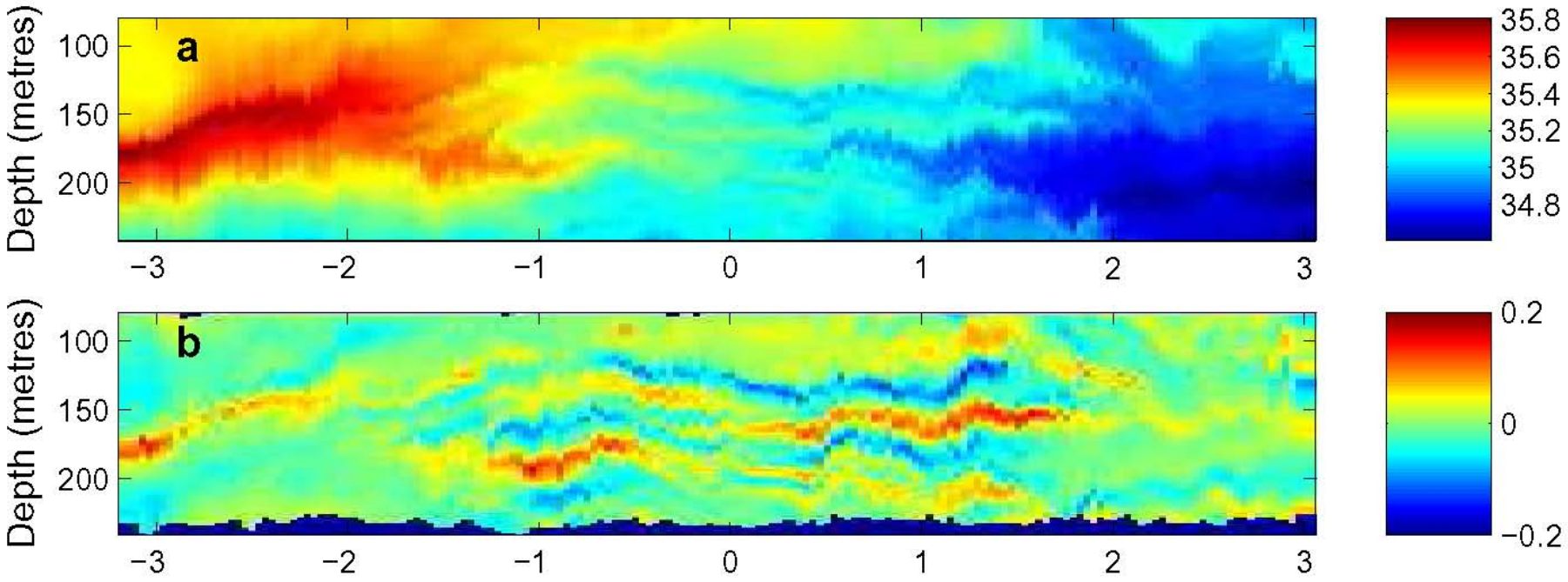
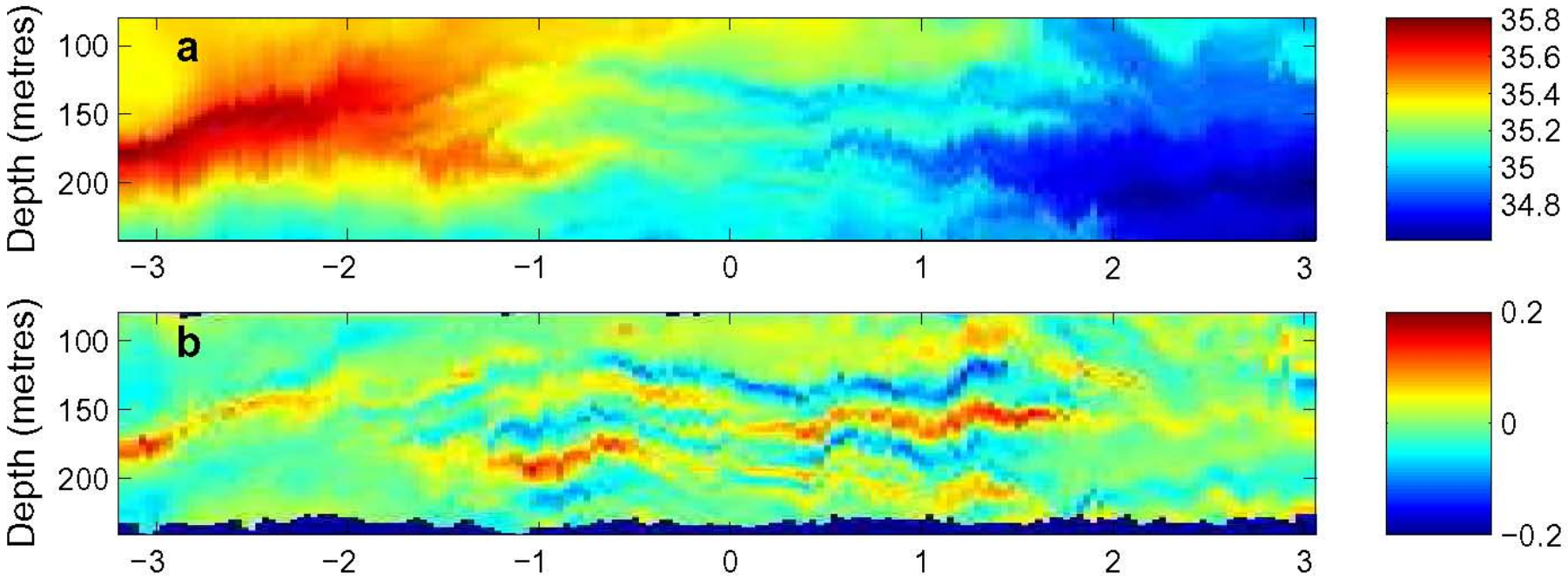
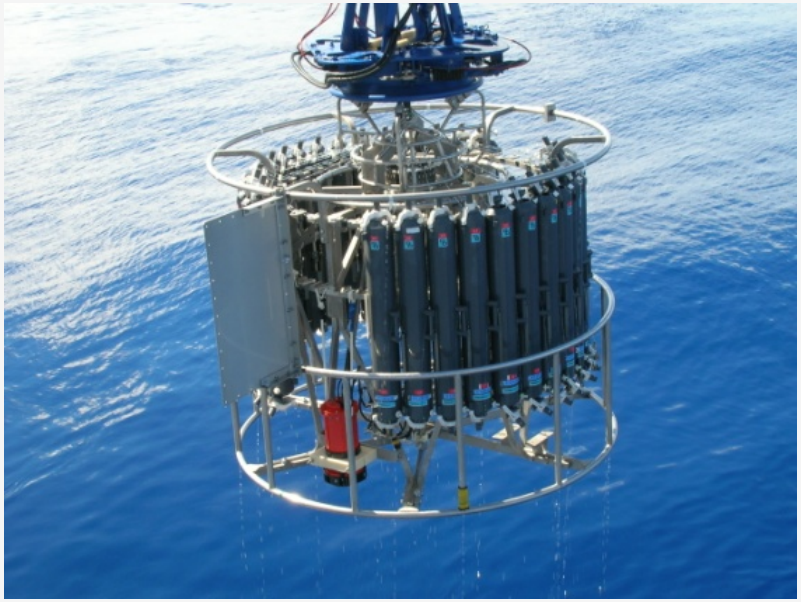
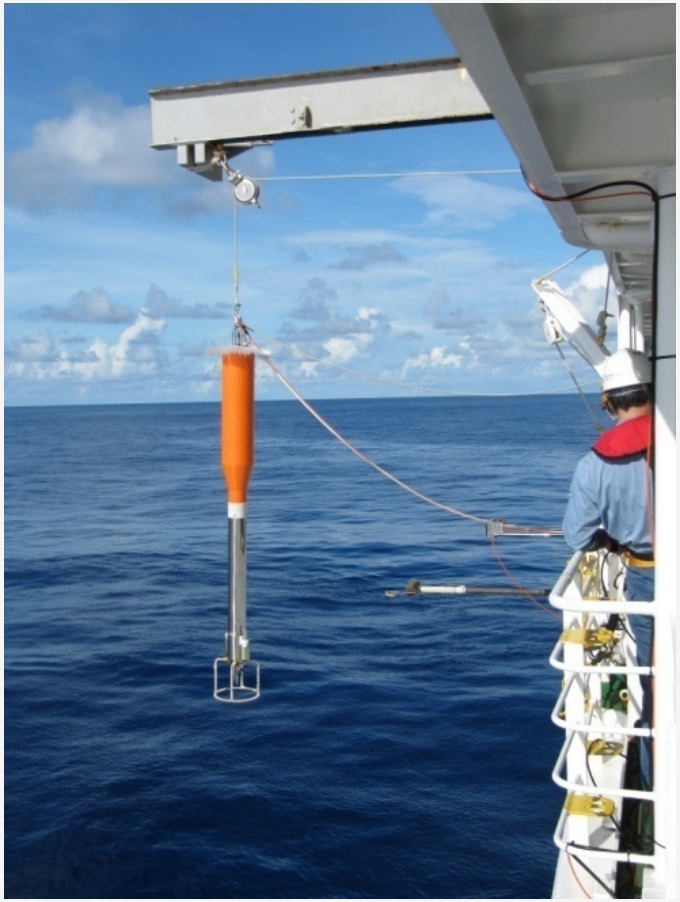
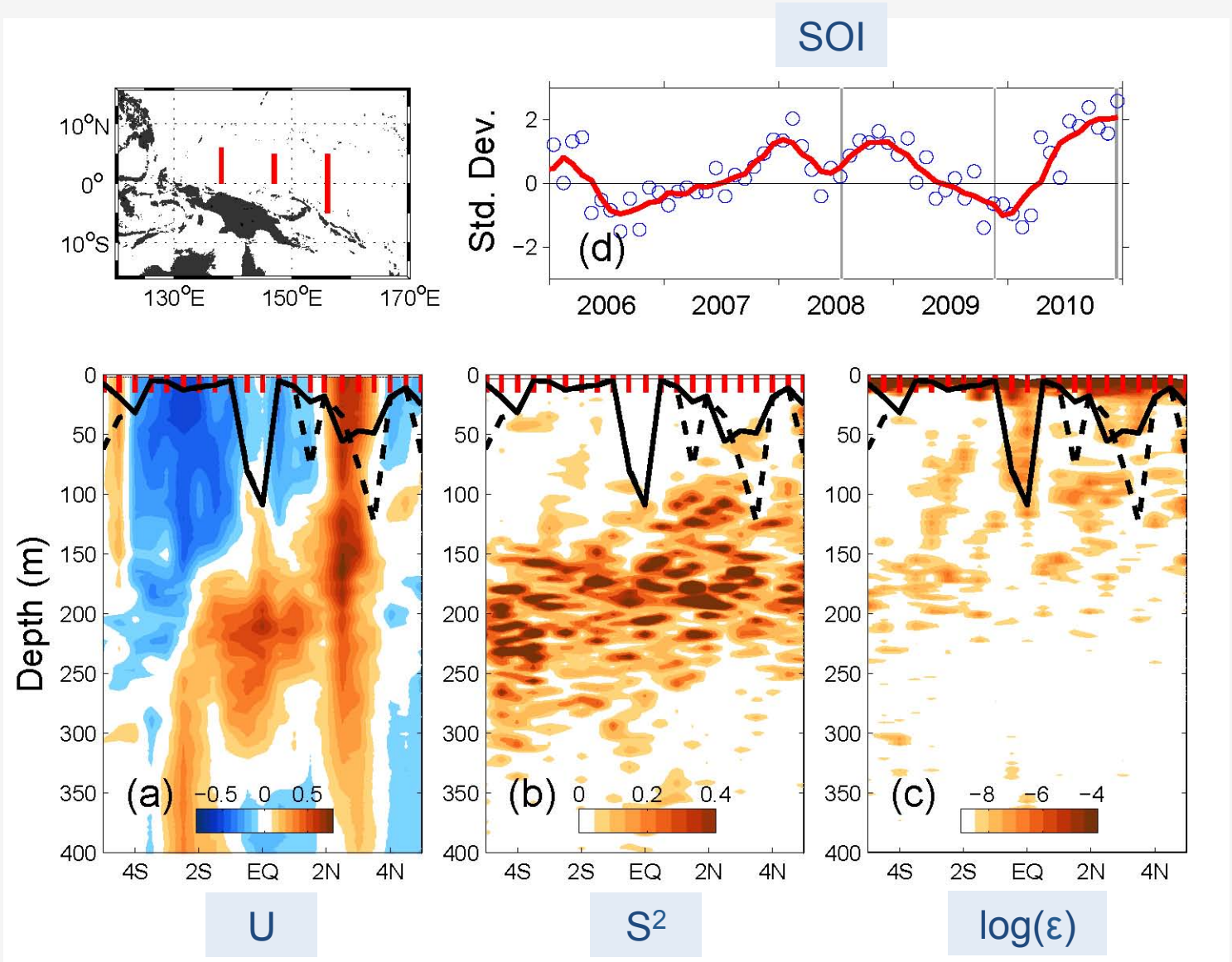

