

## **Appendix 8F**

### **MM5 Model Evaluation Document #2**

# Evaluation of 2002 Annual 12km MM5 Surface Parameters for OTC Modeling

*Shan He and Gary Kleiman*

**NESCAUM**

And

*Winston Hao*

**NYDEC**

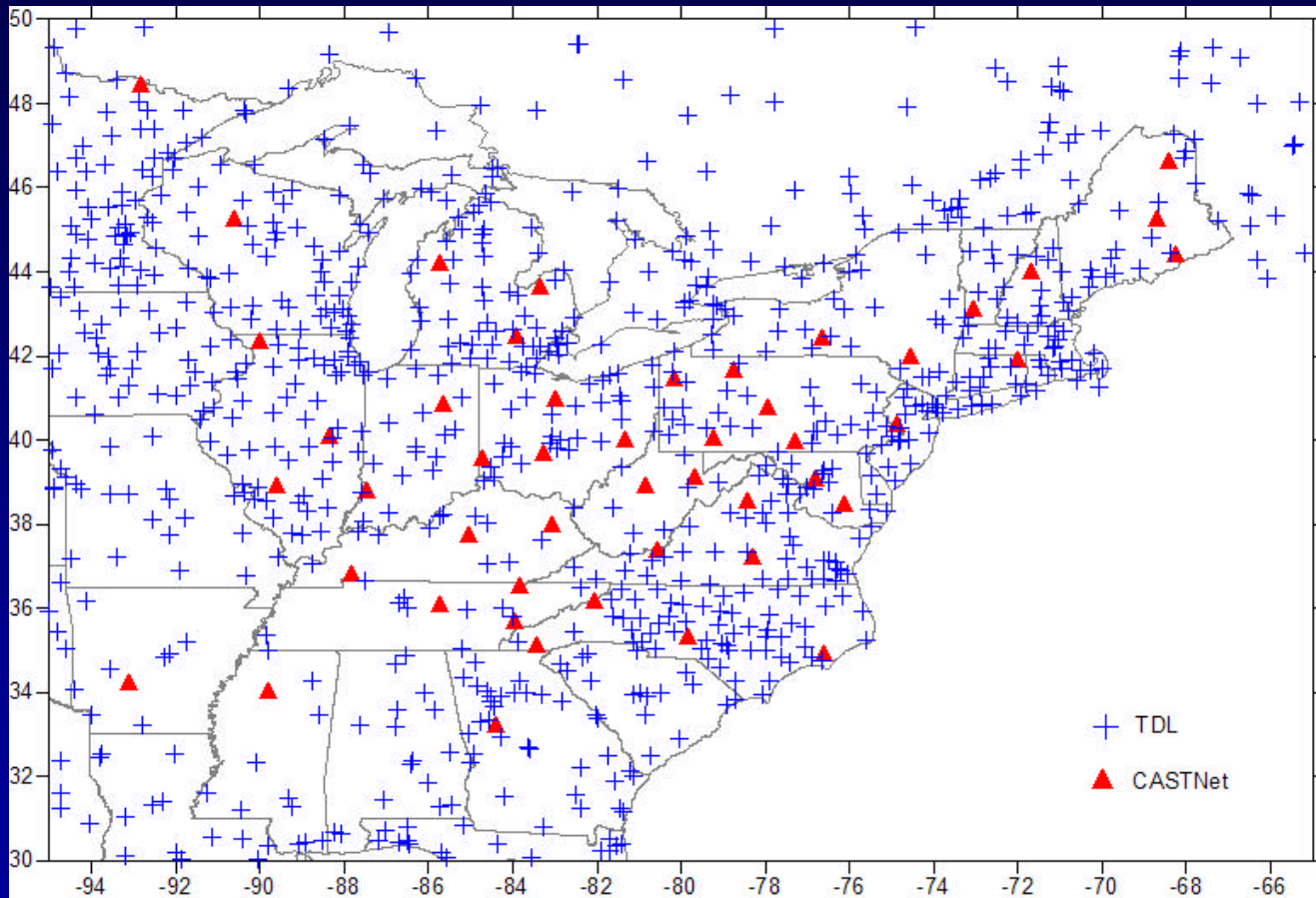
Review of Application and Assessment of CMAQ in OTC

