Comparison of 12km and 4km MM5 Domains for Two Episodes for St. Louis

Presented by:
Ken Anderson – Ameren
Steven King – Illinois EPA

June 30 – July 1, 2005
Ad-Hoc Met Group
Denver, CO

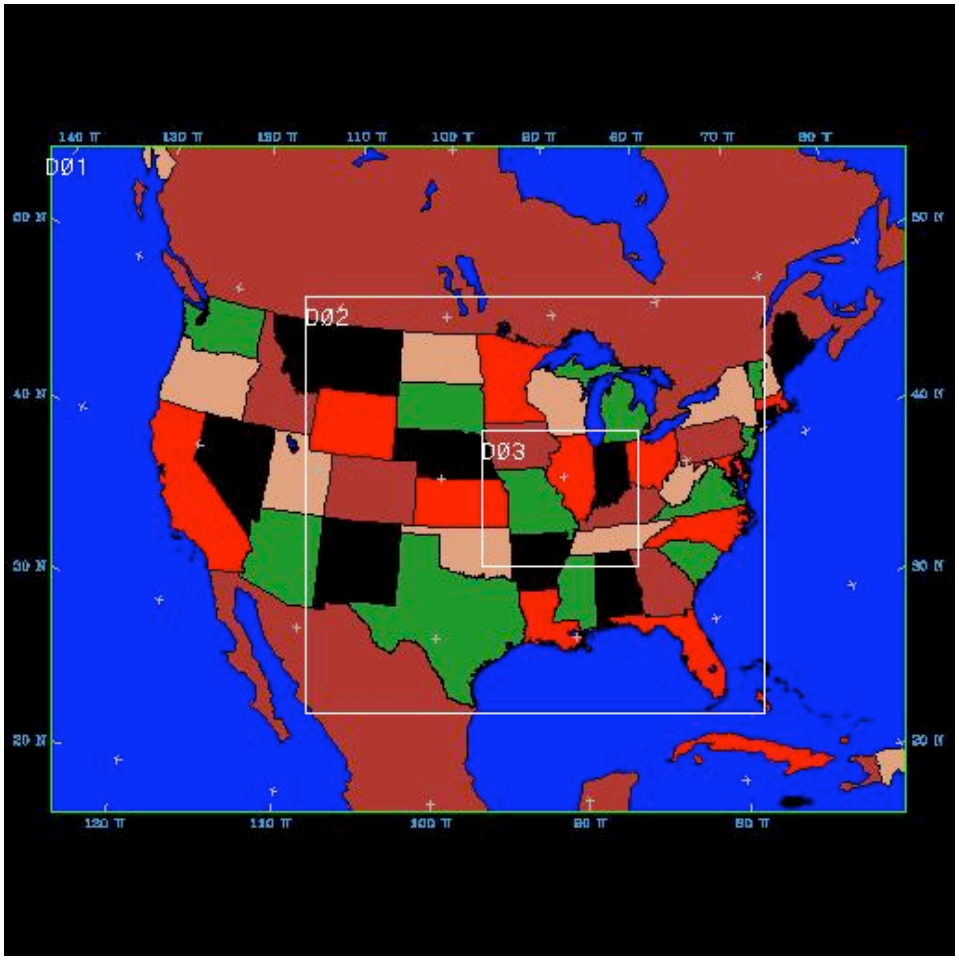
Four Episodes Being Evaluated Plus 2002 Annual

- Jan 25 - Feb 13, 2002 (Illinois EPA)
- June 10 - 24, 2002 (Mo DNR)
- July 2 - 16, 2002 (EPA Region VII)
- July 29 – August 5, 2002 (Ameren)
- Annual 36 - 12km 2002

MM5 Domains

- 36 KM – 165 x 129
  - Center -97° Lon 40° Lat
  - True Latitudes 33° & 45°
- 12 KM – 265 x 241
- 4 KM – 271 x 235

The MM5 Domains



MM5 Options

- Moisture Scheme – Mixed Phase
- Sub grid Scale Cumulus – KF2 (36 & 12 km grids only)
- LSM Scheme – Pleim-Xiu
- Atmospheric Radiation Scheme – RRTM
- Soil layers – Pleim-Xiu LSM (ISOIL=3)
- No Shallow Convection

MM5 Options - continued

- PX – Soil Moisture from ETA files
- PX – Nudge Soil Moisture
- PX – Plant Growth Model (no planting dates)
- FDDA

  - Nudge Wind in PBL and Above

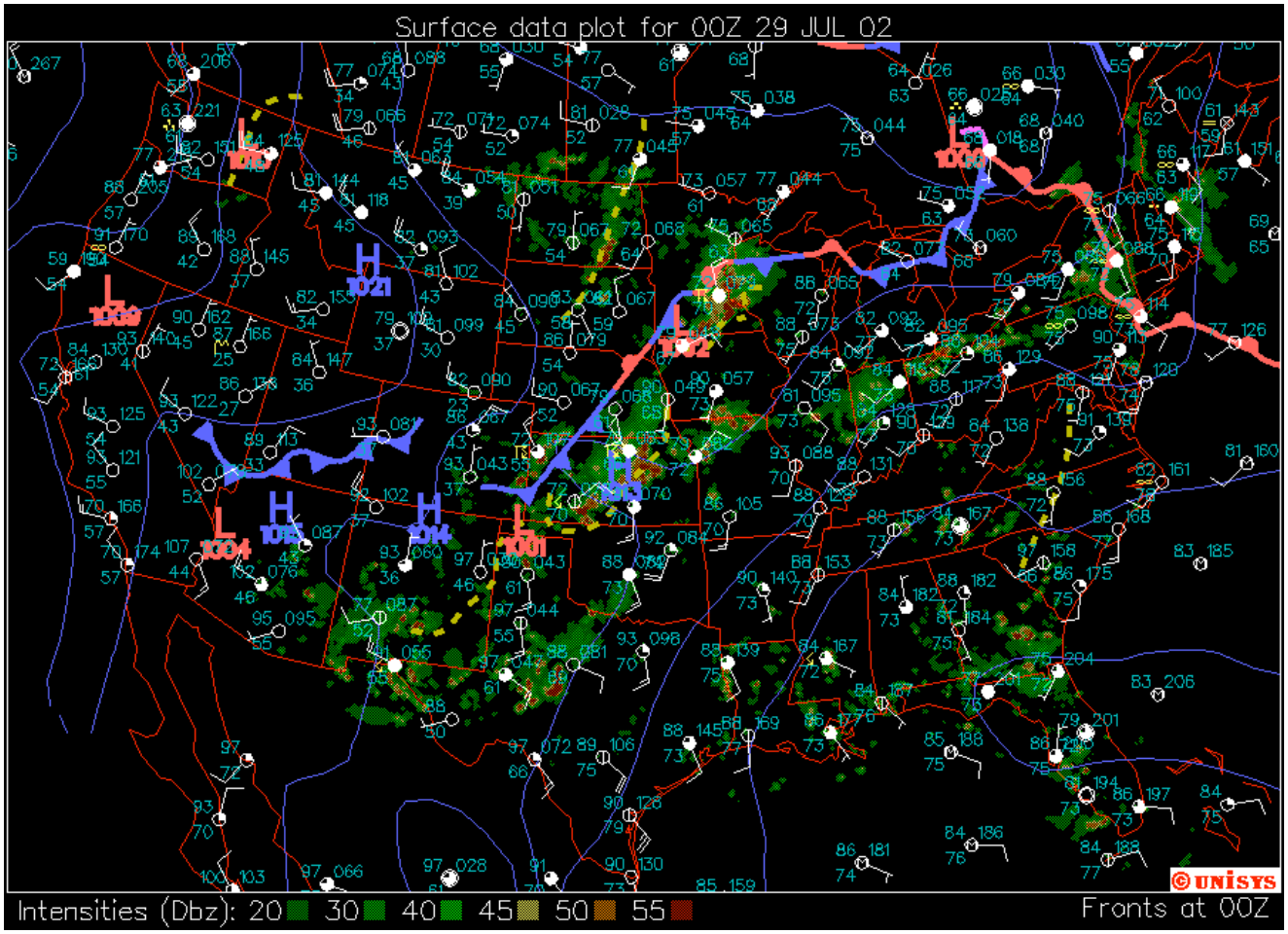
  - Temperature and Moisture Only Above PBL

MM5 Vertical Structure

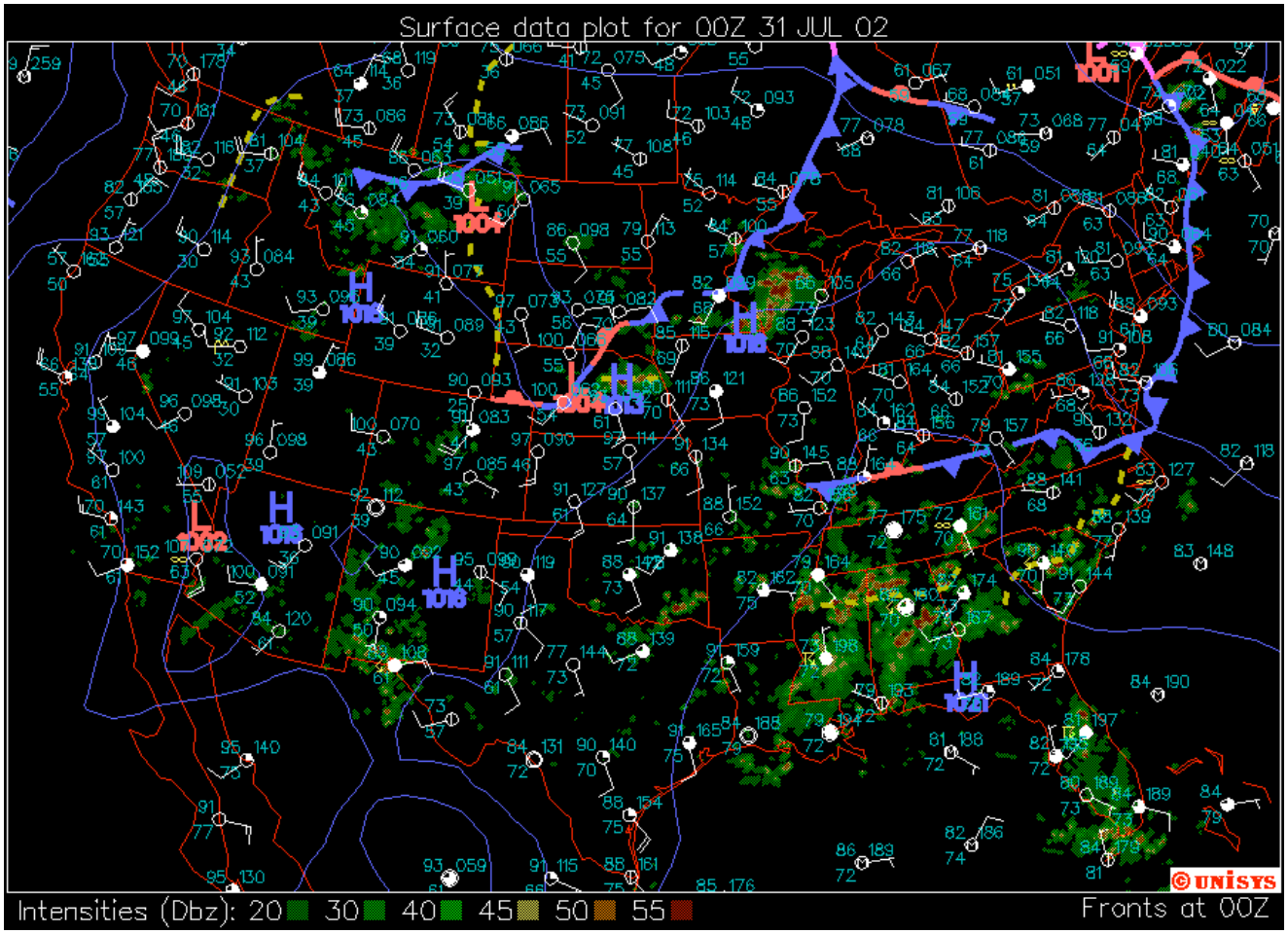
Height(m)	k(MM5)	Depth(m)	CAM-X	Depth(m)	Bottom of Layer (m)
14662	34	1841	16	4535	14661
12822	33	1466			
11356	32	1228			
10127	31	1062	15	3611	10126
9066	30	939			
8127	29	843			
7284	28	767			
6517	27	704	14	2533	6515
5812	26	652			
5160	25	607			
4553	24	569			
3984	23	536	13	1522	3982
3448	22	506			
2942	21	480			
2462	20	367	12	634	2460
2095	19	266			
1828	18	259	11	428	1826
1569	17	169			
1400	16	166	10	329	1398
1235	15	163			
1071	14	160	9	318	1069
911	13	158			
753	12	78	8	155	751
675	11	77			
598	10	77	7	153	596
521	9	76			
445	8	76	6	151	445
369	7	75			
294	6	74	5	148	294
220	5	74			
146	4	37	4	37	146
109	3	37	3	37	109
73	2	36	2	36	72
36	1	36	1	36	36
--Surface---	Surface---	Surface---	Surface---	Surface--	--Surface--