a
b
Depth (metres)
100
150
200
−3
−2
−1
0
1
2
3
35.8
35.6
35.4
35.2
35
34.8
0.2
0
−0.2

Salinity along 165E: April 1988





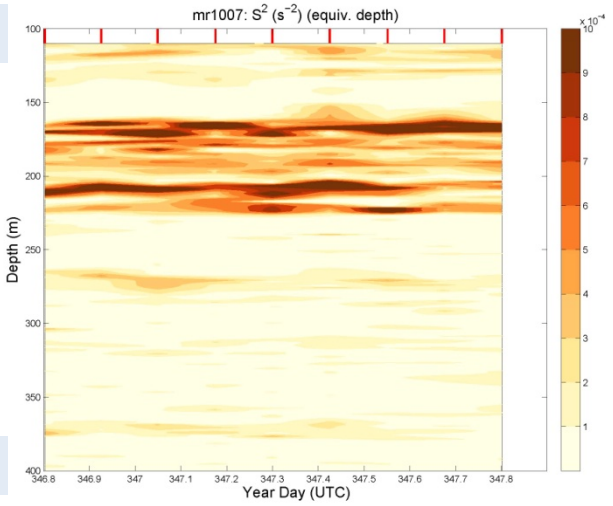




Richards et al GRL 2012

S^2

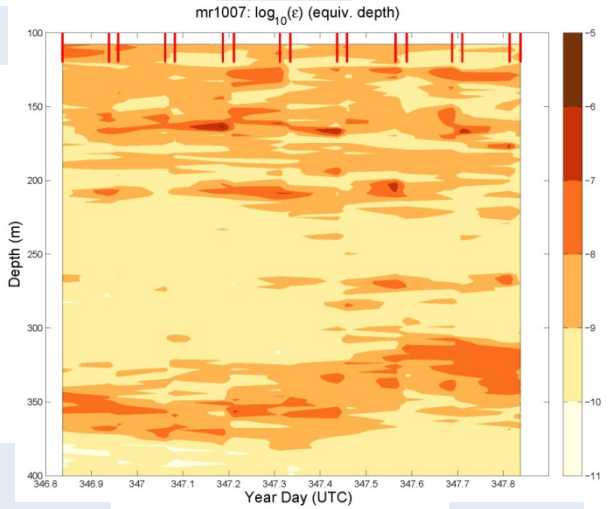
100m



400m

log(ε)