Albany, NY

November 16, 2005

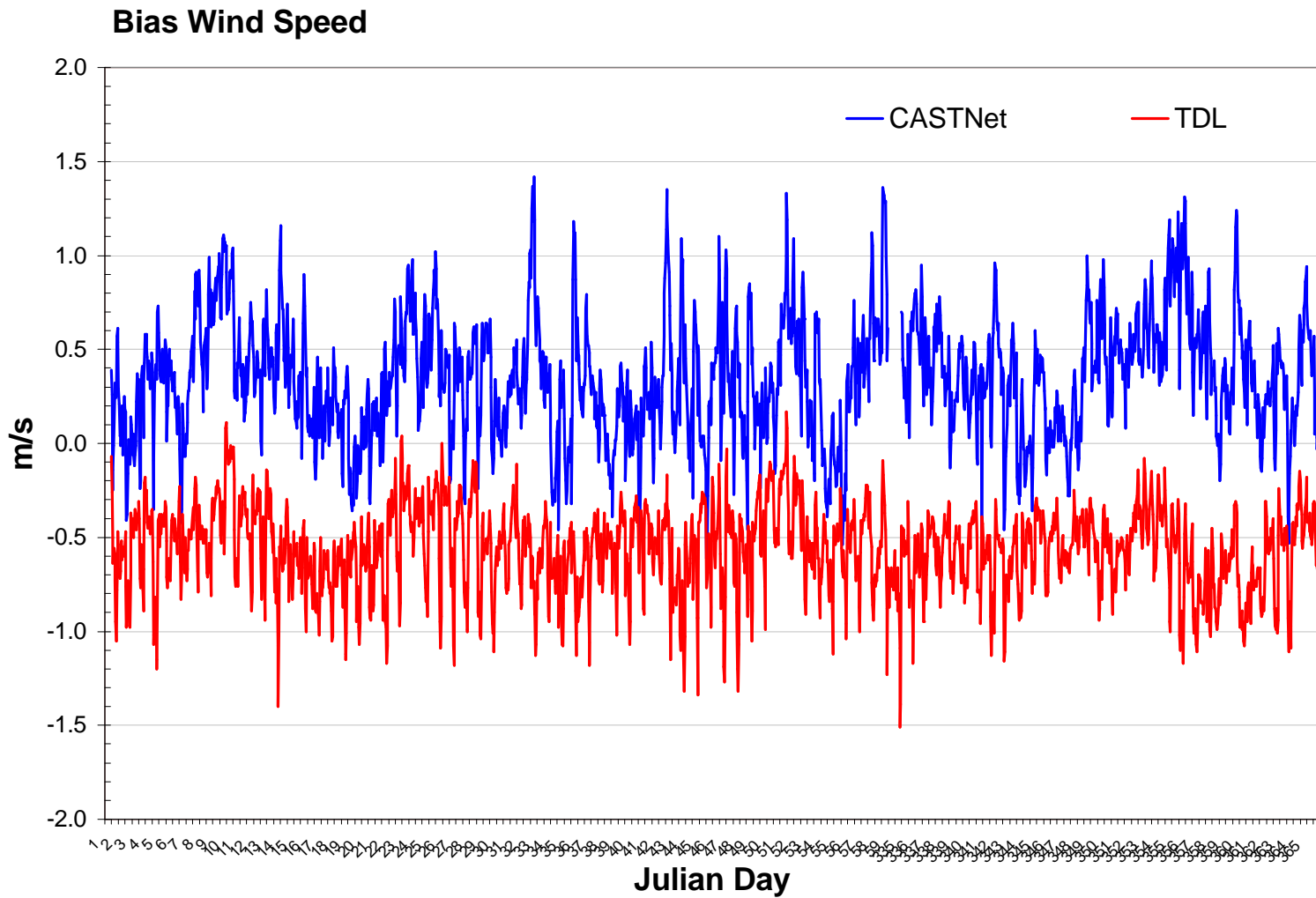


# Observation Network

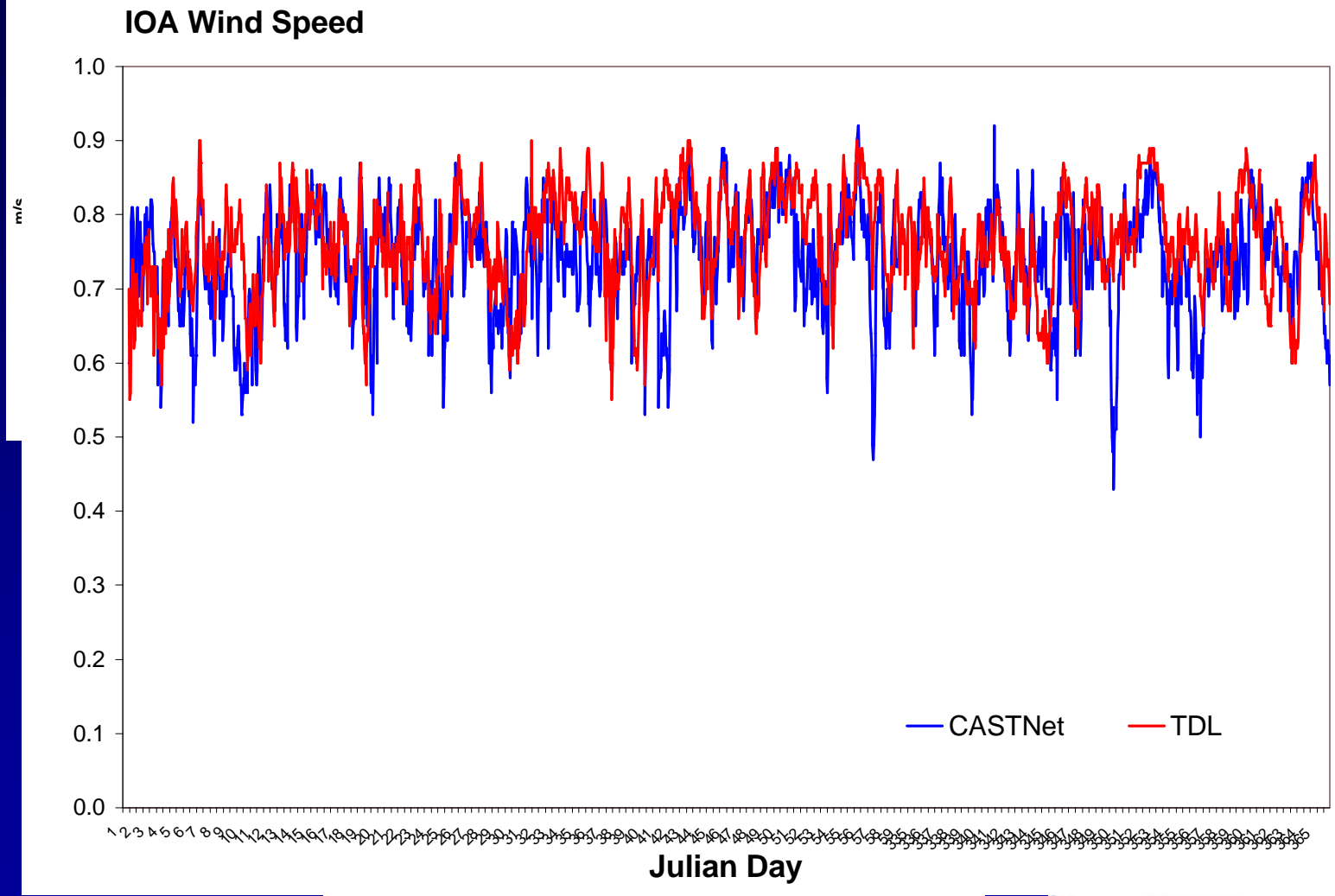


# WIND

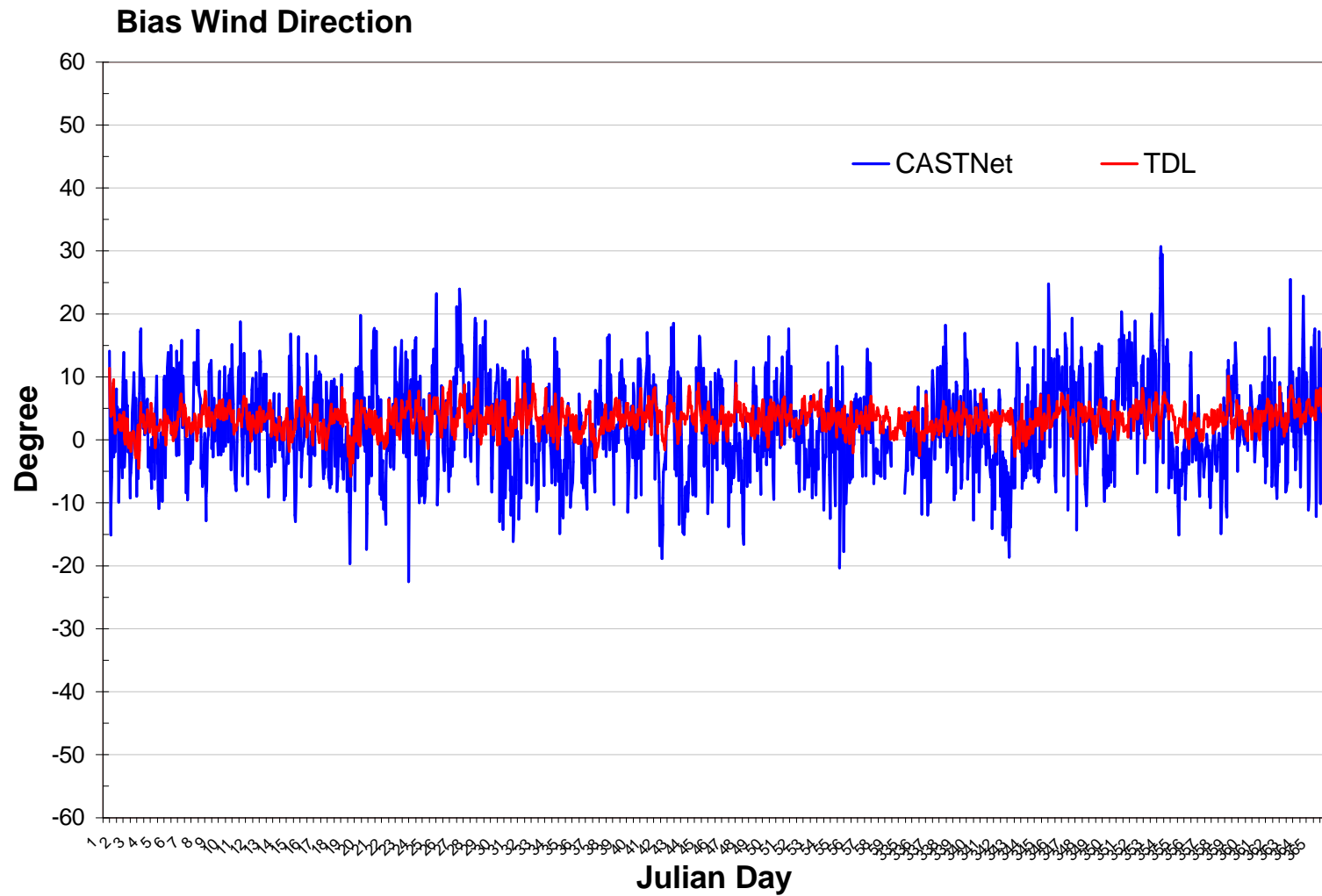
# WINTER Wind Speed



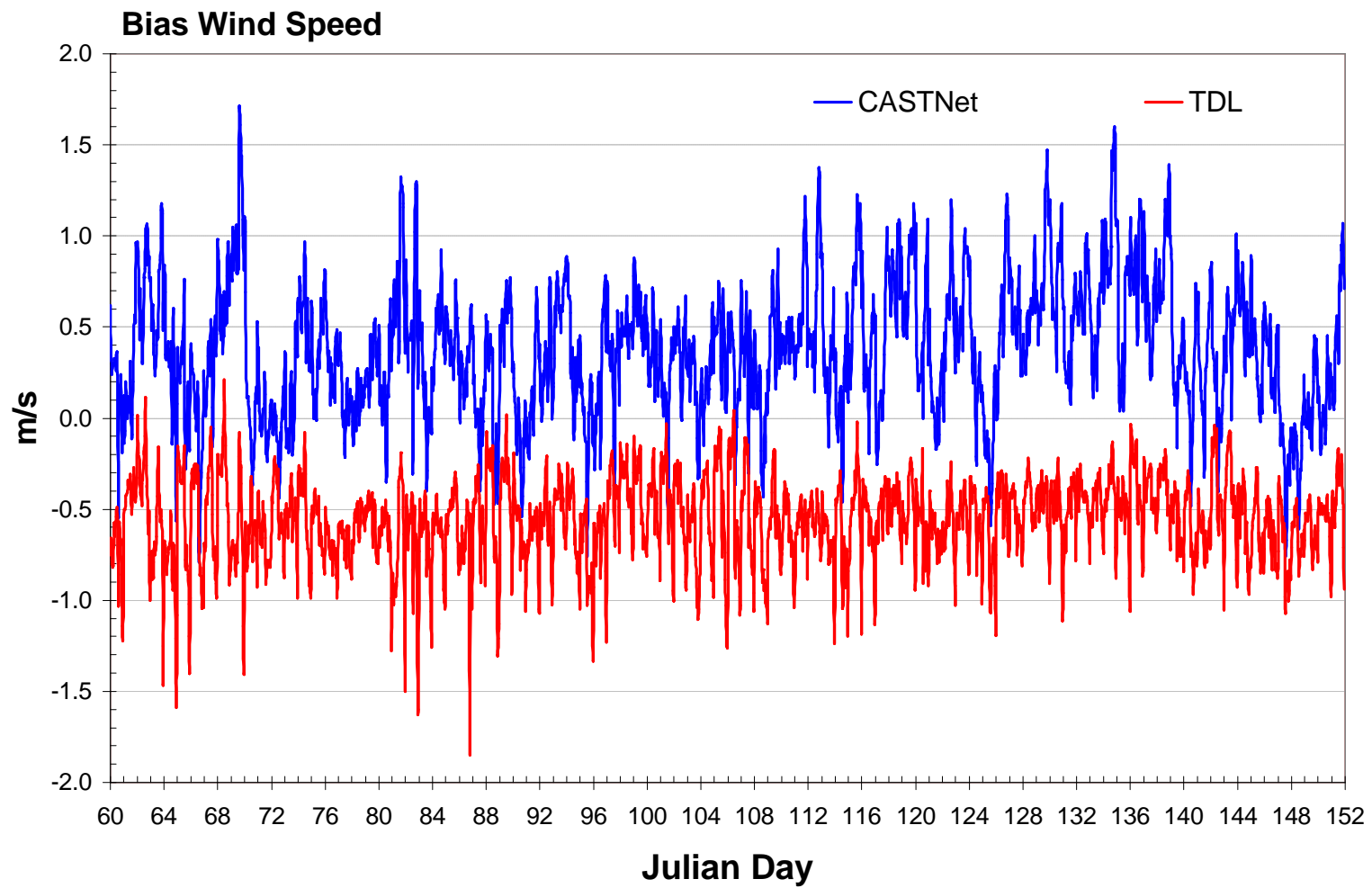
# WINTER Wind Speed (II)