St. Louis Episode July 29 – Aug 5, 2002

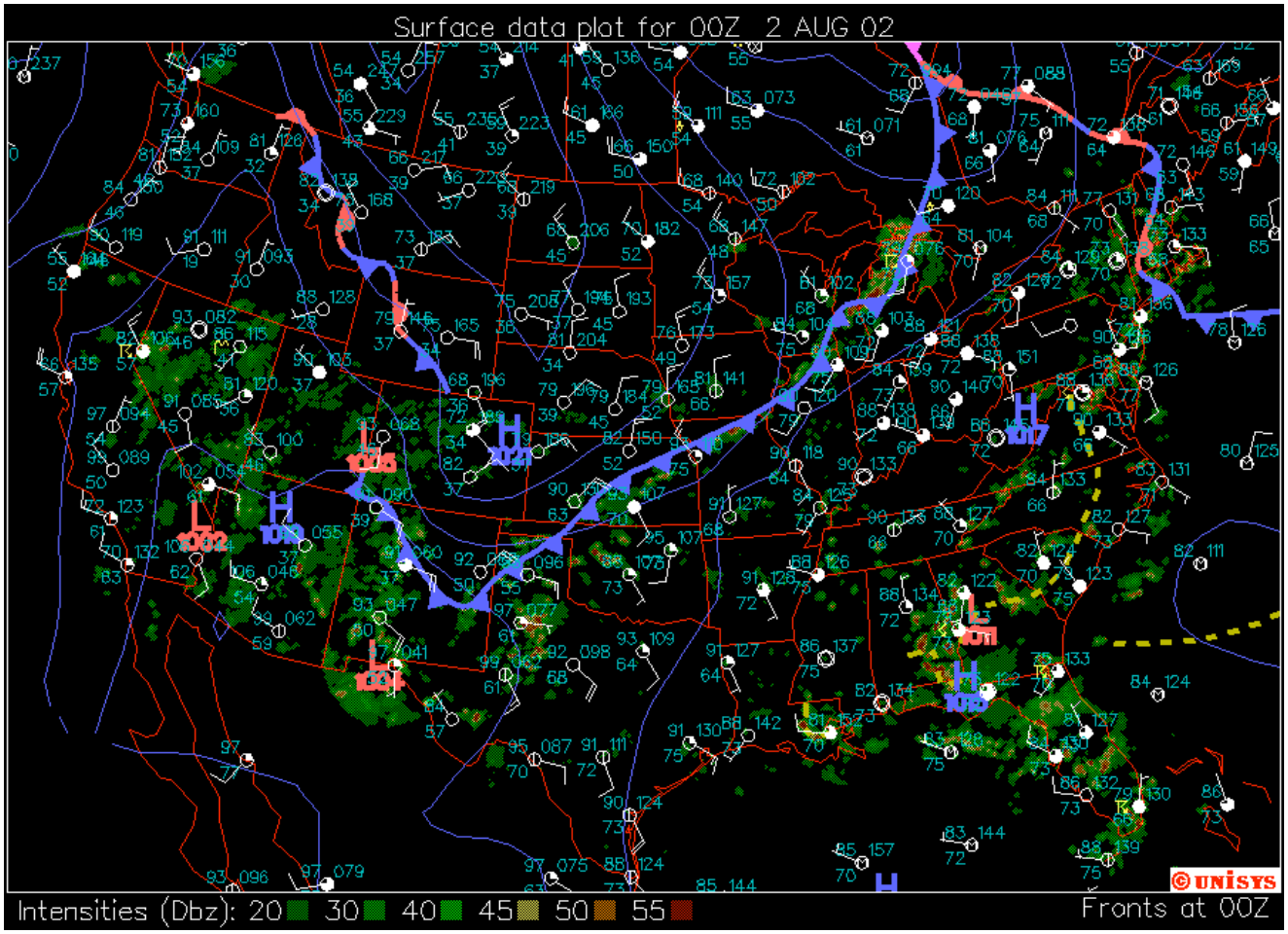
July 29, 2002 00z



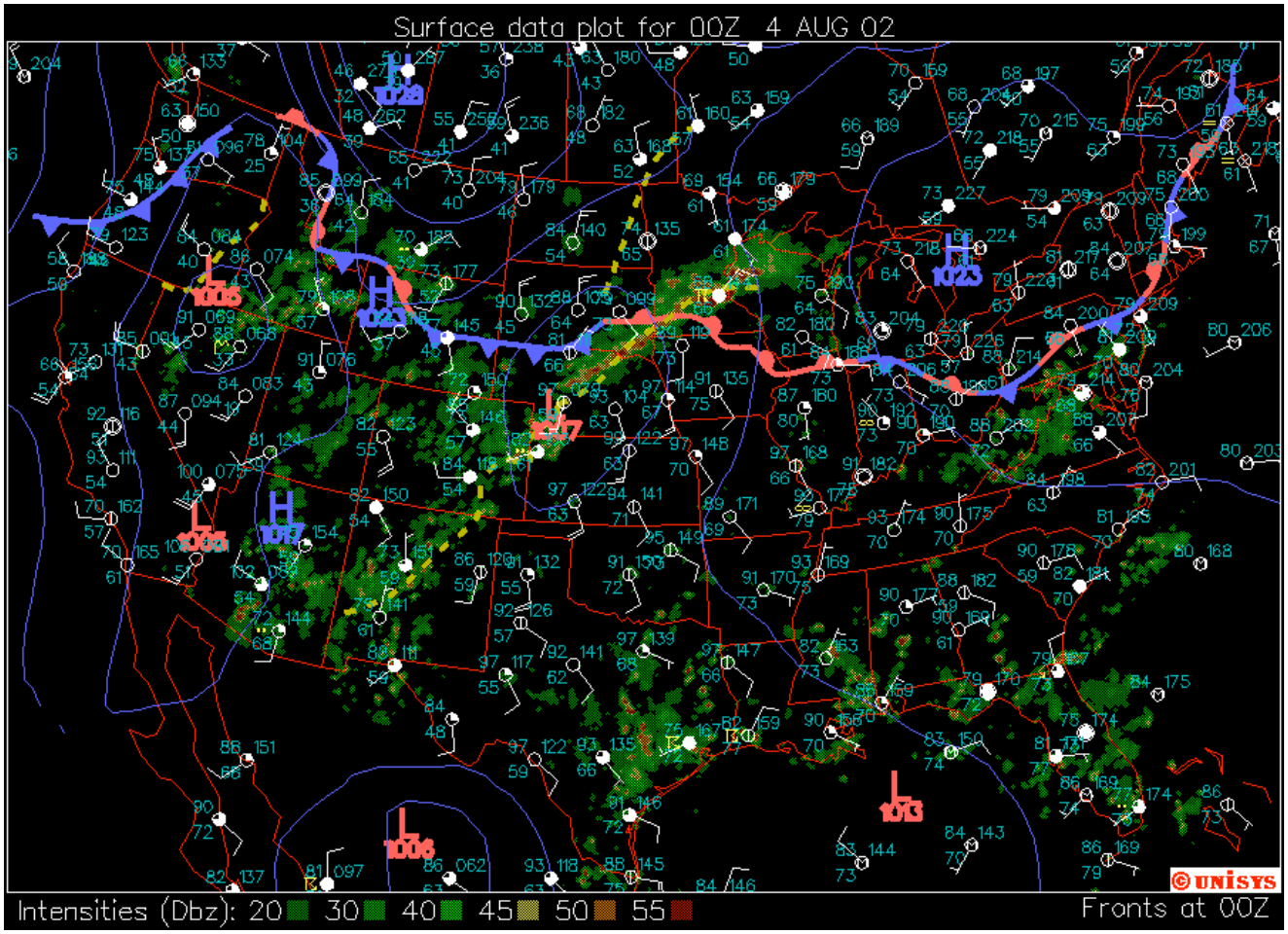
July 31, 2002 00z



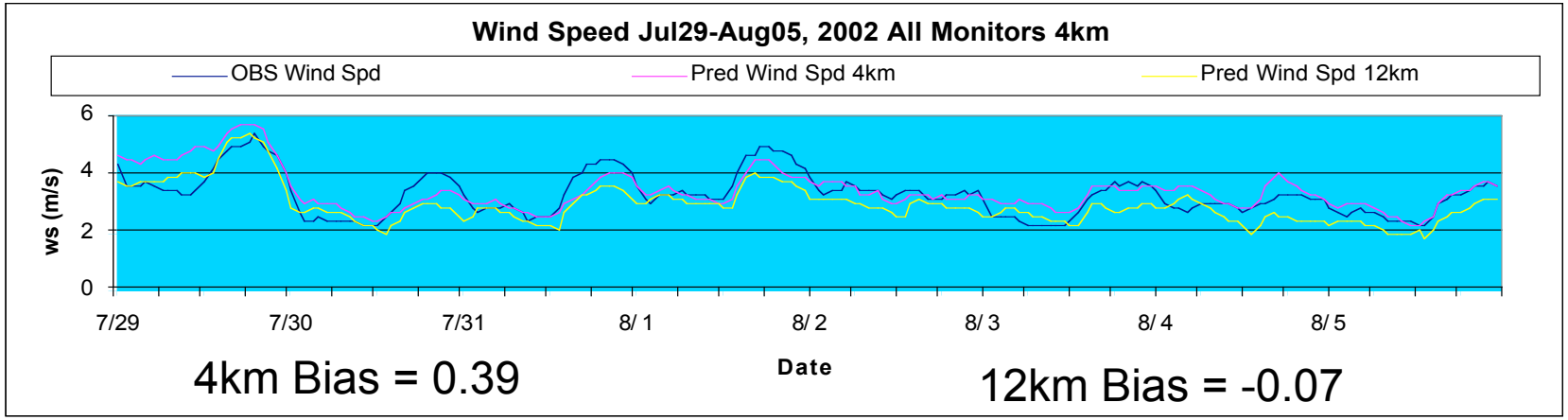
August 2, 2002 00z

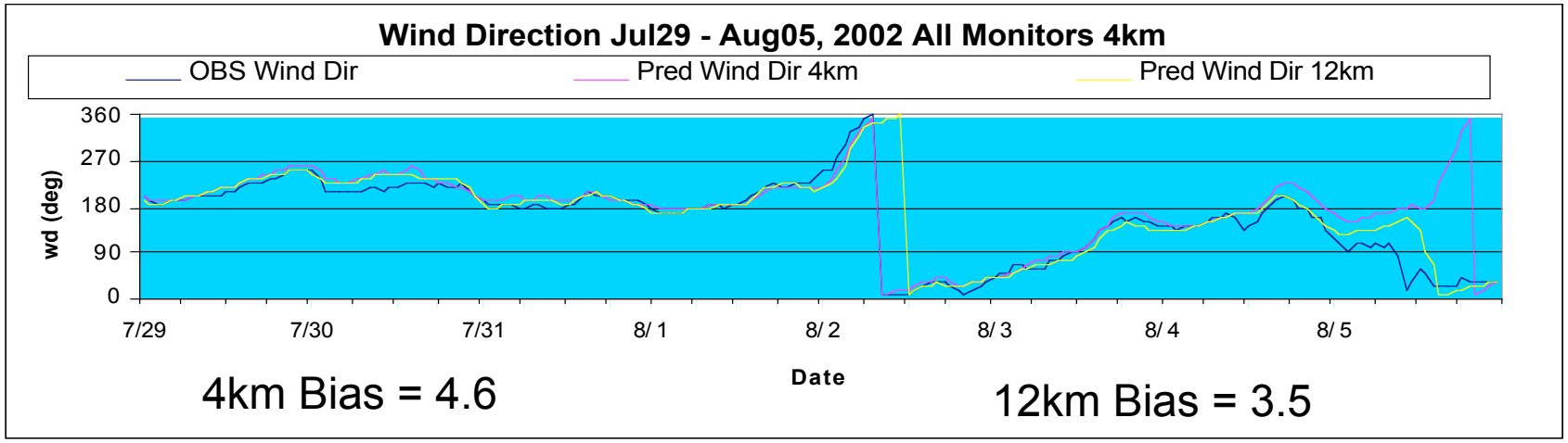


August 4, 2002 00z

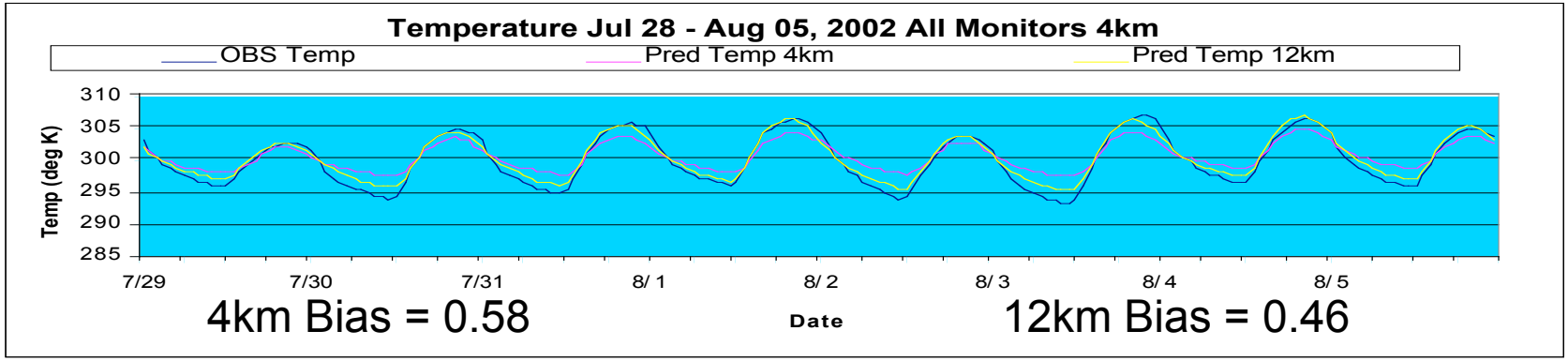


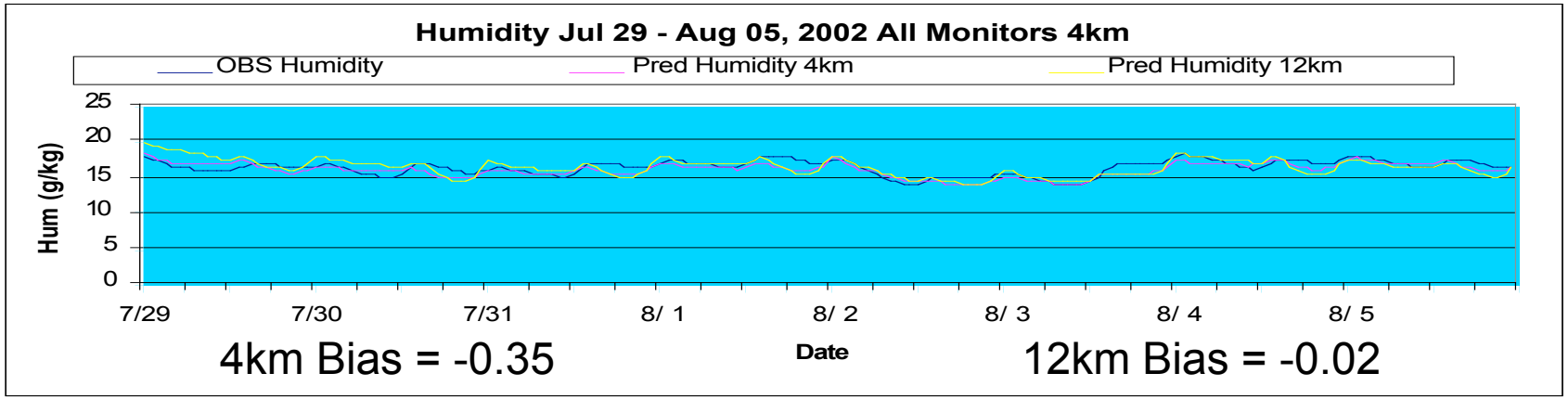
Wind Speed/Direction Entire 4km Domain



