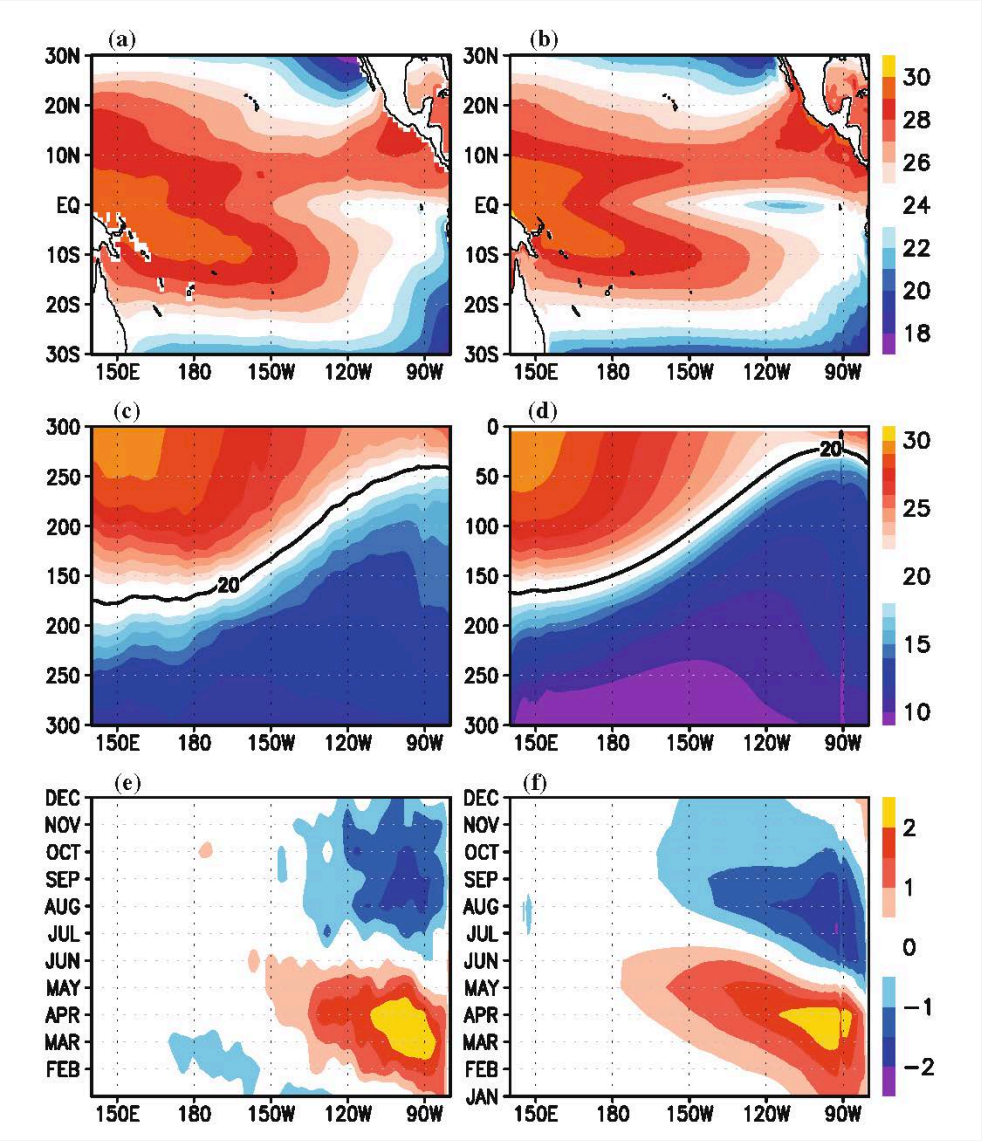
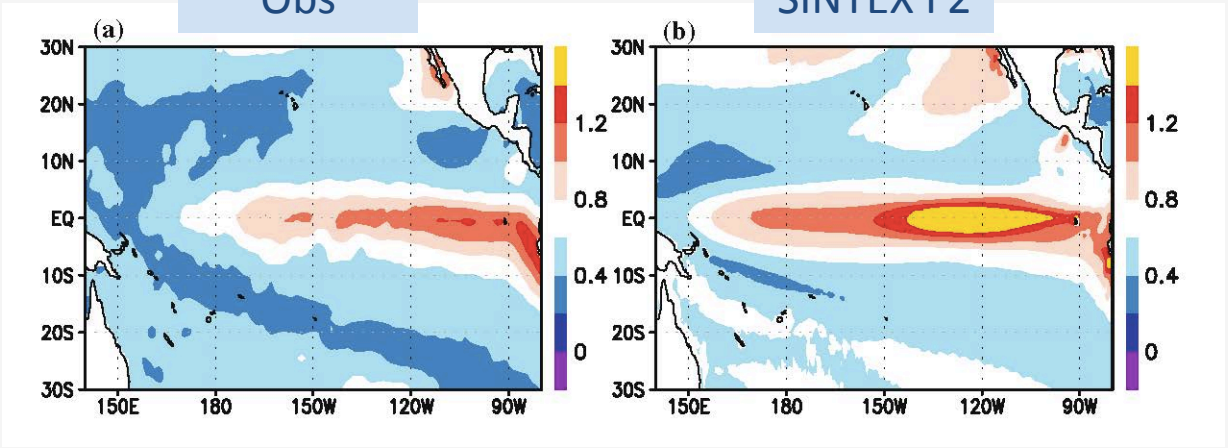