# WINTER Wind Direction

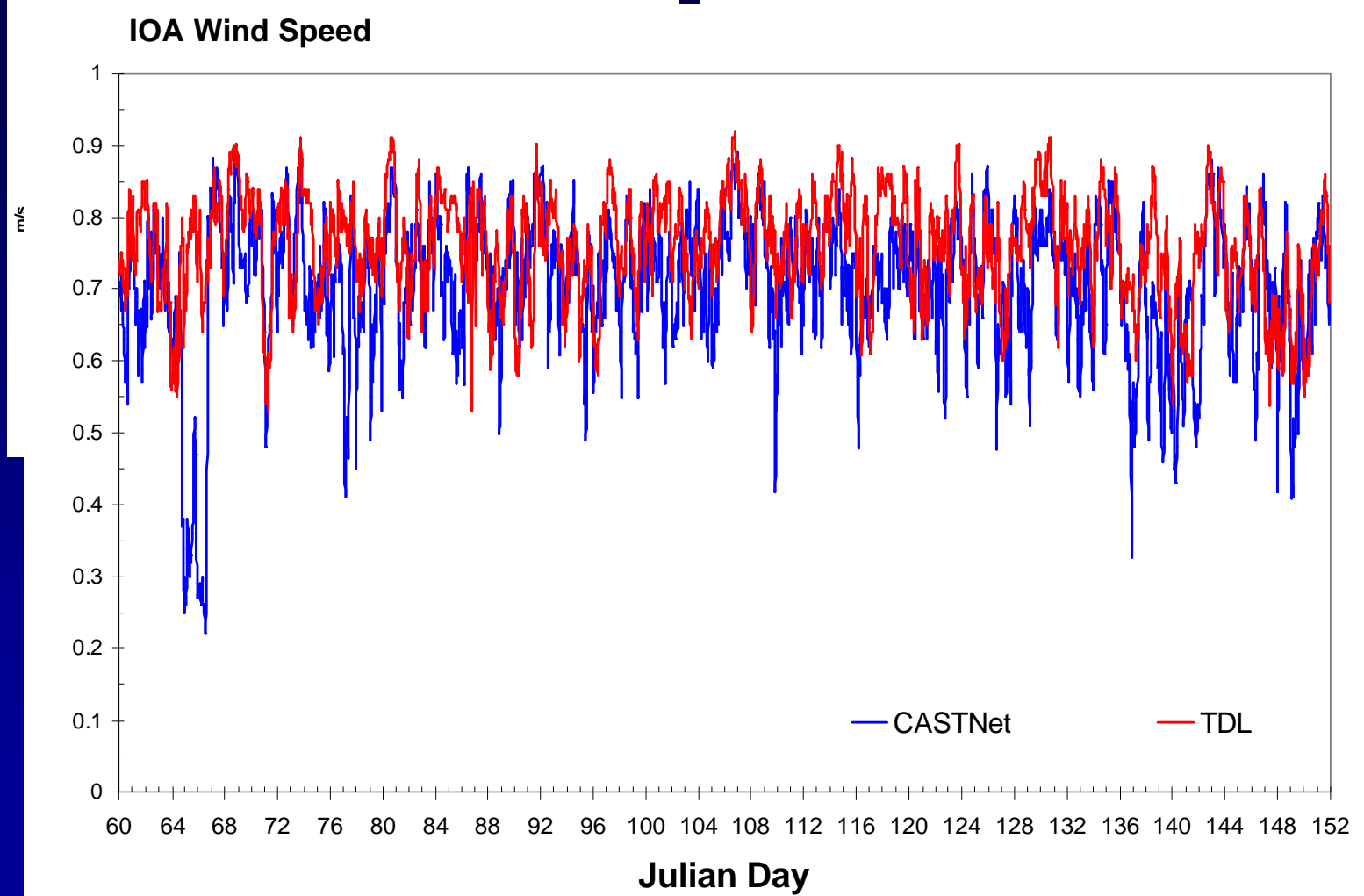


# SPRING Wind Speed

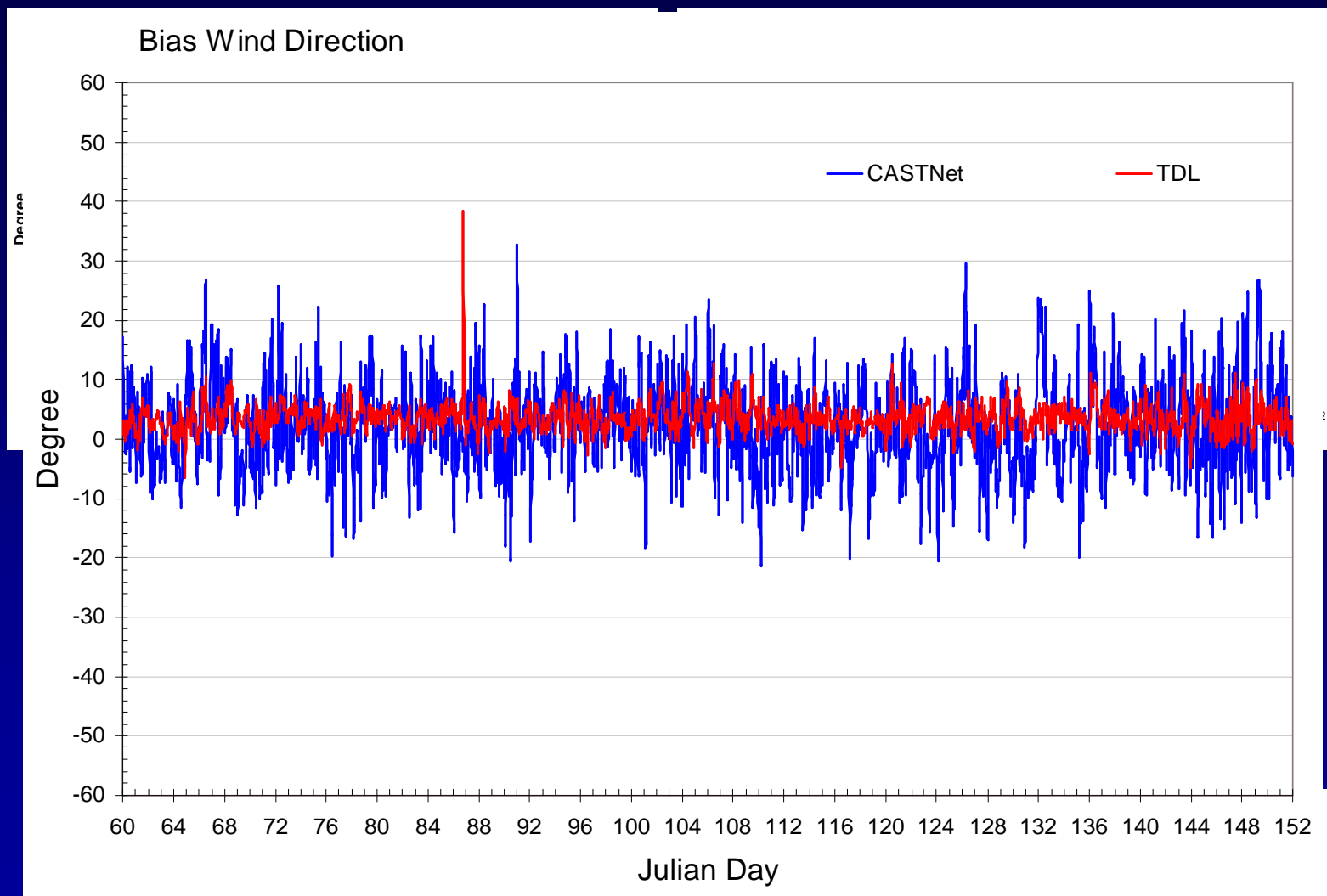




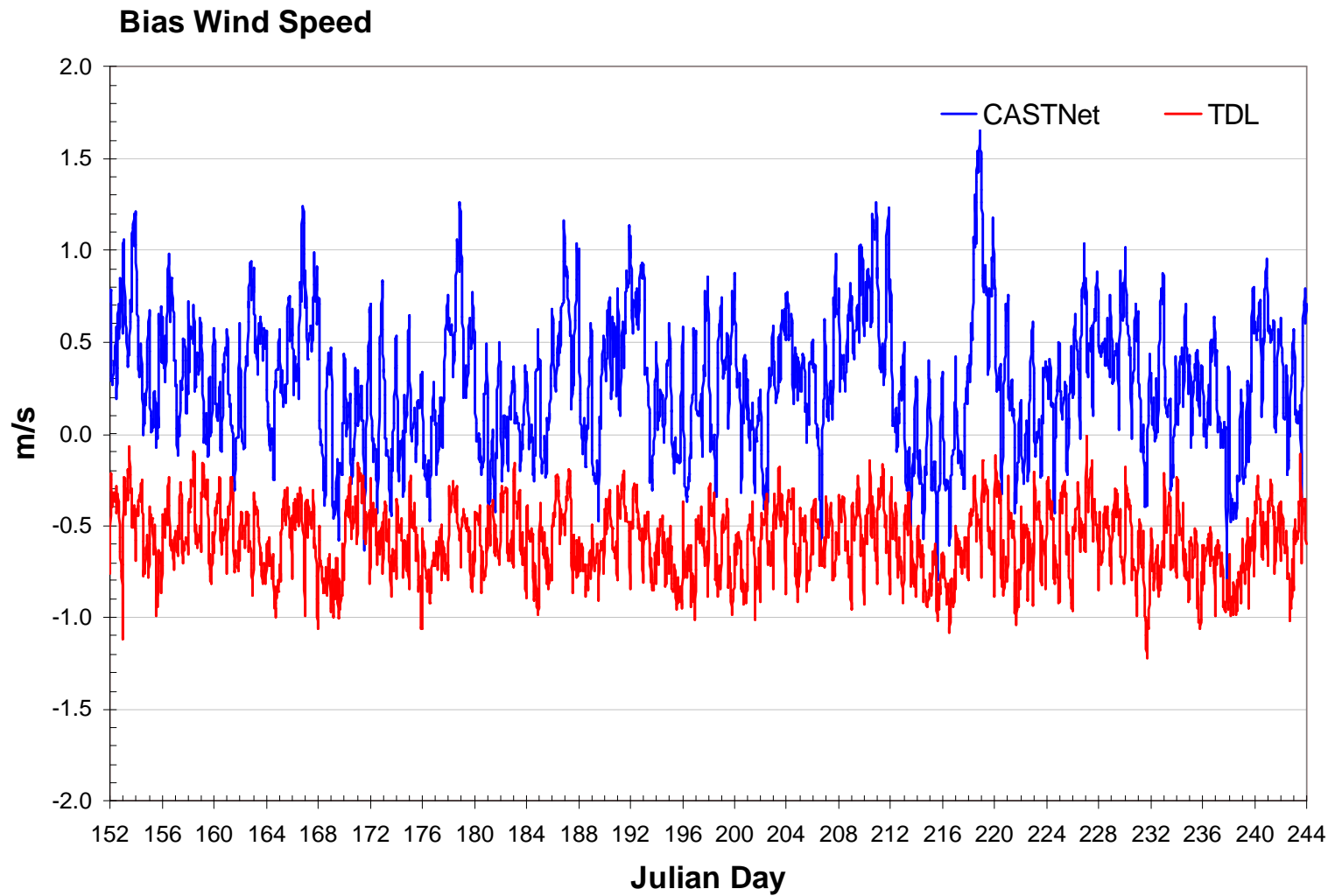
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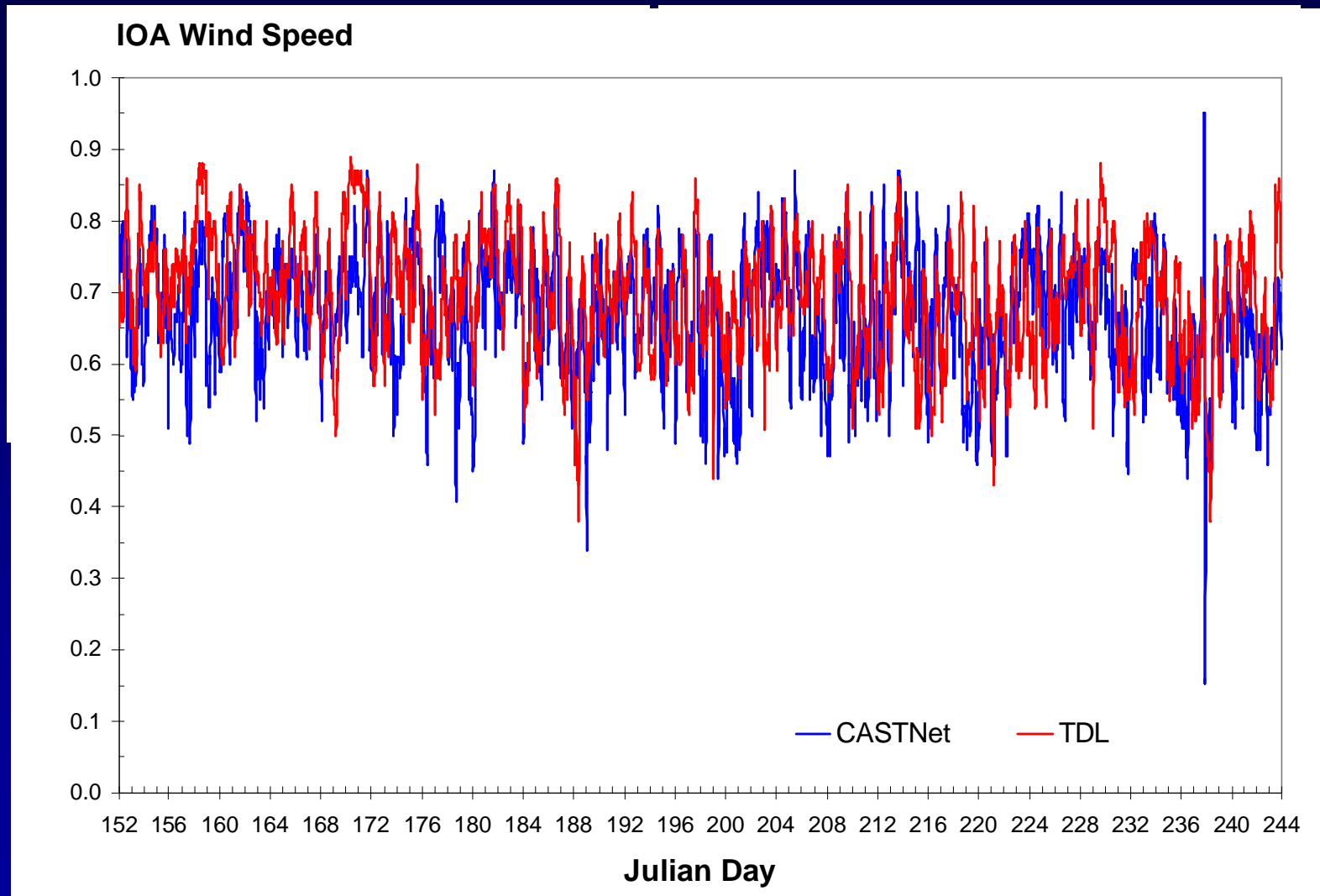
# SPRING Wind Direction