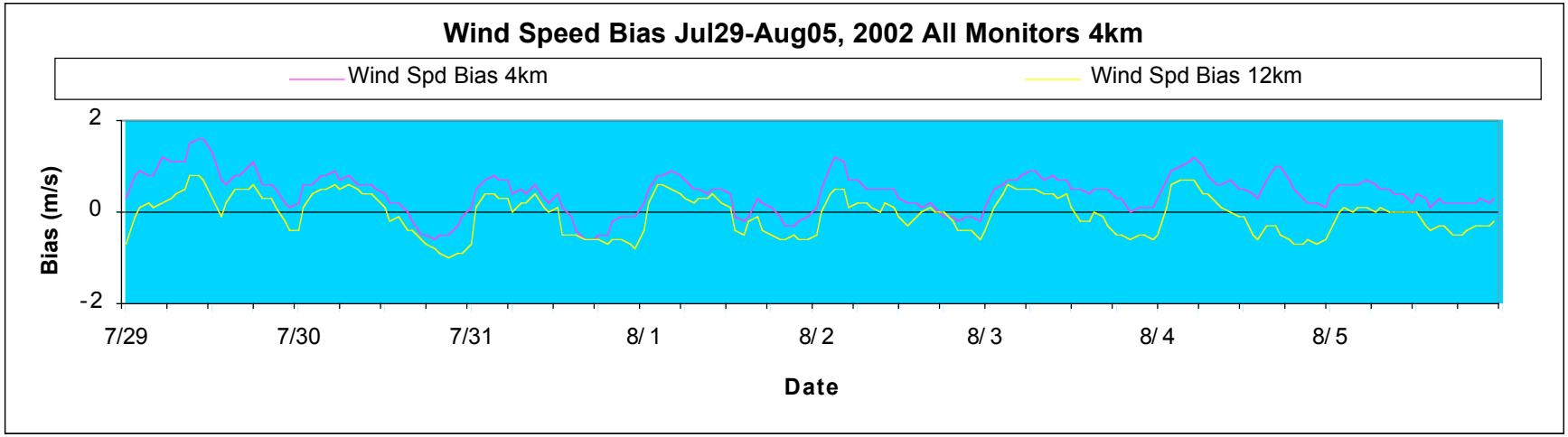


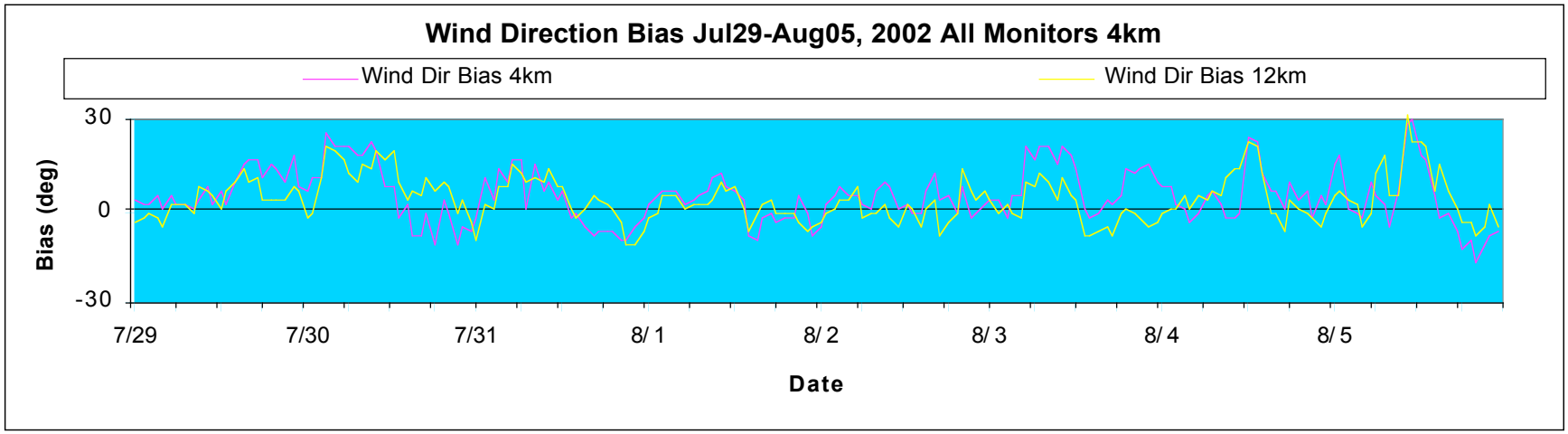
Temperature/Moisture Entire 4km Domain



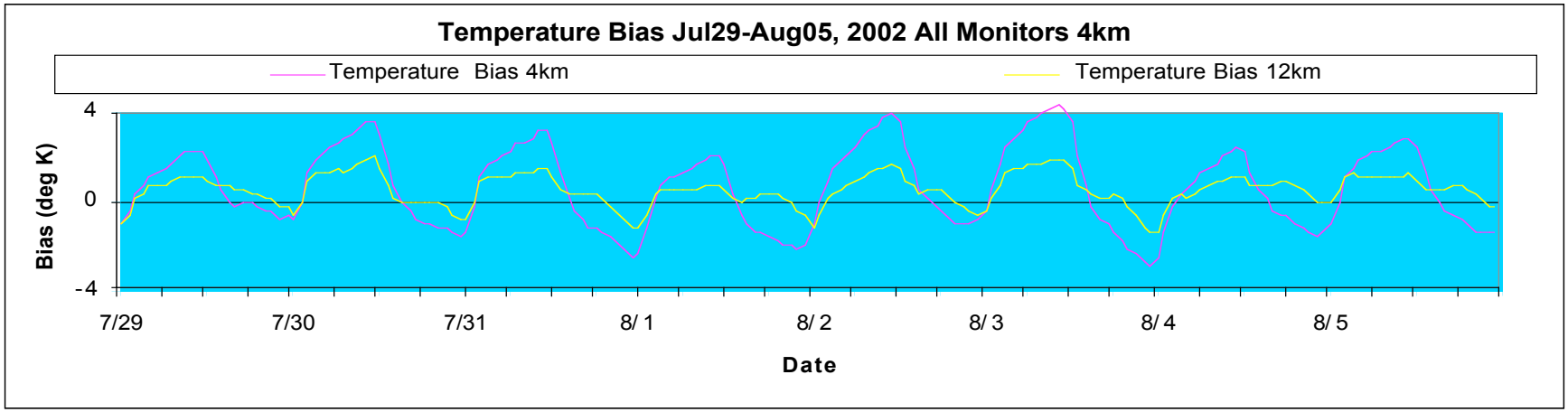


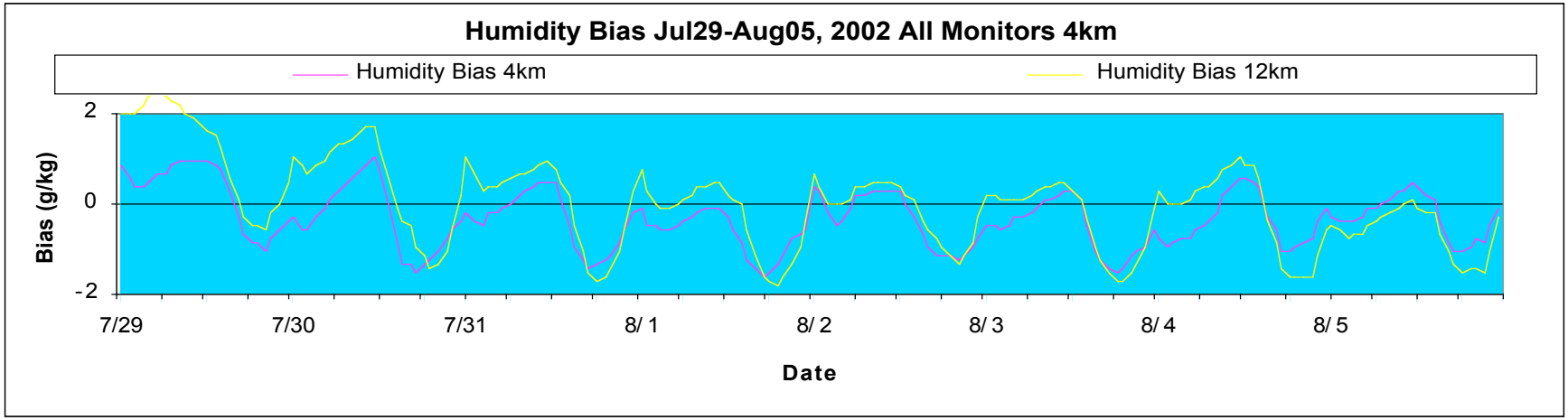
Wind Speed/Direction Bias Entire 4km Domain



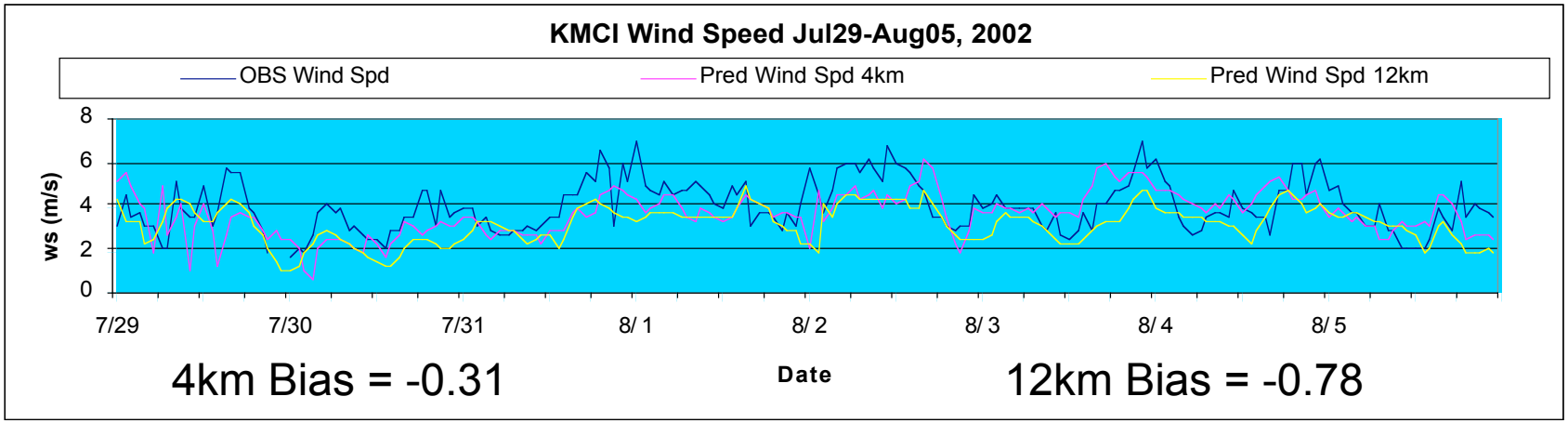


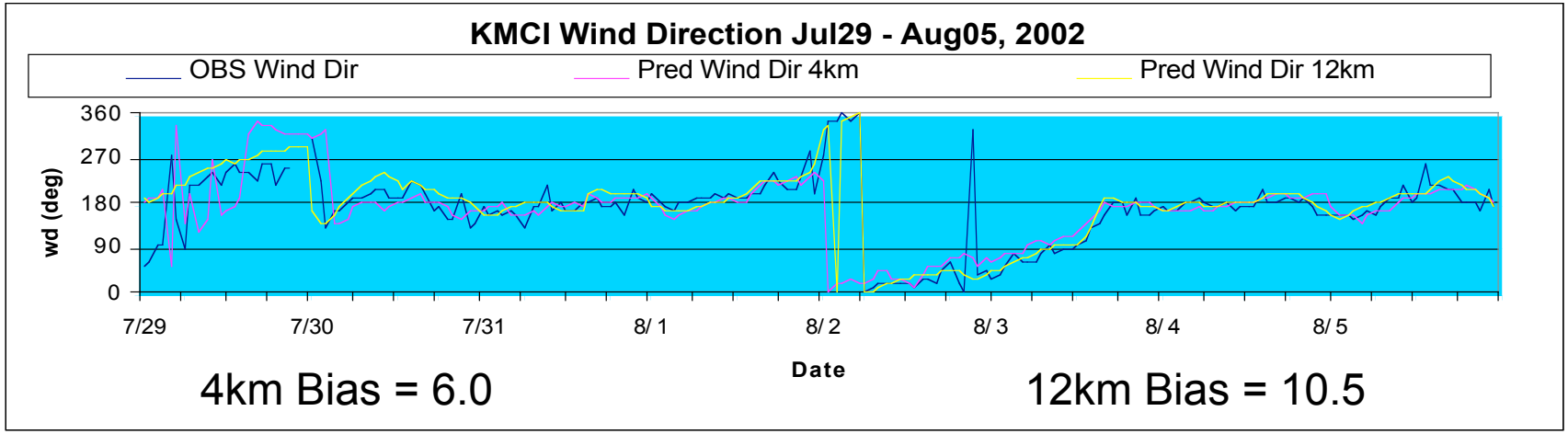
Temperature/Moisture Bias Entire 4km Domain