Obs

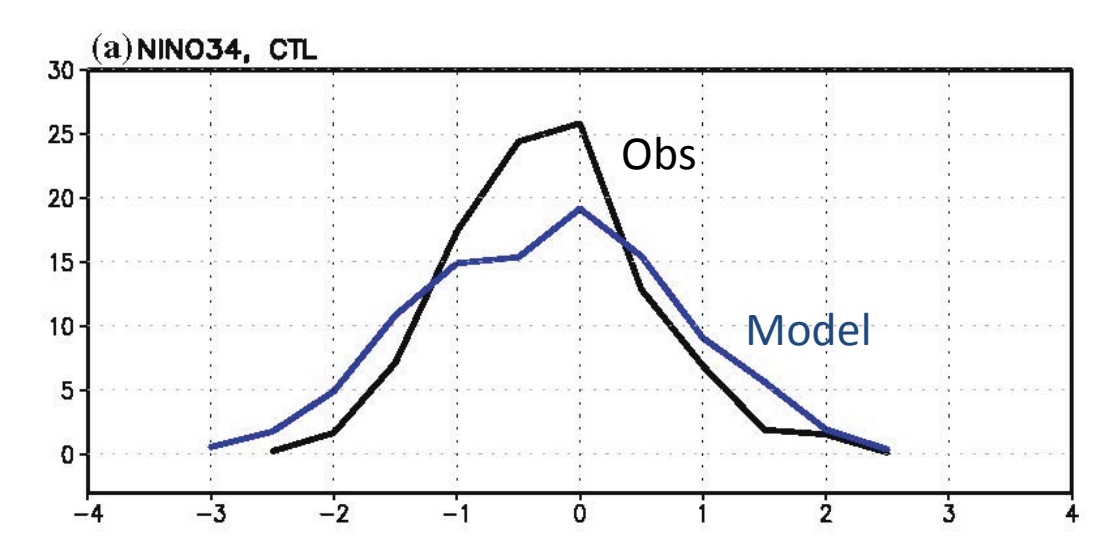
SINTEX F2

Obs

SINTEX F2

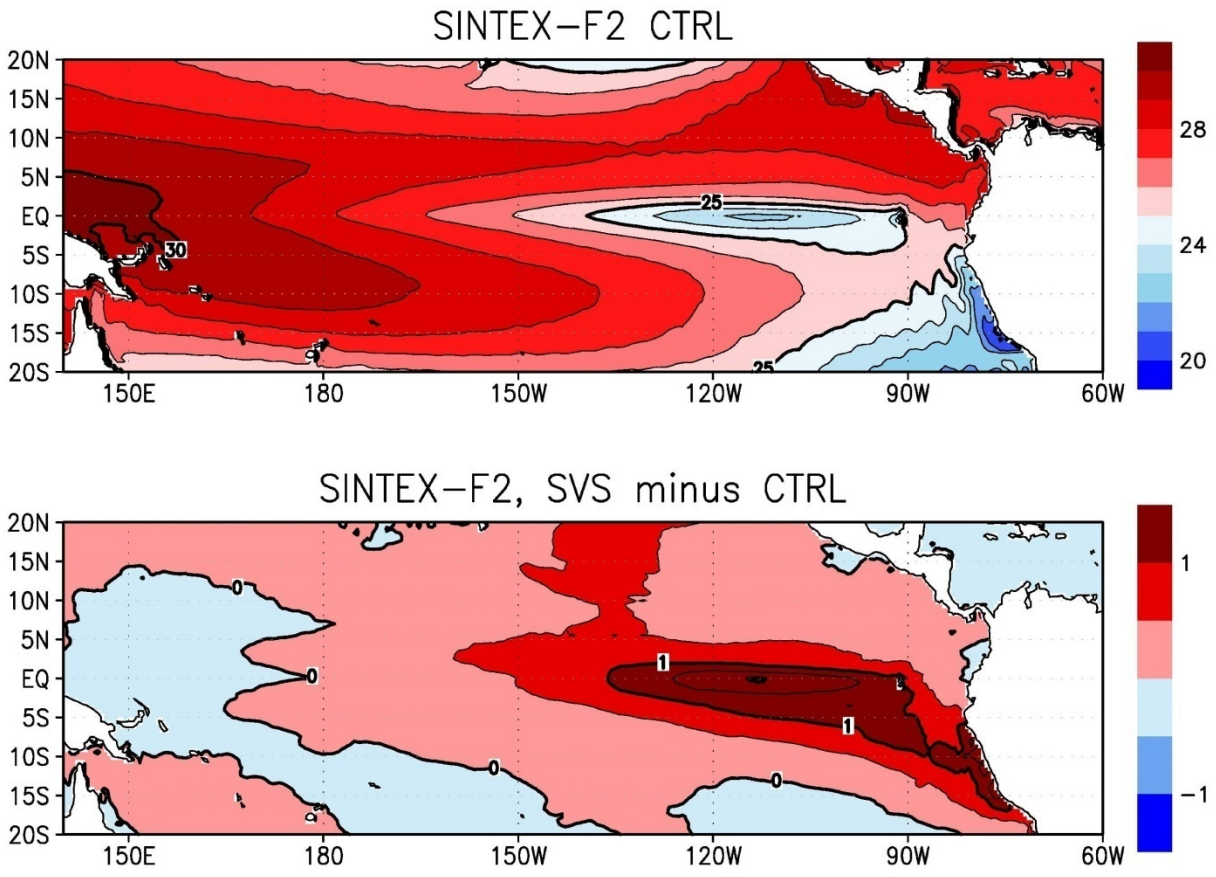


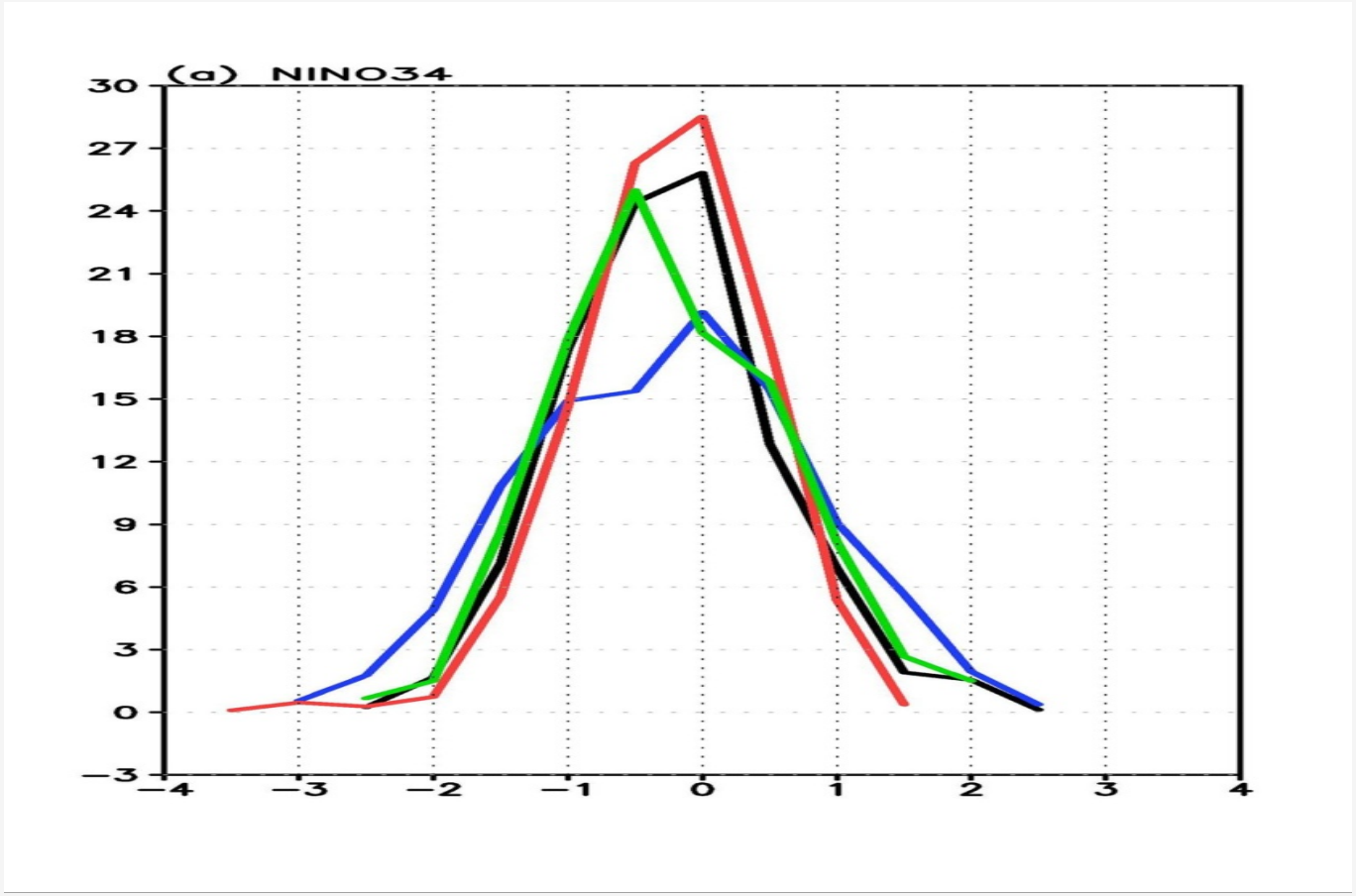
Standard deviation SST monthly SST anomalies



PDF Nino 3.4 SST

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





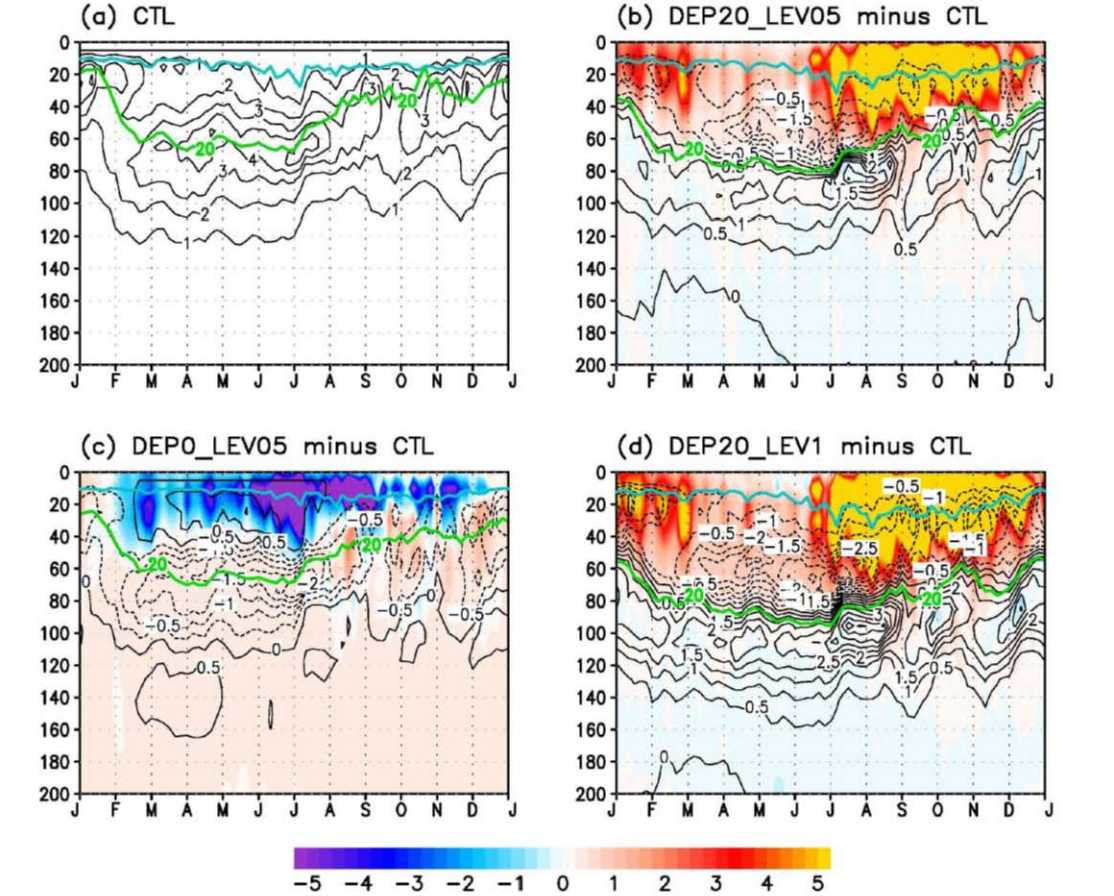
Nino3.4 skewness

CTL	**-0.02**
SVS	**-0.52**
SVS_N2	**0.3**
OBS	**0.33**

Saski et al Ocean Modelling 2012

Sasaki et al Climate Dynamics 2013

Changes to stratification and vertical mixing by SVS enhanced mixing: 2S-2N, 100-120W



