HEAT FLUXES & STRESS FROM TURBULENCE AND COARE 3.x

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MEASUREMENTS & PRODUCTS

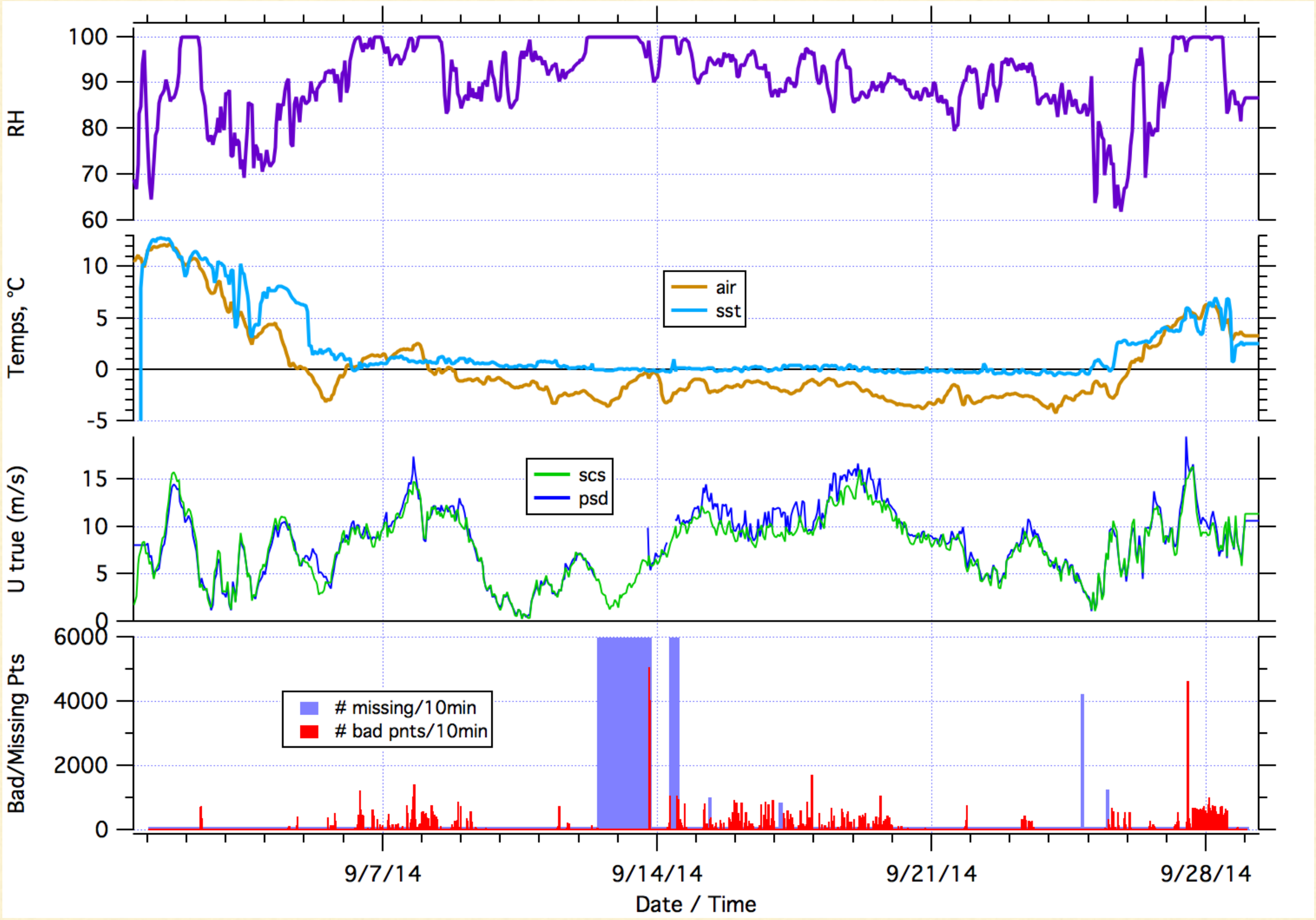
- Bulk meteorological observations: T, P, RH, Wind, PSP, PIR.
- Turbulent variables: Wind (U,V,W) and water vapor, 10 Hz.
- Flux measurements: Stress , Sensible Heat, Latent Heat by two methods: eddy correlation and inertial dissipation.
- Bulk Model: Stress, Sensible Heat, Latent Heat, L, Rain Heat Flux, and many other related quantities.

BULK MET MEASUREMENTS

- In most cases PSD and ship met measurements compare very well.

- Ship measurements are used for COARE model, with adjustments for PIR temperature correction, icing conditions and (possibly) PSP calibration and offset.

- PSD sonic anemometer affected by frost and rain: illustrated in next slide.