100m

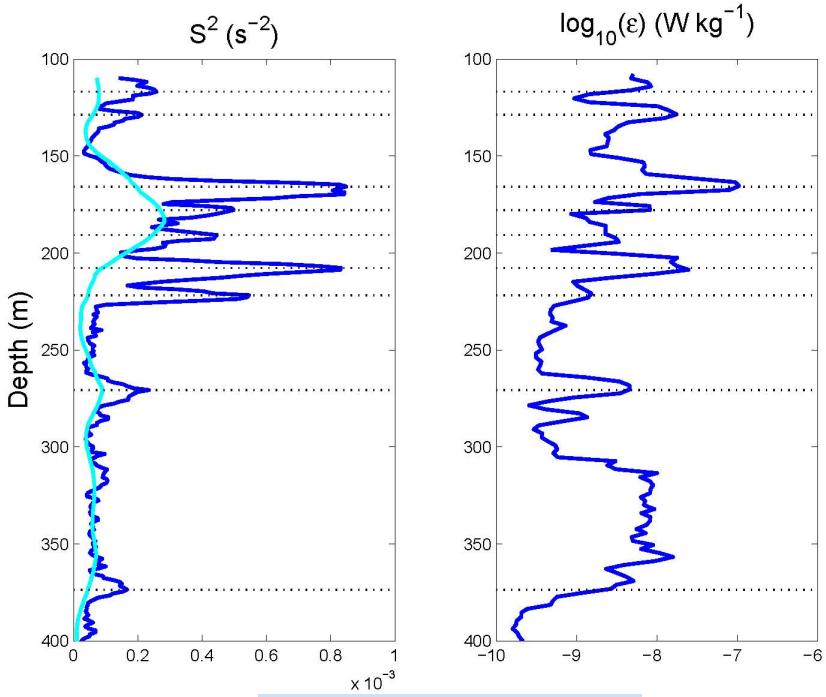


400m

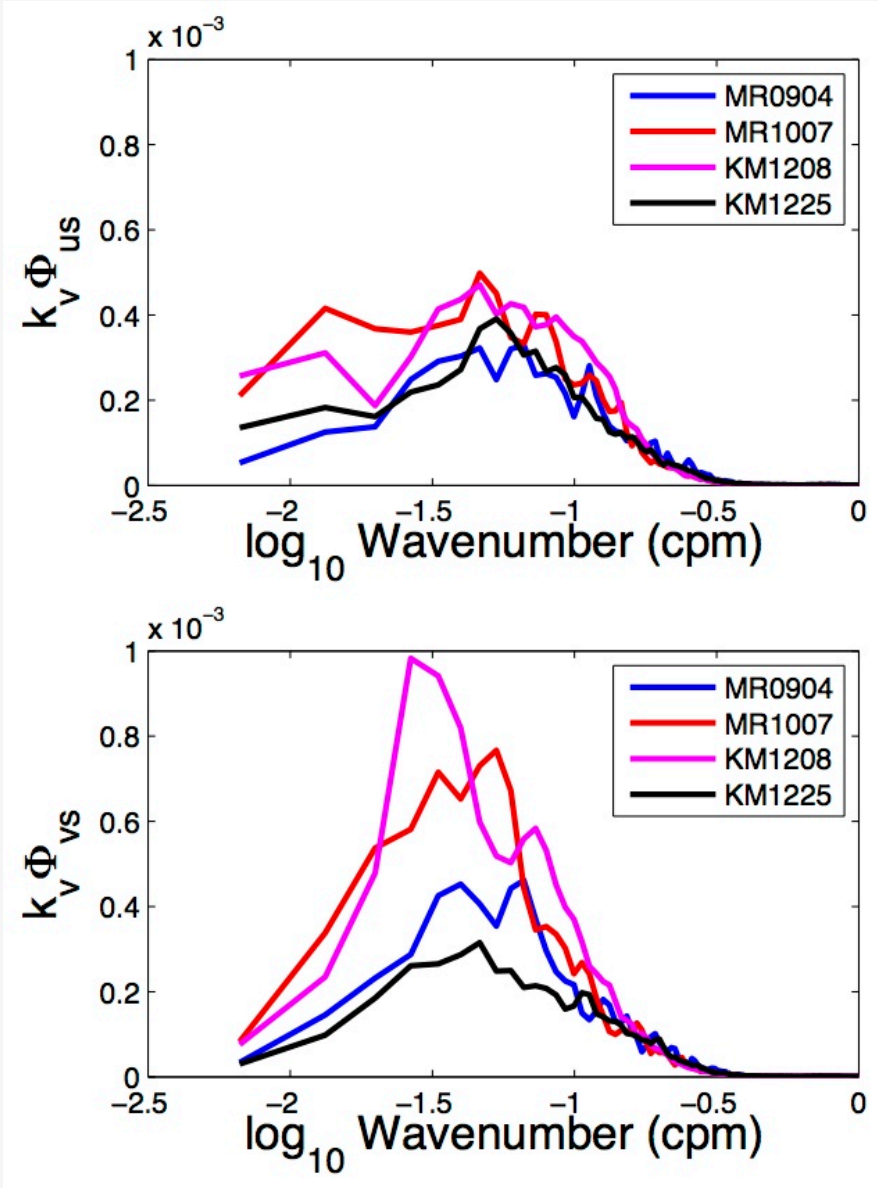
6am

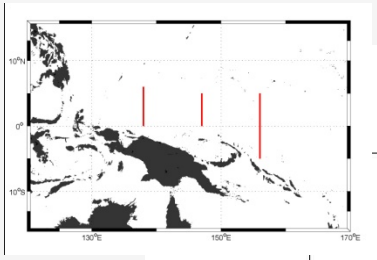
6am

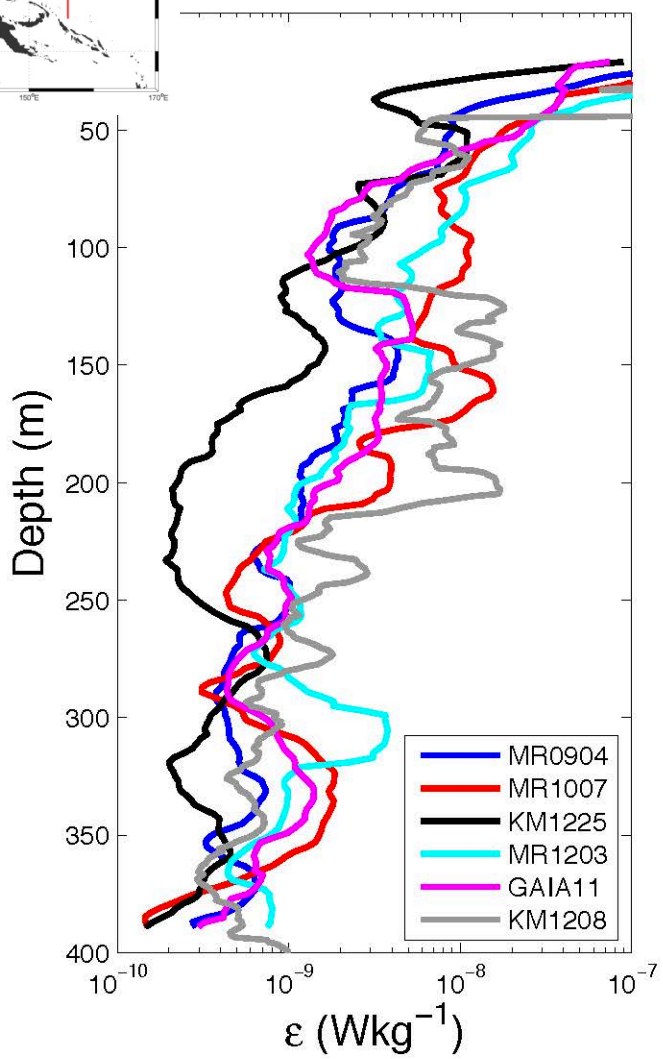
24hr Time Series

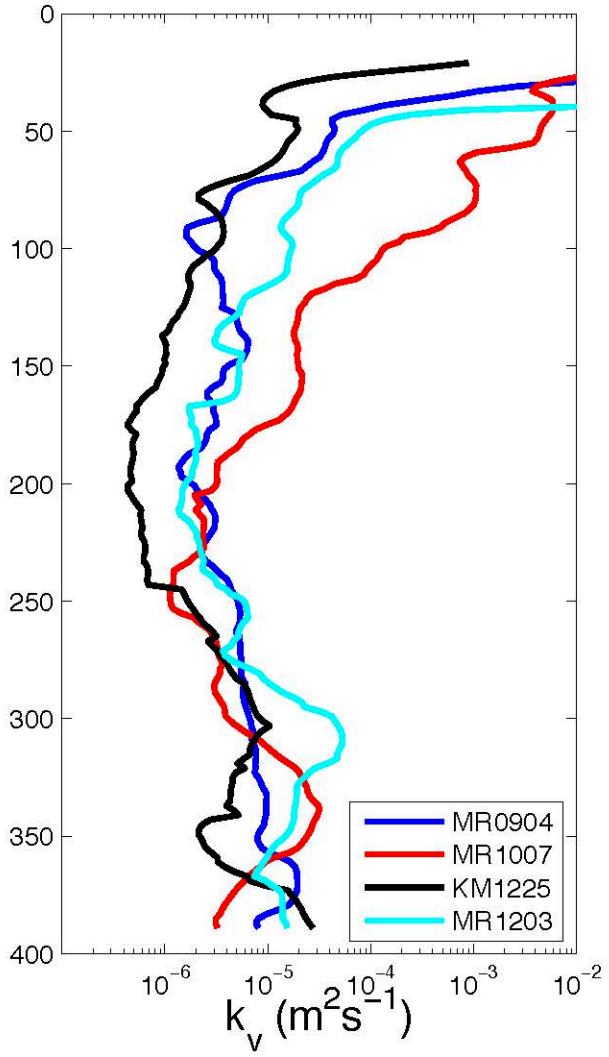


Time mean


x 10^-3
1
0.8
0.6
0.4
0.2
0
k Φ v us
MR0904
MR1007
KM1208
KM1225
−2.5
−2
−1.5
−1
−0.5
0
log10 Wavenumber (cpm)
x 10^-3
1
0.8
0.6
0.4
0.2
0
k Φ v vs
MR0904
MR1007
KM1208
KM1225
−2.5
−2
−1.5
−1
−0.5
0
log10 Wavenumber (cpm)




Depth (m)
50
100
150
200
250
300
350
400
10^{-10}
10^{-9}
10^{-8}
10^{-7}
ε (Wkg^{-1})
MR0904
MR1007
KM1225
MR1203
GAIA11
KM1208


0
50
100
150
200
250
300
350
400
10^{-6}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
k_v (m^{2}s^{-1})
MR0904
MR1007
KM1225
MR1203