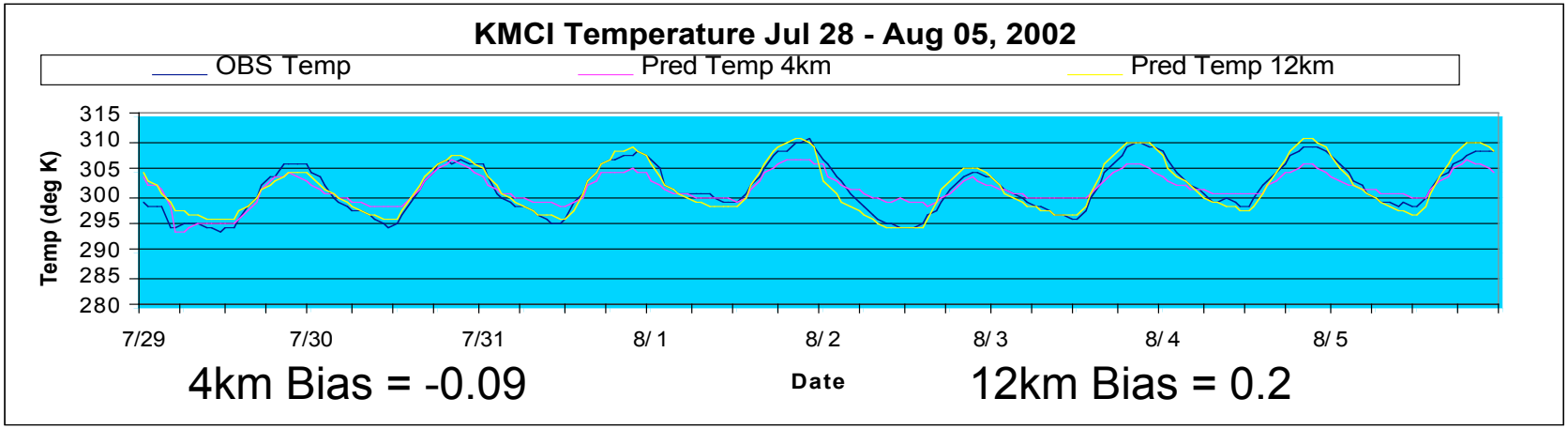


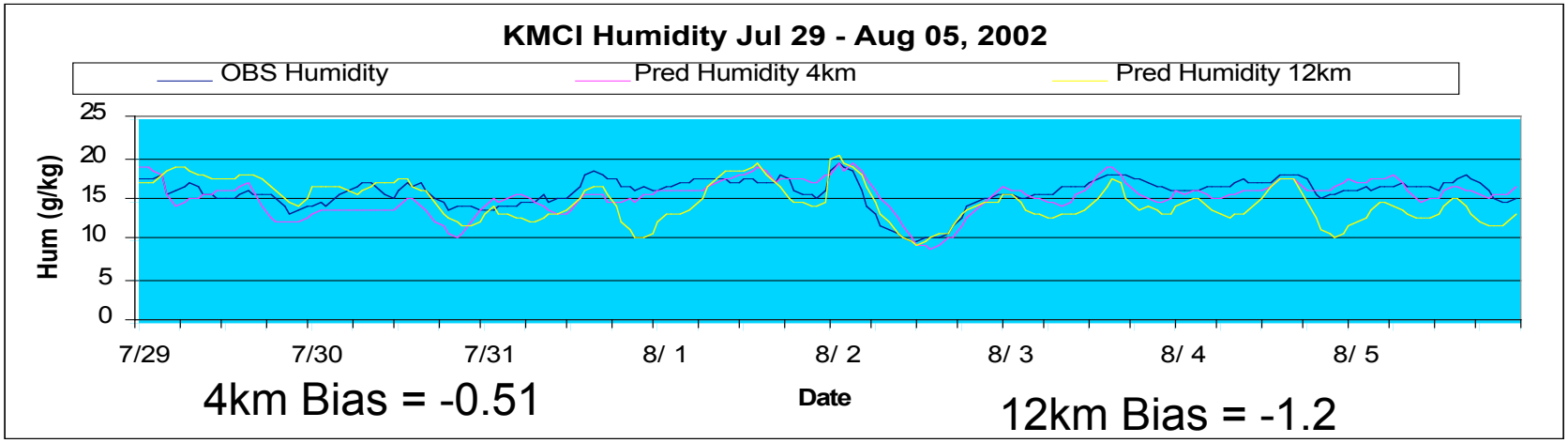
Wind Speed/Direction for KMCI



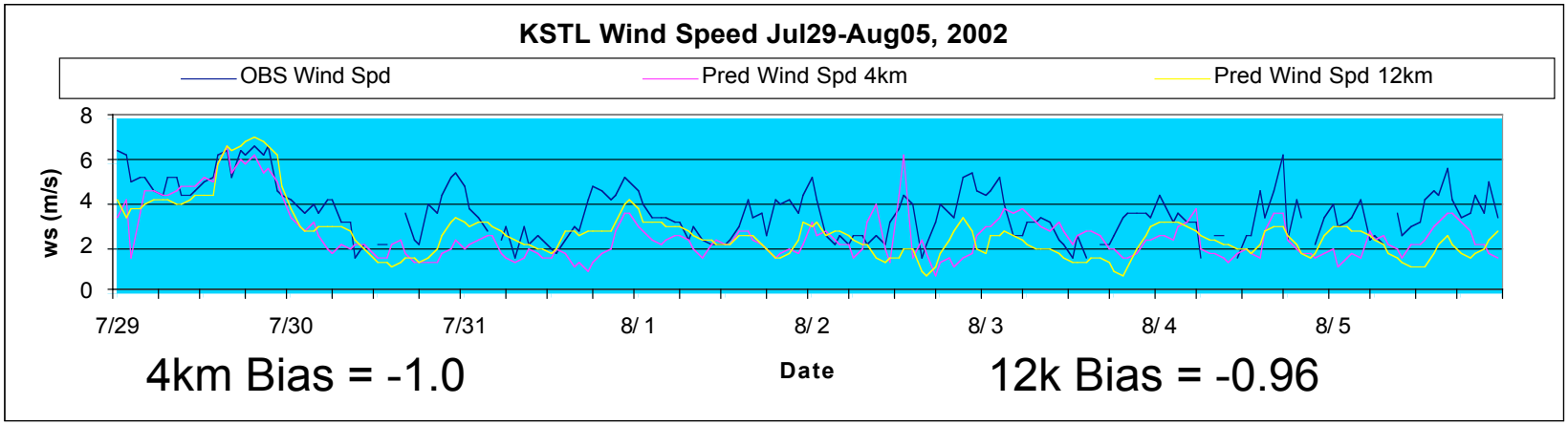


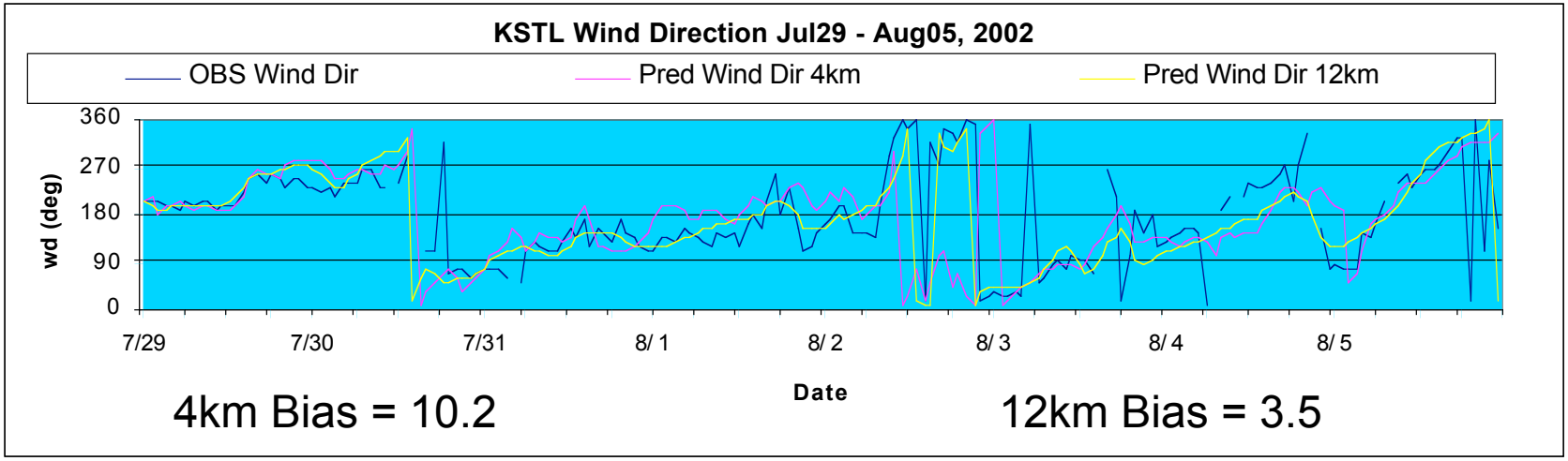
Temperature/Moisture for KMCI



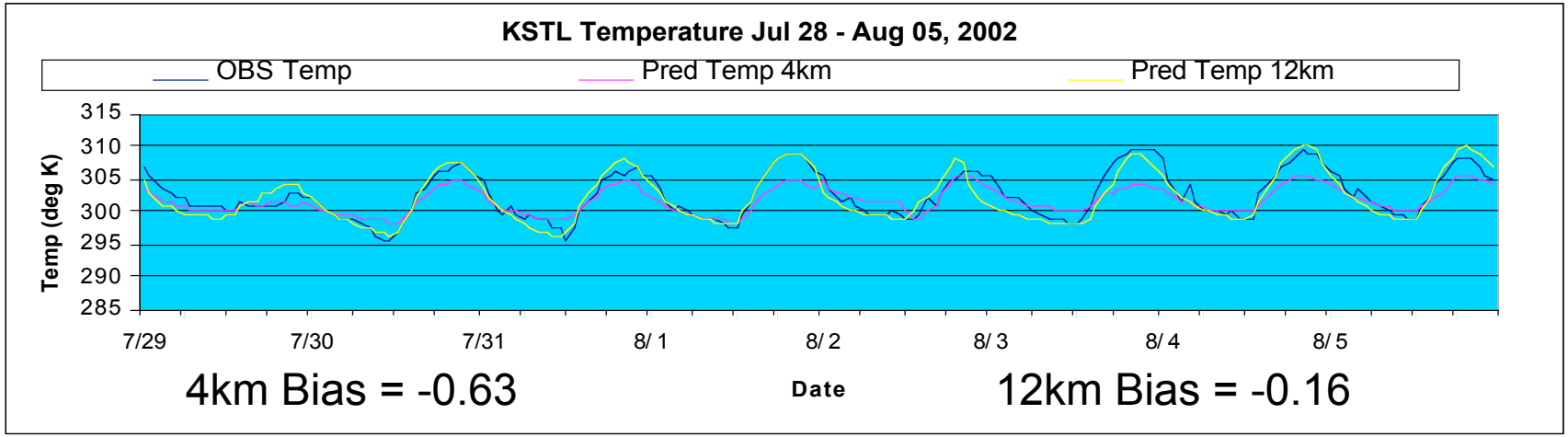


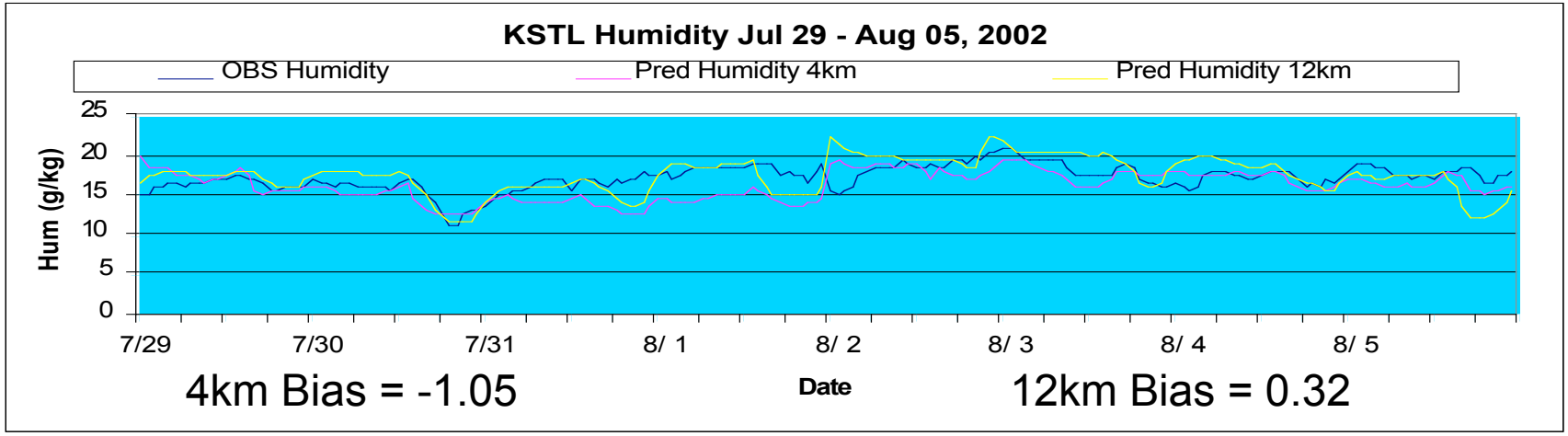
Wind Speed/Direction for KSTL



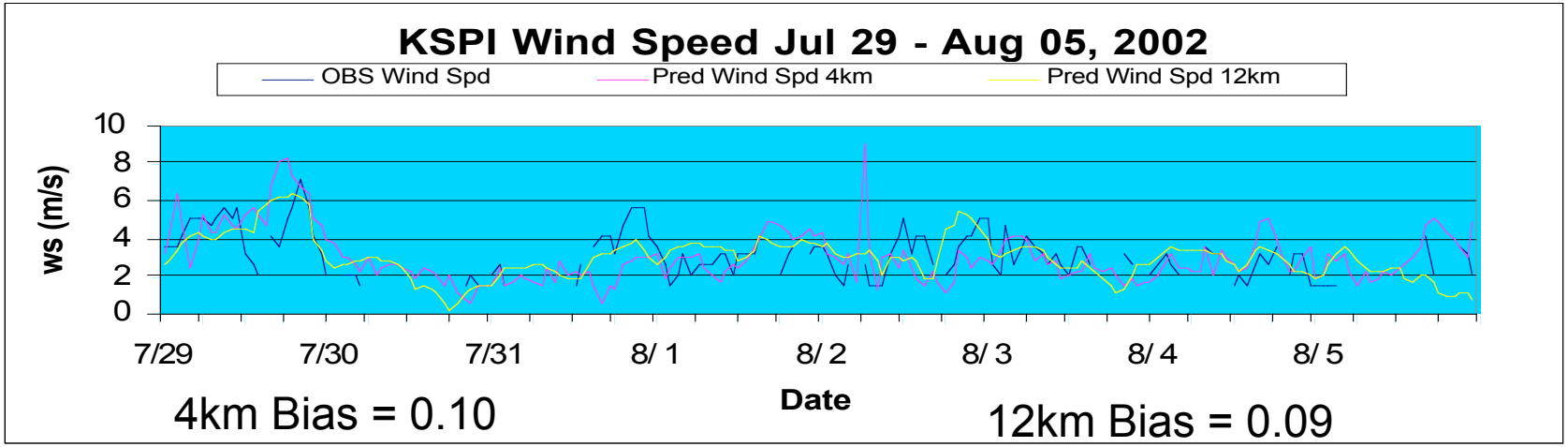


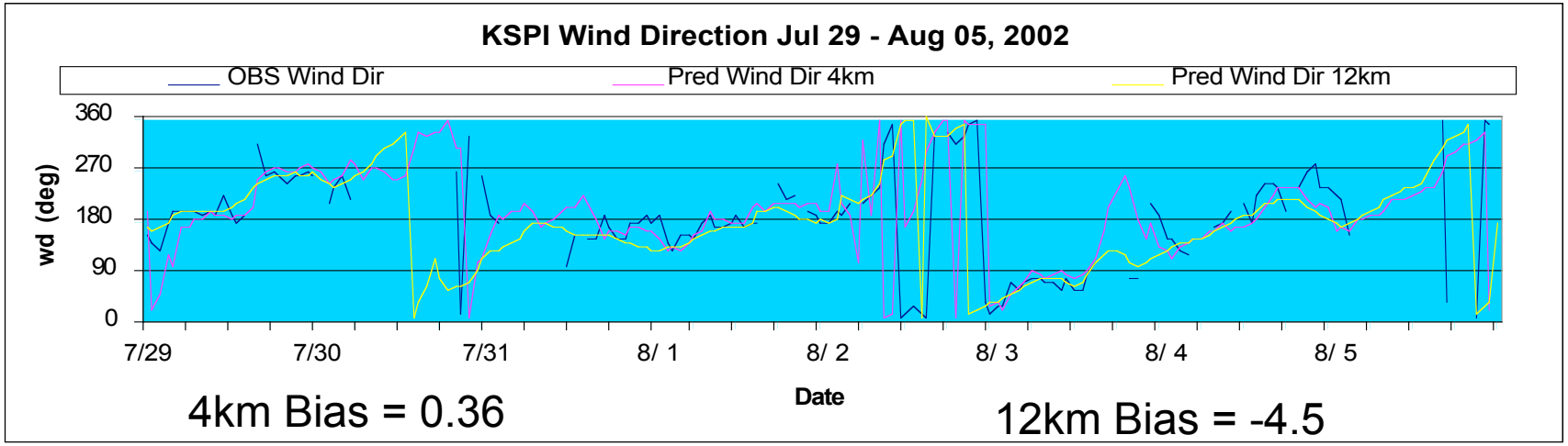
Temperature/Moisture for KSTL



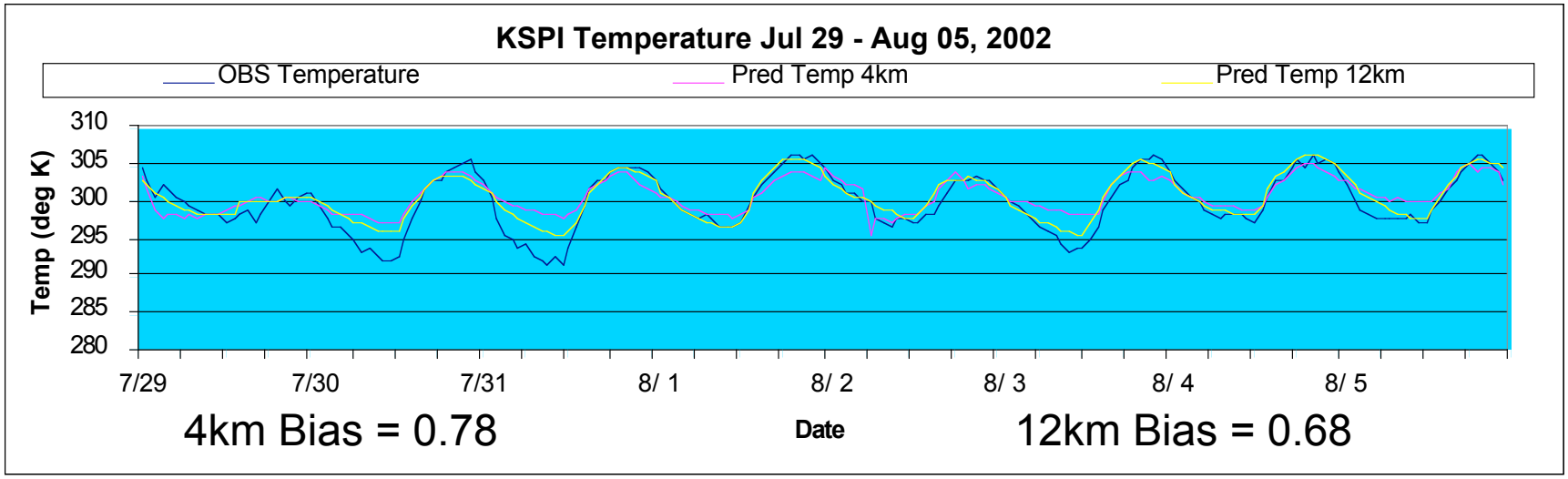


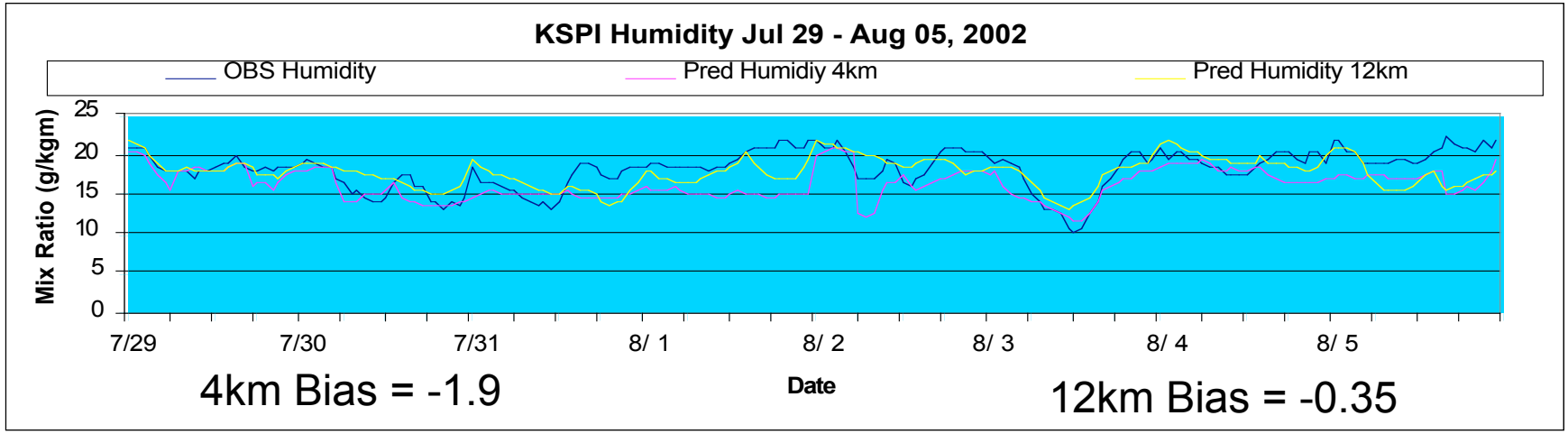
Wind Speed/Direction for KSPI



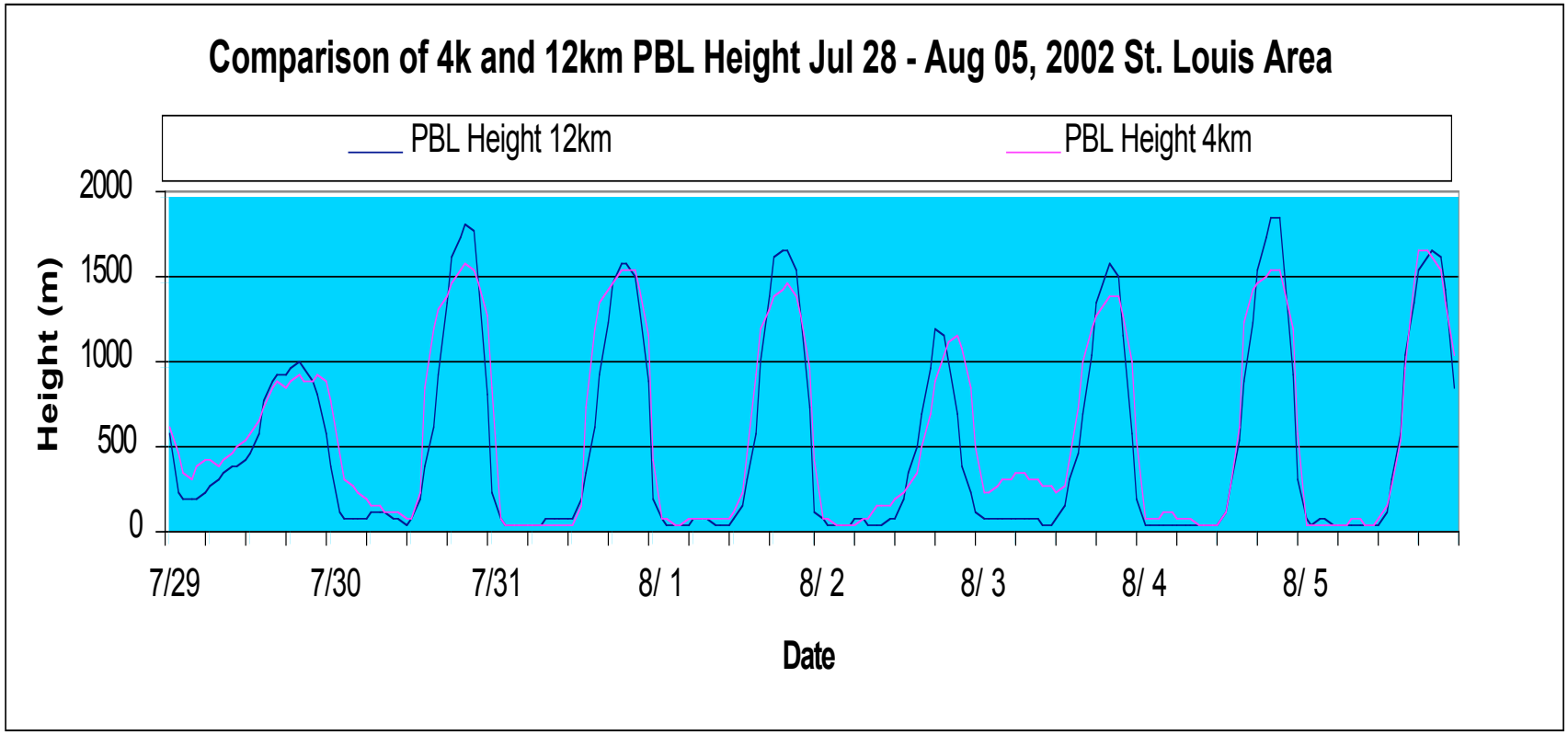


Temperature/Moisture for KSPI

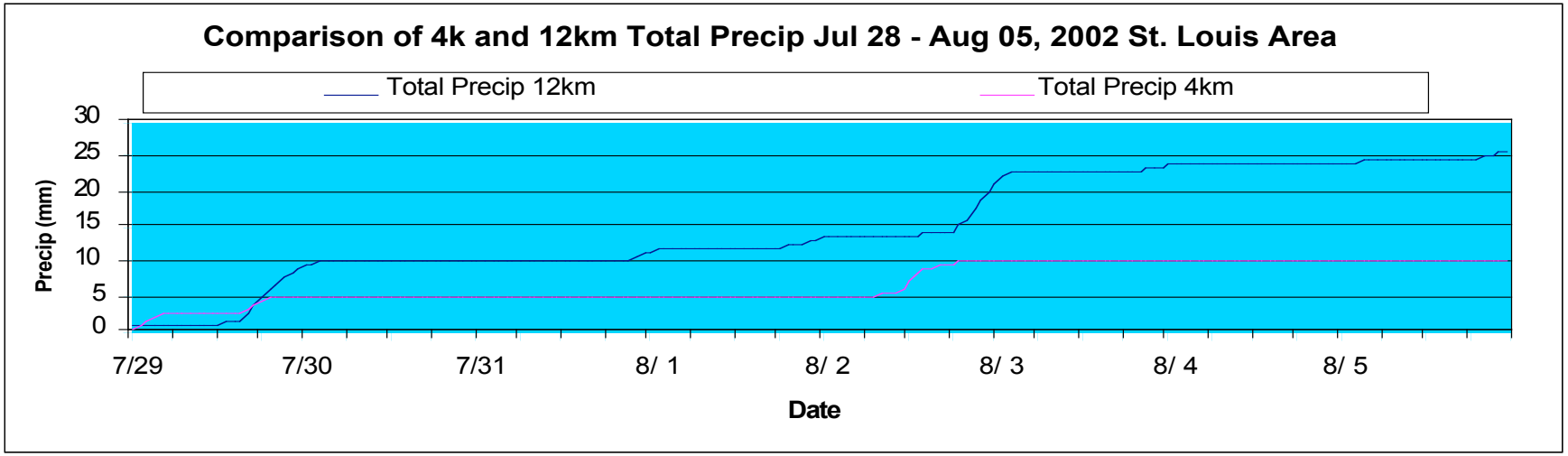


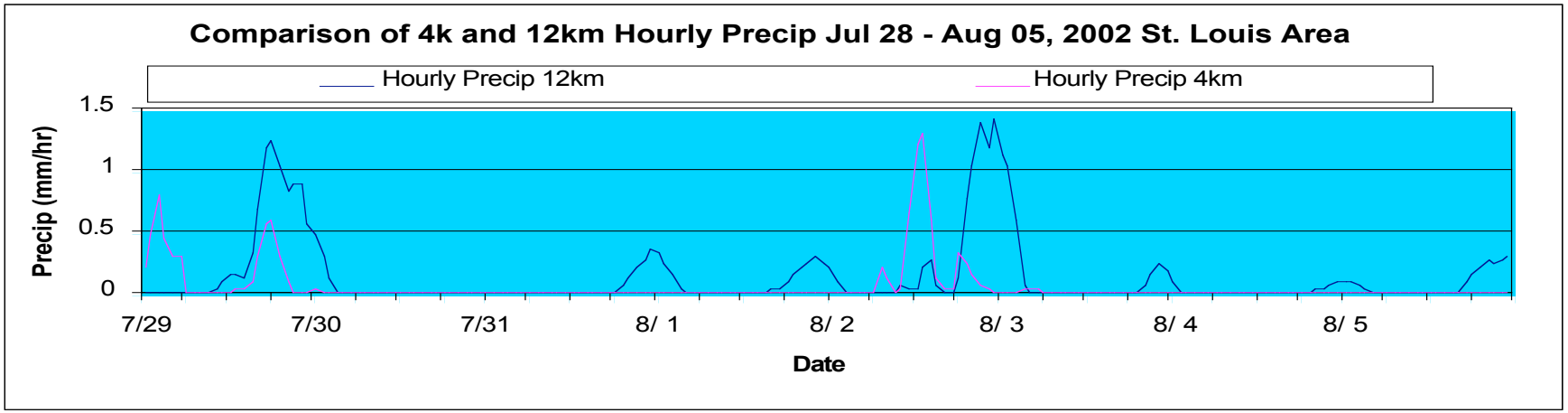