RH
100
90
80
70
60
Temps, °C
10
5
0
-5
air
sst
U true (m/s)
15
10
5
0
scs
psd
Bad/Missing Pts
6000
4000
2000
0
missing/10min
bad pnts/10min
9/7/14
9/14/14
9/21/14
9/28/14
Date / Time

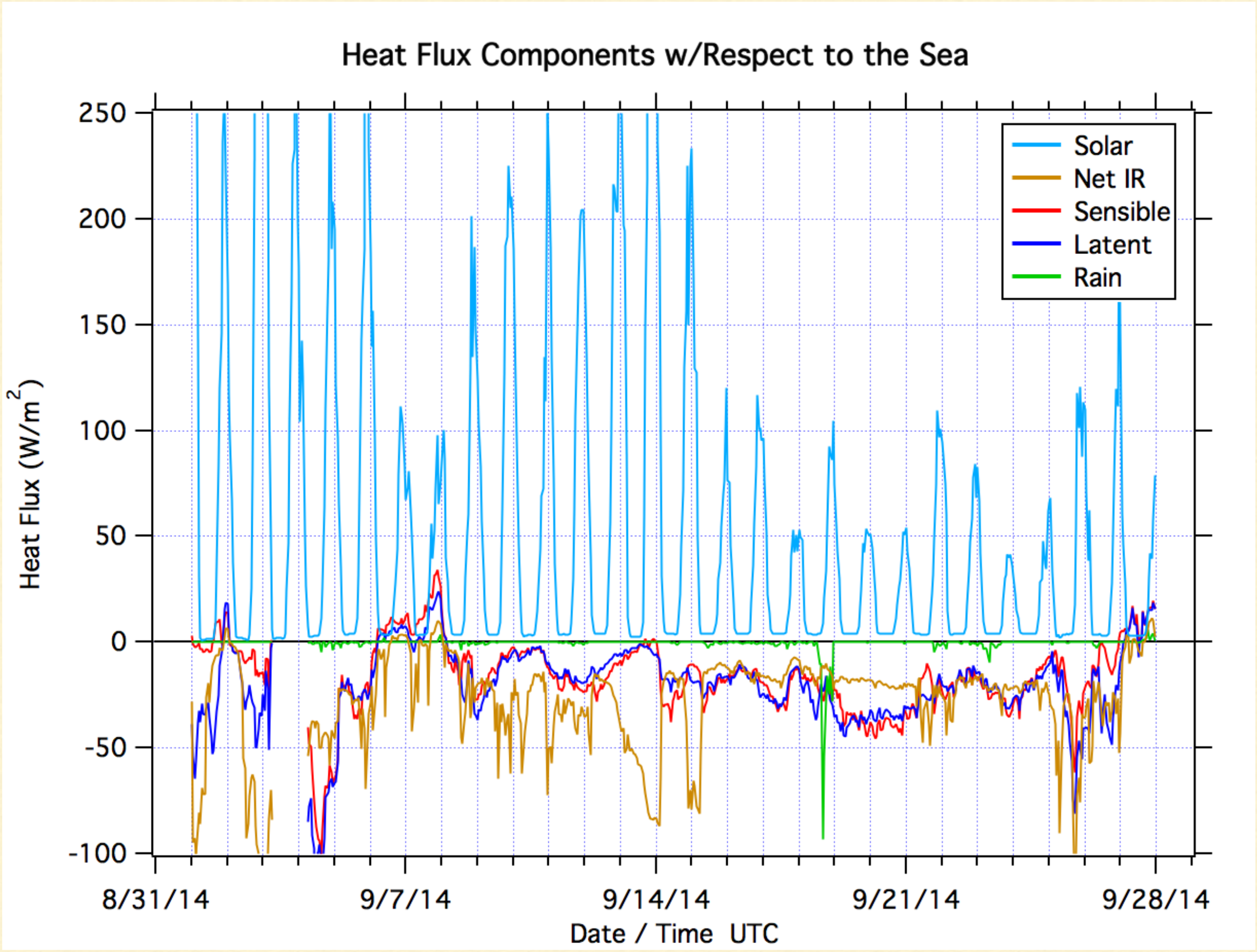
HEAT FLUXES

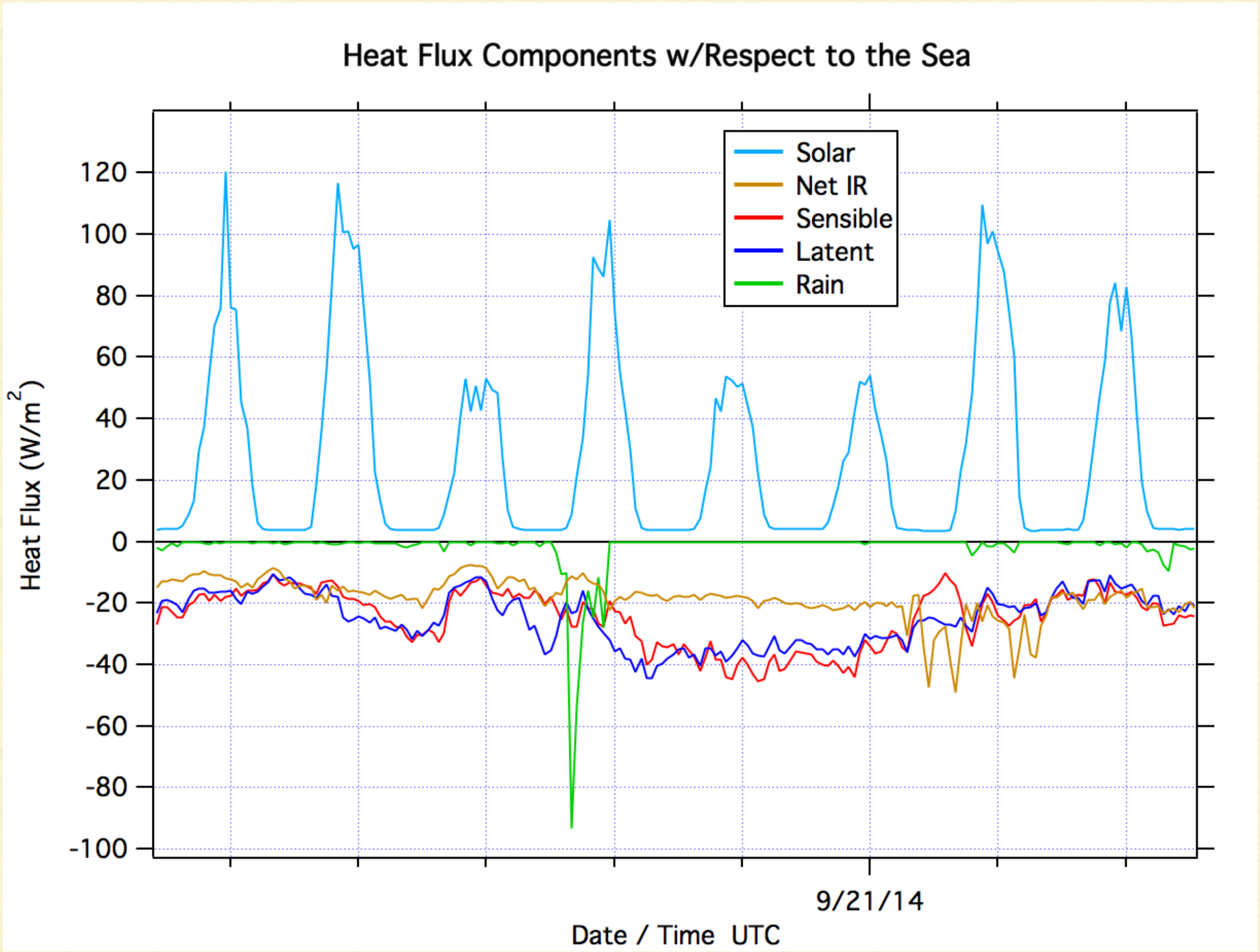