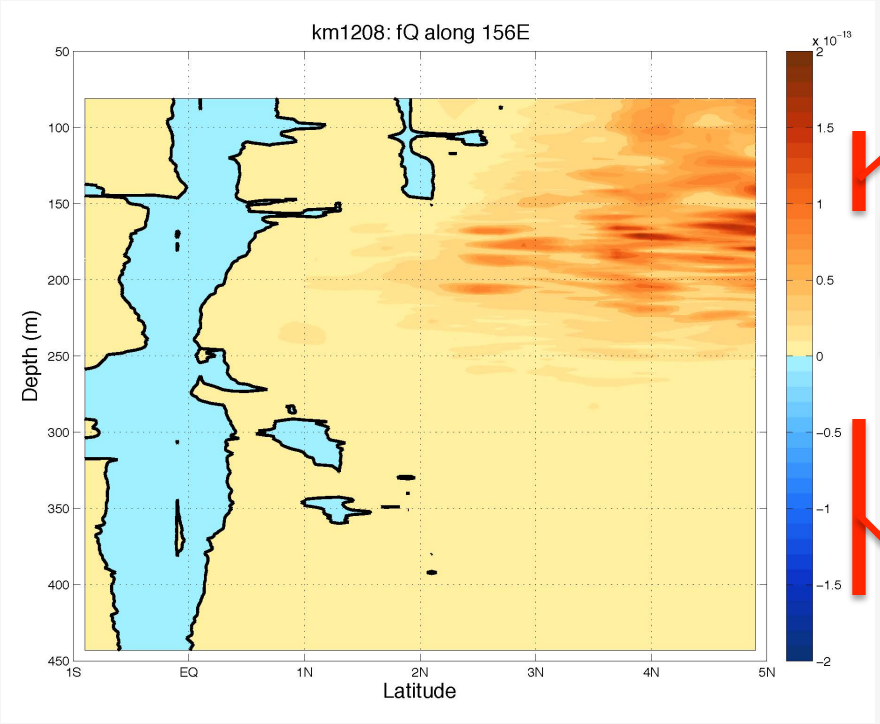
Two questions:

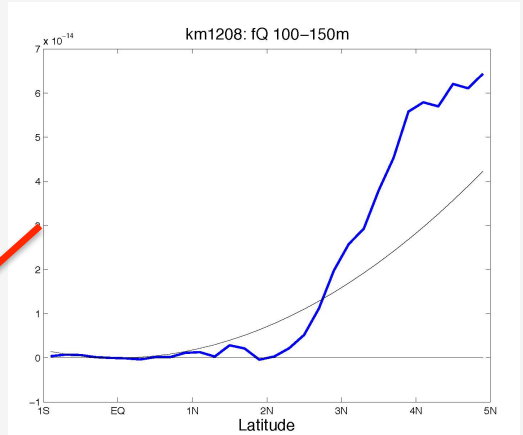
What causes the small vertical scale features?

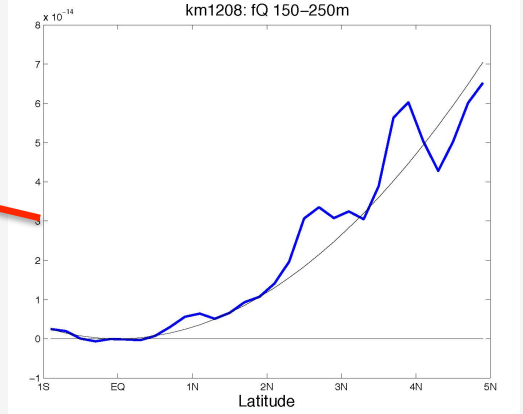
What is their impact?

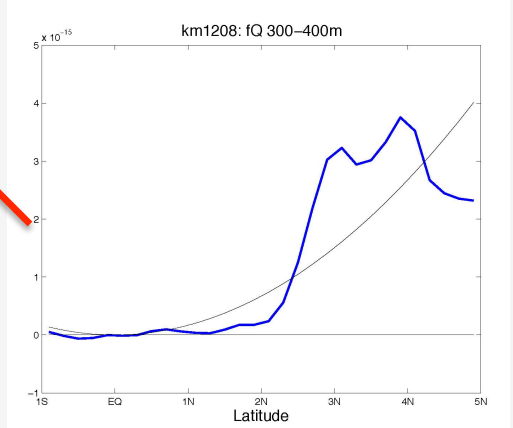
Instabilities

Shear + Oscillatory flow = Inertial Instability and/or PSI producing small vertical scales


km1208: fQ along 156E
Depth (m)
Latitude
1S
EQ
1N
2N
3N
4N
5N
50
100
150
200
250
300
350
400
450
x 10^-13
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2