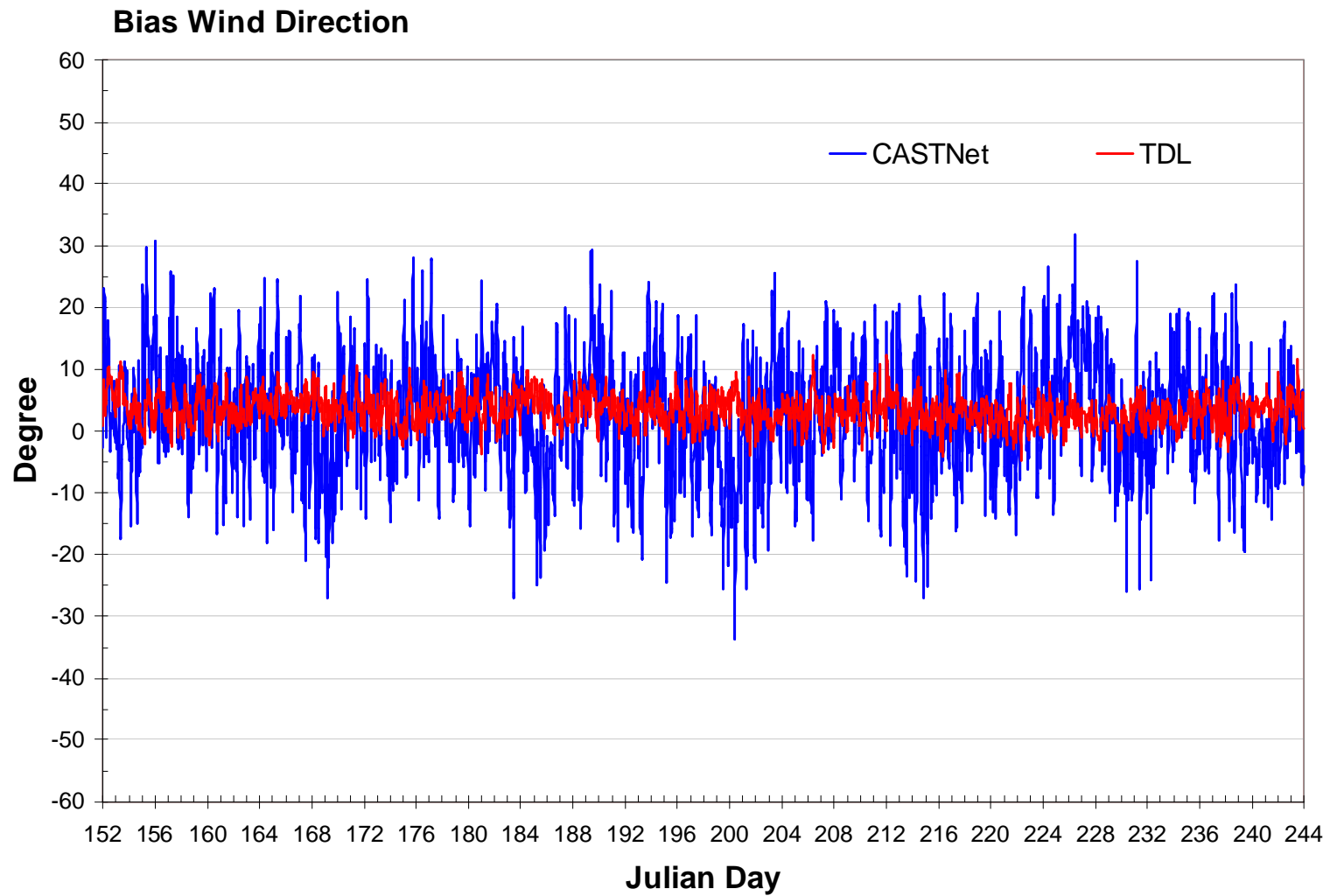
# SUMMER Wind Speed



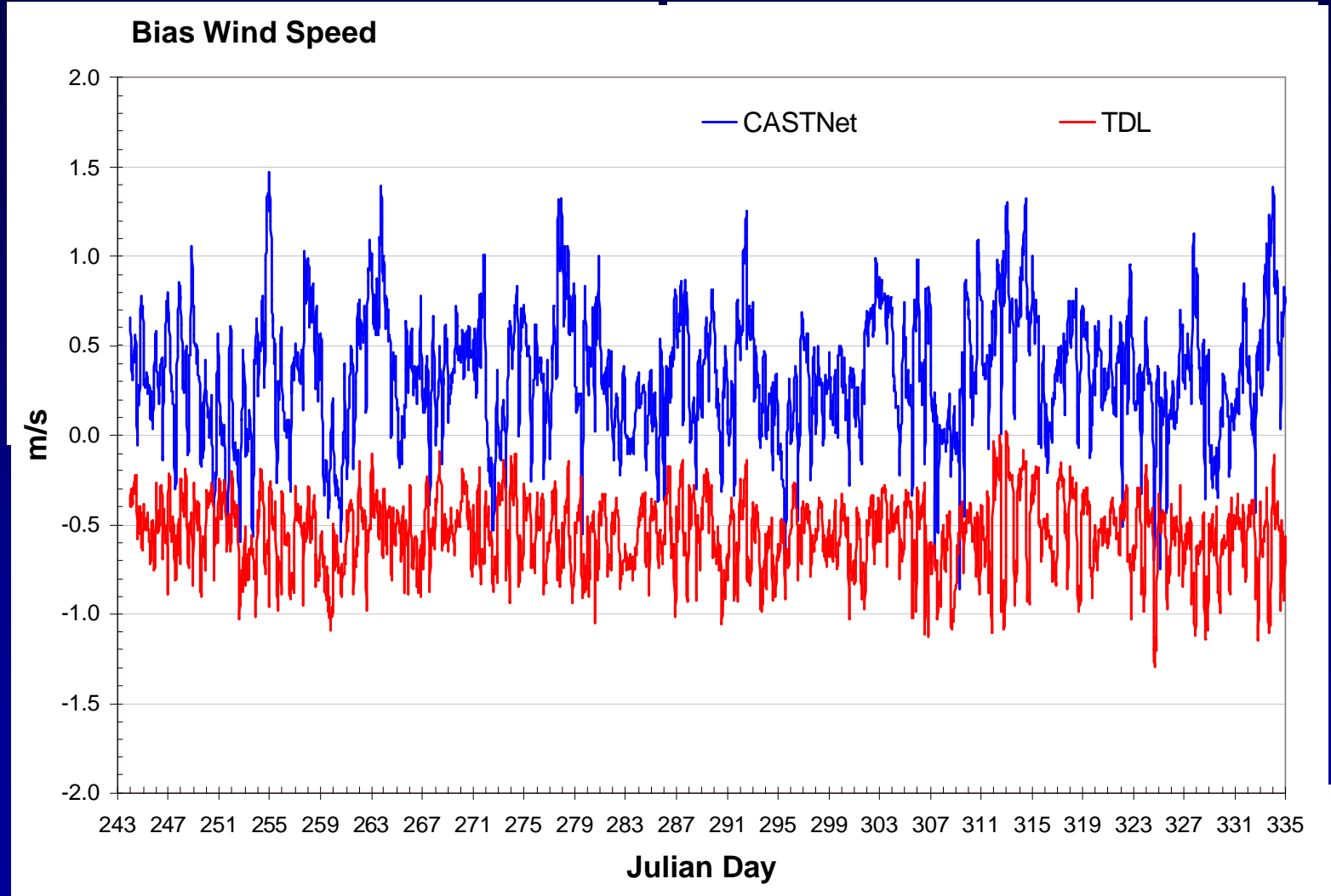
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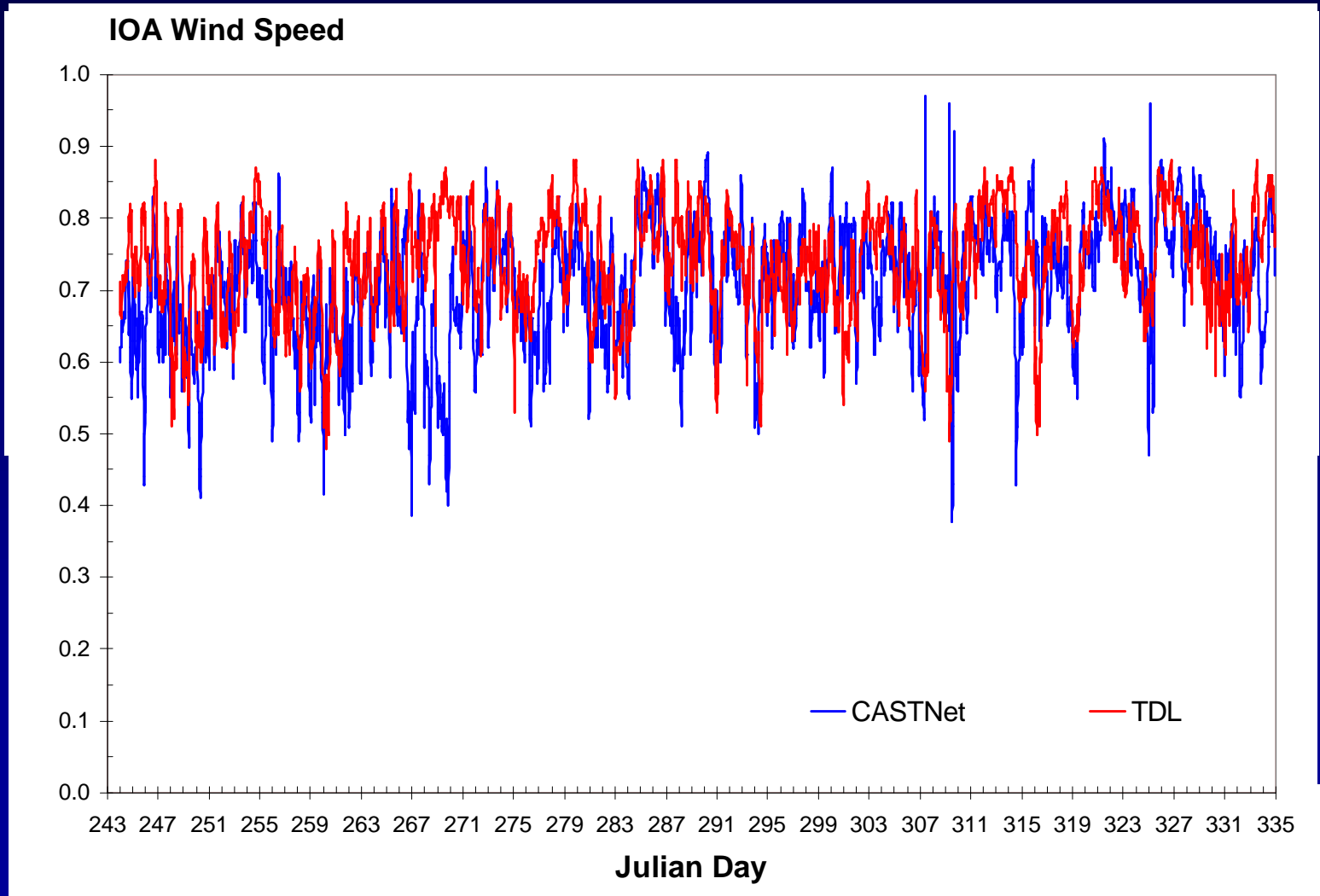
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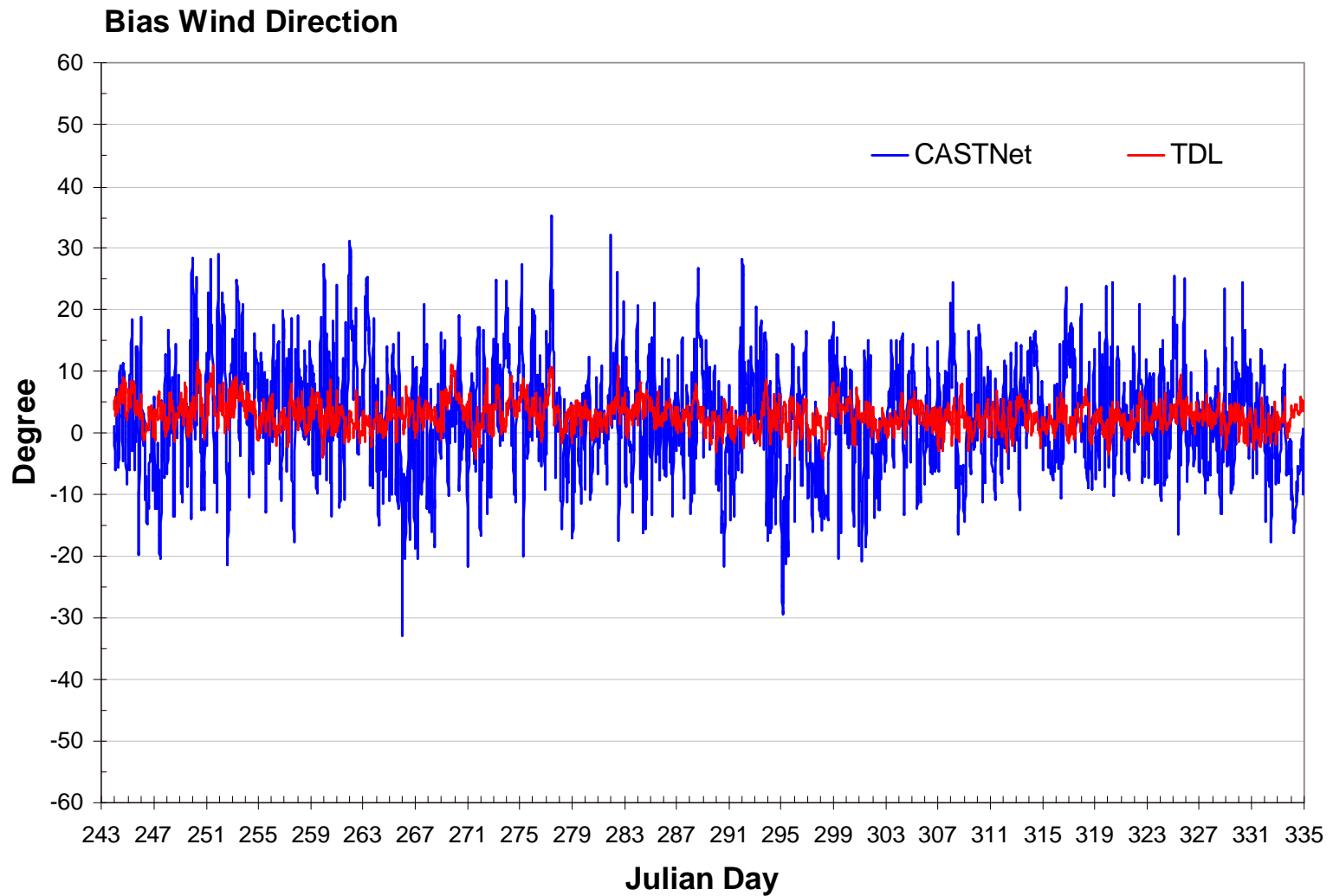
# FALL Wind Speed



# FALL Wind Speed (II)



# FALL Wind Direction





# WIND

2002	Network	Wind Speed						Wind Direction		
		Bias			IOA			Bias		
		Max	Min	Mean	Max	Min	Mean	Max	Min	Mean
JAN	CASTNET	1.16	-0.42	0.34	0.88	0.52	0.73	23.98	-22.55	2.54
	TDL	0.11	-1.40	-0.53	0.90	0.55	0.74	11.42	-5.81	3.12
FEB	CASTNET	1.42	-0.61	0.31	0.92	0.47	0.75	18.55	-20.29	0.88
	TDL	0.17	-1.51	-0.56	0.90	0.55	0.79	8.98	-2.80	3.31
MAR	CASTNET	1.70	-0.79	0.31	0.89	0.22	0.70	26.54	-20.04	1.93
	TDL	0.21	-1.85	-0.59	0.91	0.53	0.76	38.45	-6.45	3.48
APR	CASTNET	1.37	-0.76	0.38	0.89	0.42	0.73	32.74	-21.19	2.49
	TDL	0.04	-1.33	-0.55	0.92	0.58	0.77	12.80	-4.59	3.61
MAY	CASTNET	1.60	-0.76	0.44	0.88	0.33	0.69	29.64	-20.58	2.33
	TDL	-0.04	-1.19	-0.52	0.91	0.54	0.74	11.25	-4.80	3.53
JUN	CASTNET	1.25	-0.63	0.28	0.87	0.41	0.69	30.65	-26.33	3.33
	TDL	-0.07	-1.11	-0.56	0.89	0.50	0.73	11.15	-3.65	3.89
JUL	CASTNET	1.26	-0.58	0.31	0.87	0.34	0.66	29.26	-33.34	1.44
	TDL	-0.14	-1.01	-0.58	0.86	0.38	0.68	12.30	-3.84	3.62
AUG	CASTNET	1.65	-0.87	0.24	0.95	0.16	0.65	31.83	-26.96	2.34
	TDL	-0.02	-1.22	-0.61	0.88	0.38	0.67	11.76	-4.67	2.74
SEP	CASTNET	1.47	-0.75	0.30	0.87	0.39	0.67	30.95	-32.73	3.01
	TDL	-0.09	-1.09	-0.54	0.88	0.48	0.72	11.54	-4.19	3.31
OCT	CASTNET	1.32	-0.72	0.32	0.89	0.50	0.72	35.10	-28.90	1.39
	TDL	-0.10	-1.05	-0.56	0.88	0.51	0.74	10.82	-4.09	2.81
NOV	CASTNET	1.39	-0.86	0.37	0.97	0.38	0.74	25.62	-17.68	2.35
	TDL	0.02	-1.29	-0.57	0.88	0.49	0.75	9.30	-3.58	2.28
DEC	CASTNET	1.31	-0.53	0.39	0.92	0.43	0.74	30.70	-18.60	2.69
	TDL	-0.08	-1.17	-0.59	0.89	0.60	0.76	10.08	-5.47	3.41