Contours: change to N^2 ($x10^{-4}$ s^{-1}). Color: changes to K_v ($x10^{-4}$ m^2s^{-1})

Vertical mixing in the ocean

Global coupled model: SINTEX-F

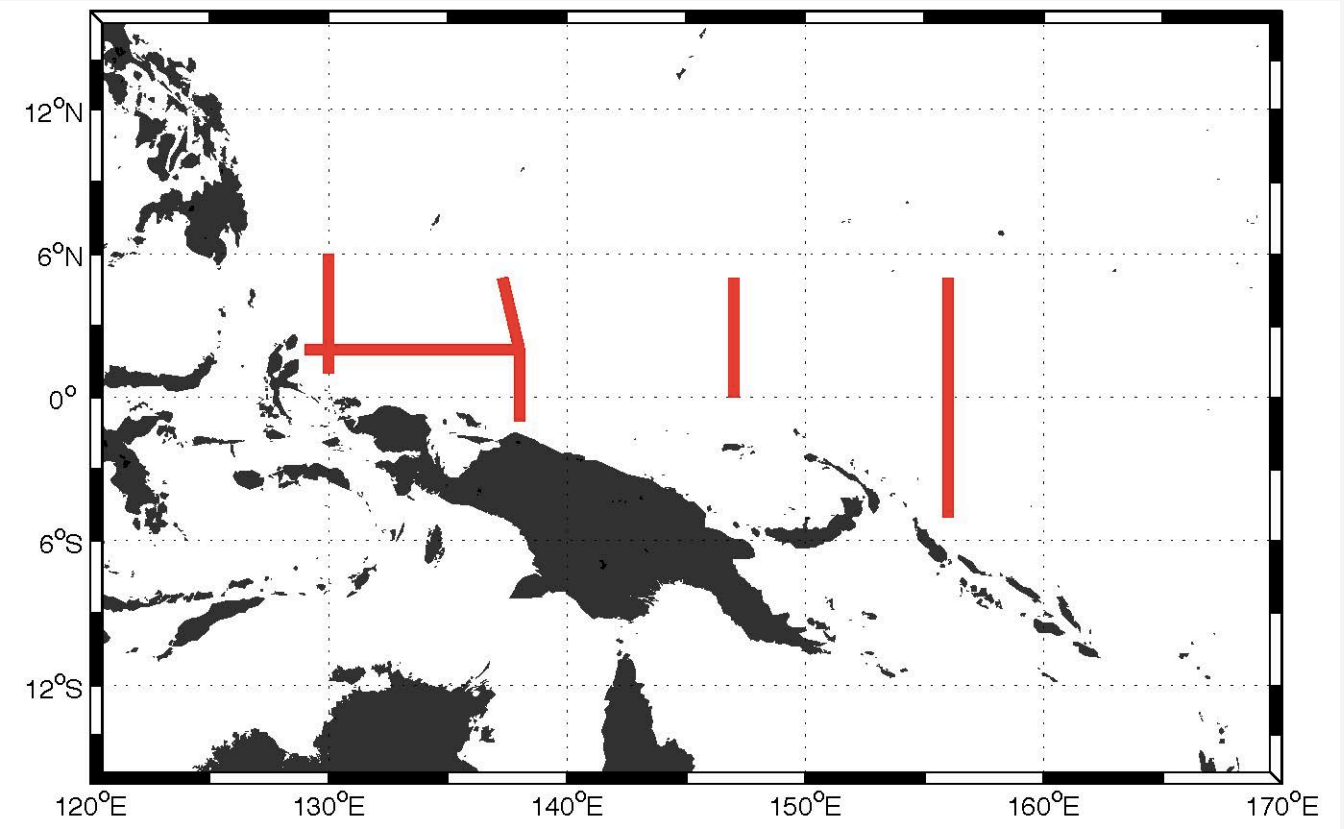
Vertical mixing in the ocean is parameterized using an EKE scheme, i.e.

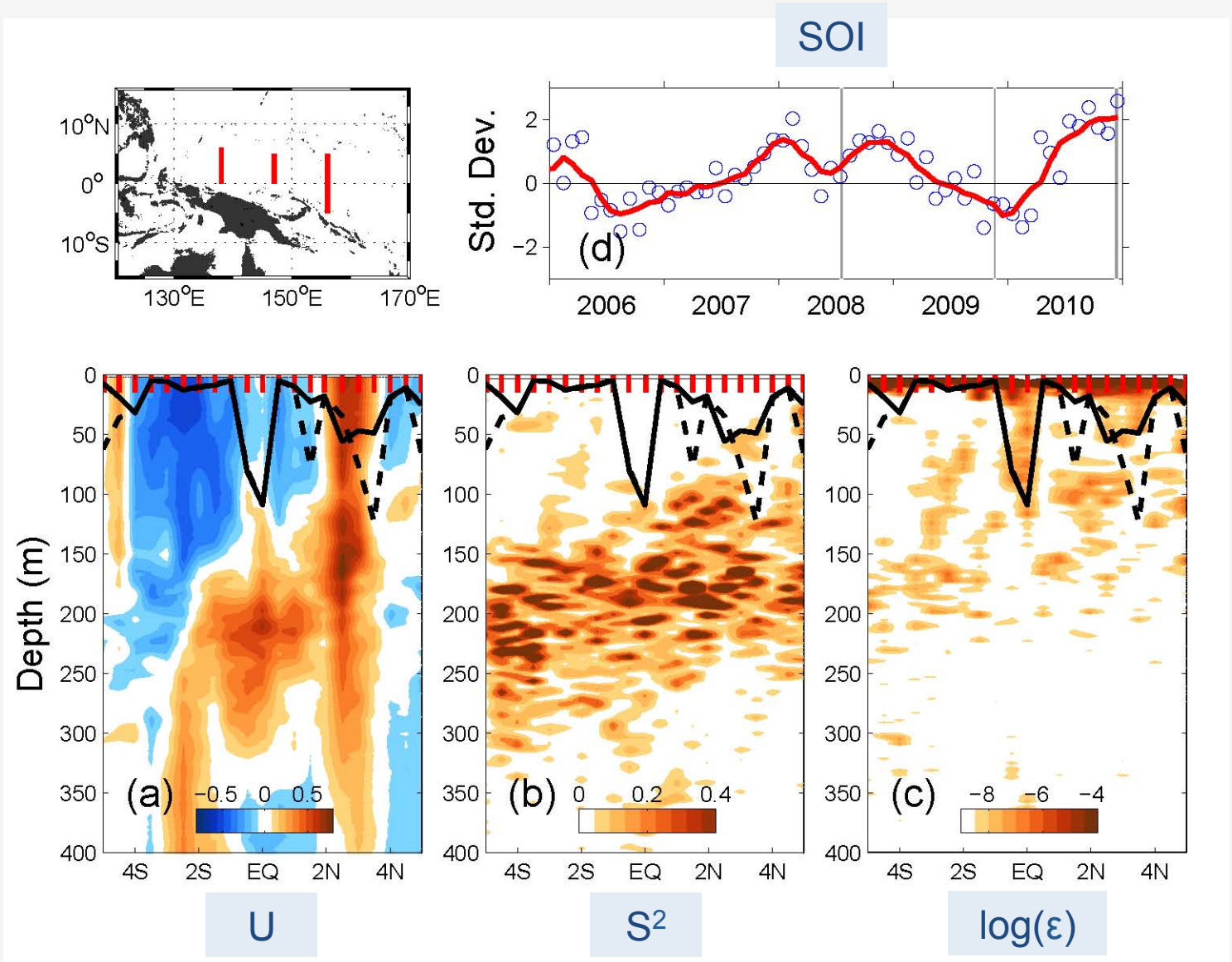
$$K_v = f(EKE) + \kappa_0 + \kappa_{svs}$$