- Sensible Heat: best value is avg of covariance and inertial dissipation results.

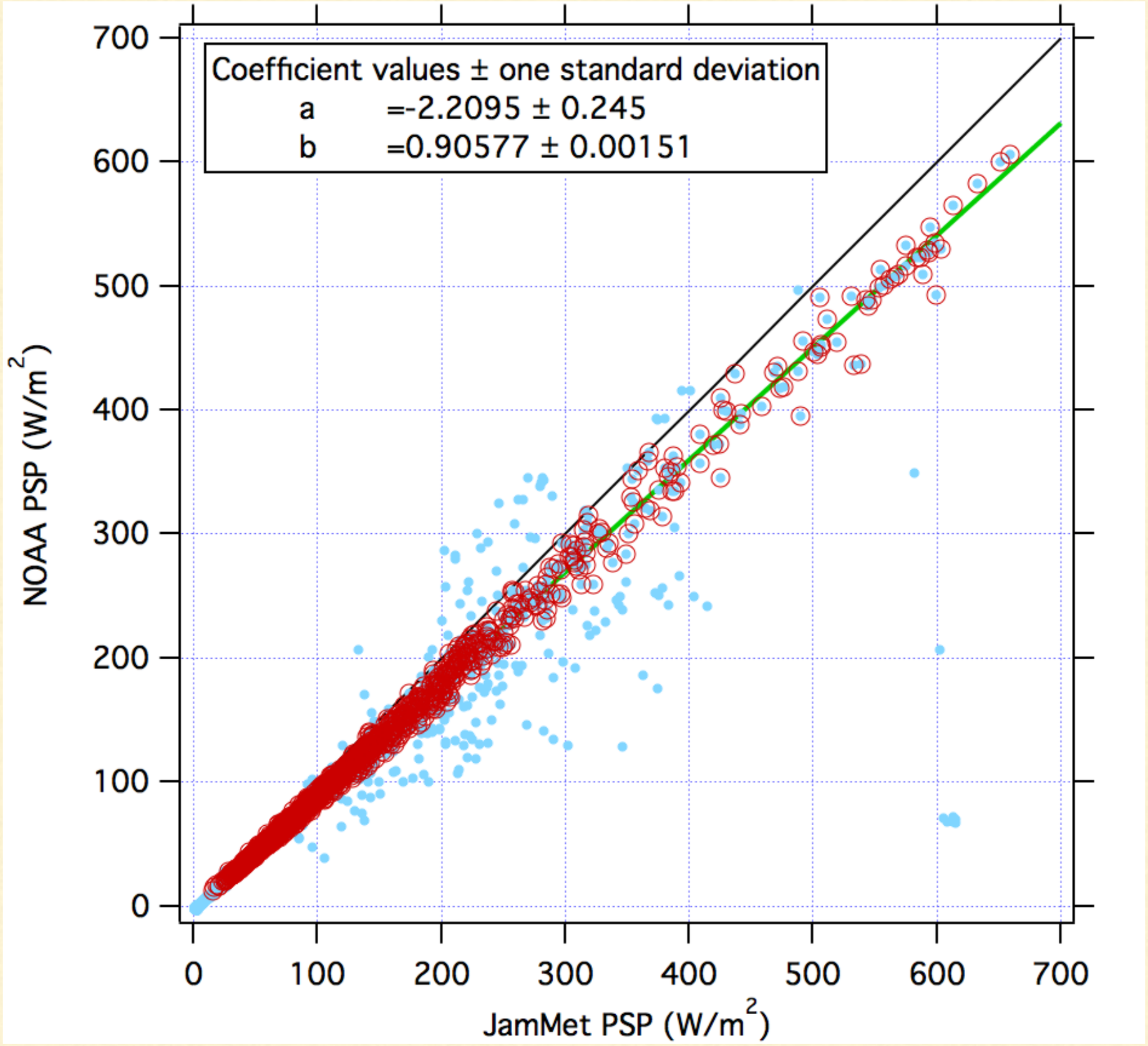
- Latent Heat: best value is from inertial dissipation due to issues with the sonic anemometer and Licor in cold, wet condition