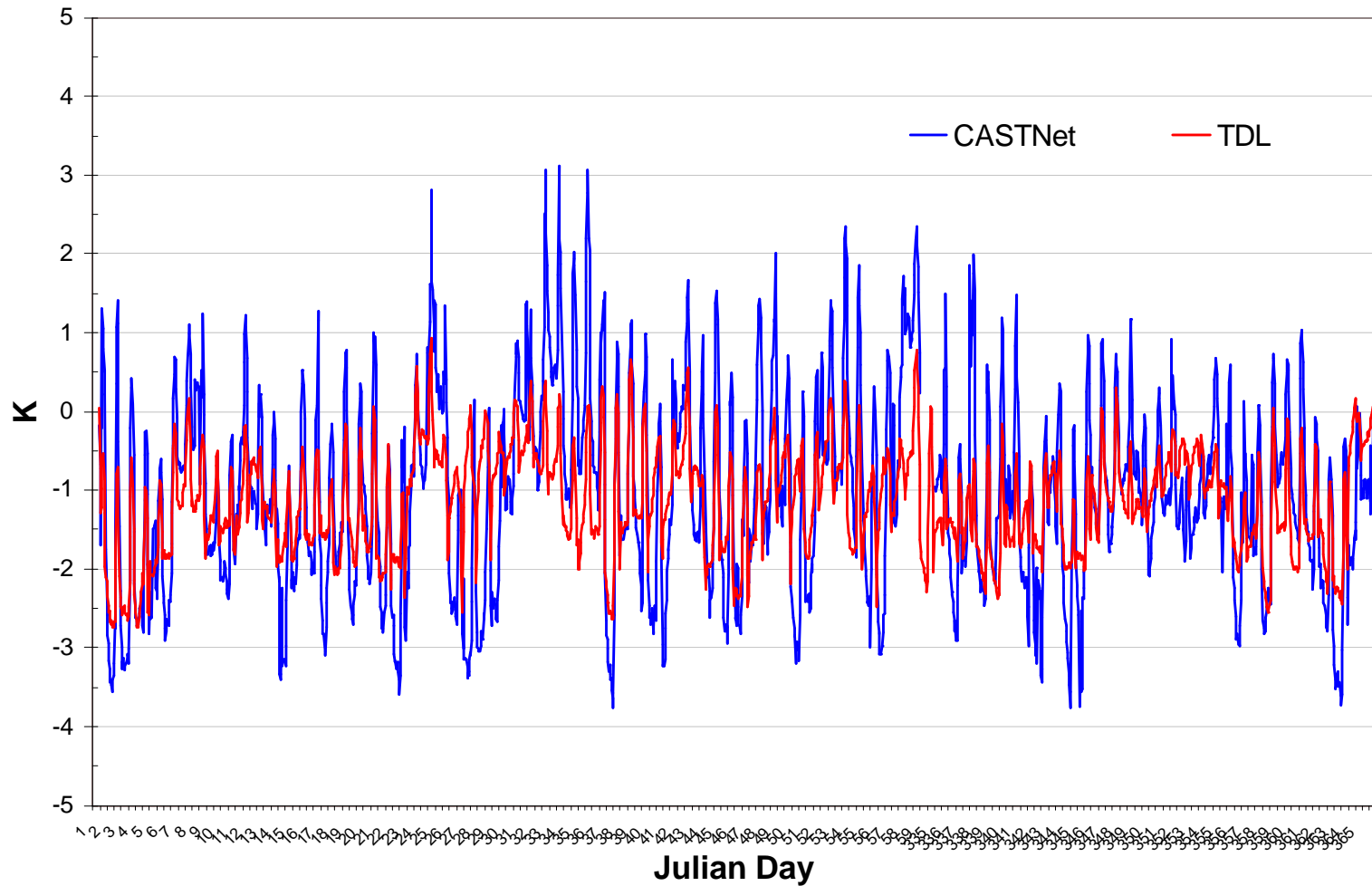
- MM5 tends to overestimate wind speed at CASTNet sites, and underestimate wind speed at TDL sites
- Mean bias of MM5 wind speed to CASTNet wind speed is ~0.3 to 0.4m/s, while mean bias of MM5 wind speed to TDL wind speed is about ~-0.5 to -0.6m/s
- MM5 wind speed shows similar IOA (~0.7 to 0.8) for both CASTnet data and TDL data
- MM5 wind direction shows larger variation to CASTNet wind direction than to TDL wind direction
- However, mean bias of MM5 wind direction to CASTNet wind direction is smaller than mean bias of MM5 wind direction to TDL wind direction