To model the impact of unresolved processes within the equatorial thermocline we set

$\kappa_{svs} = 5 \times 10^{-5}$ $m^2 s^{-1}$ above 20^oC

$\kappa_0 = 1 \times 10^{-6}$ $m^2 s^{-1}$


12°N
6°N
0°
6°S
12°S
120°E
130°E
140°E
150°E
160°E
170°E

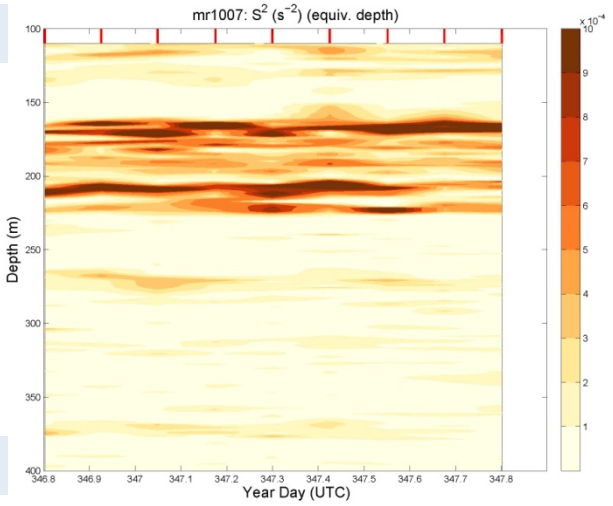


Richards et al GRL 2012

Eq, 156E

S^2

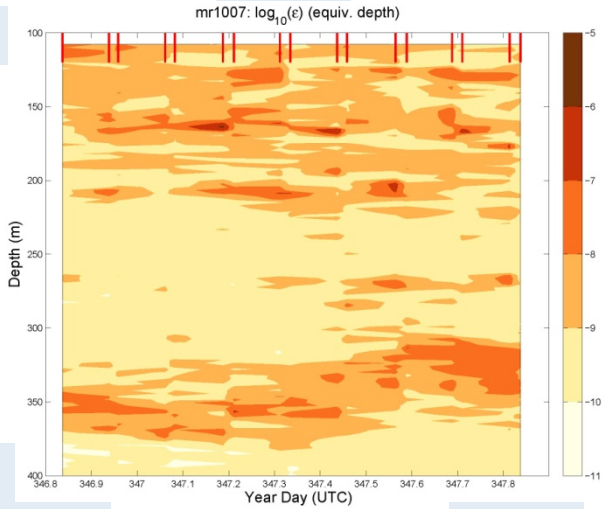
100m



400m

log(ε)