km1208: fQ 100–150m
x 10^-14
Latitude
1S
EQ
1N
2N
3N
4N
5N

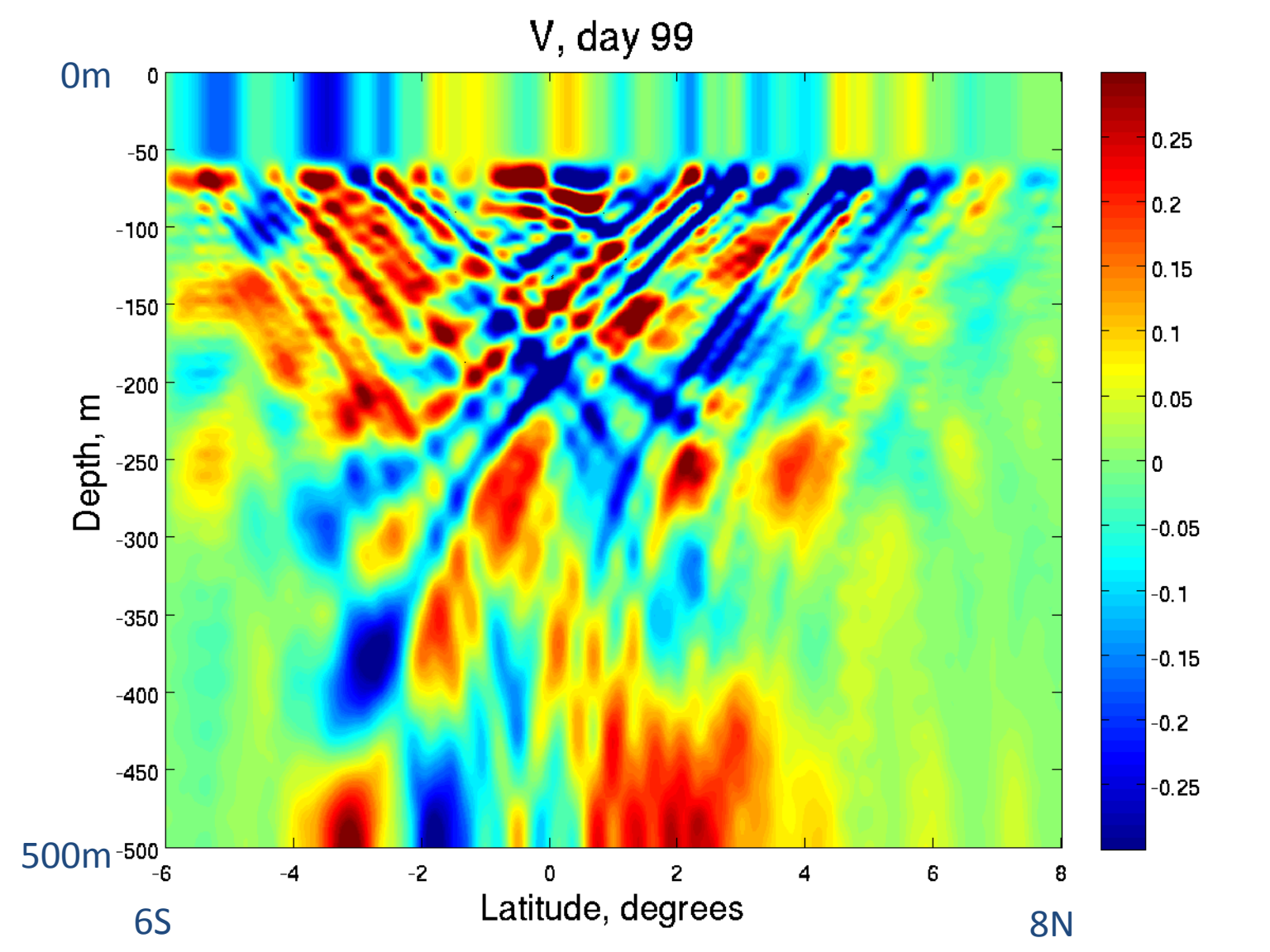

km1208: fQ 150–250m
x 10^-14
Latitude
1S
EQ
1N
2N
3N
4N
5N


km1208: fQ 300–400m
x 10^-15
Latitude
1S
EQ
1N
2N
3N
4N
5N

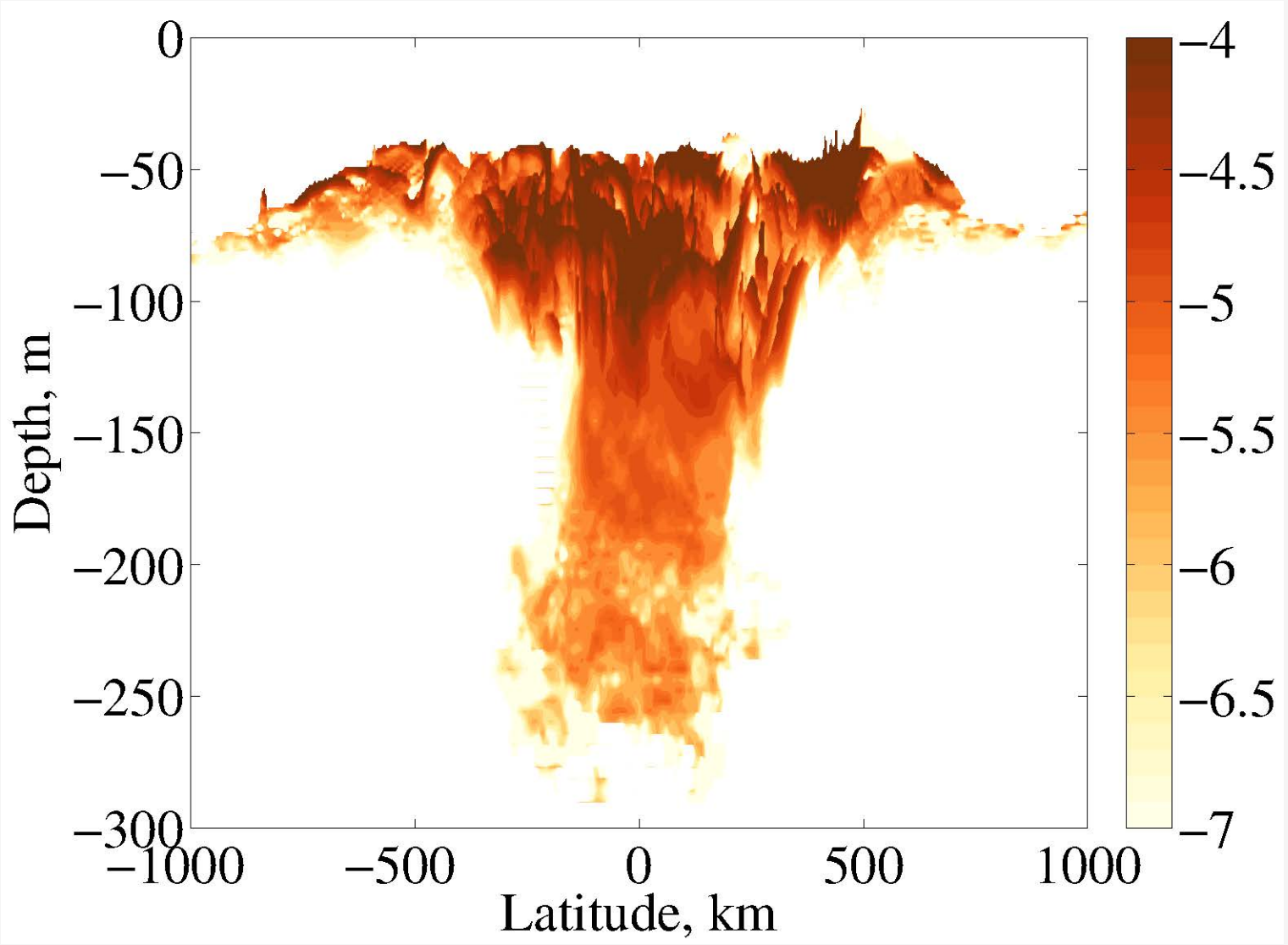
Wind

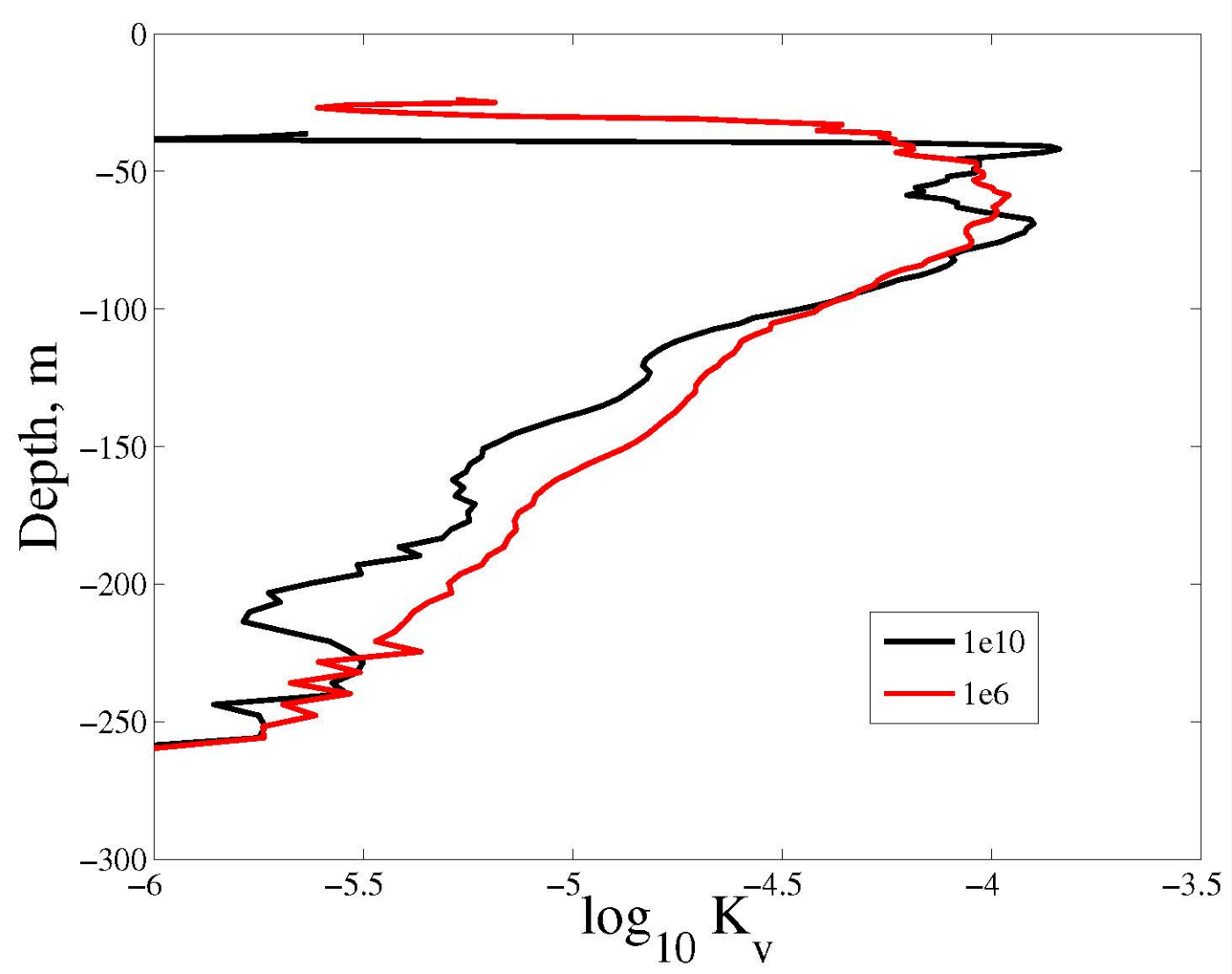
Production of near-inertial oscillations