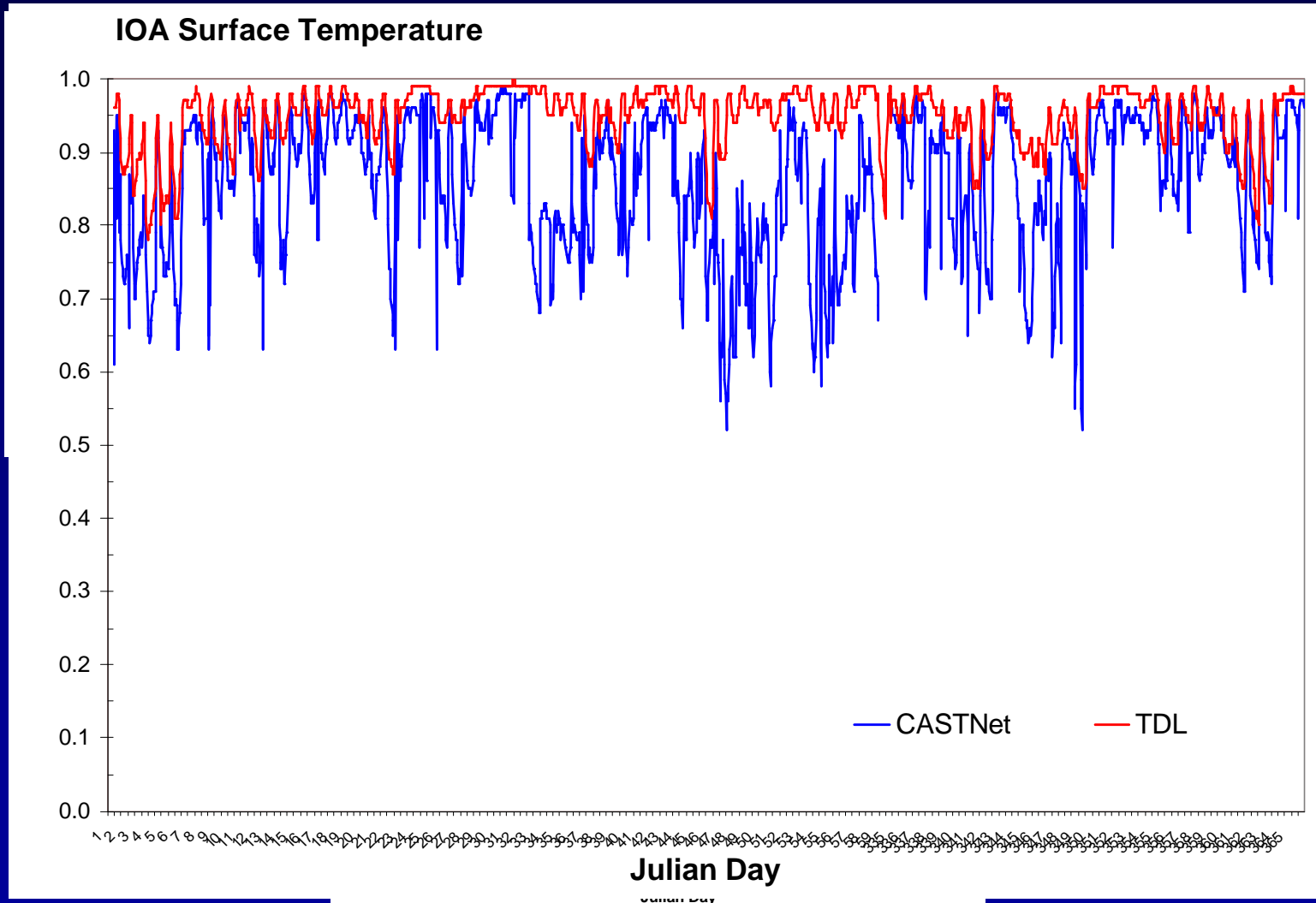
# TEMPERATURE

# WINTER Temperature

Bias Surface Temperature

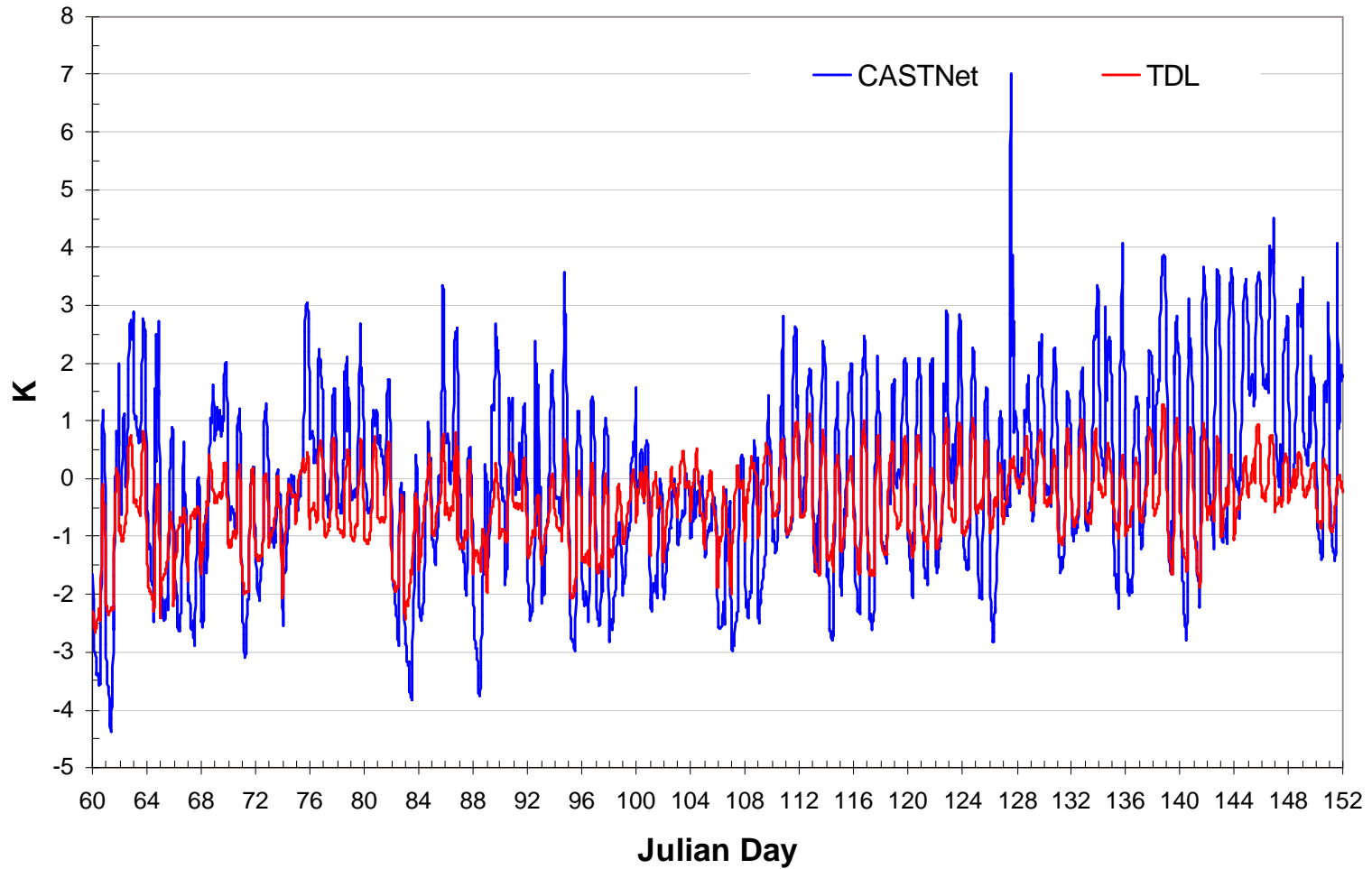


# WINTER Temperature (II)

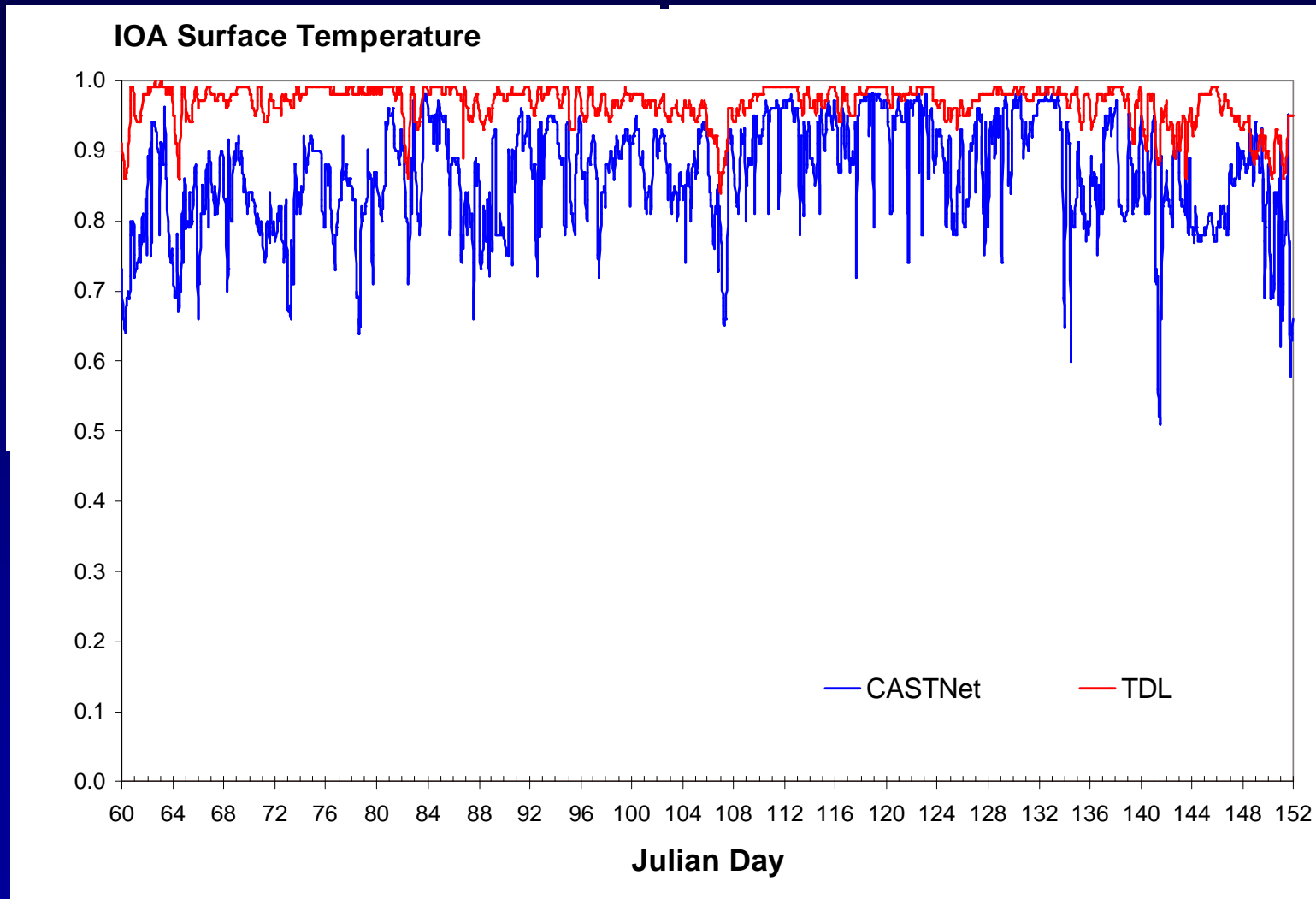


# SPRING Temperature

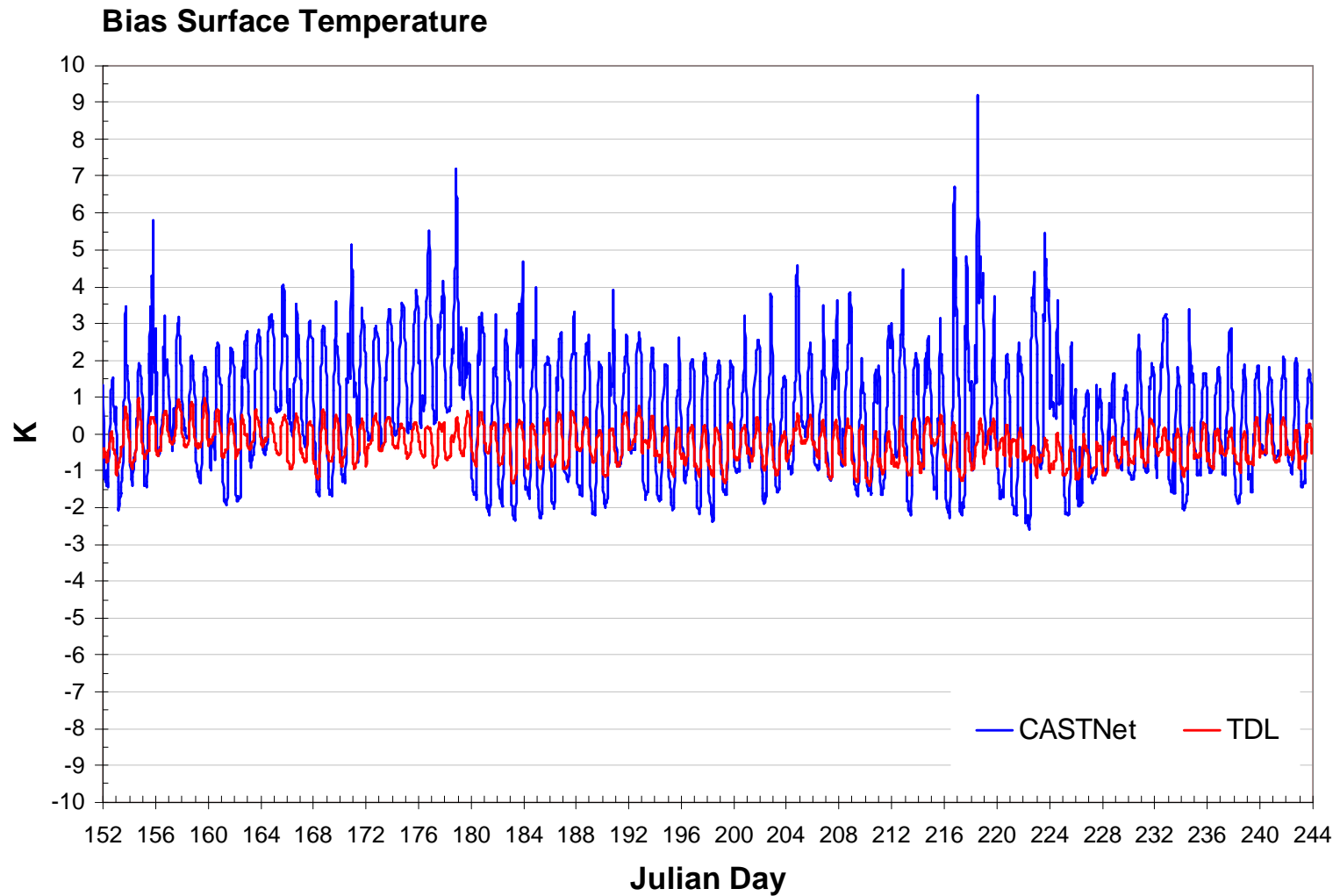
Bias Surface Temperature



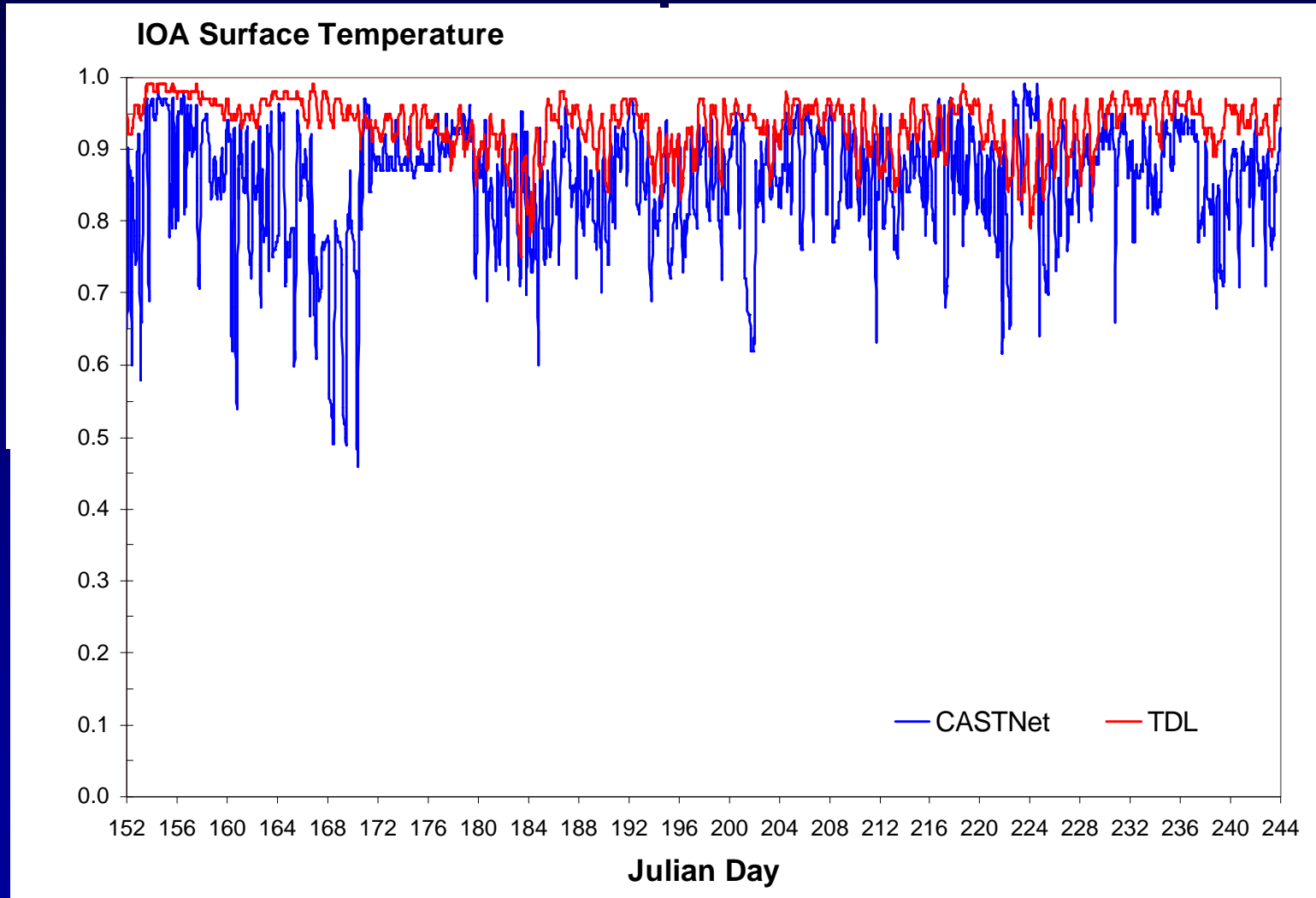
# SPRING Temperature (II)



# SUMMER Temperature



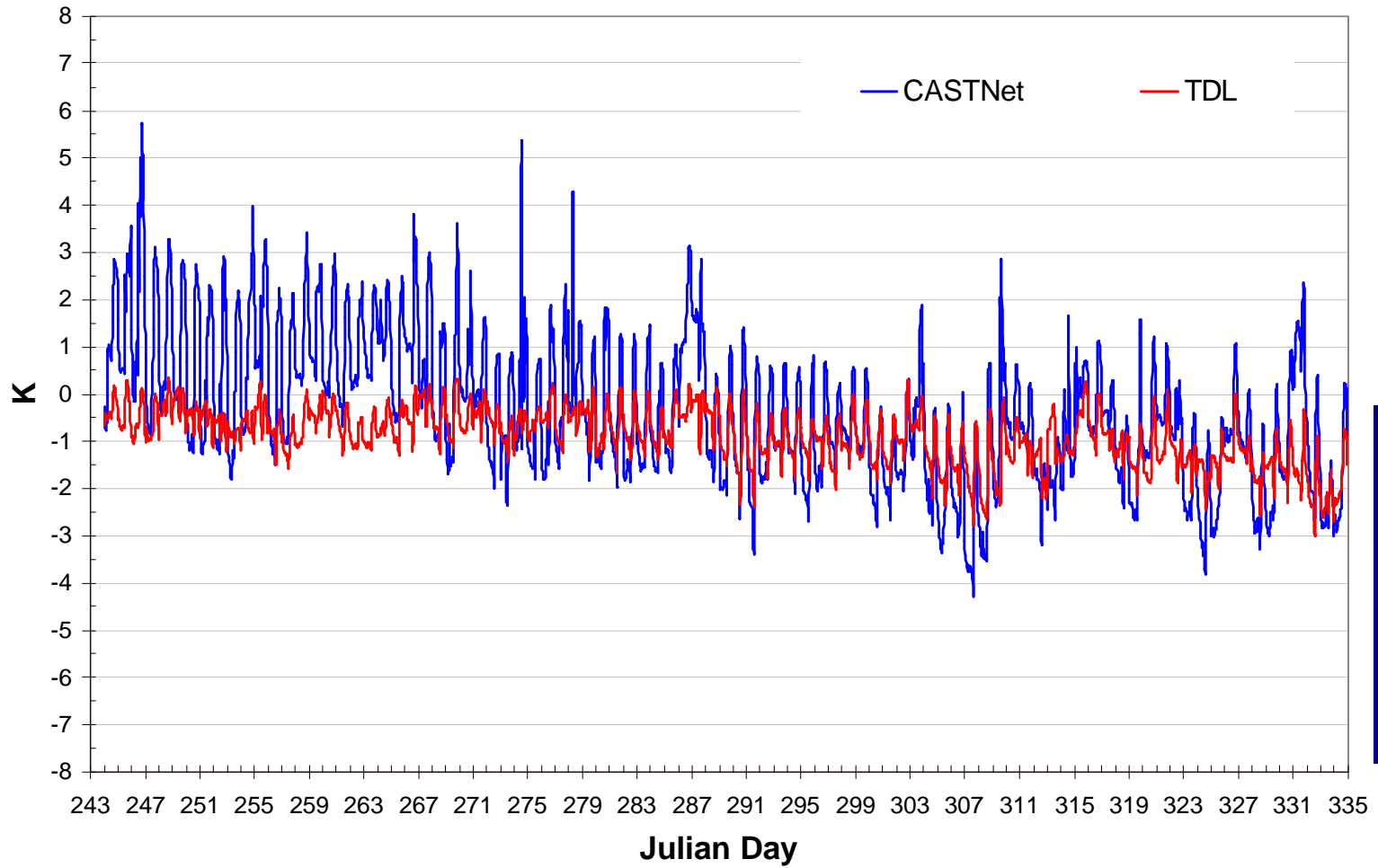
# SUMMER Temperature (II)