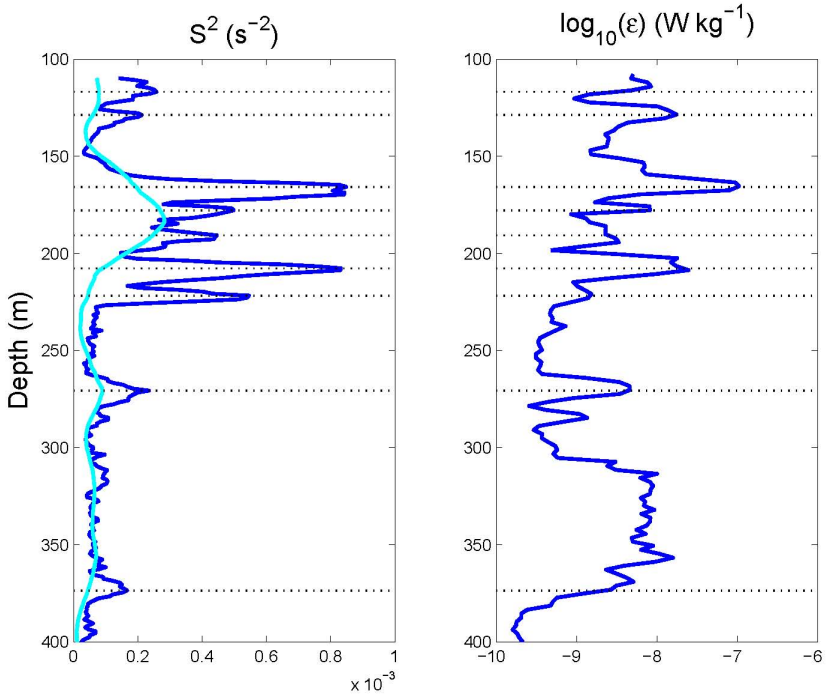
100m



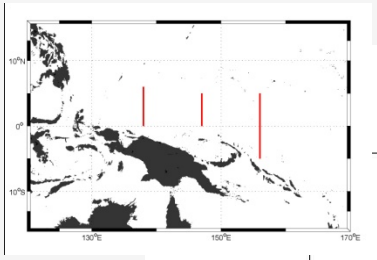
400m

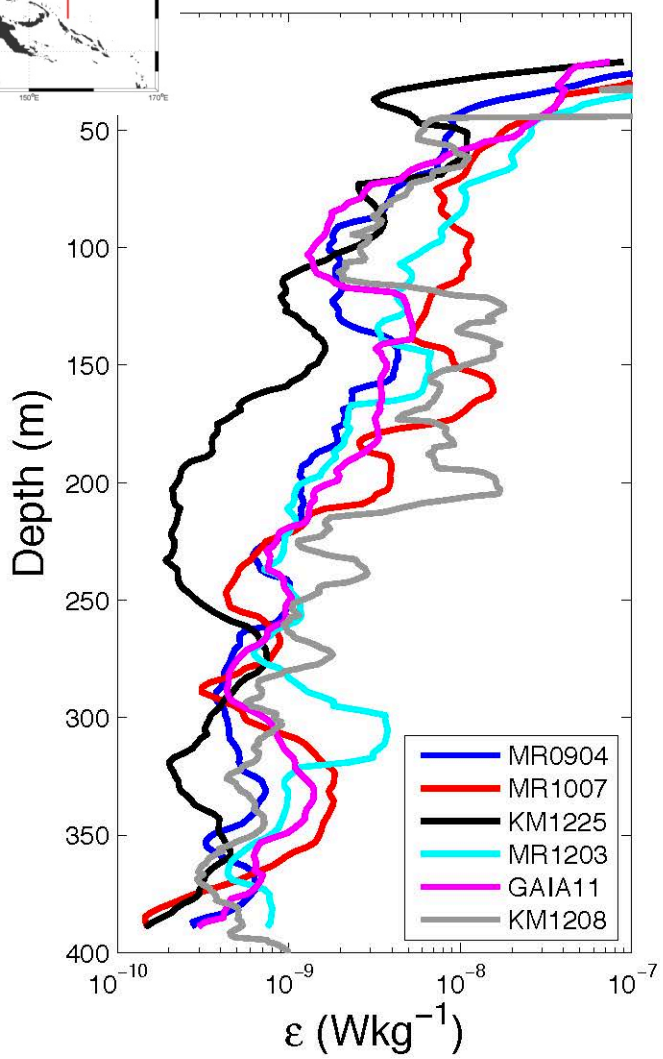
6am

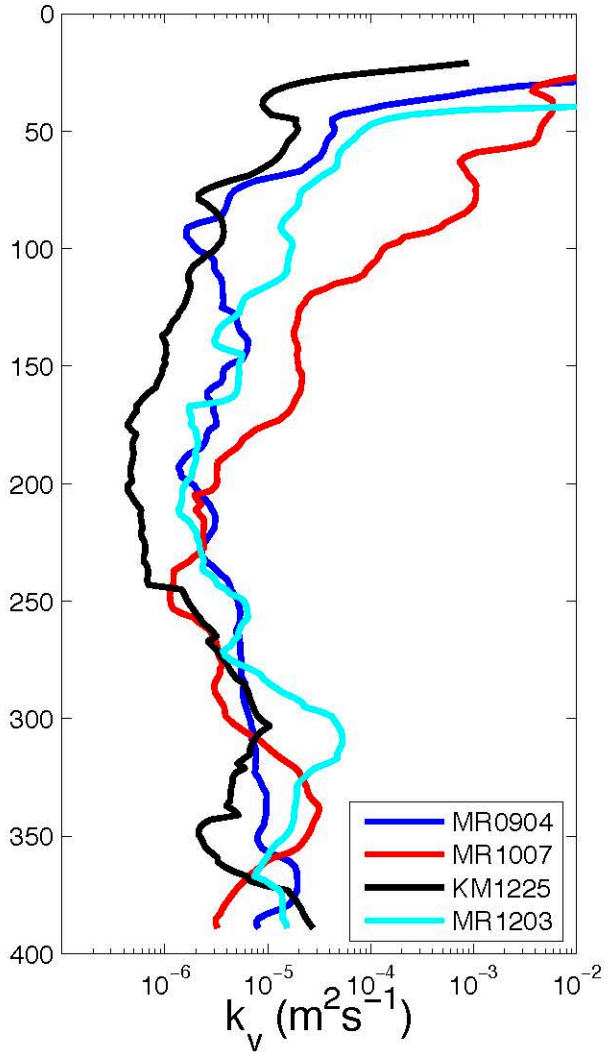
6am



24hr time average




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

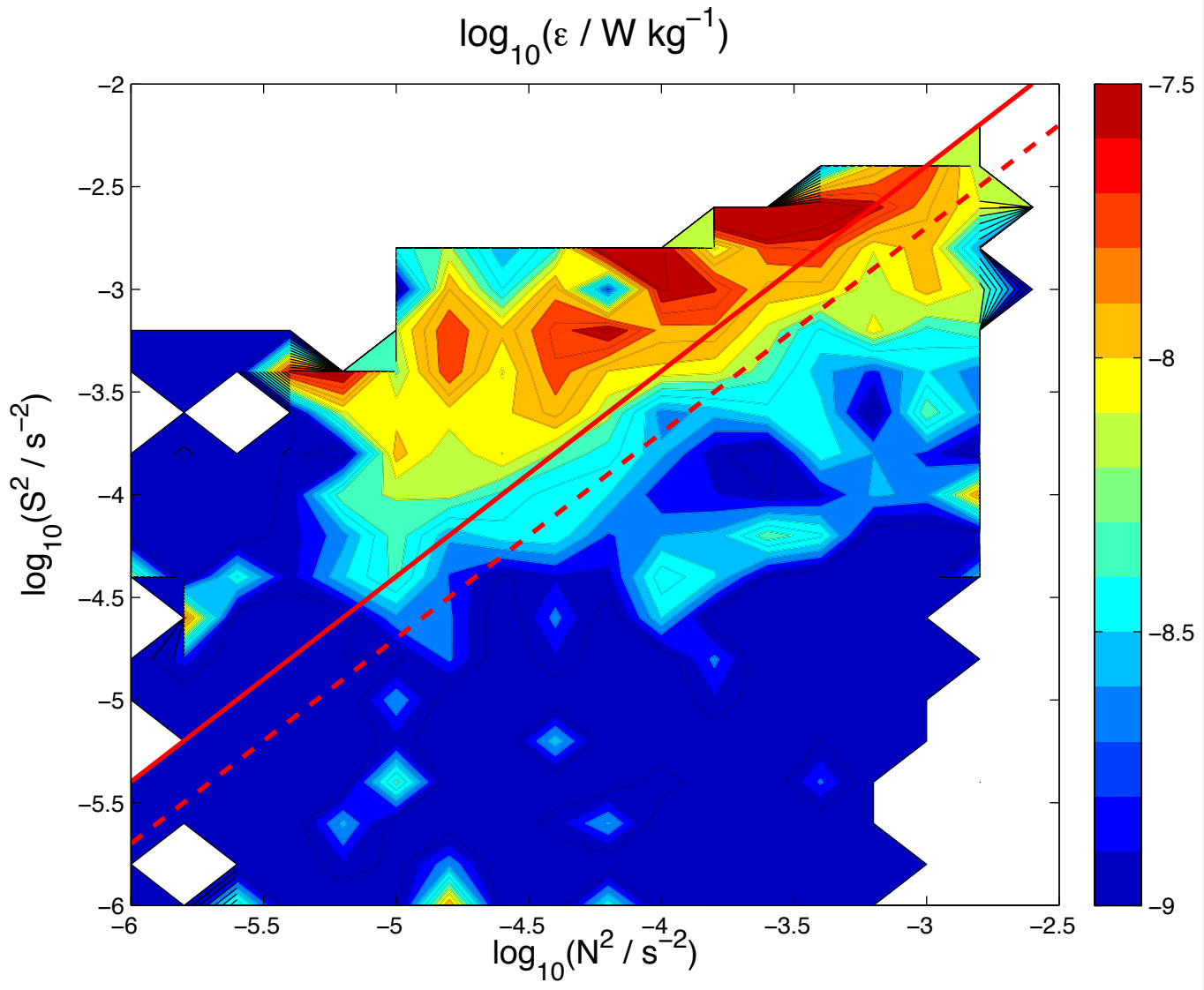

0
50
100
150
200
250
300
350
400
10^{-6}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
k_v (m^{2}s^{-1})
MR0904
MR1007
KM1225
MR1203