Linear model forced with QuikSCAT along 156E

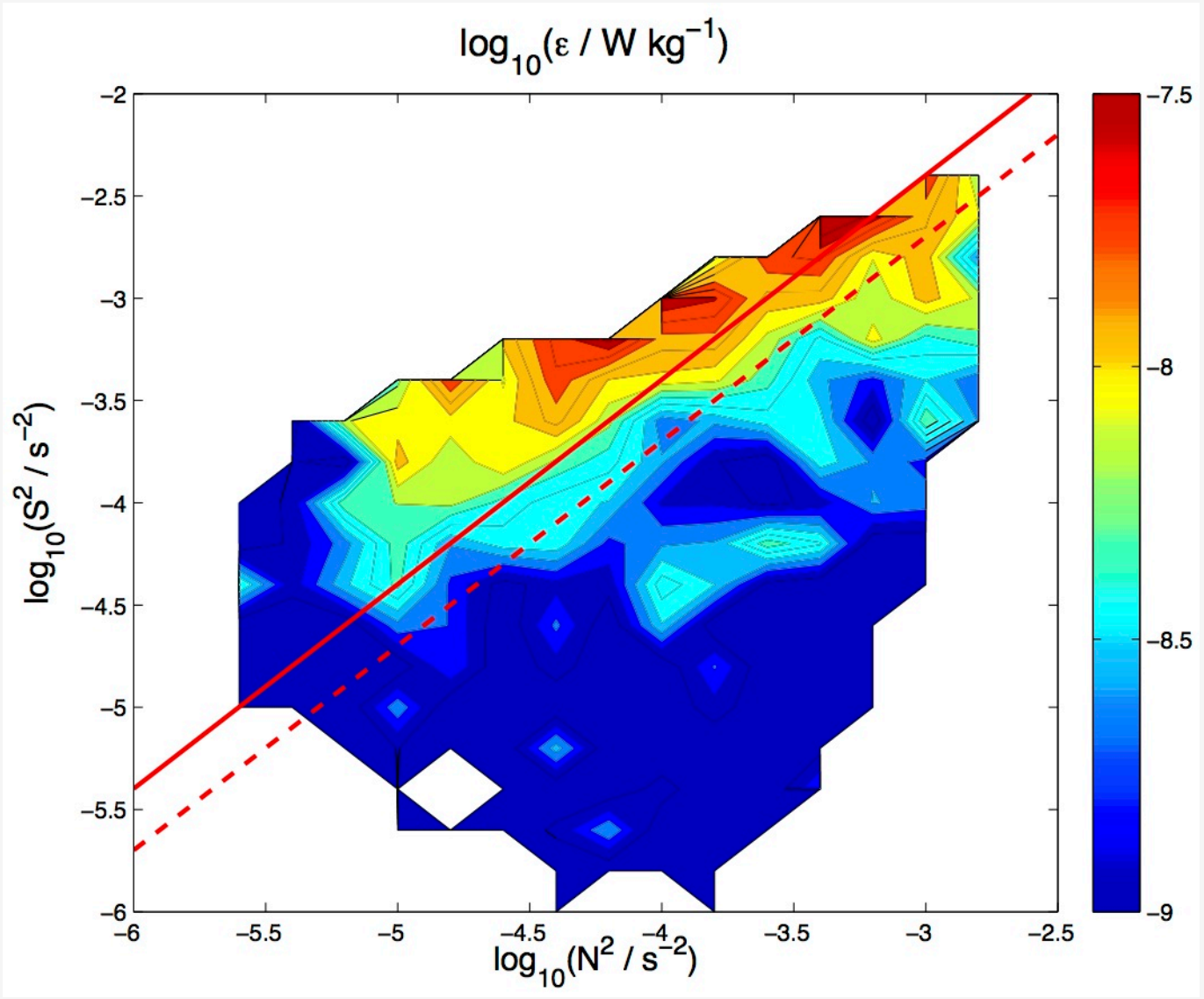


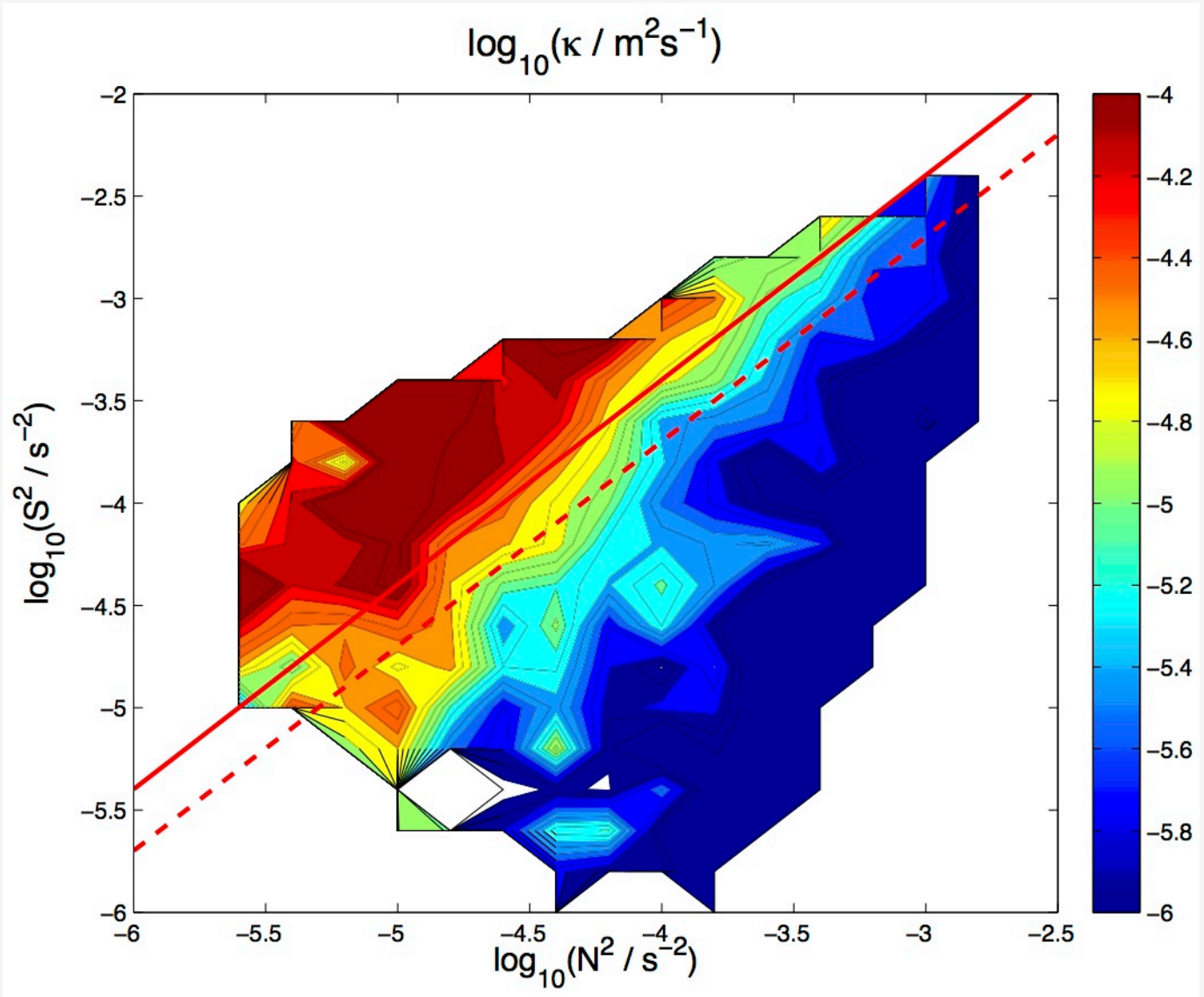
Time mean vertical diffusion coefficient

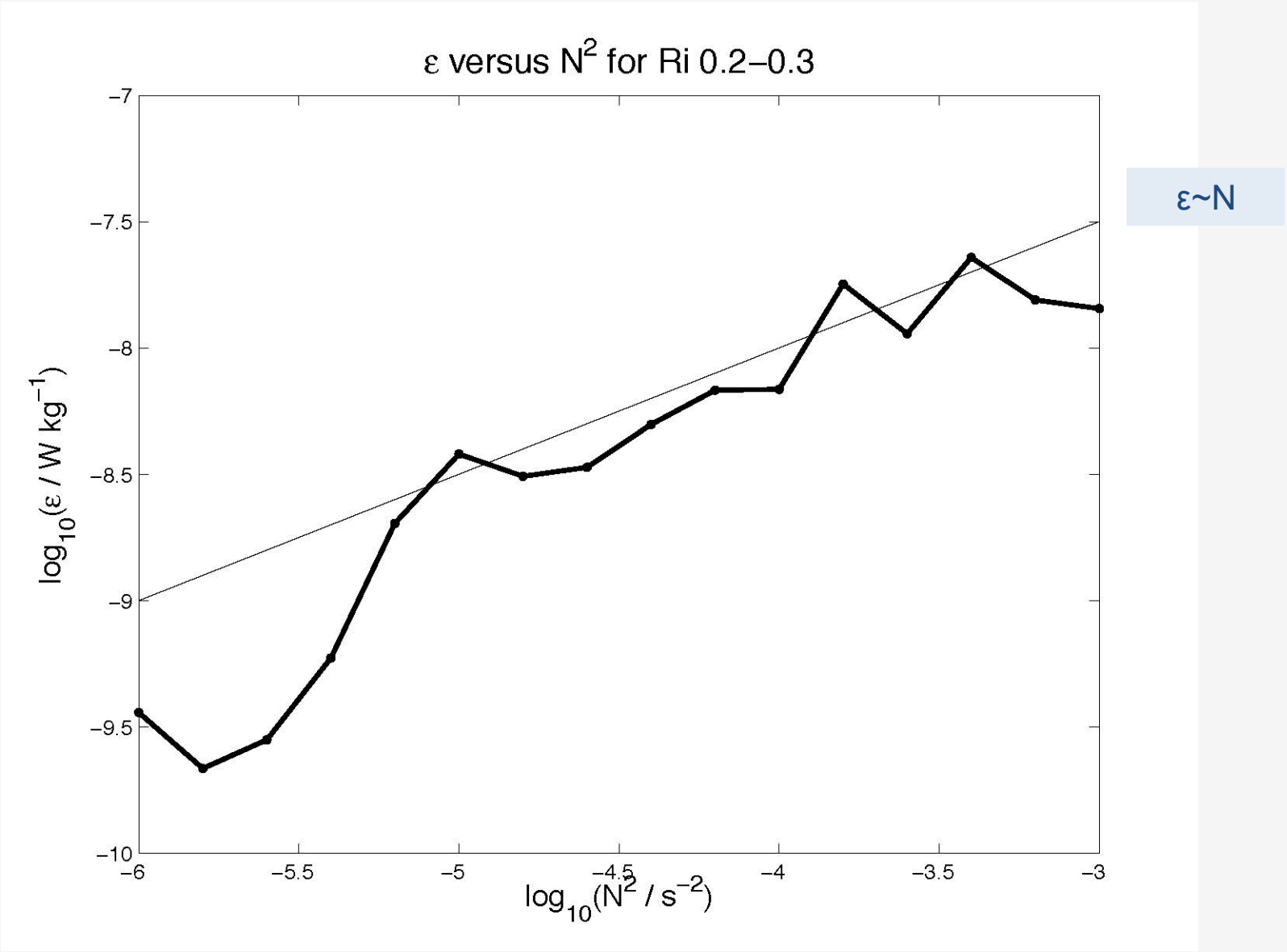



0
−50
−100
−150
−200
−250
−300
Depth, m
−6
−5.5
−5
−4.5
−4
−3.5
log10 Kv
1e10
1e6