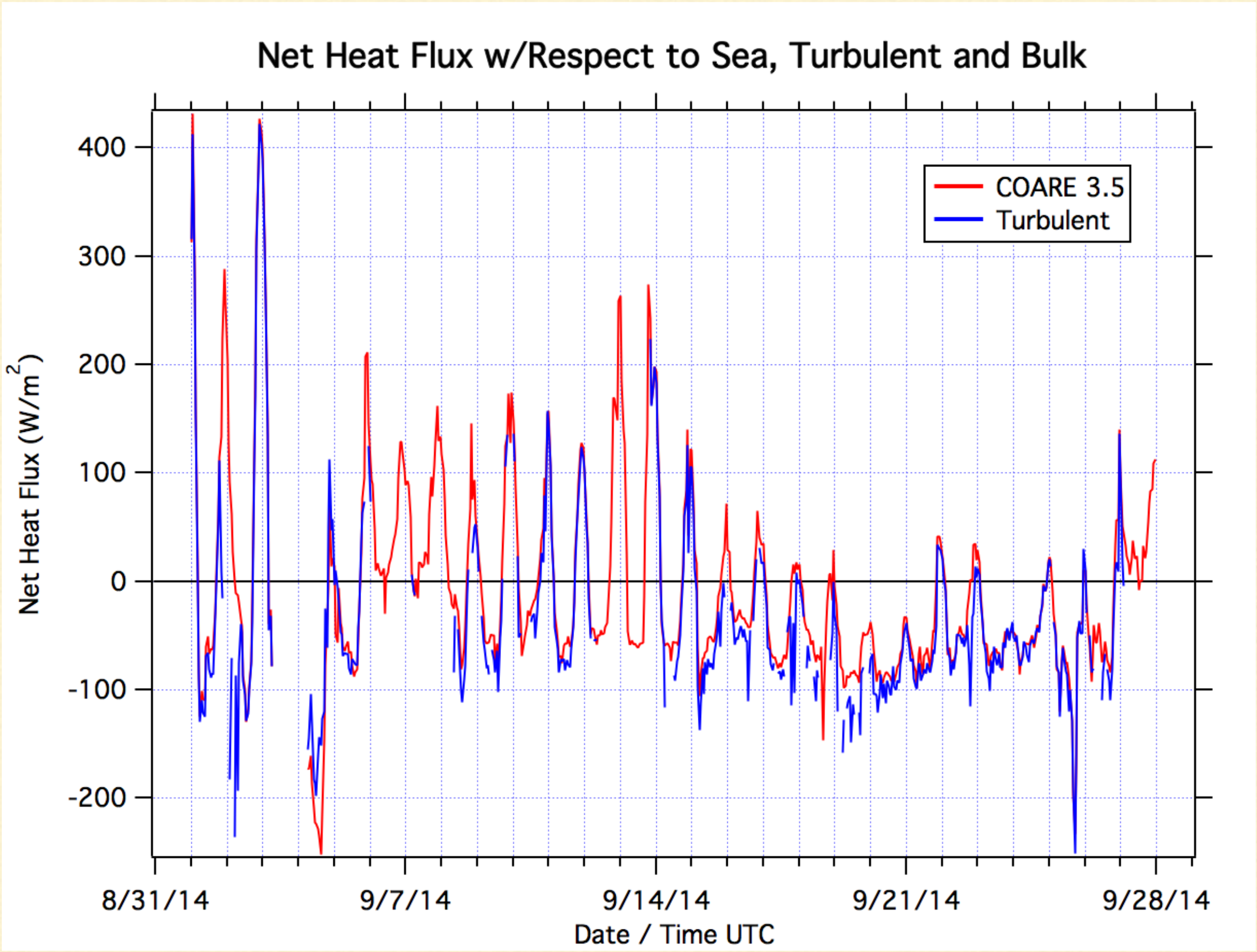
$$H_n(sea) = 0.955\, R_s - R_{l,net} - H_s - H_l - H_{rain}$$