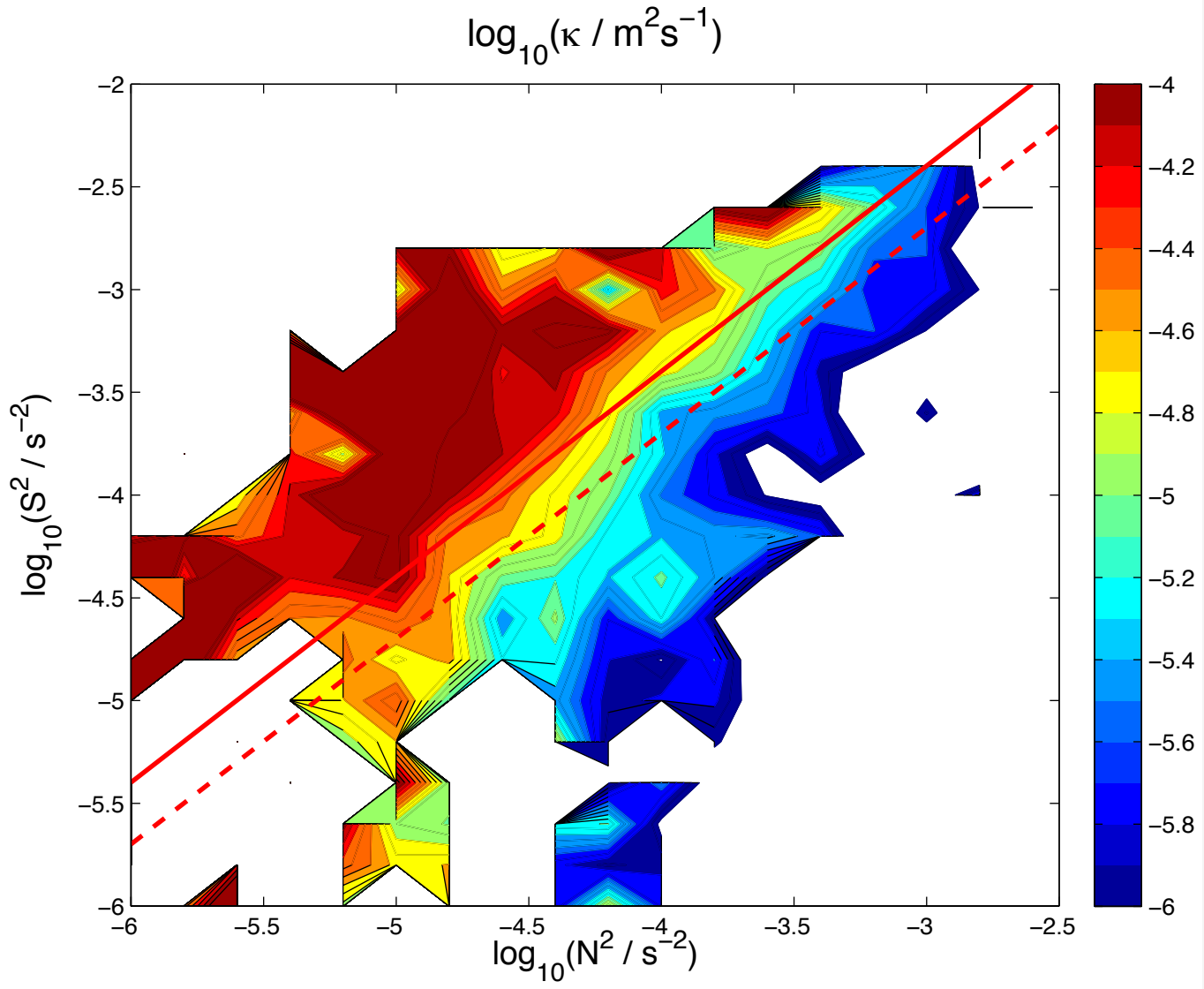
Parameterization if S^2, N^2 resolved

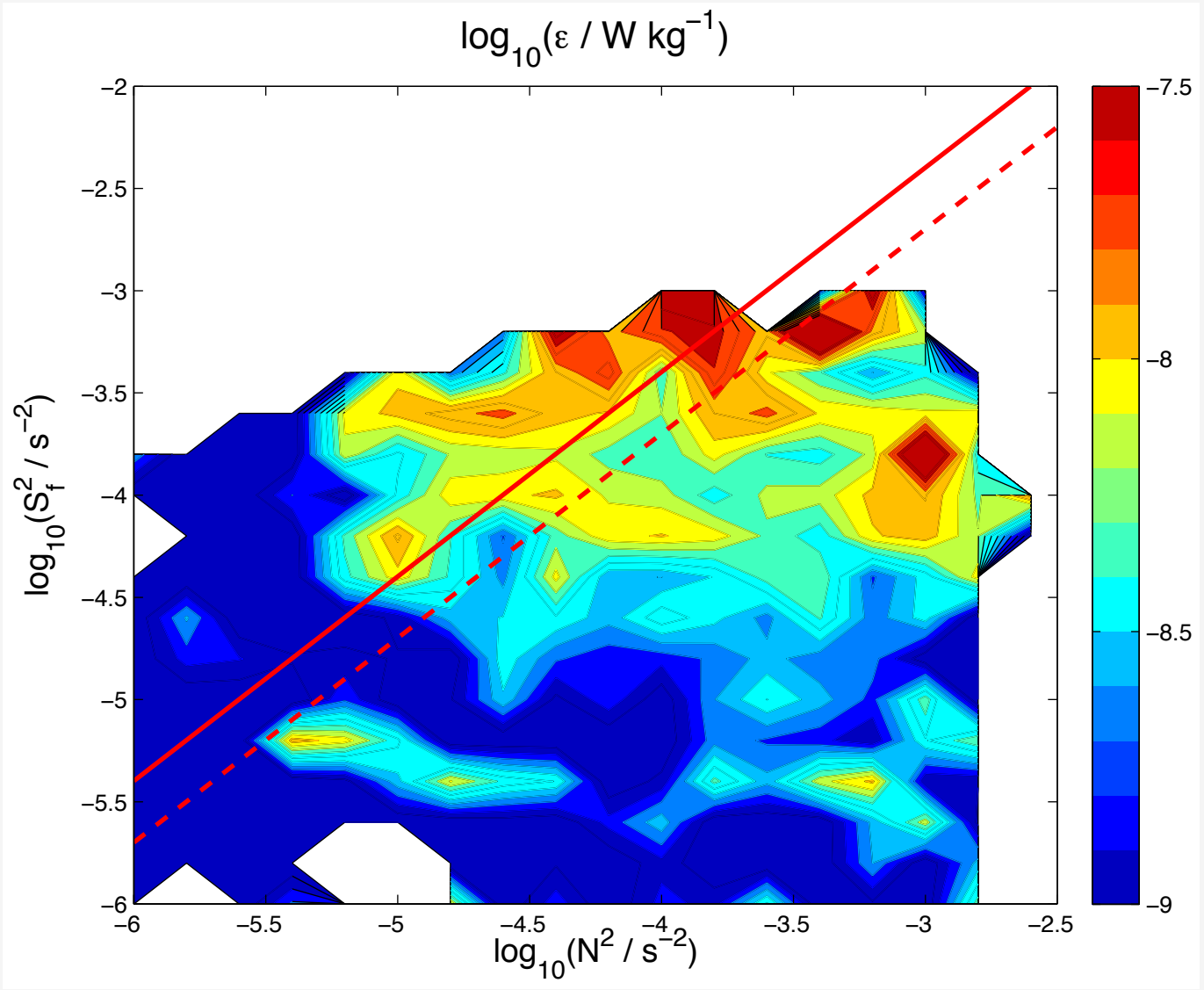
$$\kappa_o(\mathbf{x}, t) = \frac{\gamma}{N^2}\,\epsilon(S^2, N^2)$$

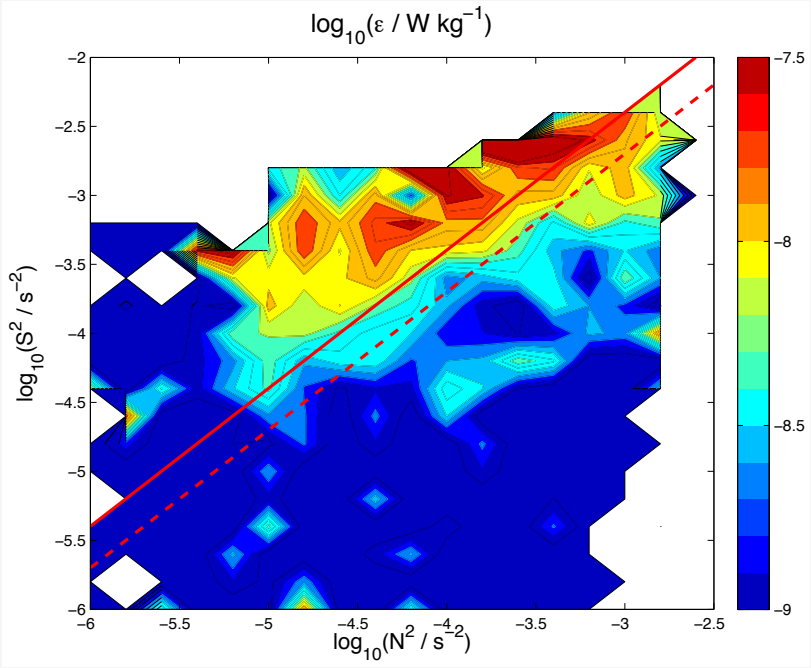
$$\epsilon_{KWB} = \Delta z^2 \frac{(S^2 - N^2/R_0)(S - N/R_0^{1/2})}{96}$$