Comparison of PBL Height for the St. Louis Area

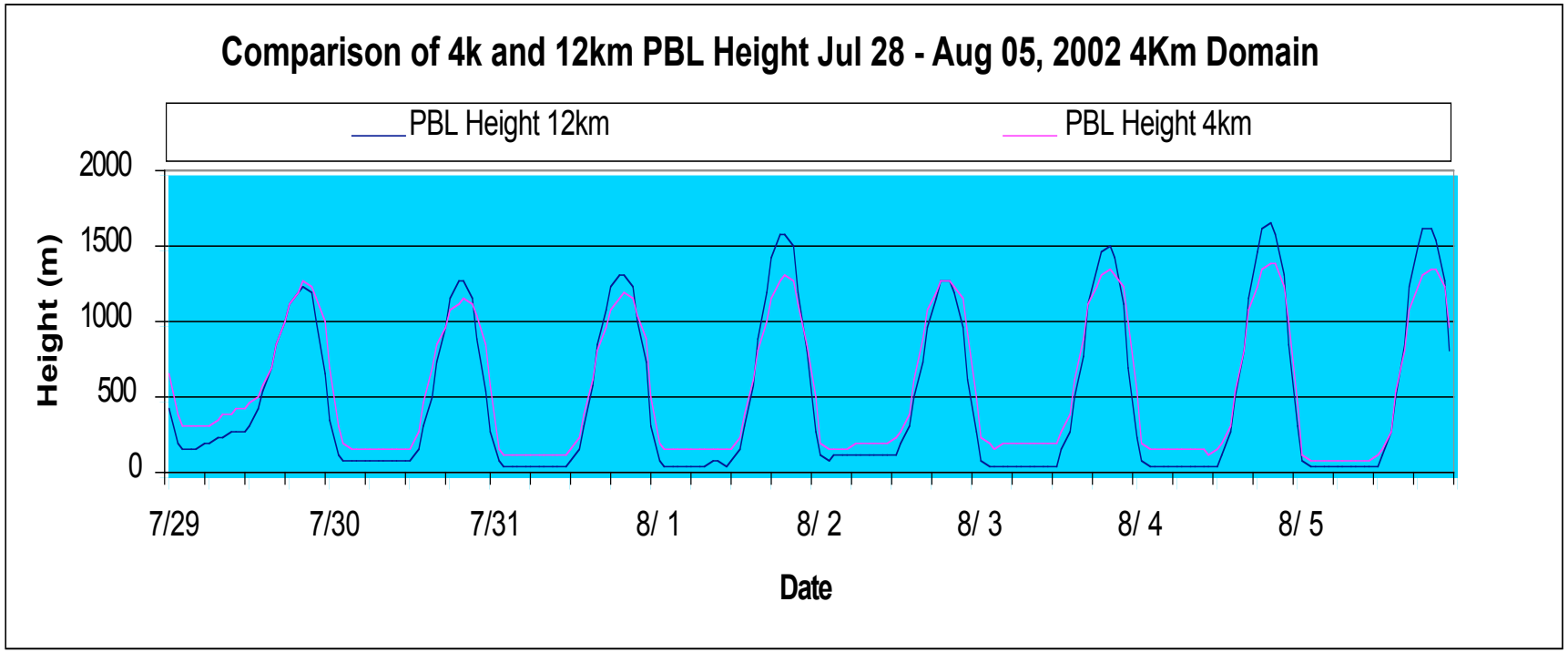


Comparison of Precipitation for St. Louis Area

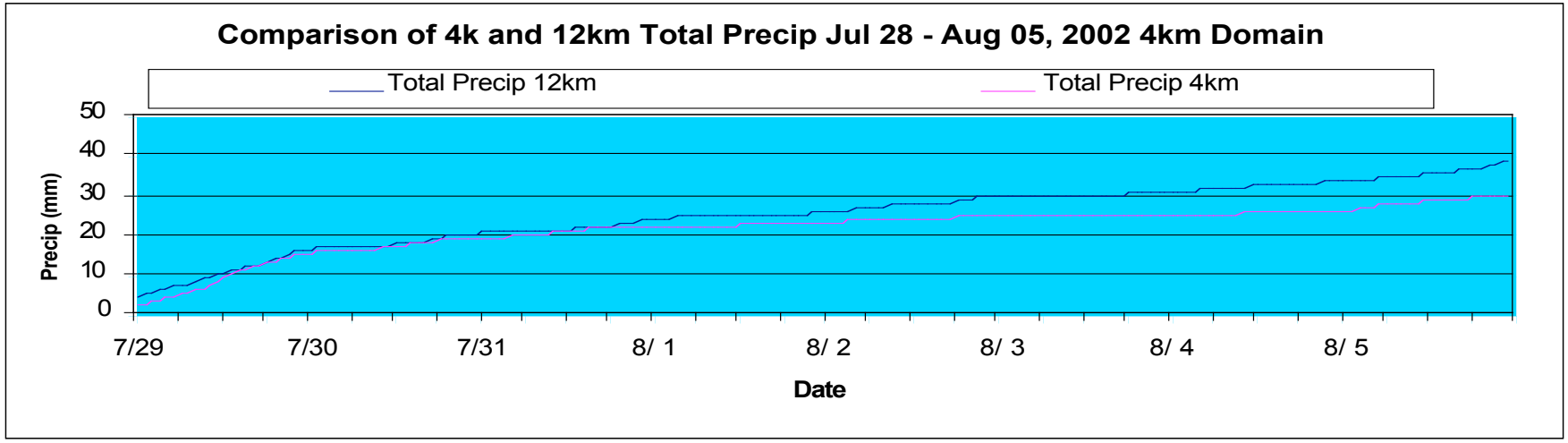


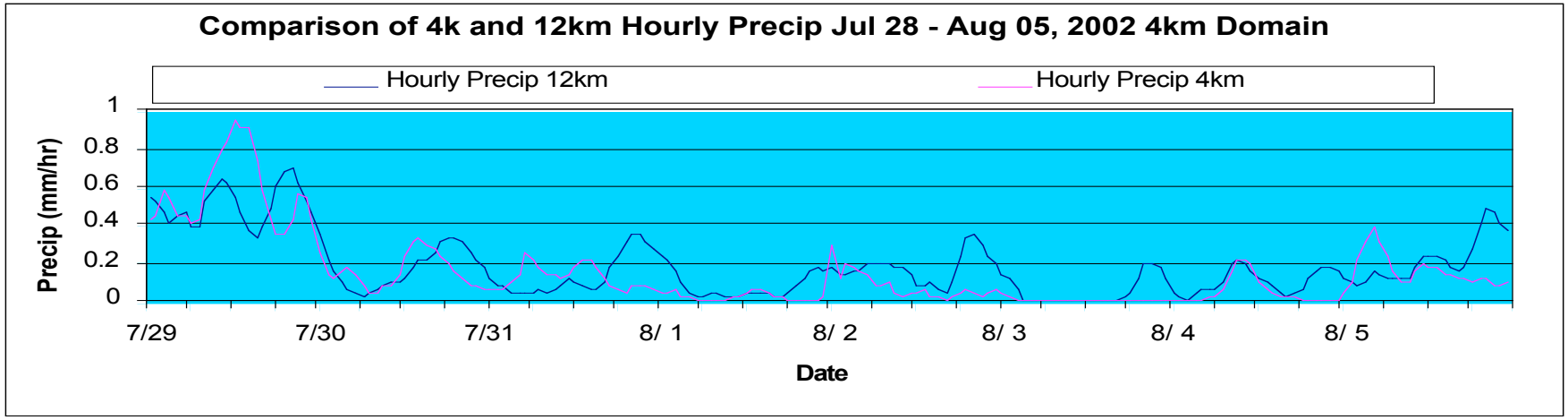


Comparison of PBL Height in the 4Km Domain Area

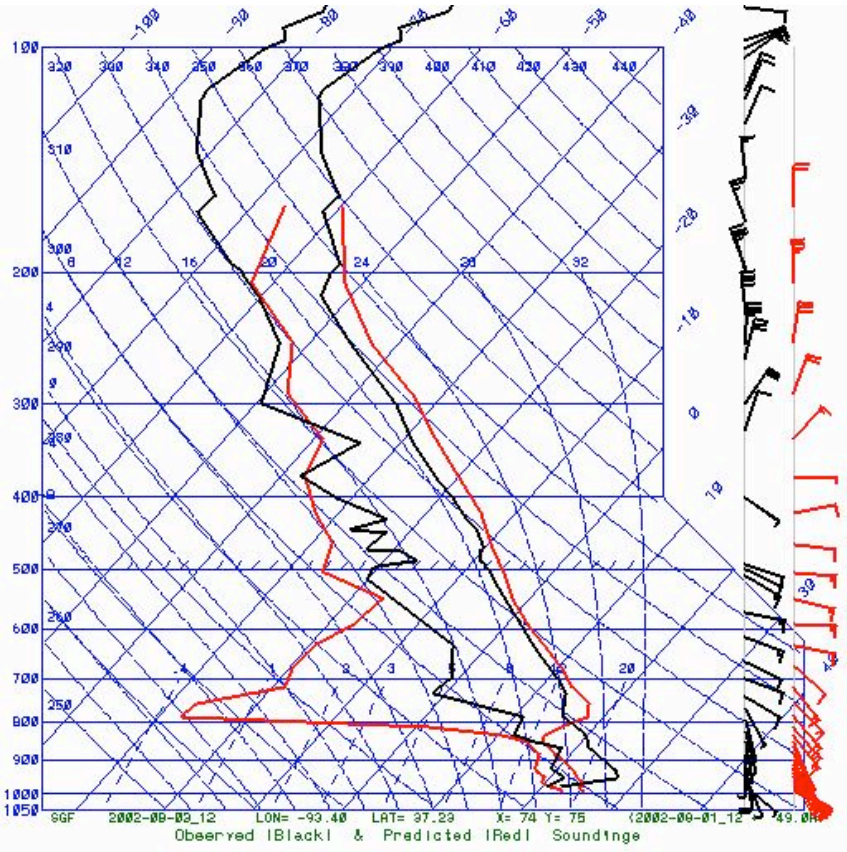


Comparison of Precipitation in the 4Km Domain Area

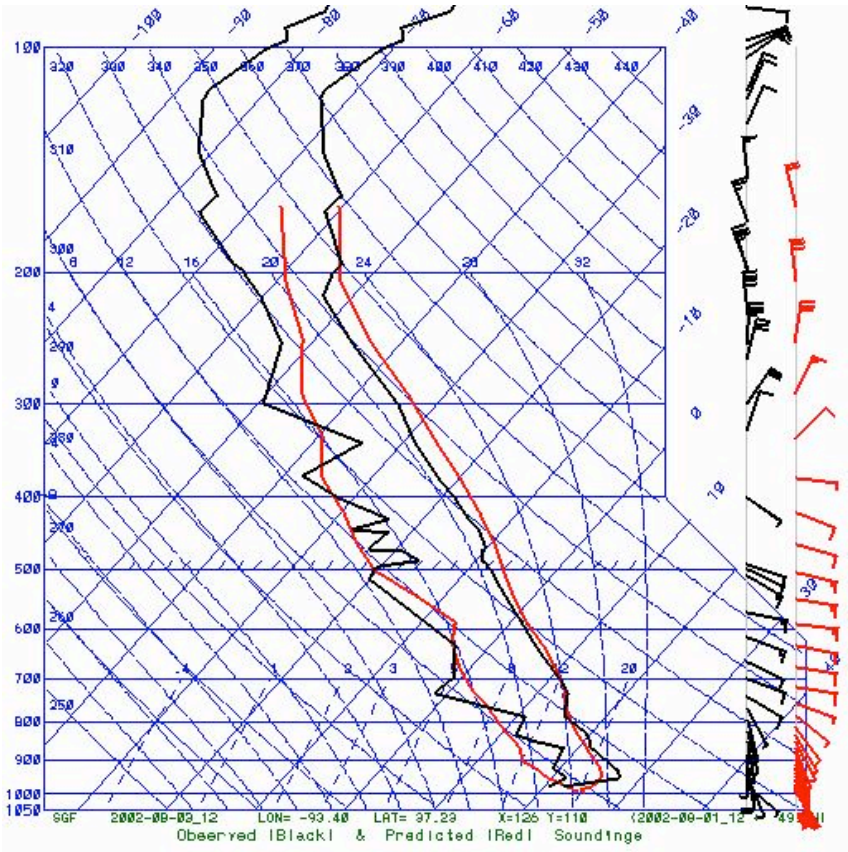




Comparison Soundings KSGF August 2, 2002 12z

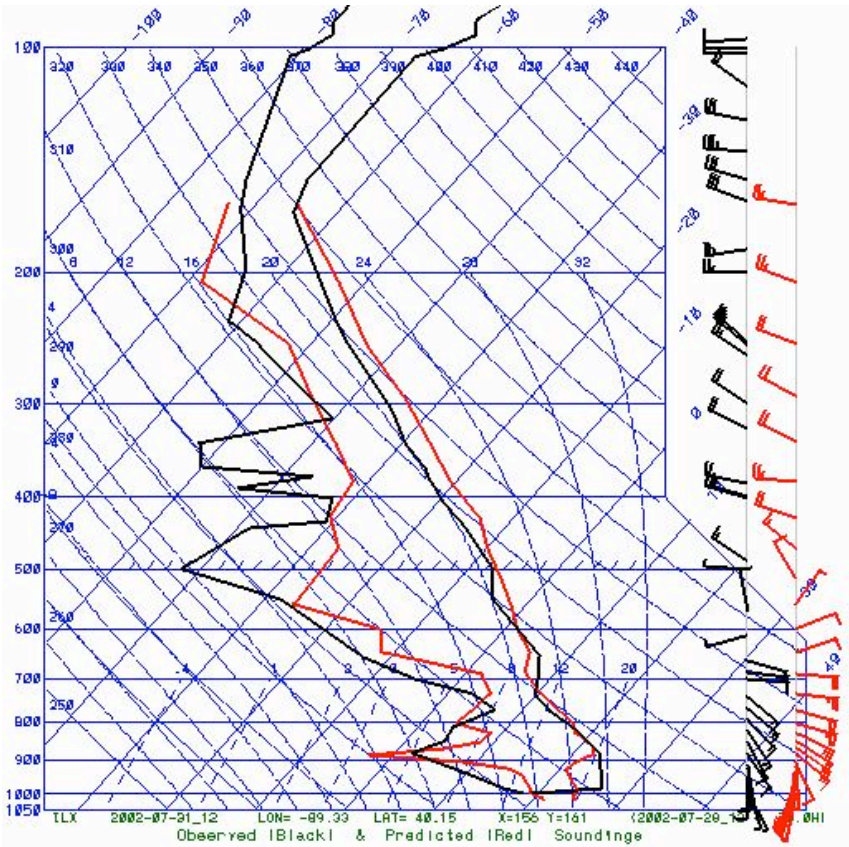


4km

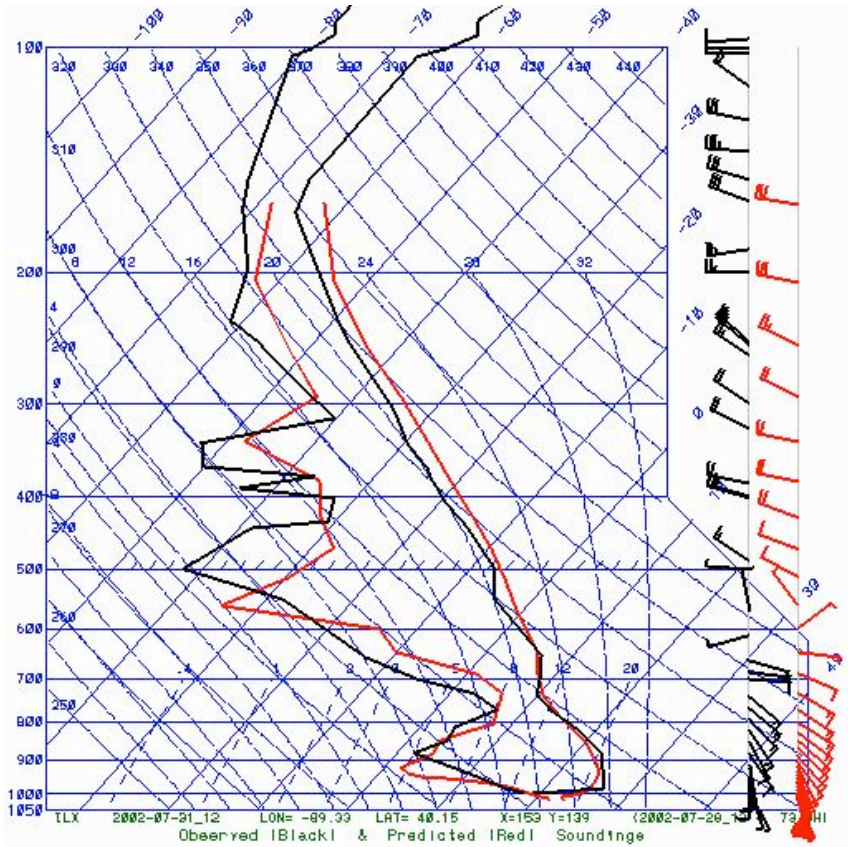


12km

Comparison Soundings KILX
July 31, 2002 12z



4Km



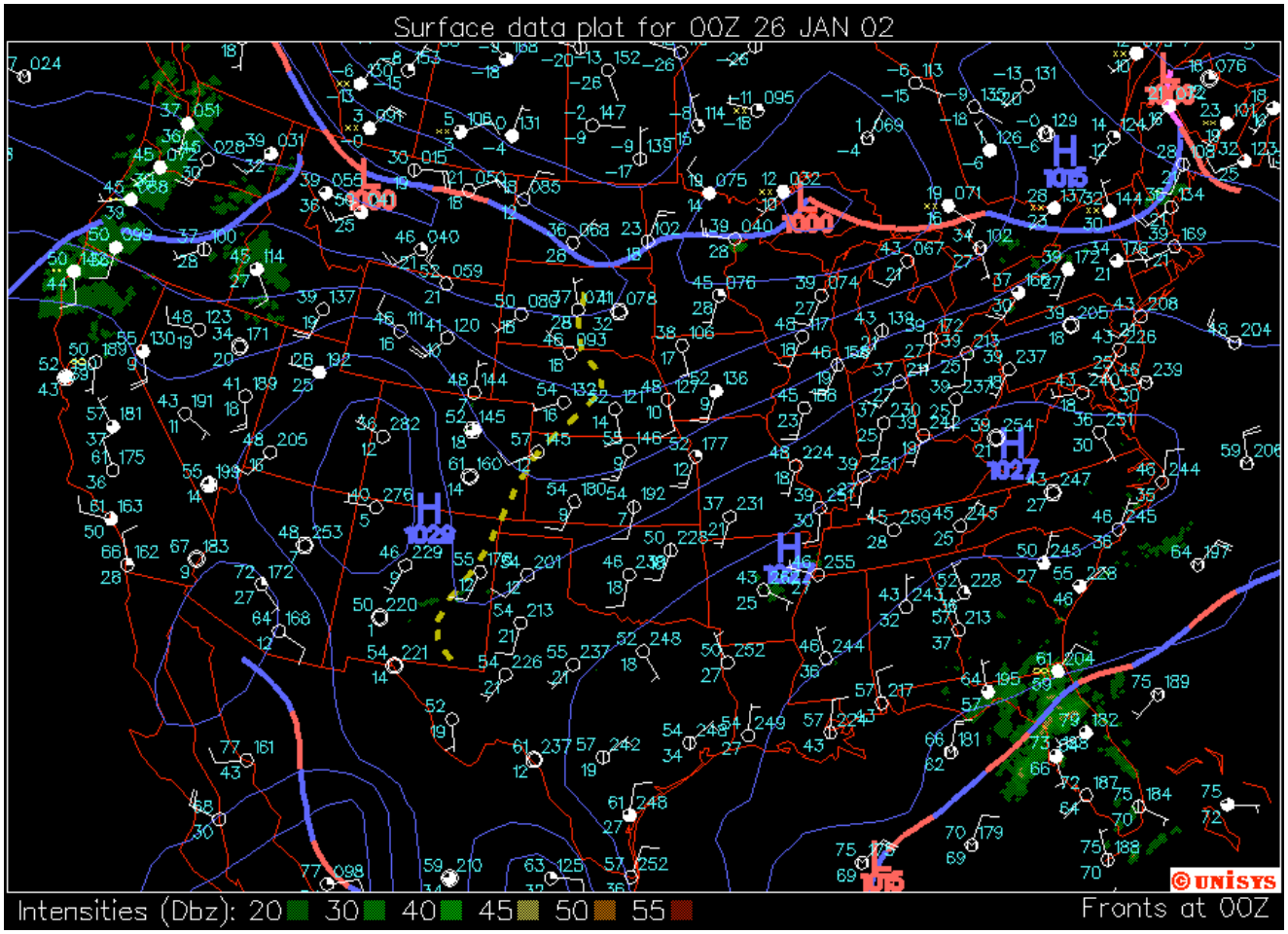
12Km

Conclusions for July 29 – August 5, 2002 Episode