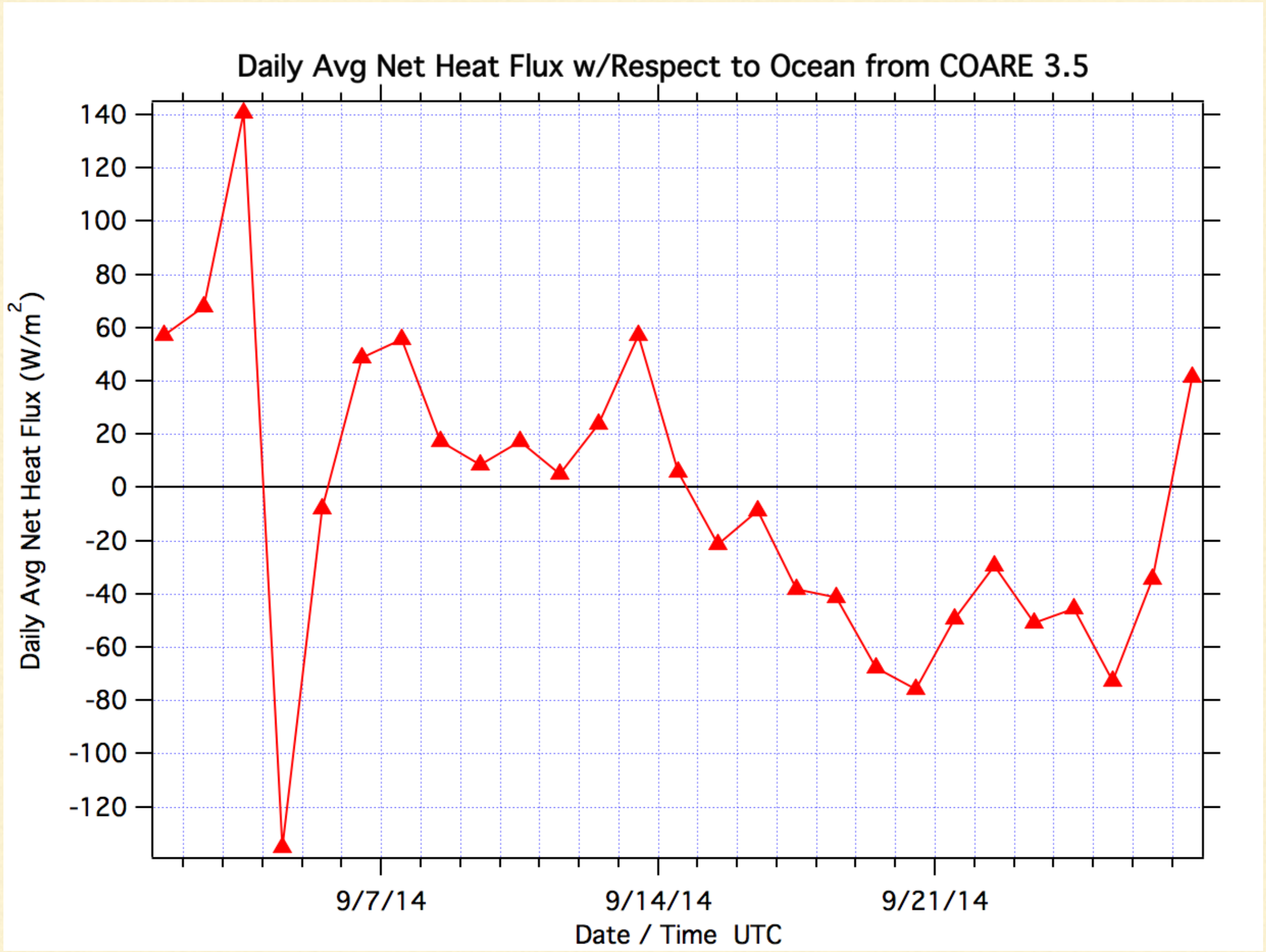
$$nR_l = 0.97(S_b\, T_{s,K}^4 - R_l)$$

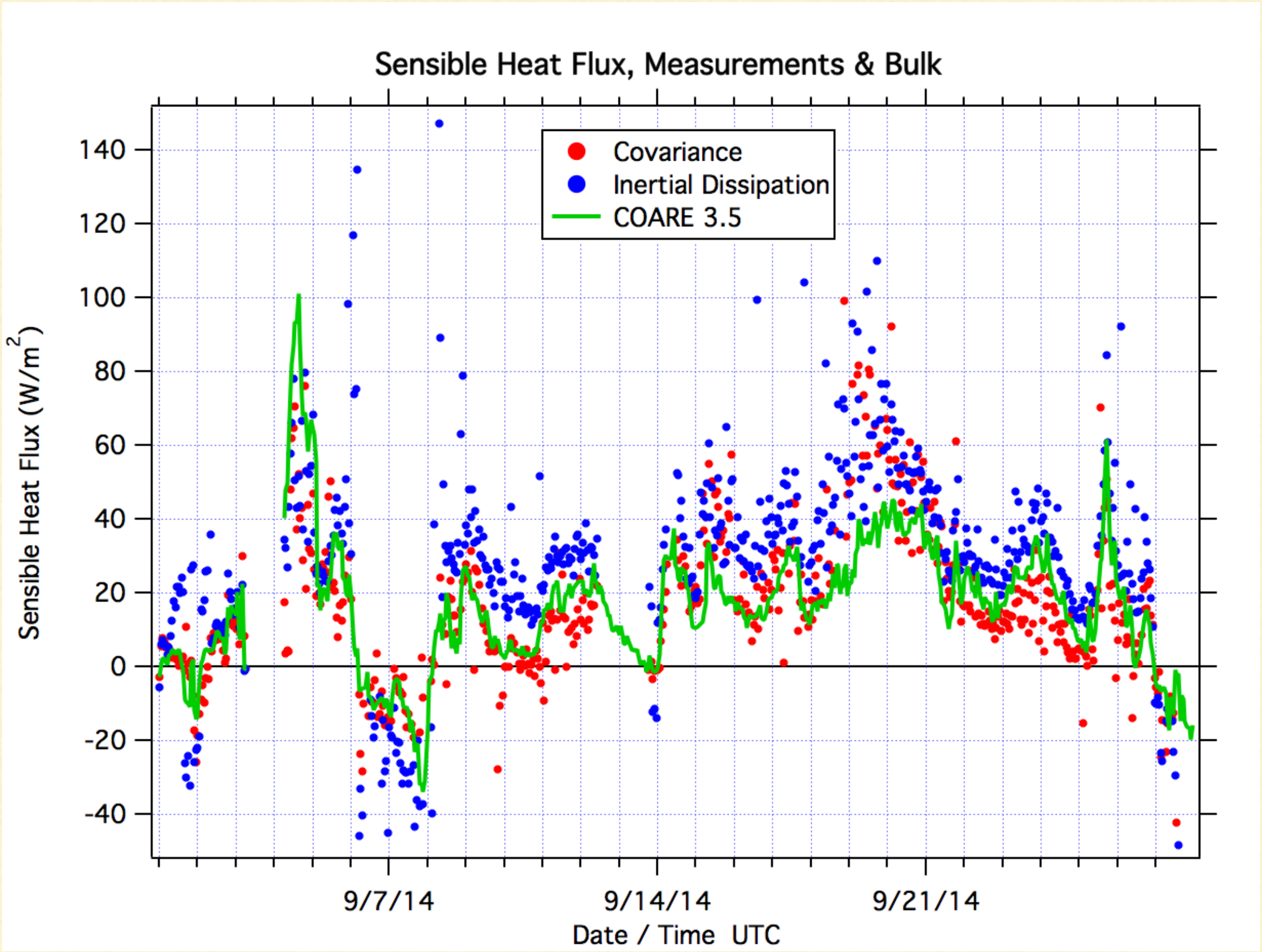

Heat Flux Components w/Respect to the Sea
Heat Flux (W/m2)
250
200
150
100
50
0
-50
-100
8/31/14
9/7/14
9/14/14
9/21/14
9/28/14
Date / Time UTC
Solar
Net IR
Sensible
Latent
Rain