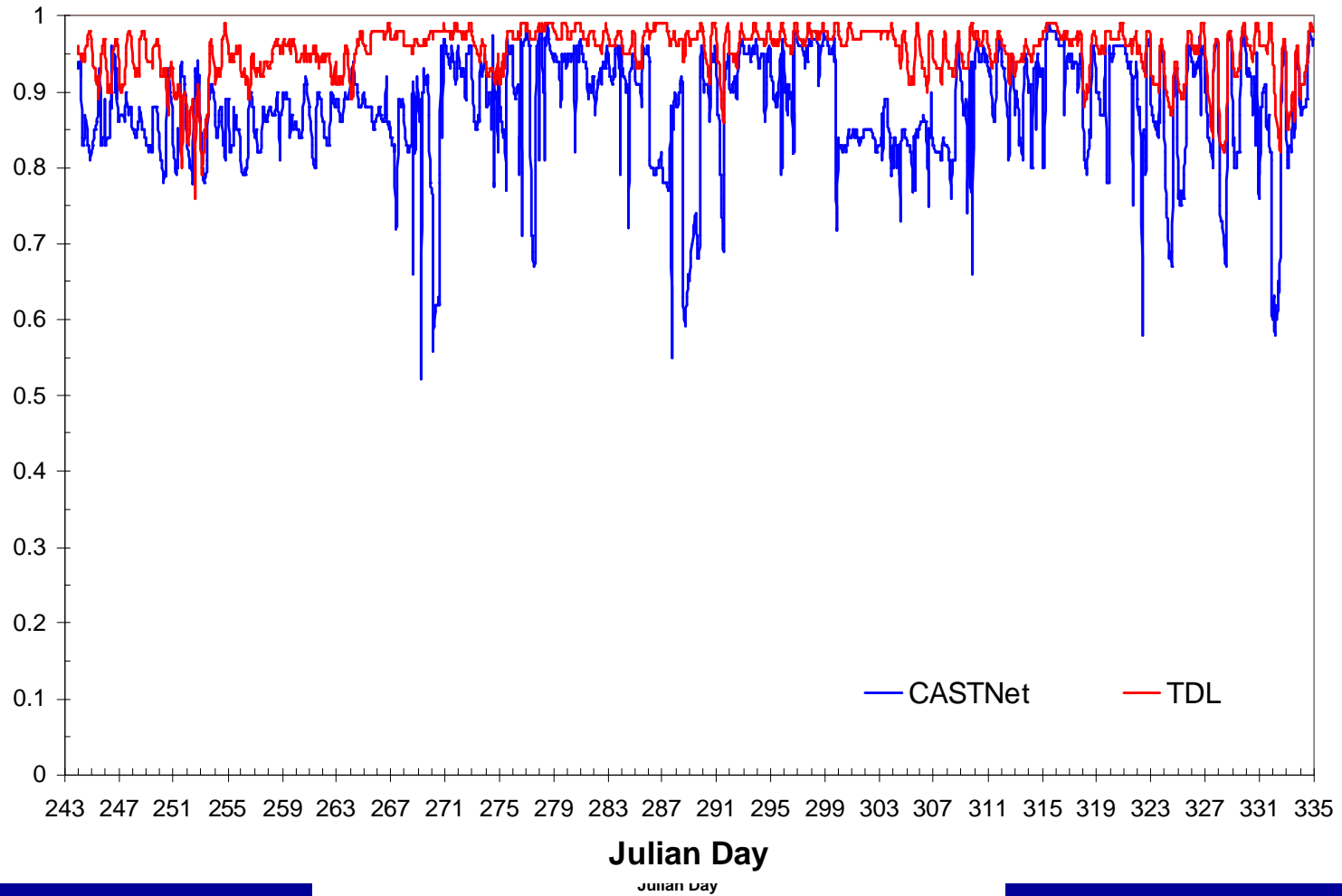
# FALL Temperature

**Bias Surface Temperature**



# FALL Temperature (II)

IOA Surface Temperature



# TEMPERATURE

2002	Network	Temperature					
		Bias			IOA		
		Max	Min	Mean	Max	Min	Mean
JAN	CASTNET	2.81	-3.59	-1.25	0.99	0.61	0.88
	TDL	0.94	-2.73	-1.18	1.00	0.78	0.94
FEB	CASTNET	3.12	-3.77	-0.65	0.98	0.52	0.81
	TDL	0.79	-2.64	-1.00	0.99	0.81	0.96
MAR	CASTNET	3.31	-4.39	-0.35	0.98	0.64	0.83
	TDL	0.81	-2.65	-0.72	1.00	0.86	0.97
APR	CASTNET	3.52	-2.97	-0.52	0.98	0.65	0.90
	TDL	1.13	-2.06	-0.48	0.99	0.84	0.97
MAY	CASTNET	7.02	-2.83	0.67	0.99	0.51	0.87
	TDL	1.27	-1.88	-0.18	0.99	0.86	0.96
JUN	CASTNET	7.13	-2.23	1.03	0.98	0.46	0.85
	TDL	0.98	-1.21	-0.12	0.99	0.85	0.95
JUL	CASTNET	4.70	-2.40	0.34	0.97	0.60	0.85
	TDL	0.74	-1.38	-0.34	0.98	0.75	0.92
AUG	CASTNET	9.03	-2.59	0.32	0.99	0.62	0.86
	TDL	0.53	-1.28	-0.42	0.99	0.79	0.93
SEP	CASTNET	5.72	-2.37	0.76	0.97	0.52	0.86
	TDL	0.34	-1.57	-0.54	0.99	0.76	0.94
OCT	CASTNET	5.17	-3.39	-0.56	0.99	0.55	0.89
	TDL	0.29	-2.39	-0.79	0.99	0.86	0.97
NOV	CASTNET	2.83	-4.29	-1.25	0.99	0.58	0.88
	TDL	0.25	-2.99	-1.35	0.99	0.82	0.95
DEC	CASTNET	1.98	-3.76	-1.17	0.98	0.52	0.88
	TDL	0.29	-2.55	-1.20	0.99	0.80	0.94

- MM5 tends to underestimate temperature at TDL sites all year, and at CASTNet sites for seasons other than 5month summer
- MM5 performs better on temperature for Summer than for Winter
- Unsystematic RMSE dominates RMSE at TDL sites consistently, while at CASTNet sites, RMSEU weights similar as RMSES
- MM5 shows good IOA at TDL sites (~0.9), better than at CASTNet sites (~0.8)

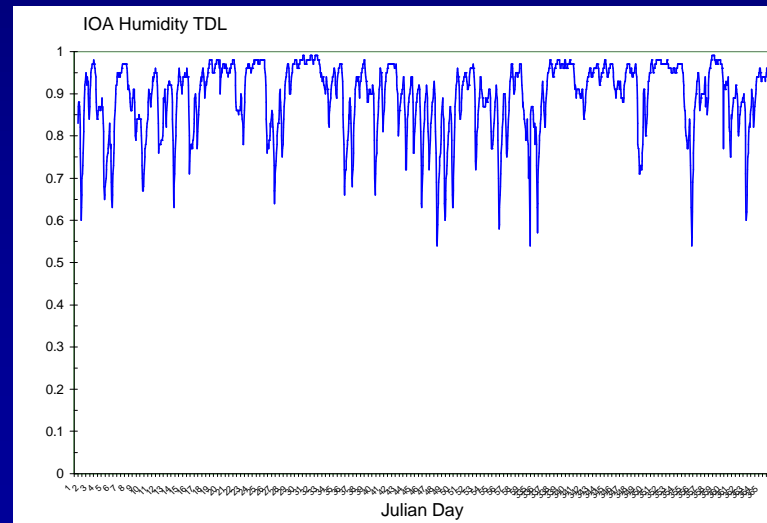
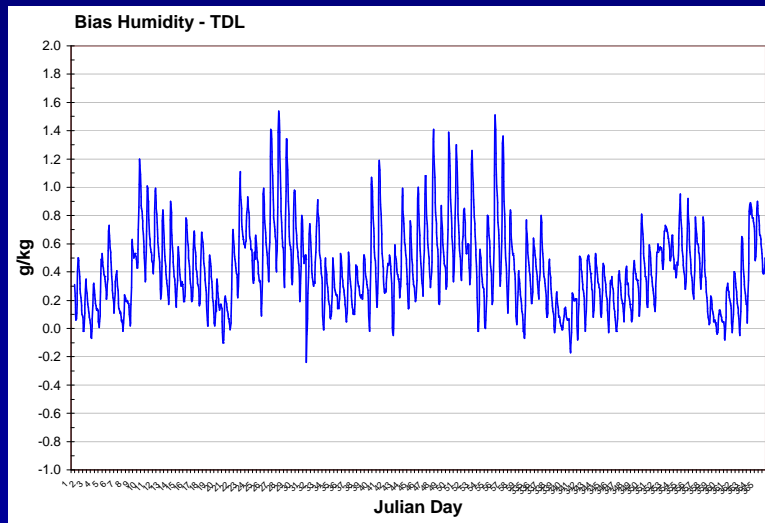
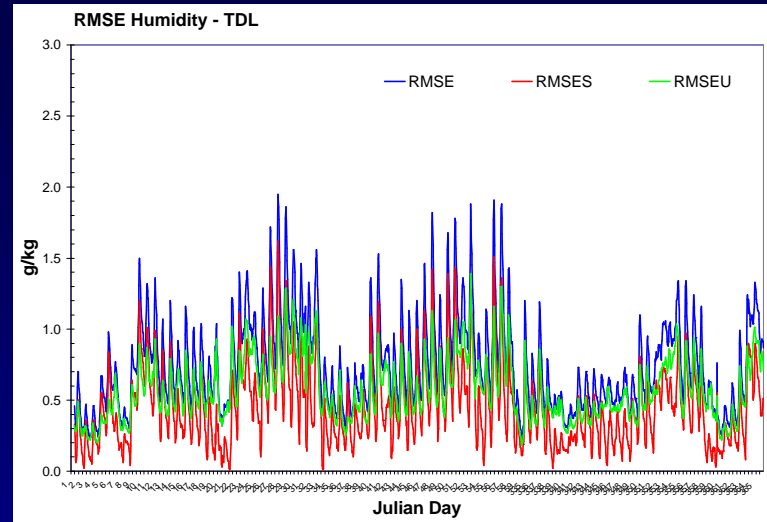
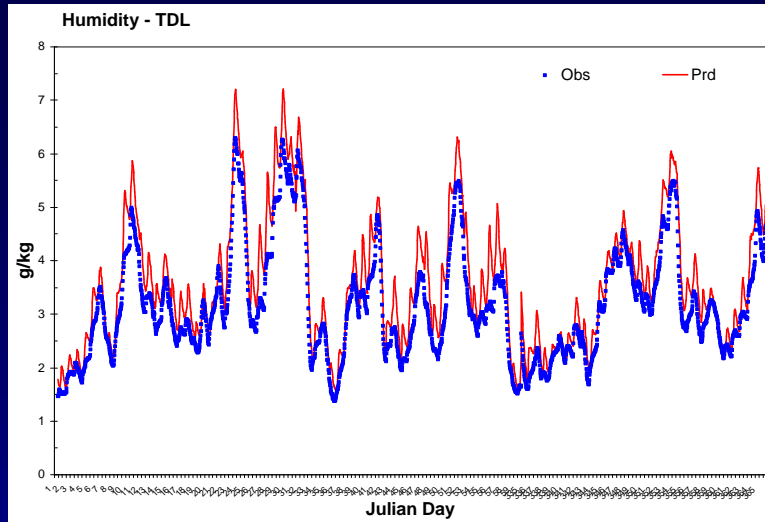


# HUMIDITY

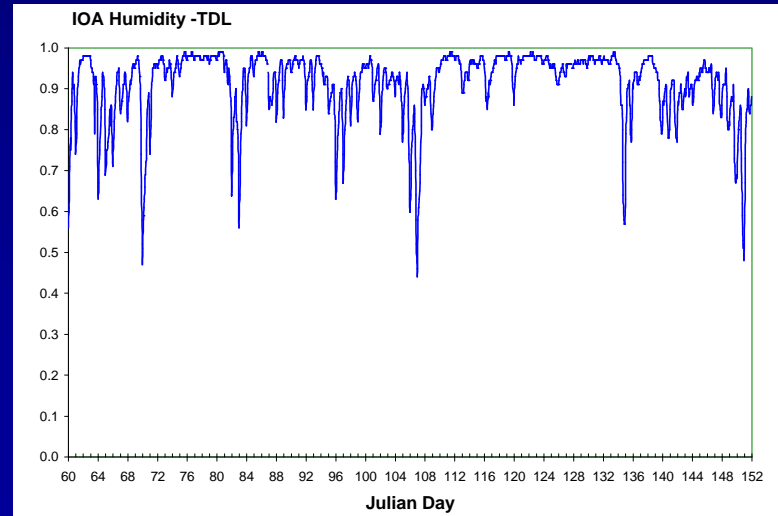
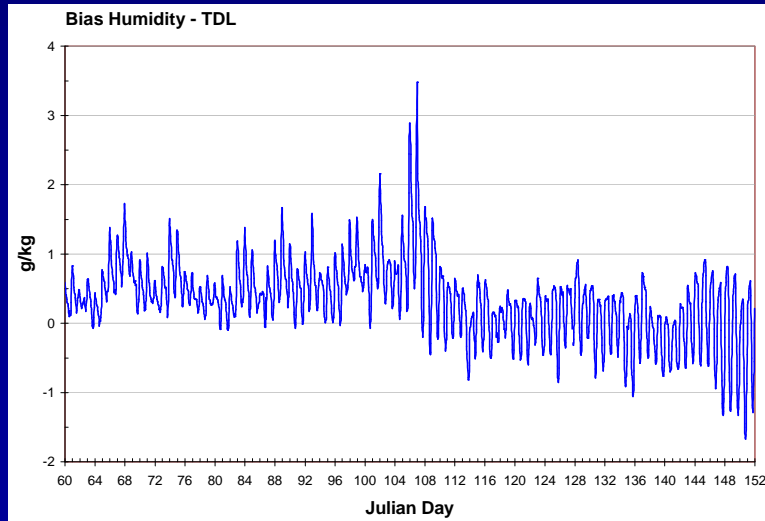
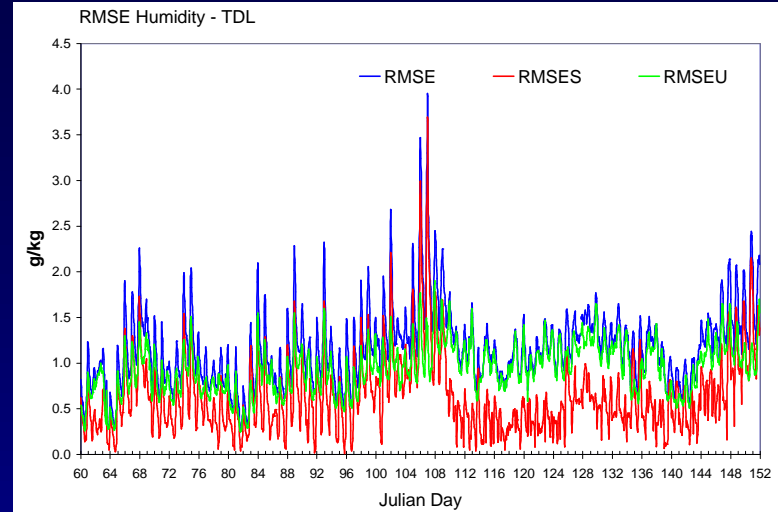
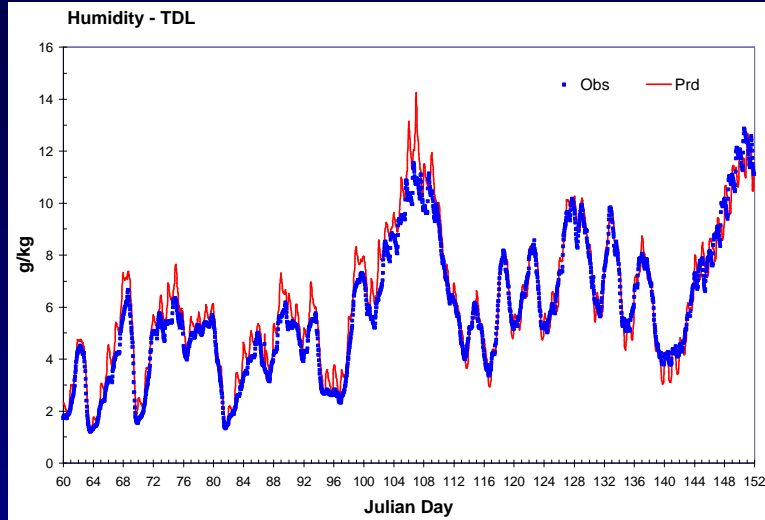
The NESCAUM logo is located in the bottom right corner of the slide. It consists of a white rectangular box containing the word "NESCAUM" in a black, sans-serif font. Above and below the text are two blue, wavy lines that resemble stylized water or steam.