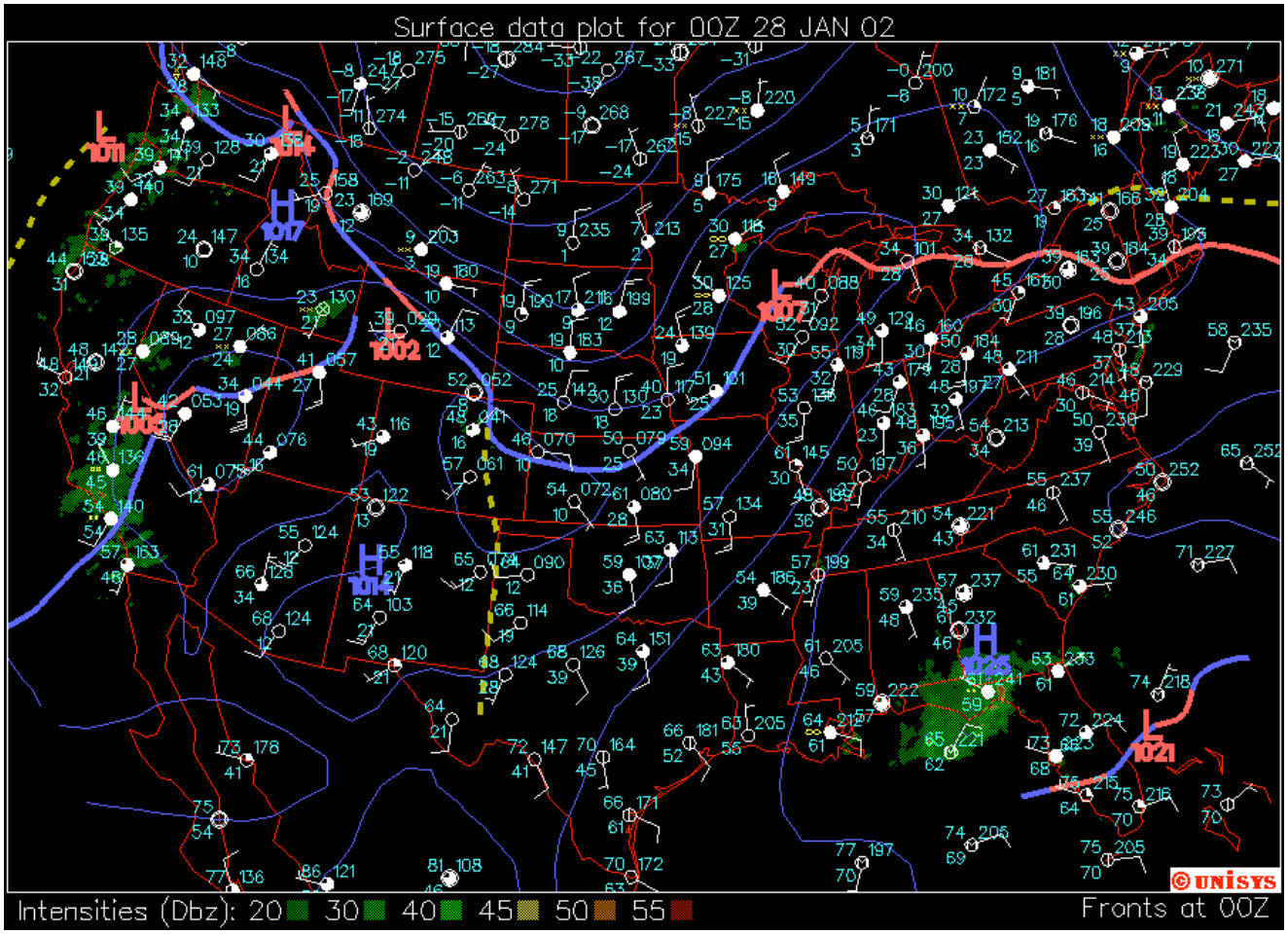
- The 4km wind speed is generally greater than the 12km, however varies by site and date.
- The 4km temperature under estimates the observed highs and over estimates the lows. The 12km appears to perform better.
- The 4km grid lower layers are noticeably cooler than the 12km and misses the surface inversion in morning soundings.
- The 12km grid produces significantly more precipitation especially in the St. Louis area. The 12km and 4km precipitation events do not always coincide with peak rates occurring at different times.
- The maximum PBL heights are generally greater in the 12km grid in both the St. Louis area and the 4km domain area. Evening PBL heights are somewhat higher in the 4km domain.