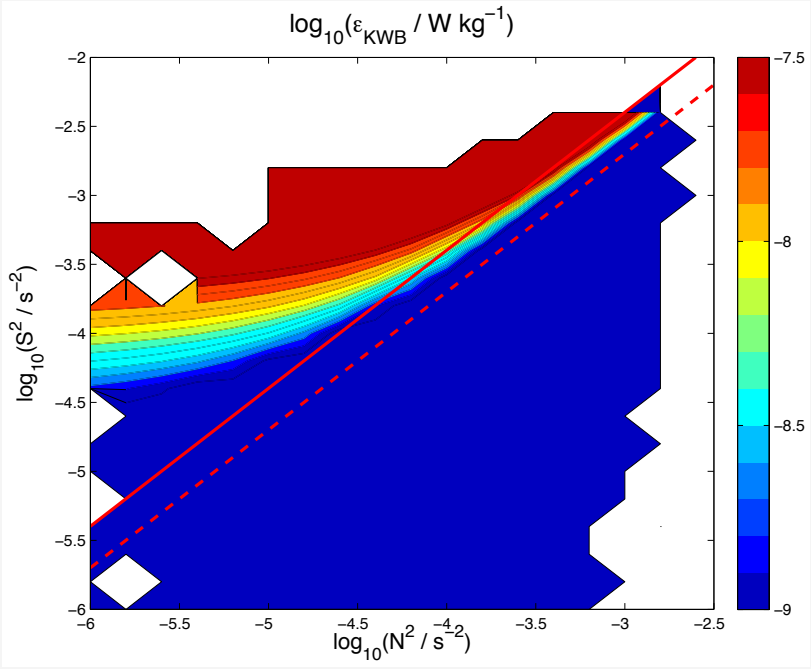
Kunze et al 1990

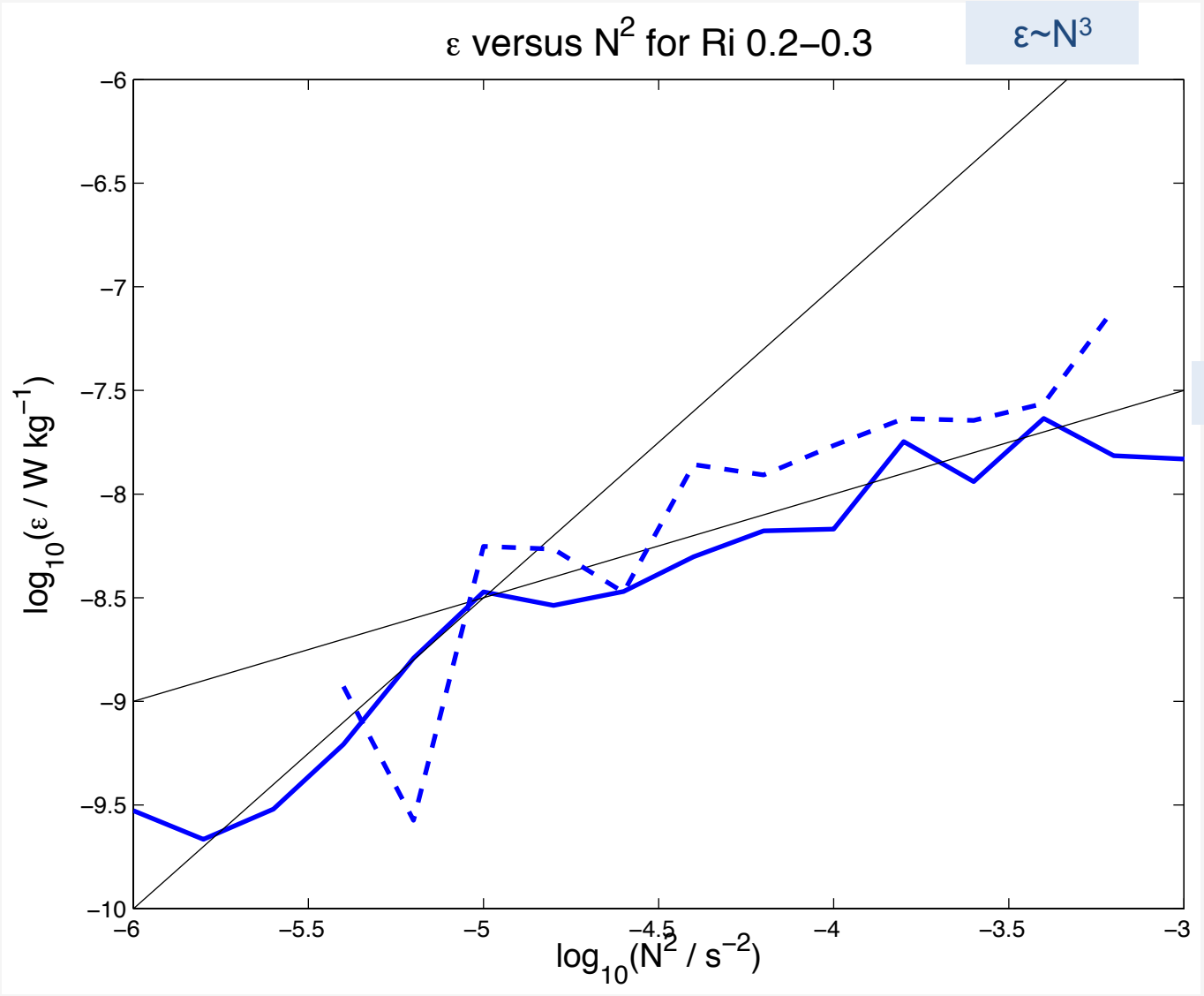

log10(ε / W kg−1)
log10(S2 / s−2)
log10(N2 / s−2)
−2
−2.5
−3
−3.5
−4
−4.5
−5
−5.5
−6
−6
−5.5
−5
−4.5
−4
−3.5
−3
−2.5
−7.5
−8
−8.5
−9


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


log10(ε / W kg−1)
log10(S2f / 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(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
−7.5
−8
−8.5
−9


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

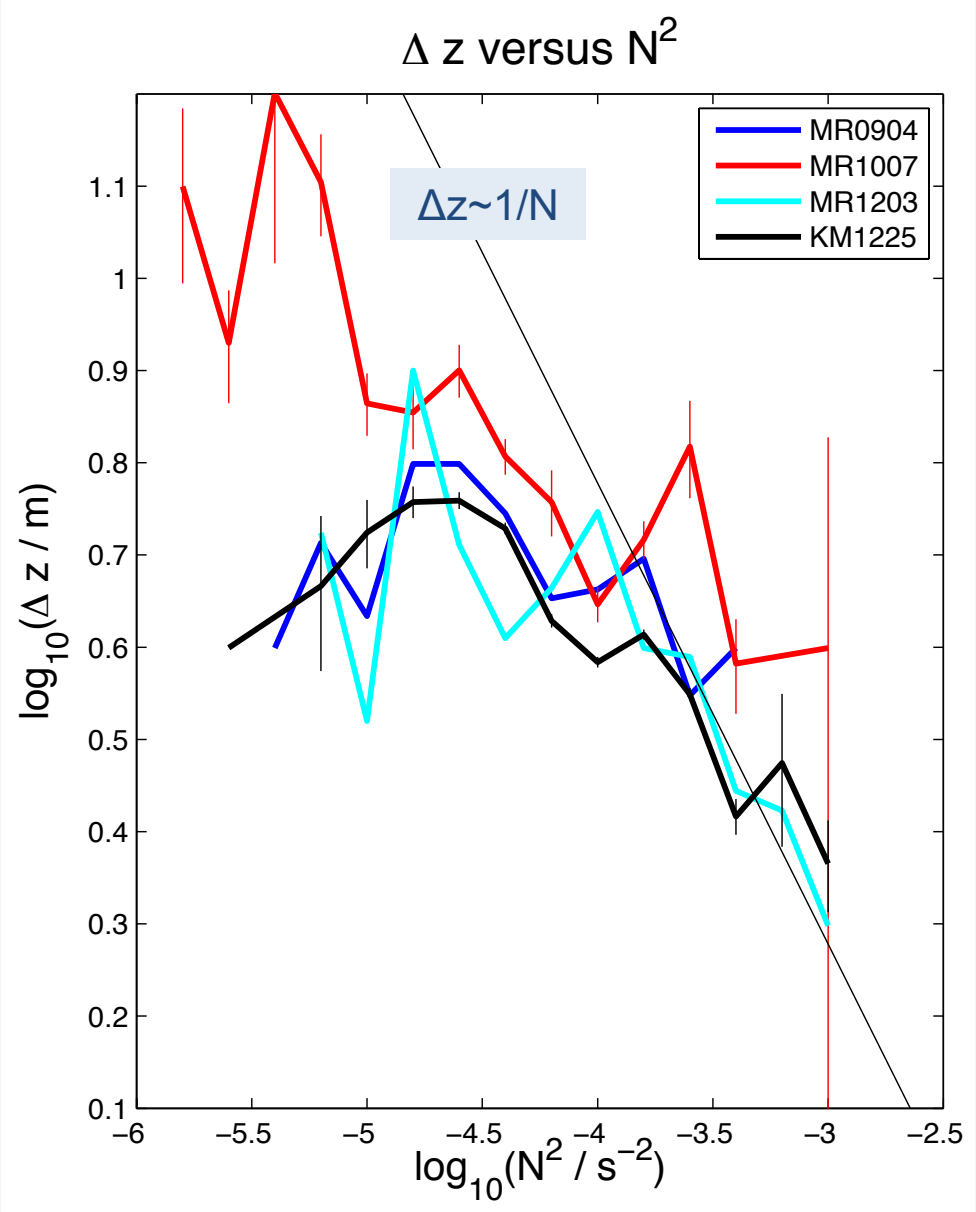

ε versus N2 for Ri 0.2–0.3
ε~N3
ε~N
log10(ε / W kg−1)
log10(N2 / s−2)
−6
−6.5
−7
−7.5
−8
−8.5
−9
−9.5
−10
−6
−5.5
−5
−4.5
−4
−3.5
−3

