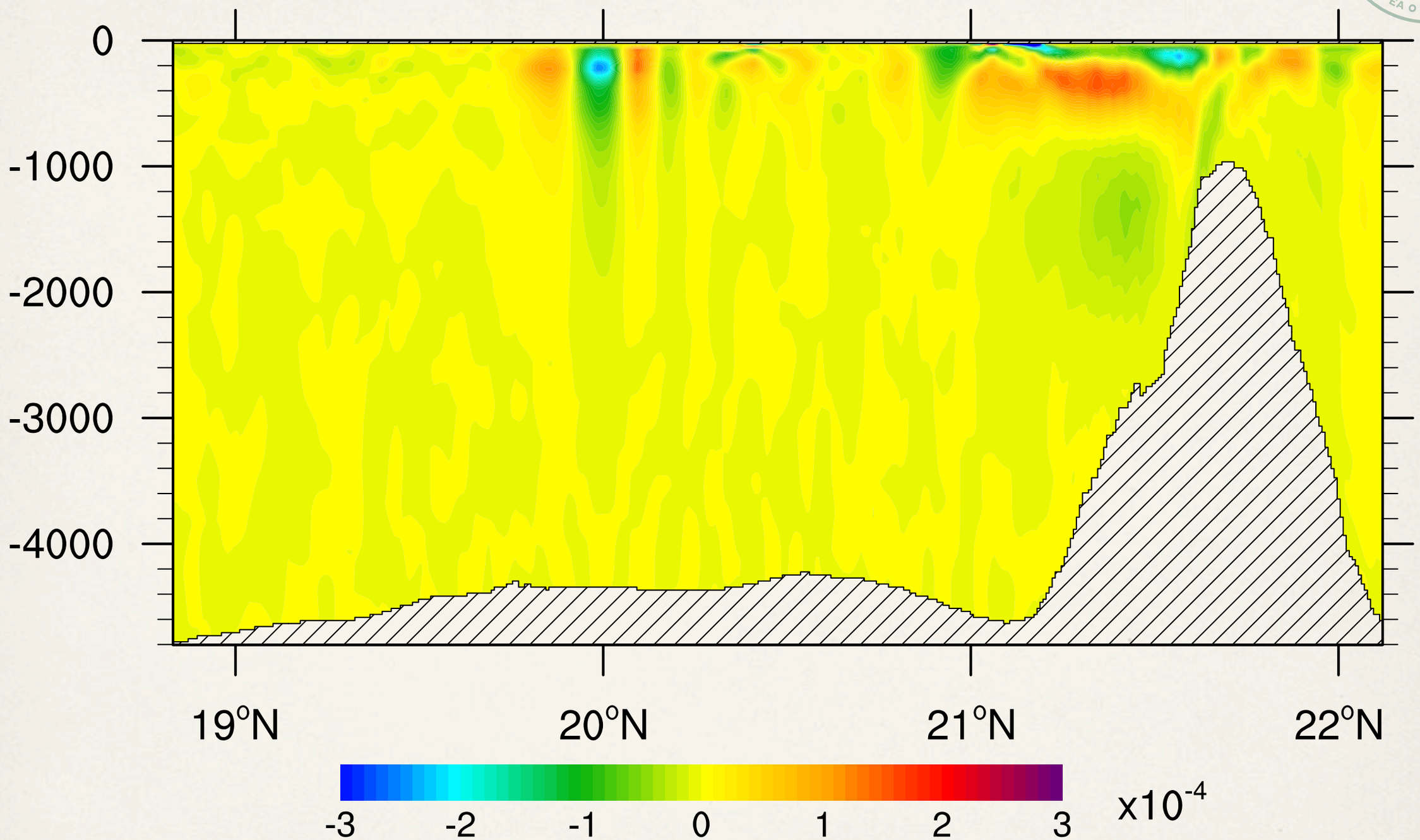


G. S. Carter, M. A. Merrifield, J. M. Becker, K. Katsumata, M. C. Gregg, D. S. Luther, M. D. Levine, T. J. Boyd, and Y. L. Firing. Energetics of M2 Barotropic-to-Baroclinic Tidal Conversion at the Hawaiian Islands. J. Phys. Oceanogr., 38:2,205–2,223, 2008.


0
-1000
-2000
-3000
-4000
19°N
20°N
21°N
22°N
-3
-2
-1
0
1
2
3
x10^-4


0
-1000
-2000
-3000
-4000
19°N
20°N
21°N
22°N
-3
-2
-1
0
1
2
3
x10^-4


0
-1000
-2000
-3000
-4000
19°N
20°N
21°N
22°N
-3
-2
-1
0
1
2
3
x10-4


0
-1000
-2000
-3000
-4000
19°N
20°N
21°N
22°N
-3
-2
-1
0
1
2
3
x10-4