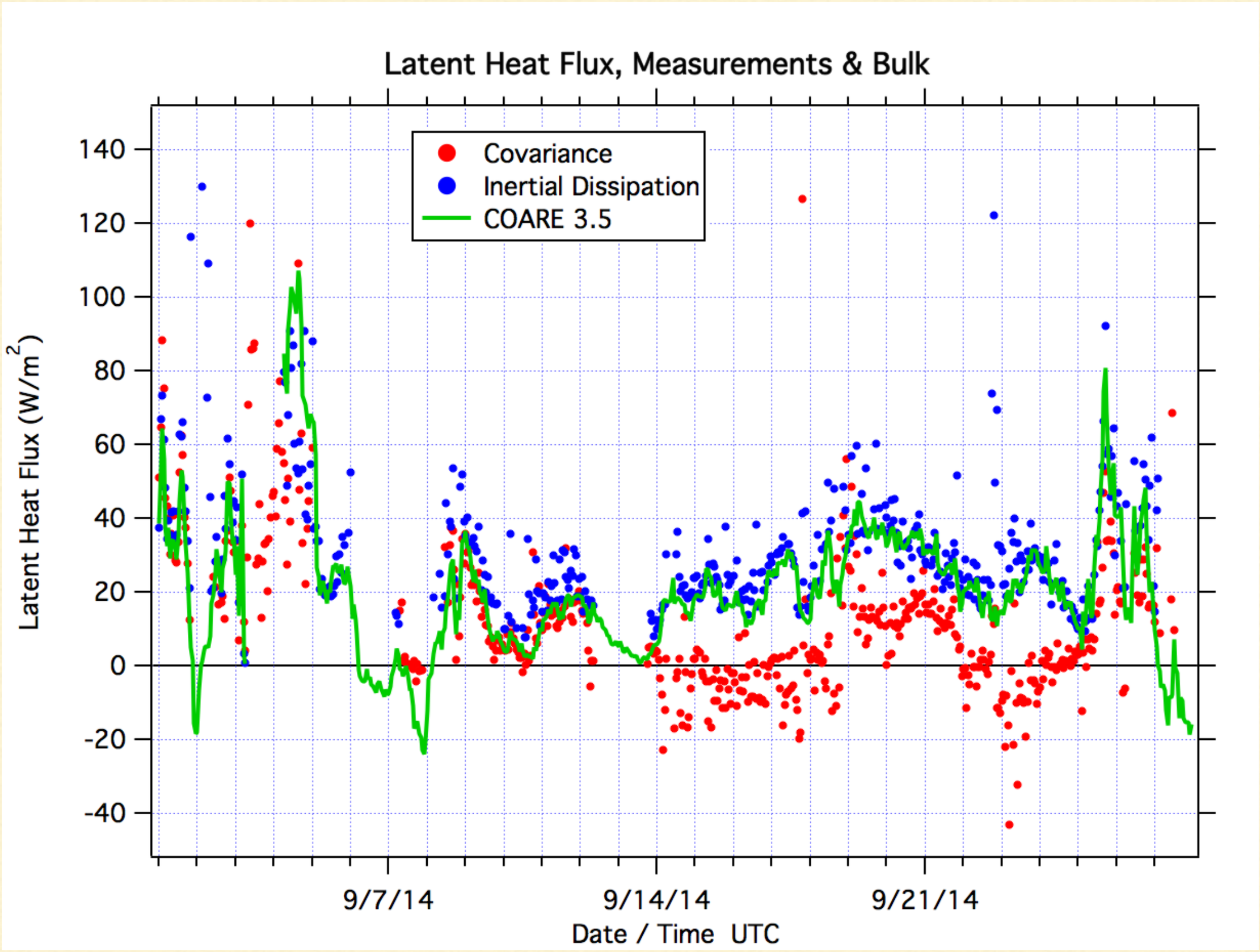

Heat Flux Components w/Respect to the Sea
Solar
Net IR
Sensible
Latent
Rain
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
Heat Flux (W/m2)
9/21/14
Date / Time UTC

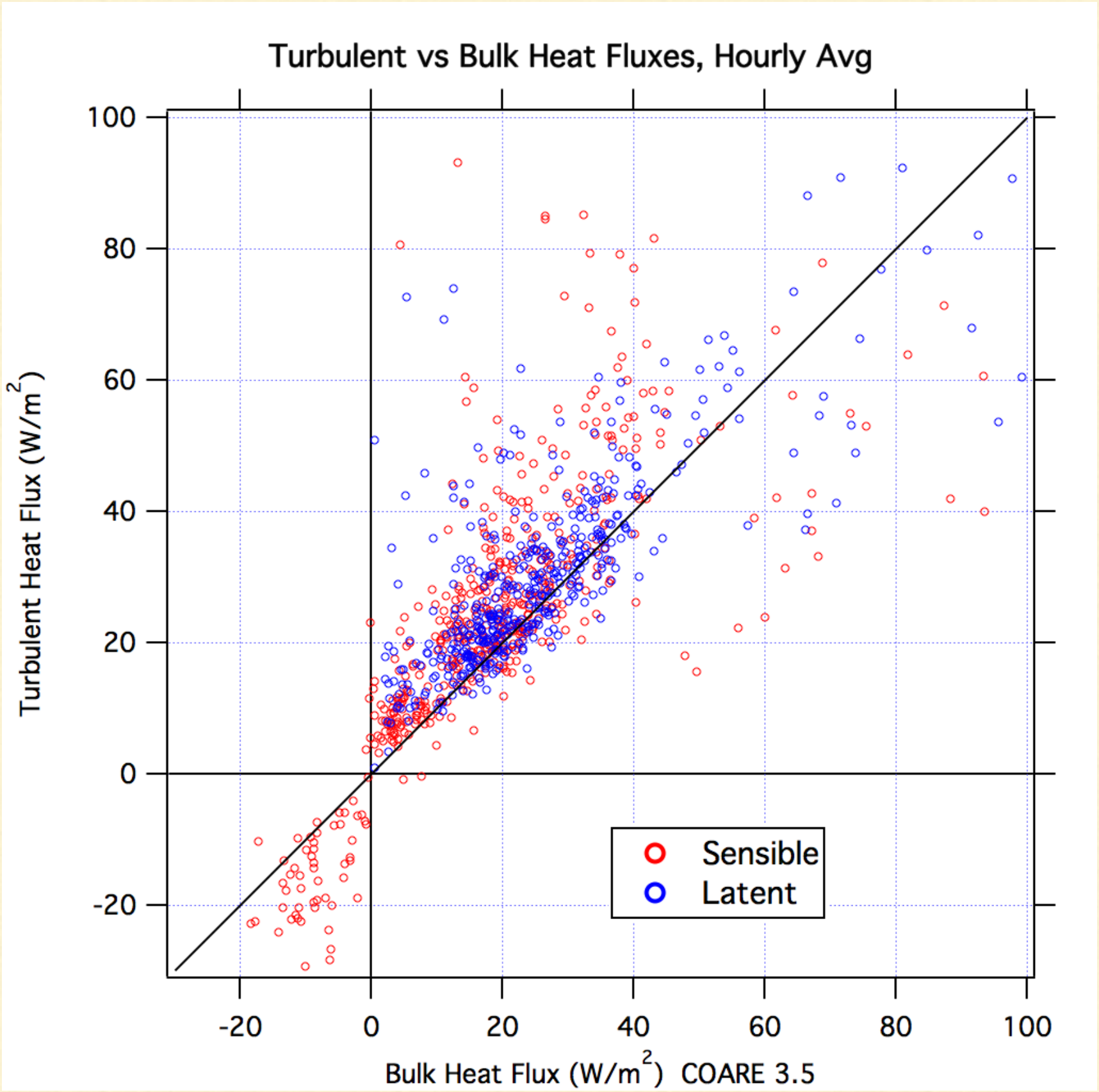

Coefficient values ± one standard deviation
a =-2.2095 ± 0.245
b =0.90577 ± 0.00151
NOAA PSP (W/m2)
JamMet PSP (W/m2)
0
100
200
300
400
500
600
700