NESCAUM

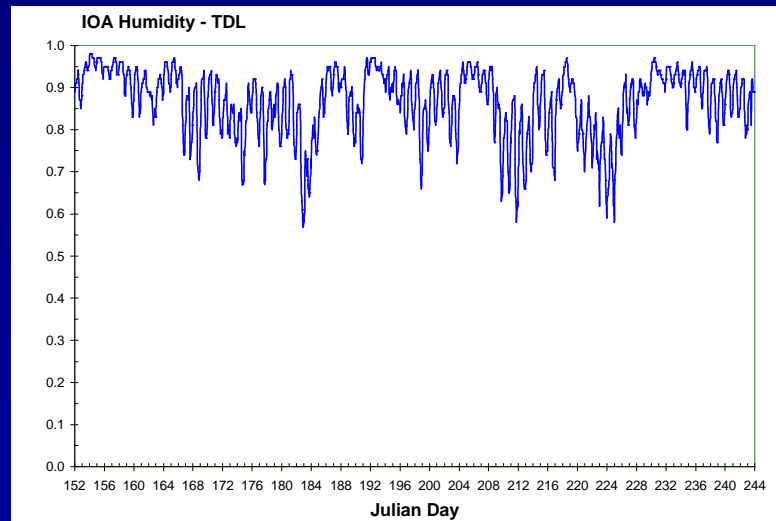
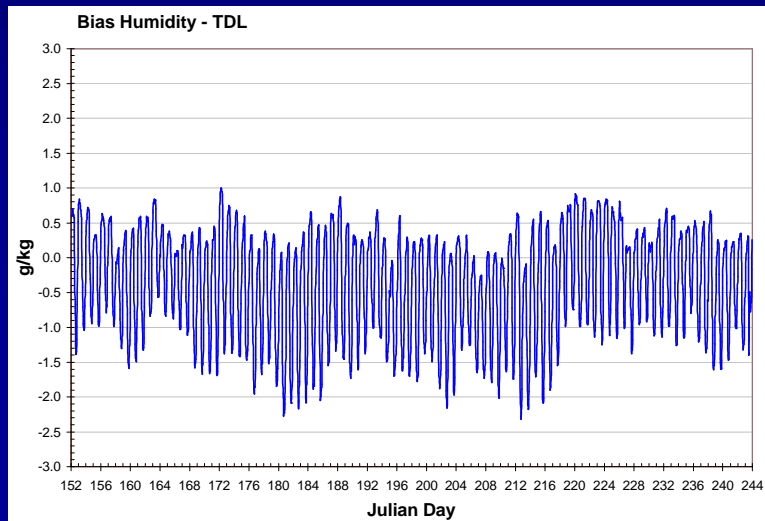
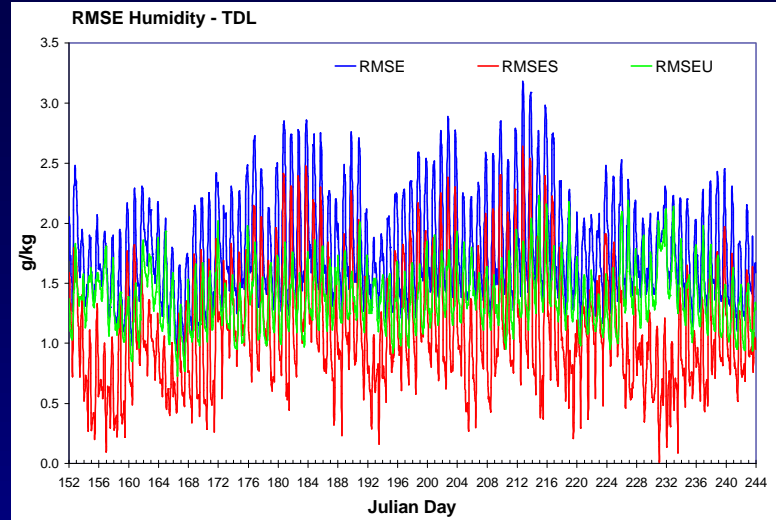
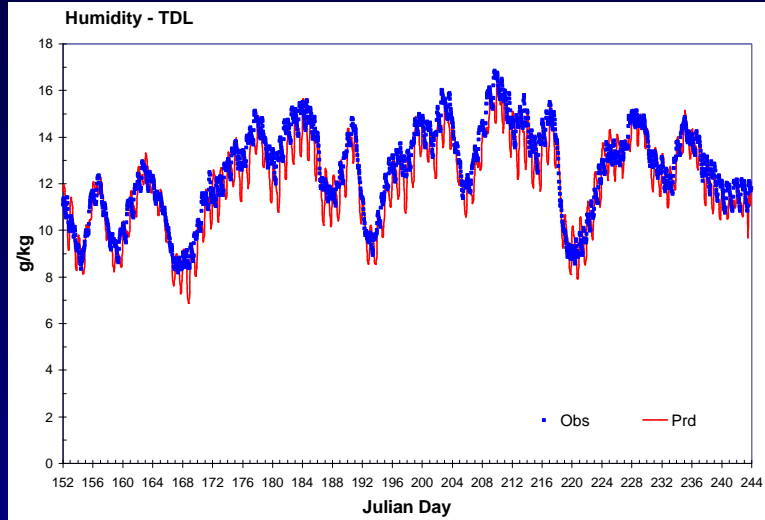
# WINTER Humidity



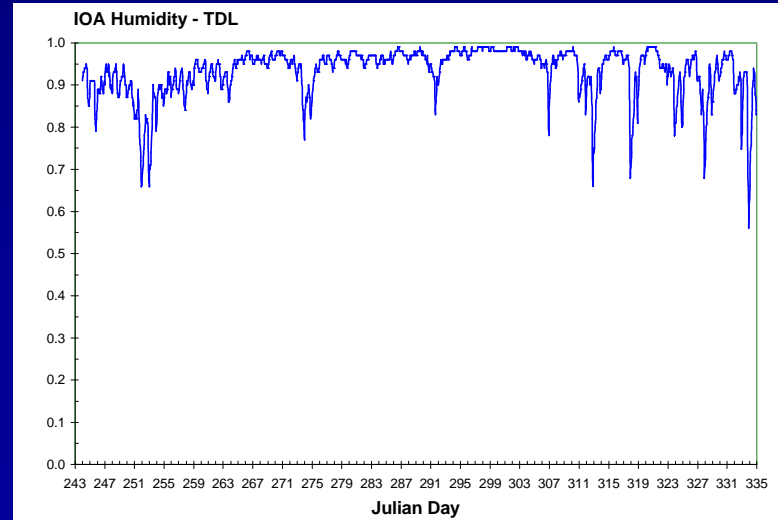
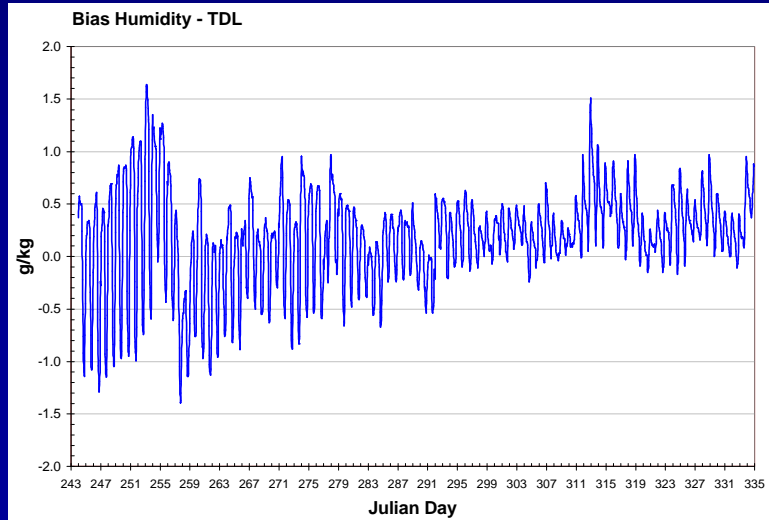
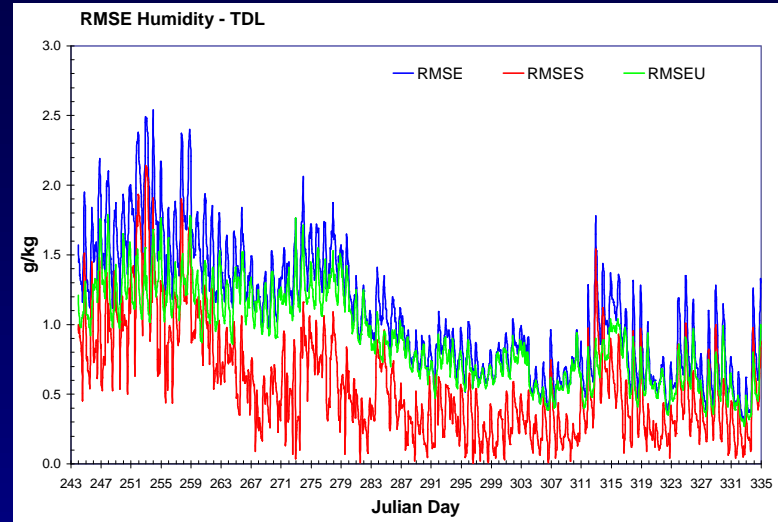
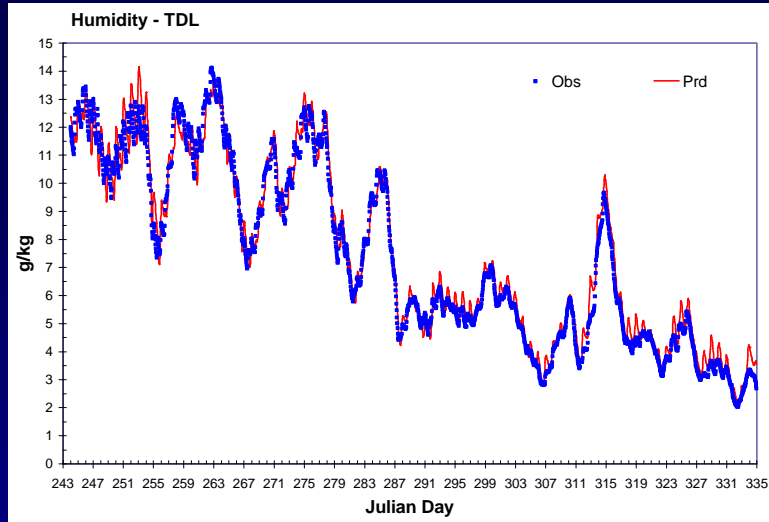
# SPRING Humidity



# SUMMER Humidity



# FALL Humidity





# HUMIDITY

2002	Network	Humidity					
		Bias			IOA		
		Max	Min	Mean	Max	Min	Mean
JAN	TDL	-0.24	-1.54	0.45	0.99	0.60	0.89
FEB	TDL	1.51	-0.07	0.48	0.99	0.54	0.87
MAR	TDL	1.73	-0.10	0.52	0.99	0.47	0.91
APR	TDL	3.48	-0.82	0.52	0.99	0.44	0.91
MAY	TDL	0.92	-1.67	-0.02	0.99	0.48	0.91
JUN	TDL	1.00	-2.27	-0.33	0.98	0.67	0.88
JUL	TDL	0.87	-2.32	-0.55	0.97	0.57	0.86
AUG	TDL	0.92	-2.17	-0.23	0.97	0.58	0.86
SEP	TDL	1.64	-1.39	0.03	0.98	0.66	0.91
OCT	TDL	0.97	-0.67	0.15	0.99	0.80	0.96
NOV	TDL	1.51	-0.17	0.34	0.99	0.56	0.92
DEC	TDL	0.95	-0.17	0.34	0.99	0.54	0.91

- MM5 captures general trend of humidity change
- MM5 tends to overestimate humidity in Winter, Spring, and Fall, but underestimate humidity in 5 month Summer
- MM5 often shows larger diurnal variations than observation
- Unsystematic RMSE dominates RMSE
- MM5 shows good IOA (~0.9) all year