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

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

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

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

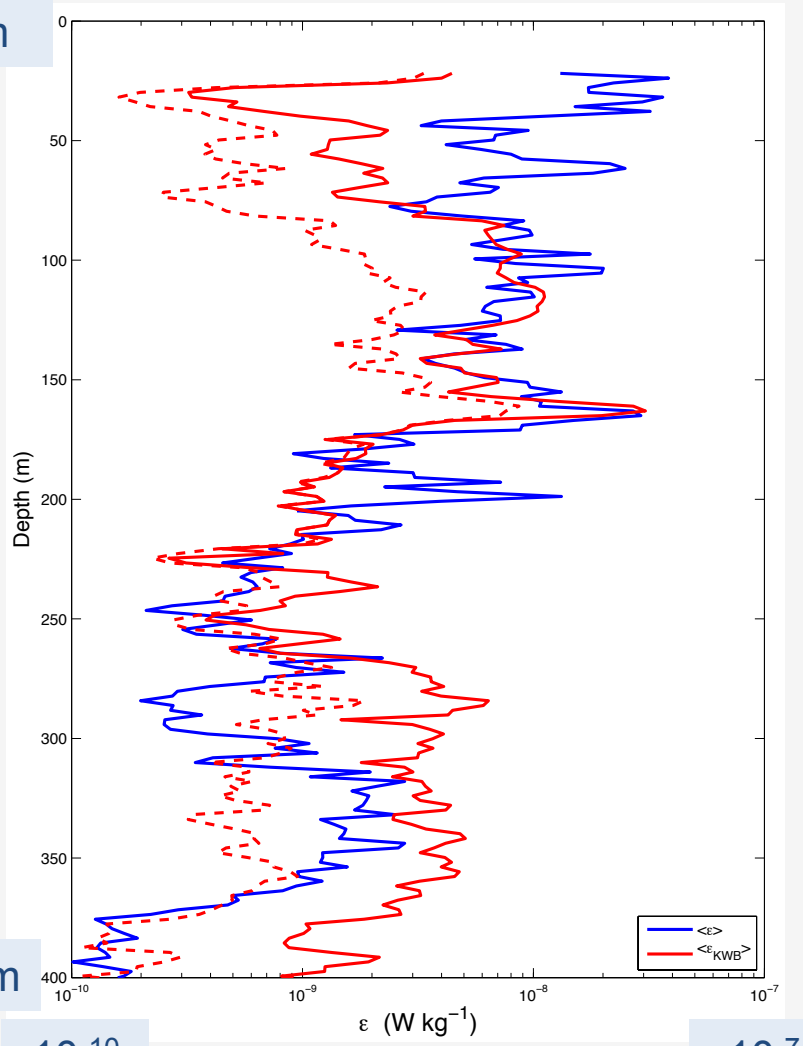

Δ z versus N2
MR0904
MR1007
MR1203
KM1225
Δz~1/N
log10(Δ z / m)
log10(N2 / s−2)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
−6
−5.5
−5
−4.5
−4
−3.5
−3
−2.5

MR1007

KM1225

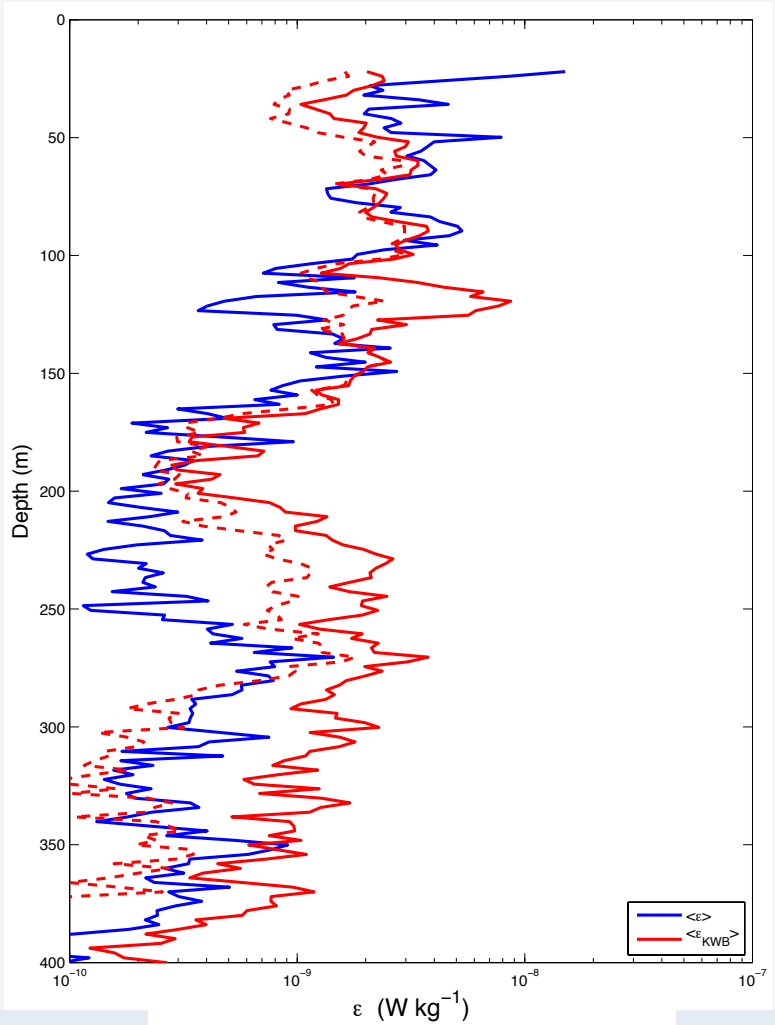
0m

400m



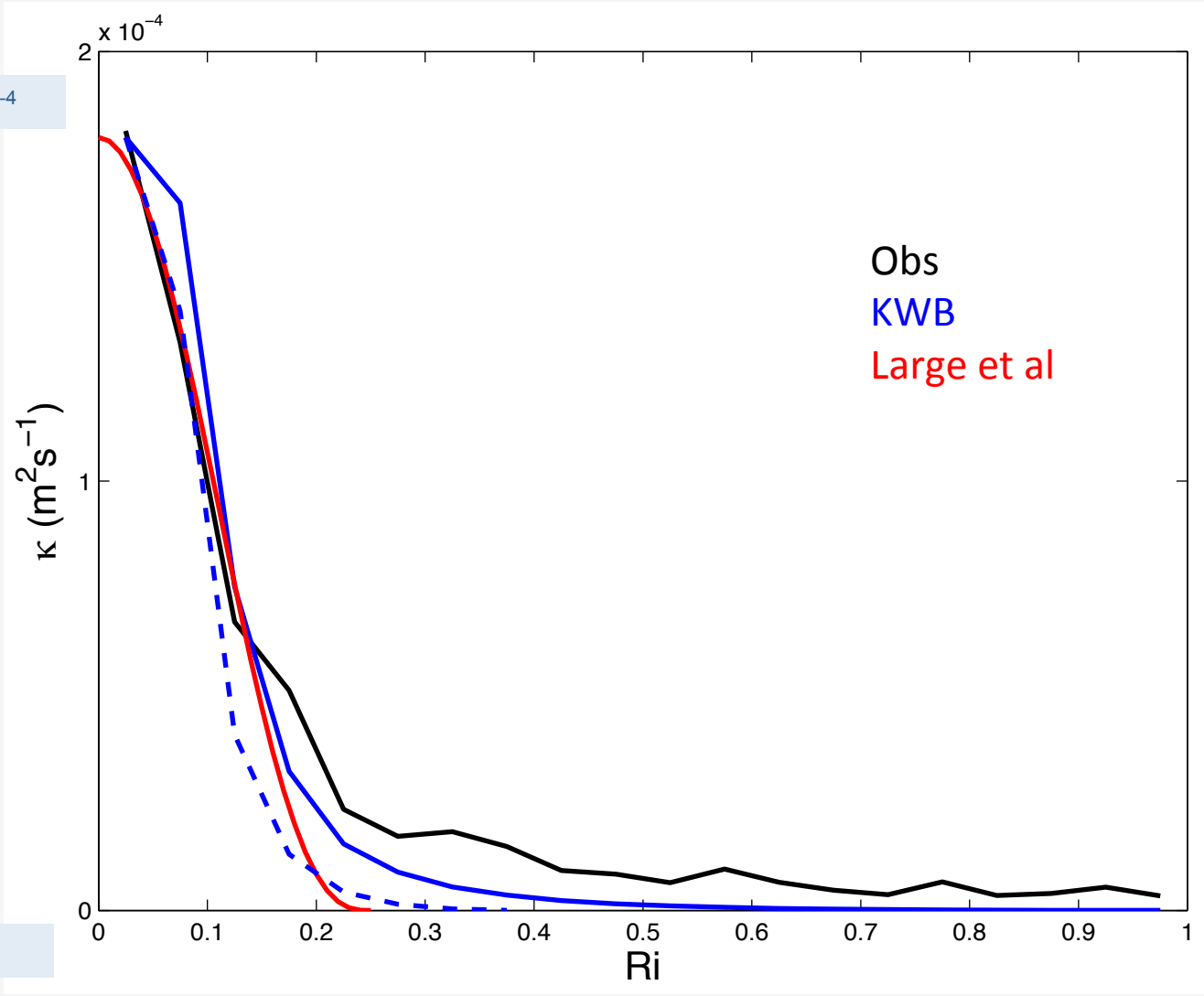
10^{-10}

10^{-7}



10^{-10}

10^{-7}



2x10-4

0

0

1

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

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

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

Linear model forced with QuikSCAT along 156E