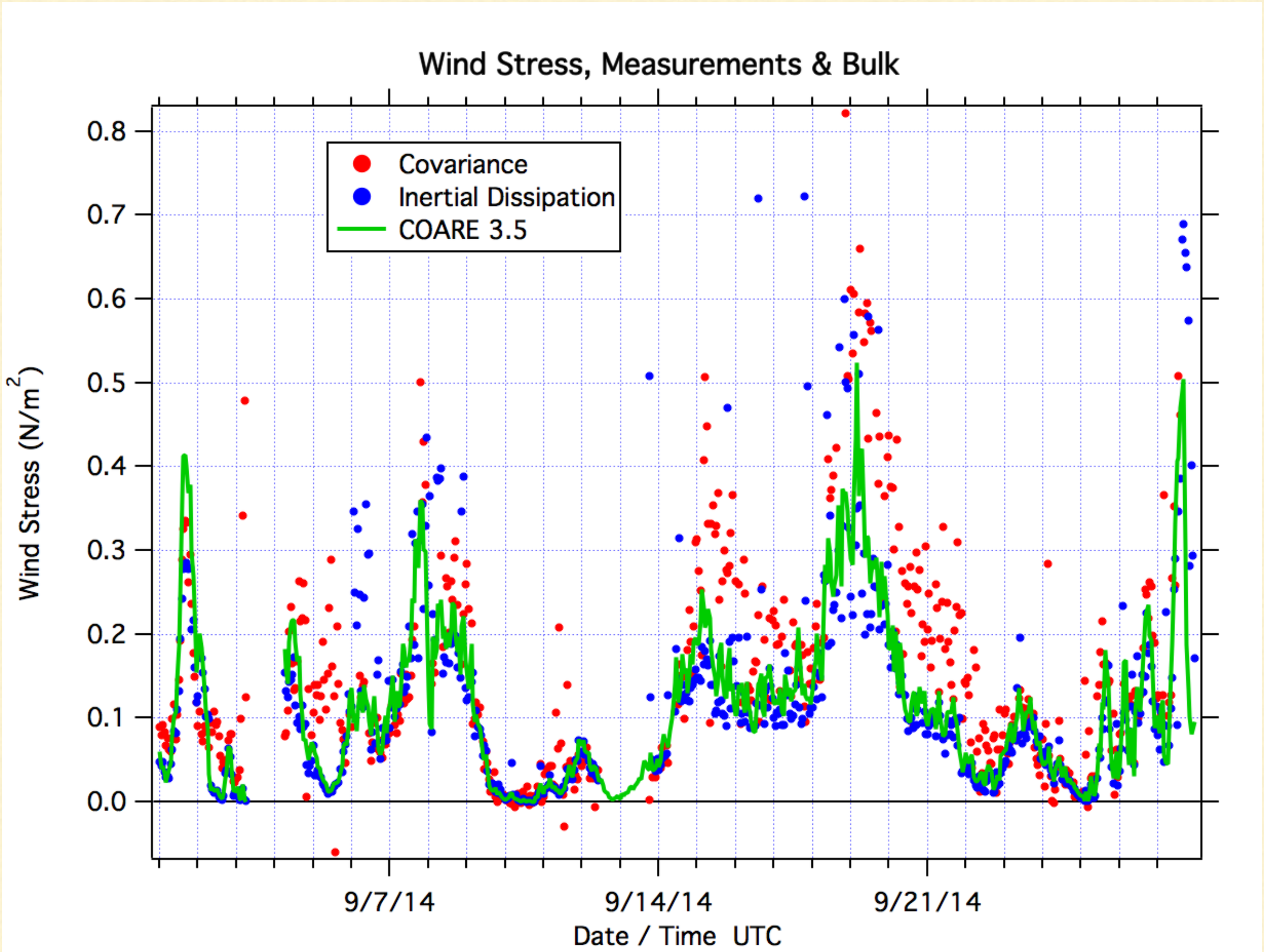

Net Heat Flux w/Respect to Sea, Turbulent and Bulk
COARE 3.5
Turbulent
Net Heat Flux (W/m2)
400
300
200
100
0
-100
-200
8/31/14
9/7/14
9/14/14
9/21/14
9/28/14
Date / Time UTC


Daily Avg Net Heat Flux w/Respect to Ocean from COARE 3.5
Daily Avg Net Heat Flux (W/m2)
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
9/7/14
9/14/14
9/21/14
Date / Time UTC


Sensible Heat Flux, Measurements & Bulk
Covariance
Inertial Dissipation
COARE 3.5
Sensible Heat Flux (W/m2)
140
120
100
80
60
40
20
0
-20
-40
9/7/14
9/14/14
9/21/14
Date / Time UTC


Latent Heat Flux, Measurements & Bulk
Covariance
Inertial Dissipation
COARE 3.5
Latent Heat Flux (W/m2)
140
120
100
80
60
40
20
0
-20
-40
9/7/14
9/14/14
9/21/14
Date / Time UTC


Turbulent vs Bulk Heat Fluxes, Hourly Avg
Turbulent Heat Flux (W/m^2)
Bulk Heat Flux (W/m^2) COARE 3.5
100
80
60
40
20
0
-20
-20
0
20
40
60
80
100
Sensible
Latent


Wind Stress, Measurements & Bulk
Covariance
Inertial Dissipation
COARE 3.5
Wind Stress (N/m^2)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
9/7/14
9/14/14
9/21/14
Date / Time UTC