Towards a parameterization ….


log10(ε / W kg−1)
log10(S2 / s−2)
log10(N2 / s−2)
−2
−2.5
−3
−3.5
−4
−4.5
−5
−5.5
−6
−6
−5.5
−5
−4.5
−4
−3.5
−3
−2.5
−7.5
−8
−8.5
−9


log10(κ / m2s−1)
log10(S2 / s−2)
log10(N2 / s−2)
−2
−2.5
−3
−3.5
−4
−4.5
−5
−5.5
−6
−6
−5.5
−5
−4.5
−4
−3.5
−3
−2.5
−4
−4.2
−4.4
−4.6
−4.8
−5
−5.2
−5.4
−5.6
−5.8
−6


ε versus N2 for Ri 0.2–0.3
−7
−7.5
−8
−8.5
−9
−9.5
−10
−6
−5.5
−5
−4.5
−4
−3.5
−3
log10(ε / W kg−1)
log10(N2 / s−2)

ε~N

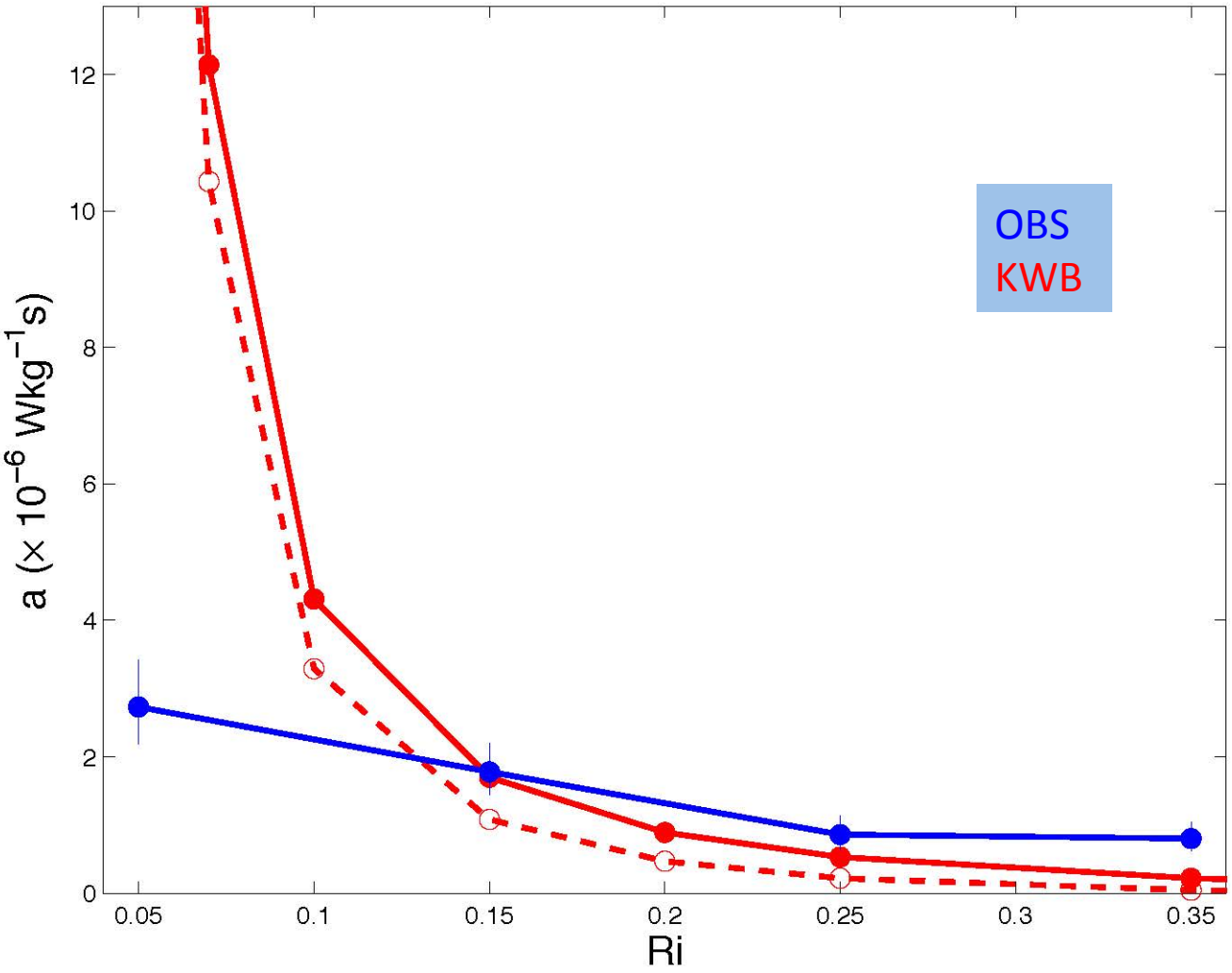
$$\epsilon_{KWB} = \Delta z^2 N^3 f(Ri)$$

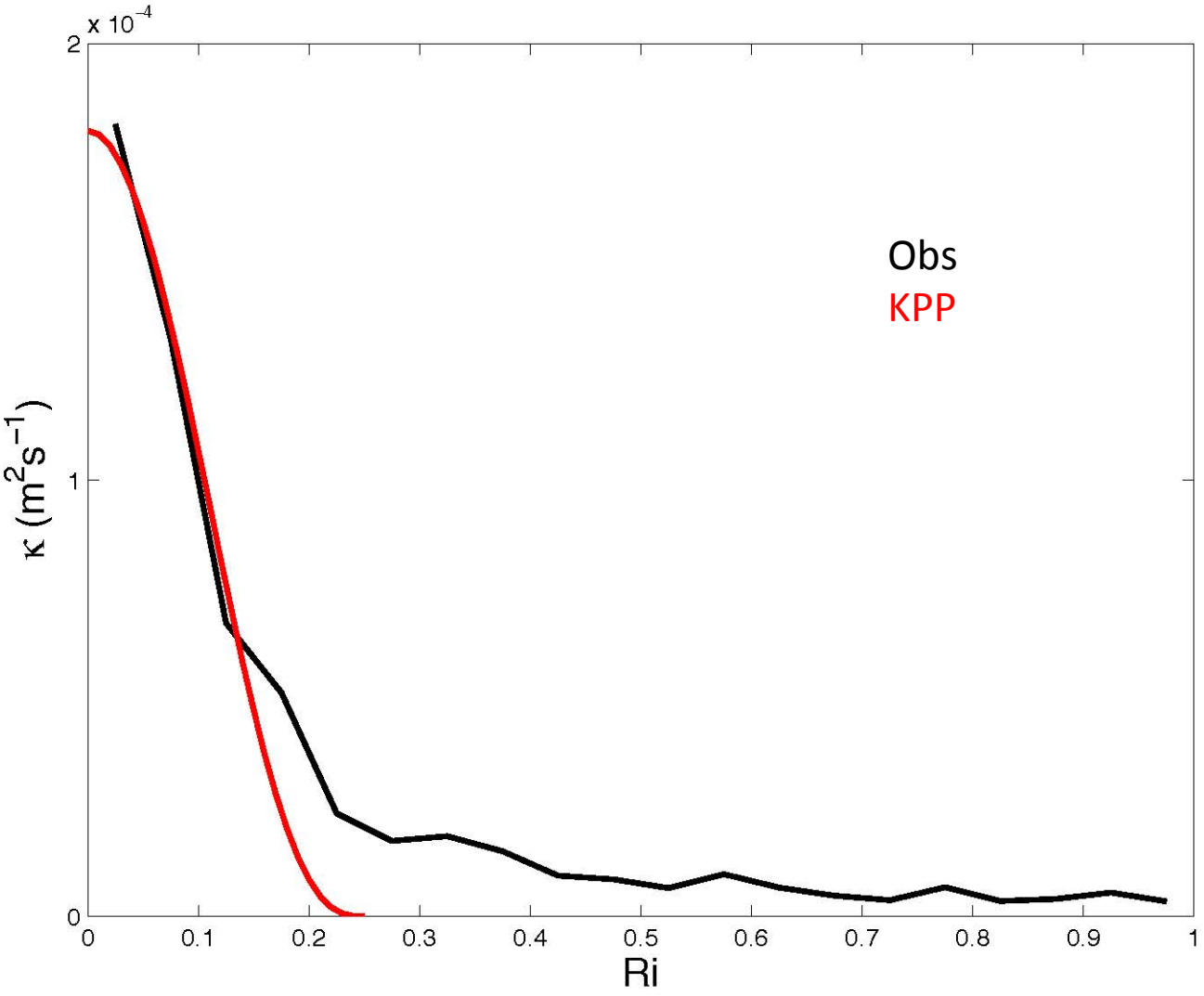
$$\kappa_{KWB} = \gamma \Delta z^2 N f(Ri)$$