St. Louis Episode Jan 25 – Feb 13, 2002

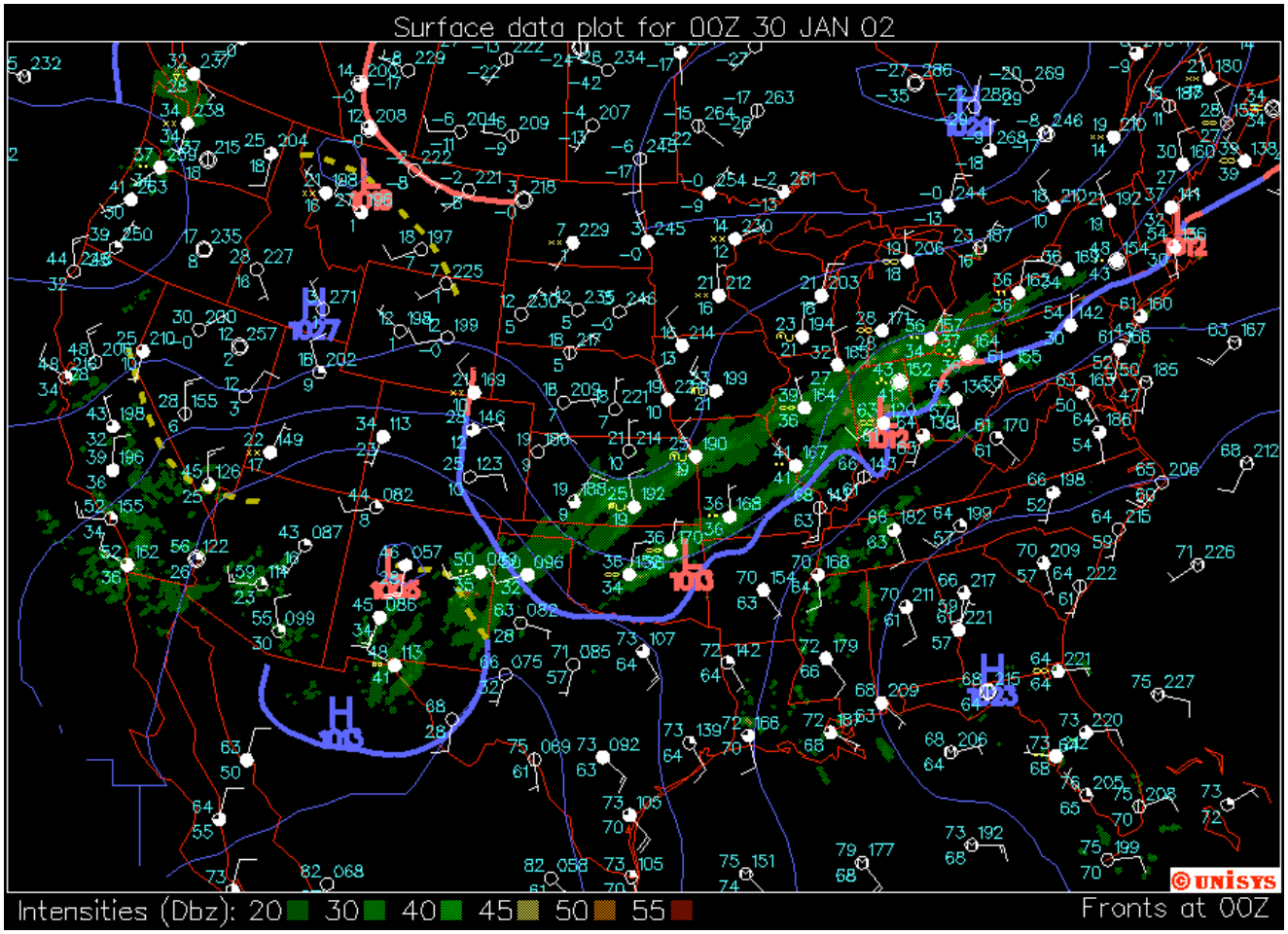
January 26, 2002 00z



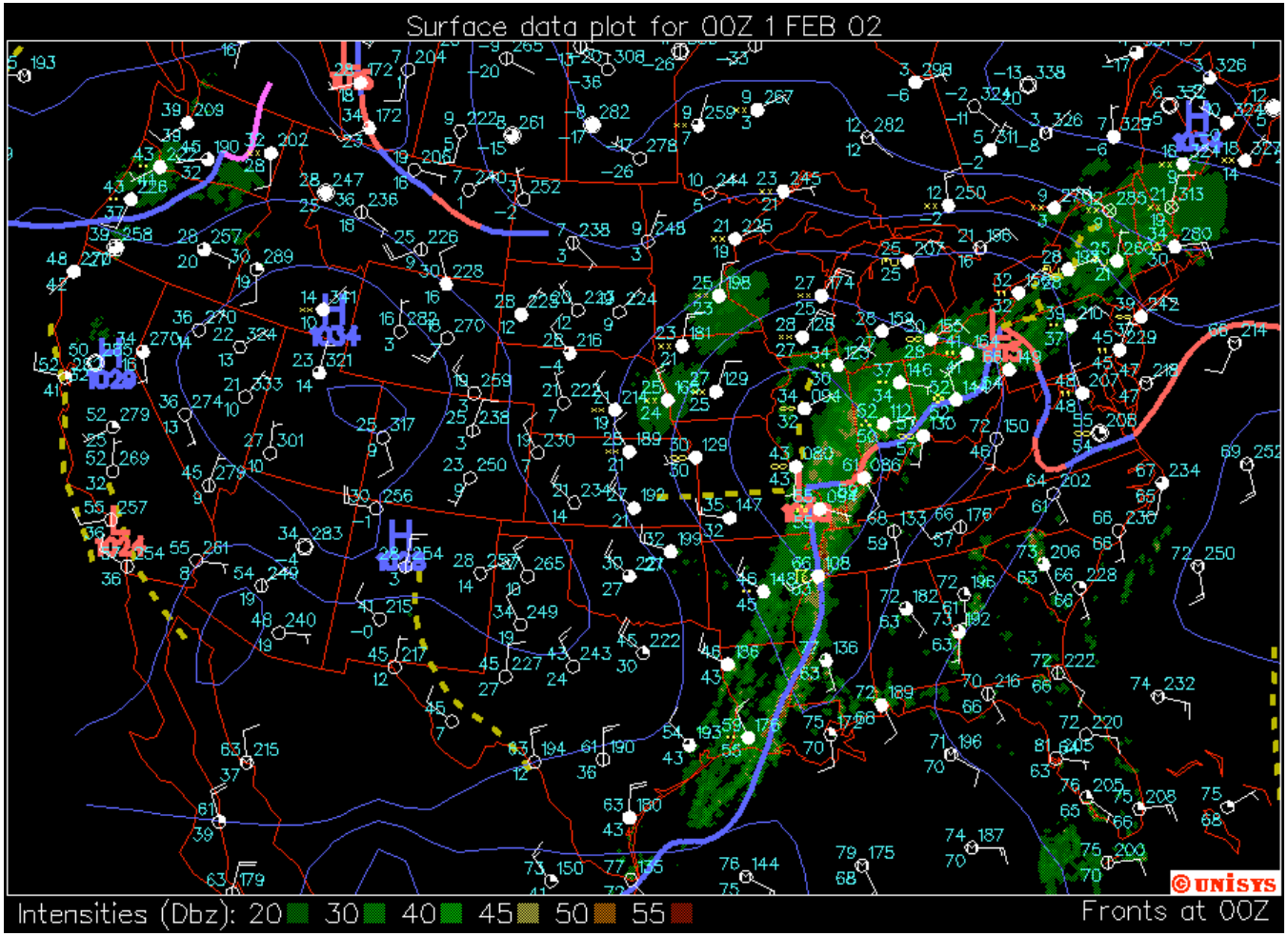
January 28, 2002 00z



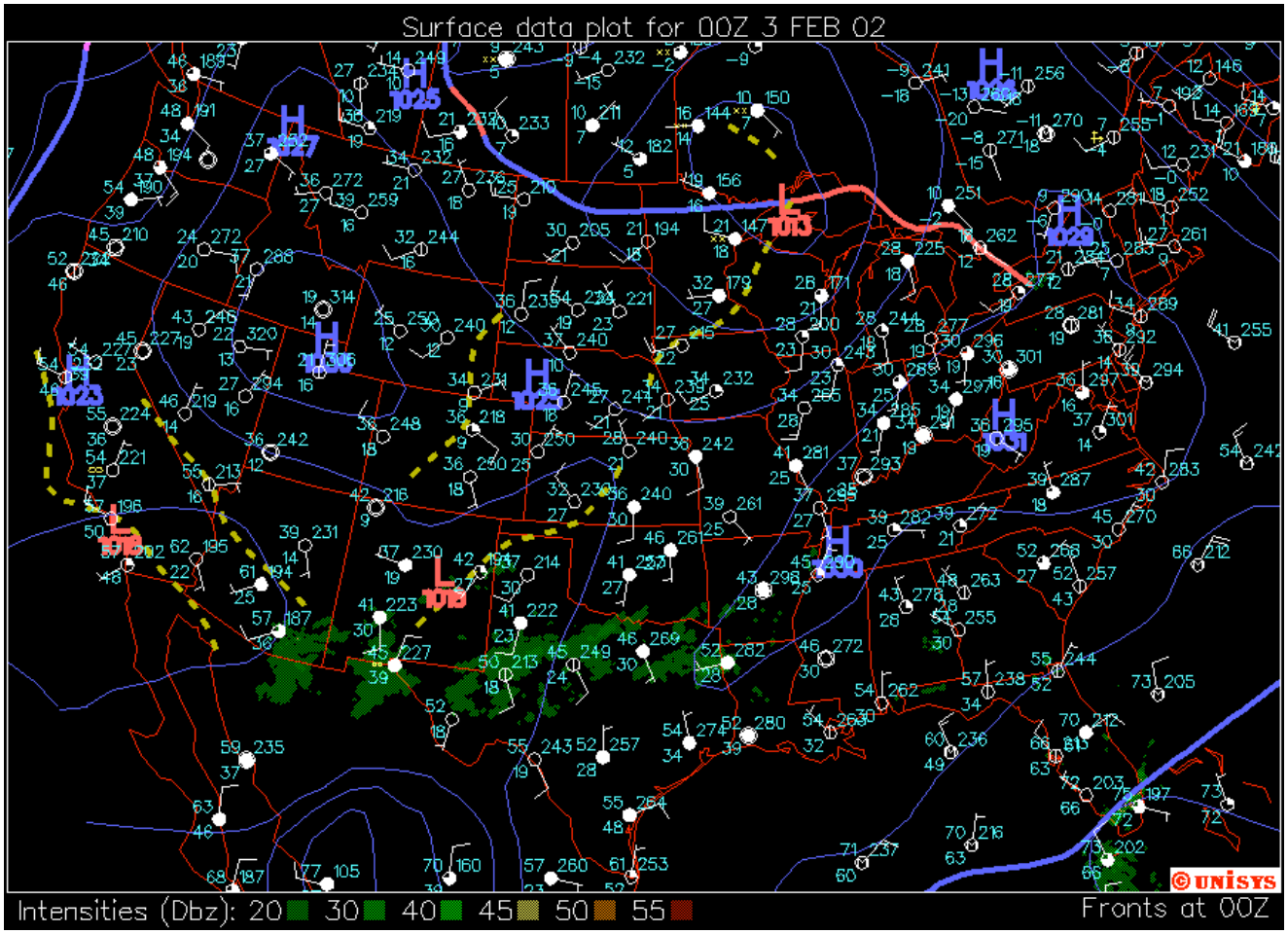
January 30, 2002 00z



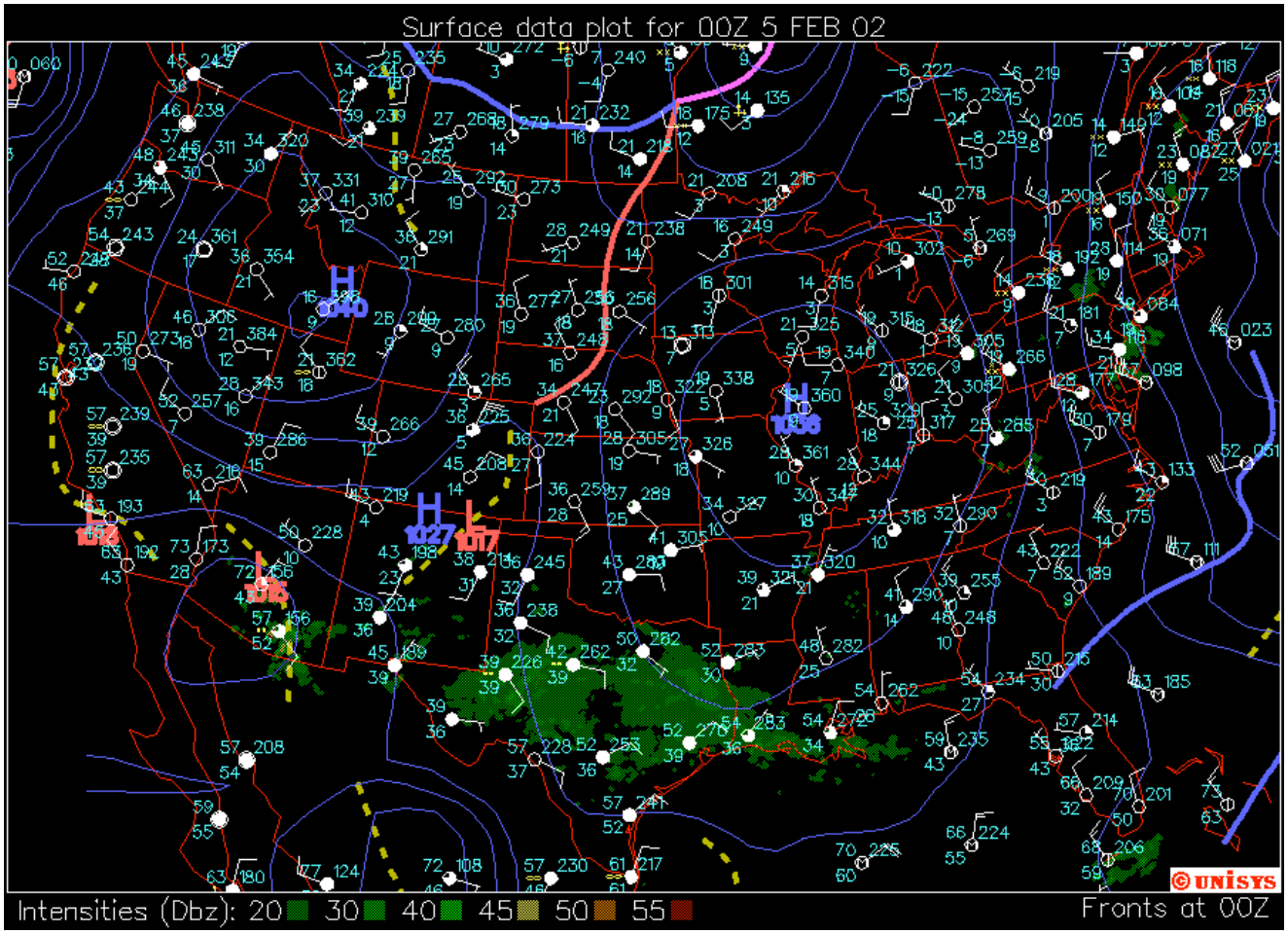
February 1, 2002 00z



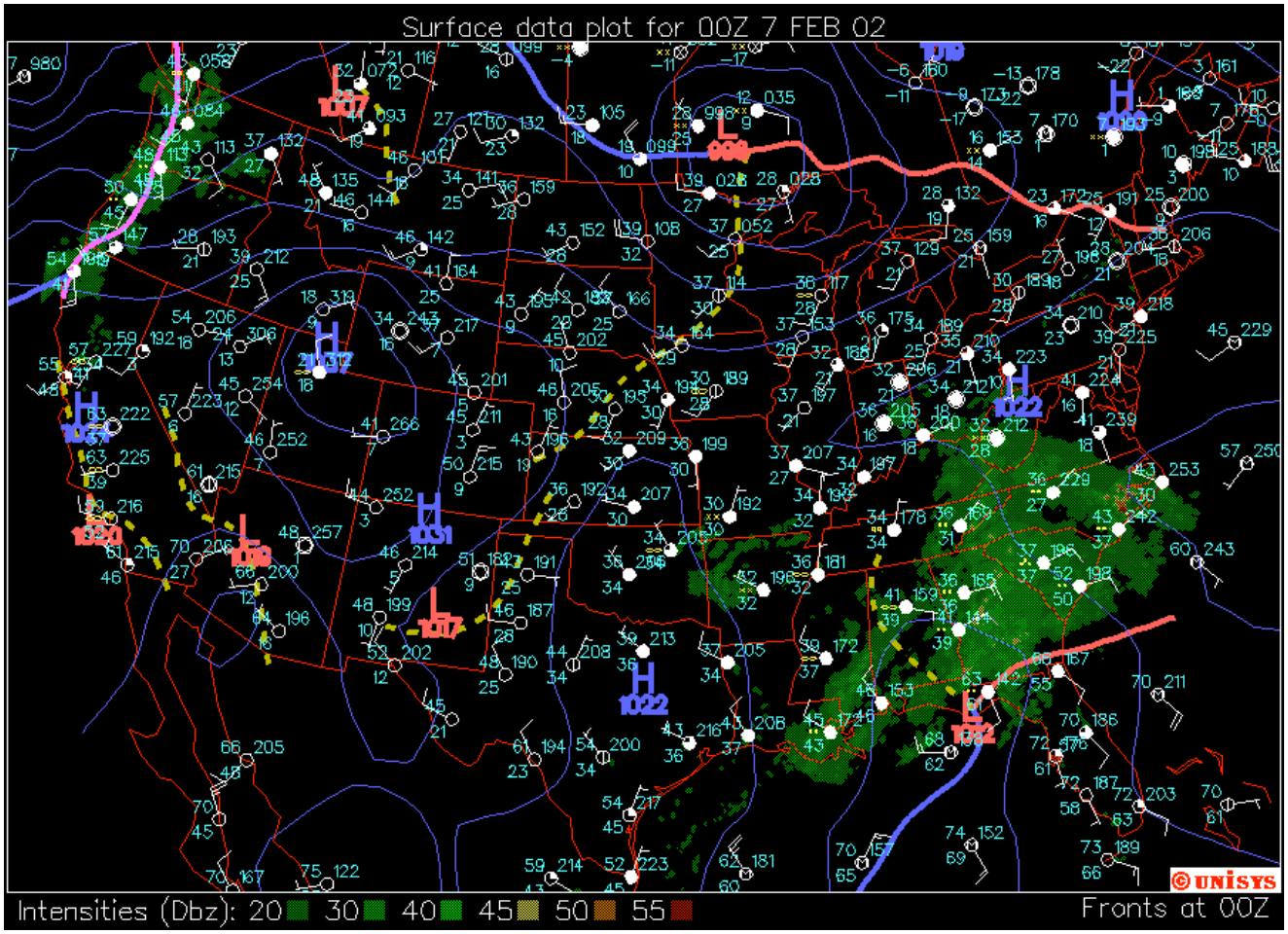
February 3, 2002 00z



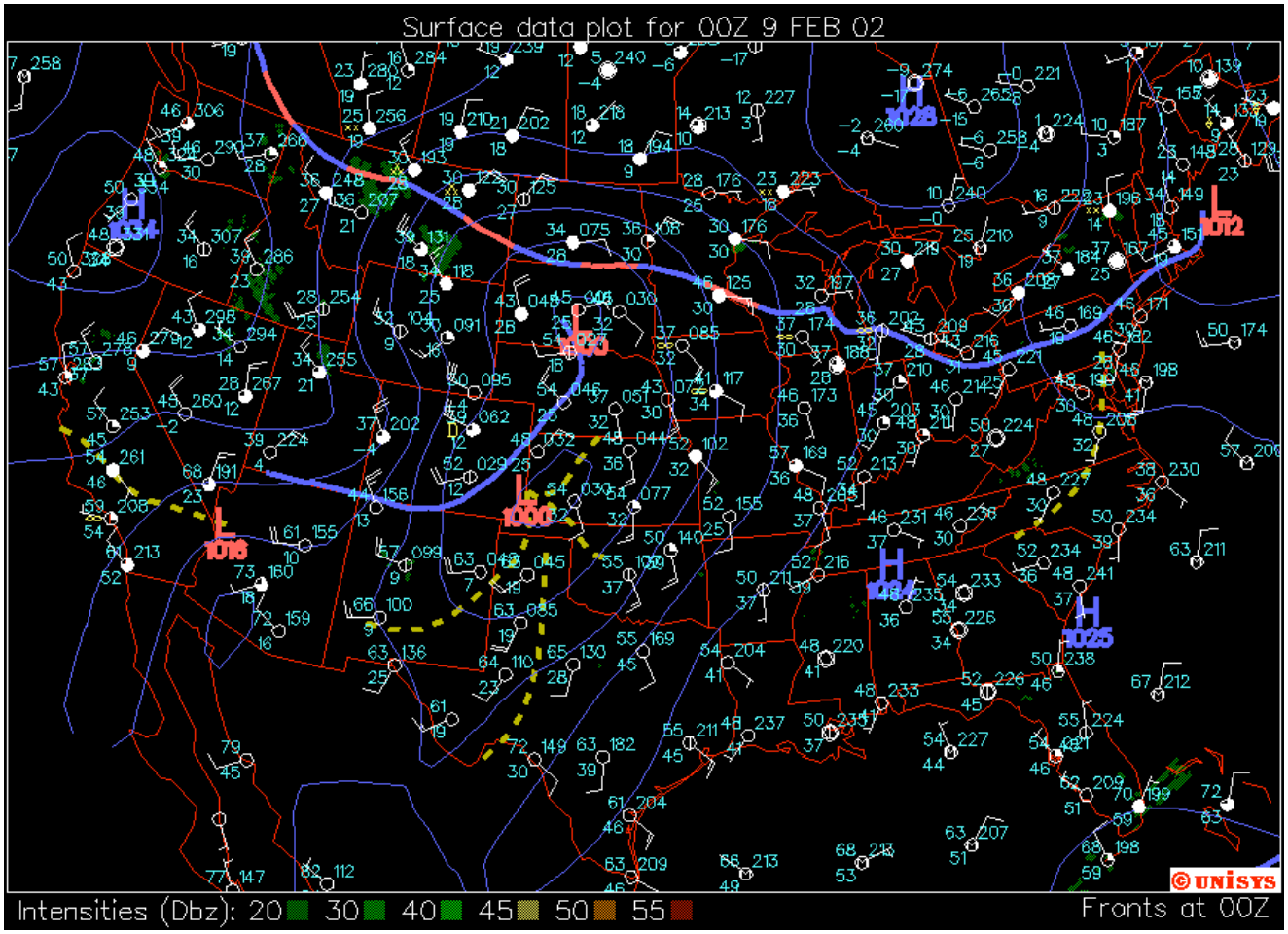
February 5, 2002 00z