$$\Delta z = \frac{\tilde{u}}{N} \qquad (N > N_o)$$

$$\kappa = \frac{\tilde{u}^2}{N} f(Ri)$$

f(Ri)



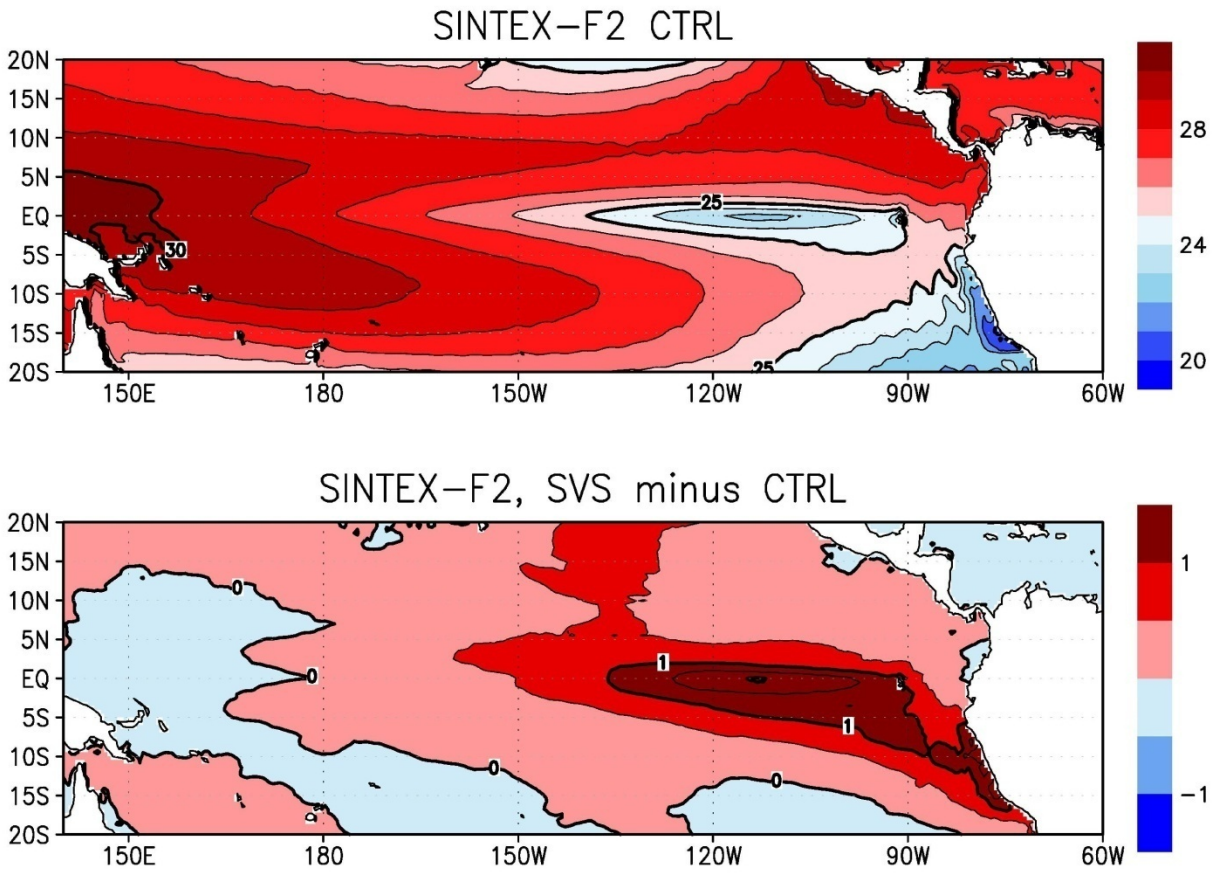

x 10^-4
2
1
0
κ (m^2s^-1)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Ri
Obs
KPP

Parameterization if S^2, N^2 **NOT** resolved

$$\kappa(\mathbf{x}, t) = \frac{\gamma}{N^2}\,\epsilon(S^2, N^2)$$

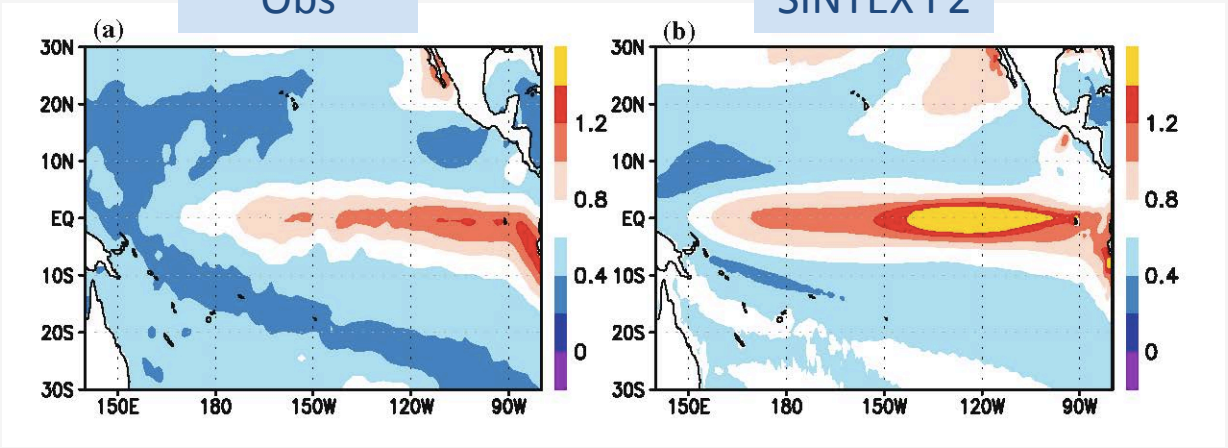
$$(S^2, N^2) \sim (\langle U \rangle, \langle N \rangle^2, F(x - x', t - t'), F_T \downarrow)$$

Impact of increasing background diffusivity above the equatorial thermocline in a coupled model

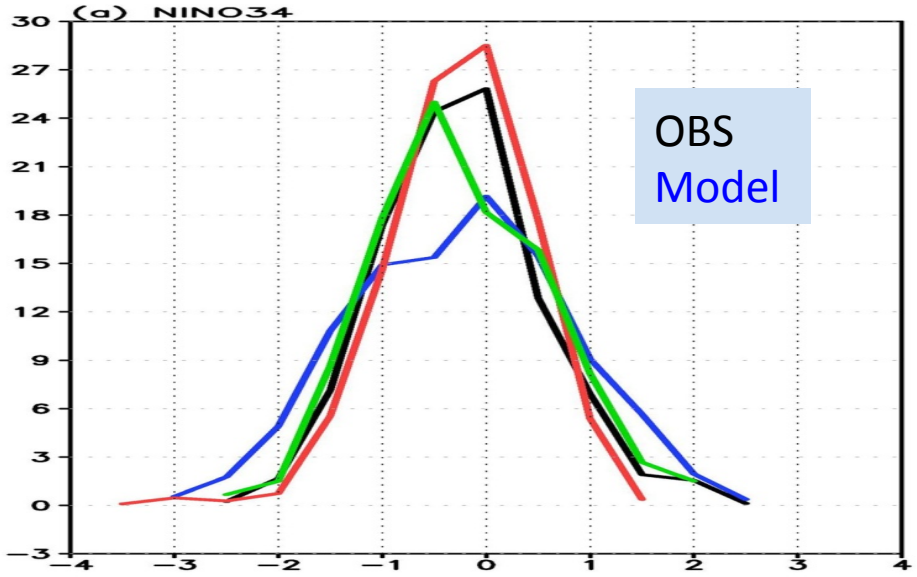


Obs

SINTEX F2



Standard deviation SST monthly SST anomalies



OBS

Model

PDF Nino 3.4 SST