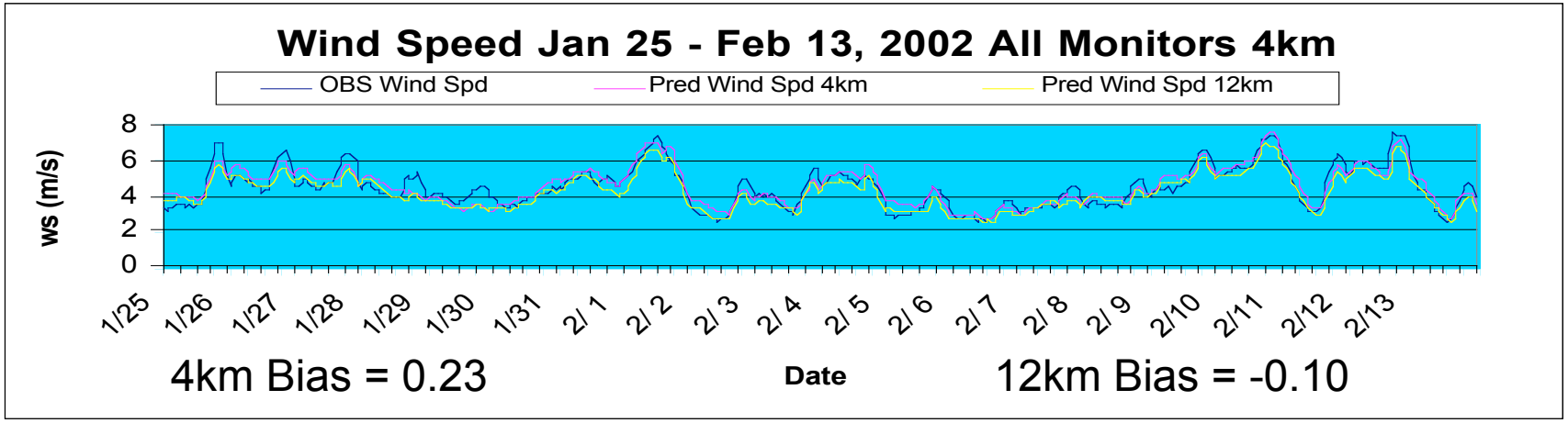
February 7, 2002 00z

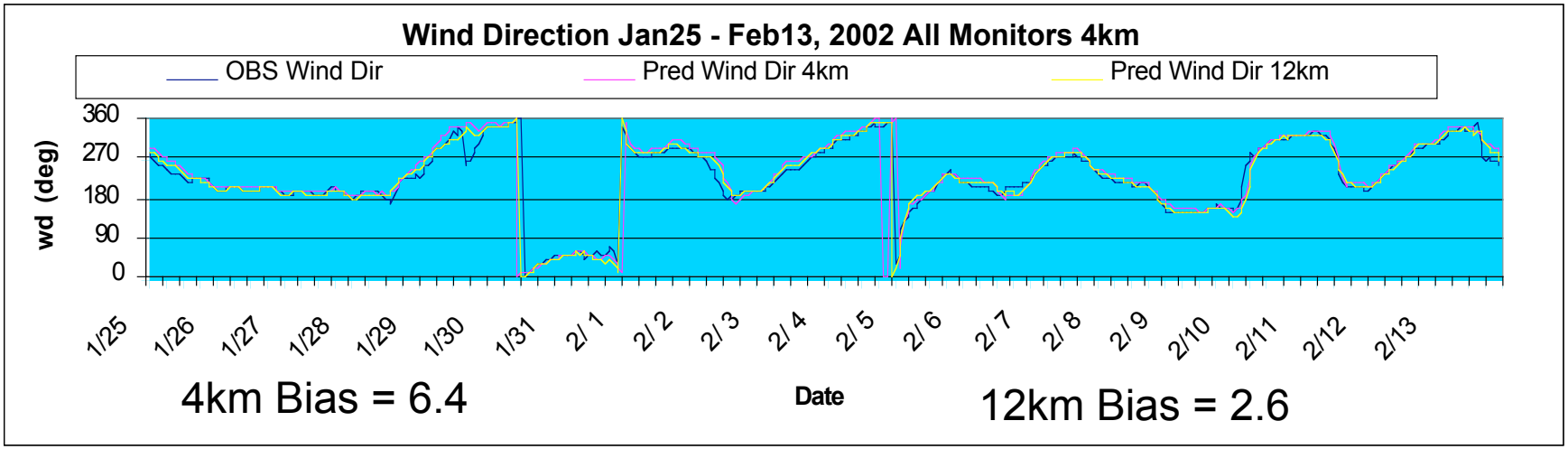


February 9, 2002 00z

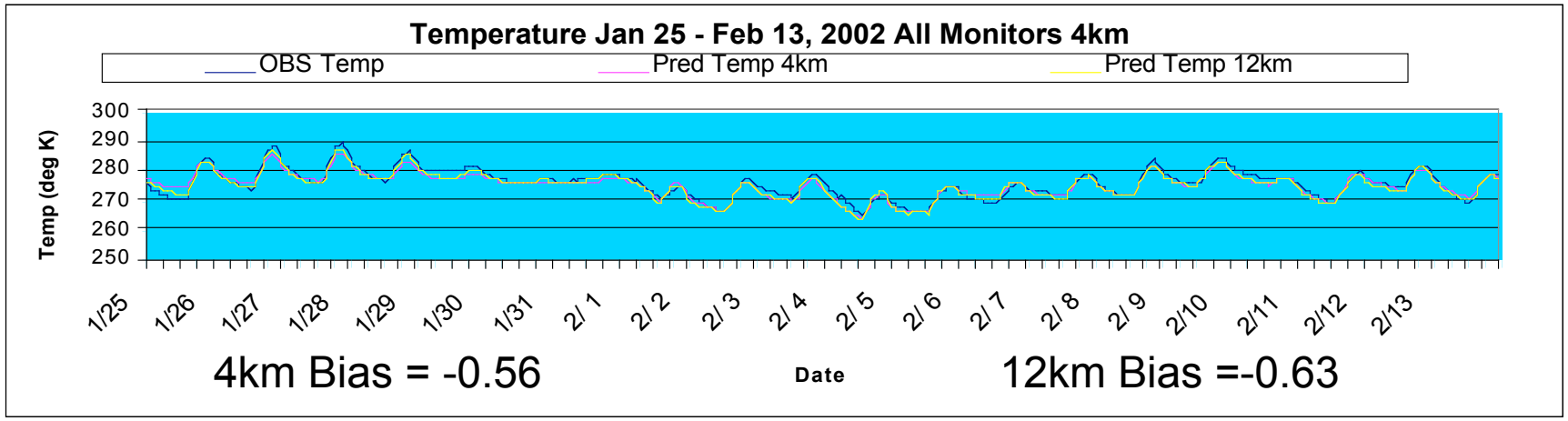


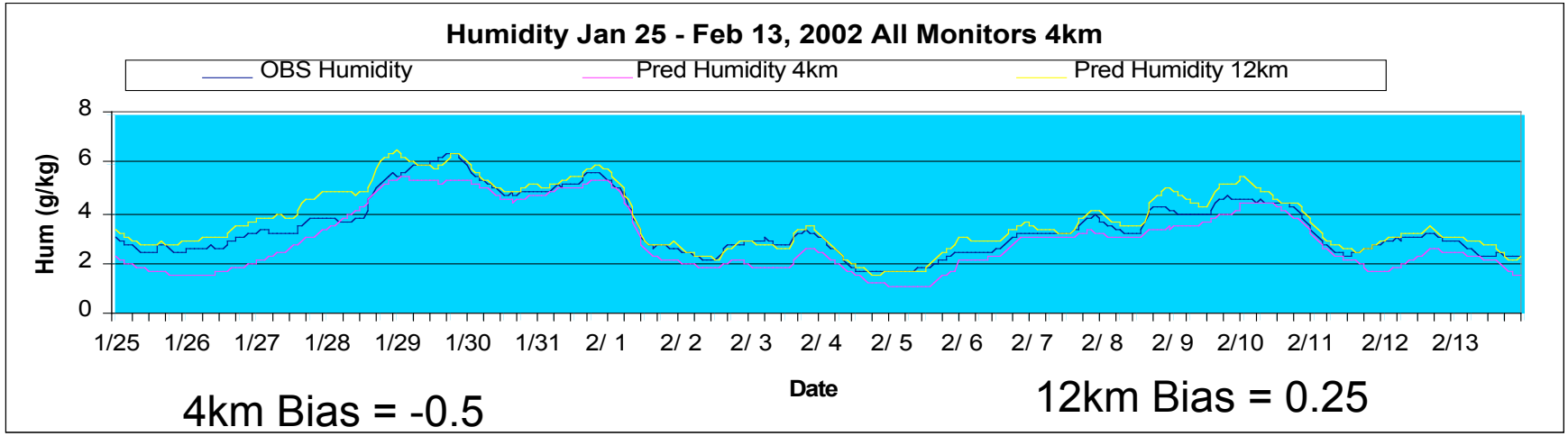
Wind Speed/Direction Entire 4km Domain



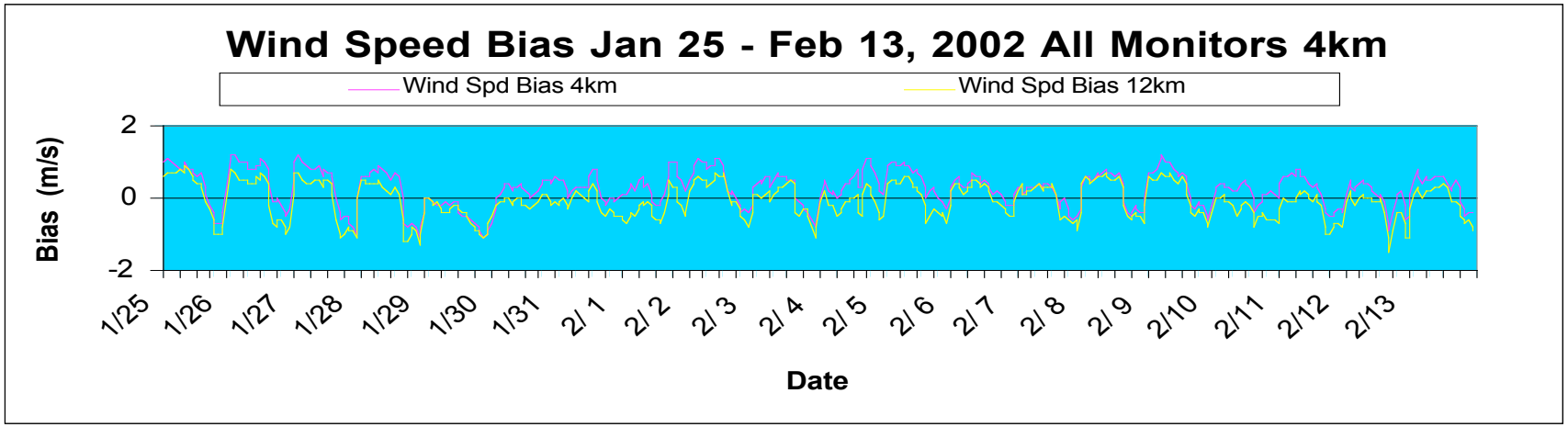


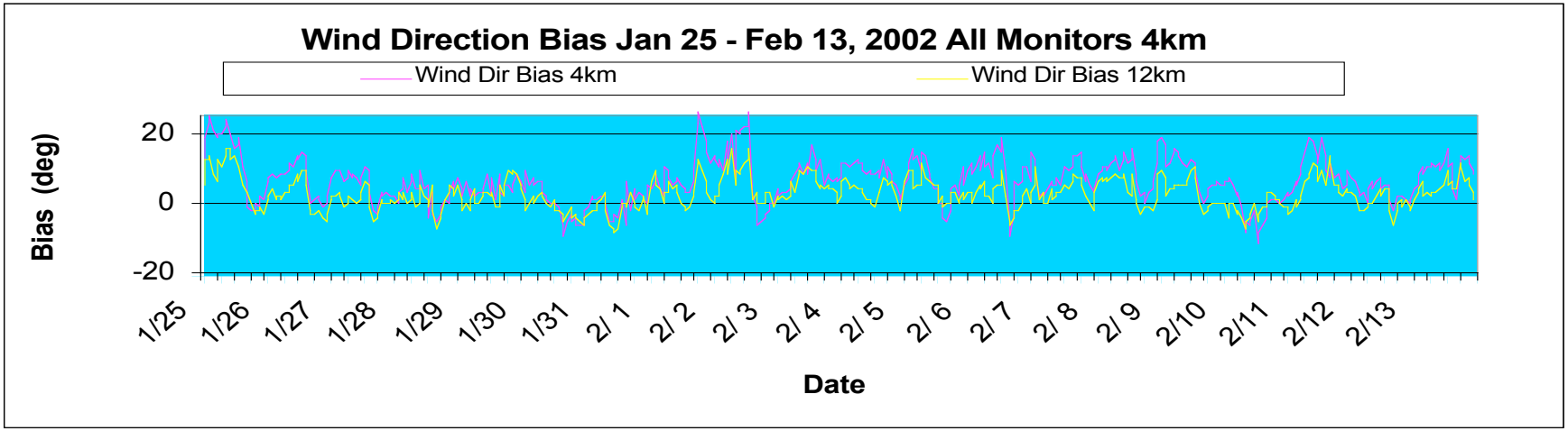
Temperature/Moisture Entire 4km Domain



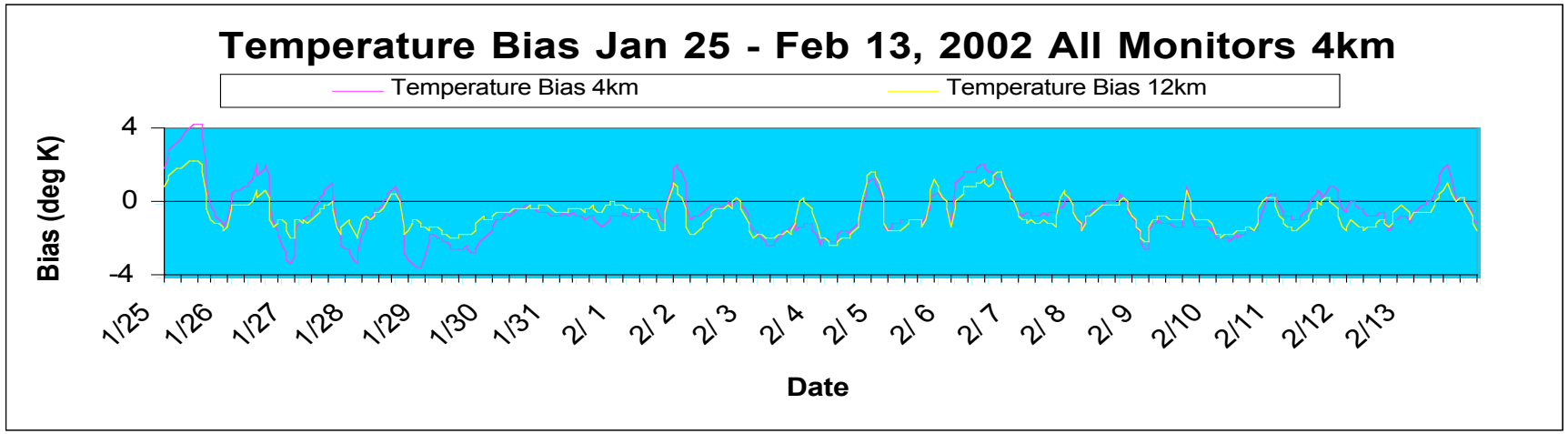


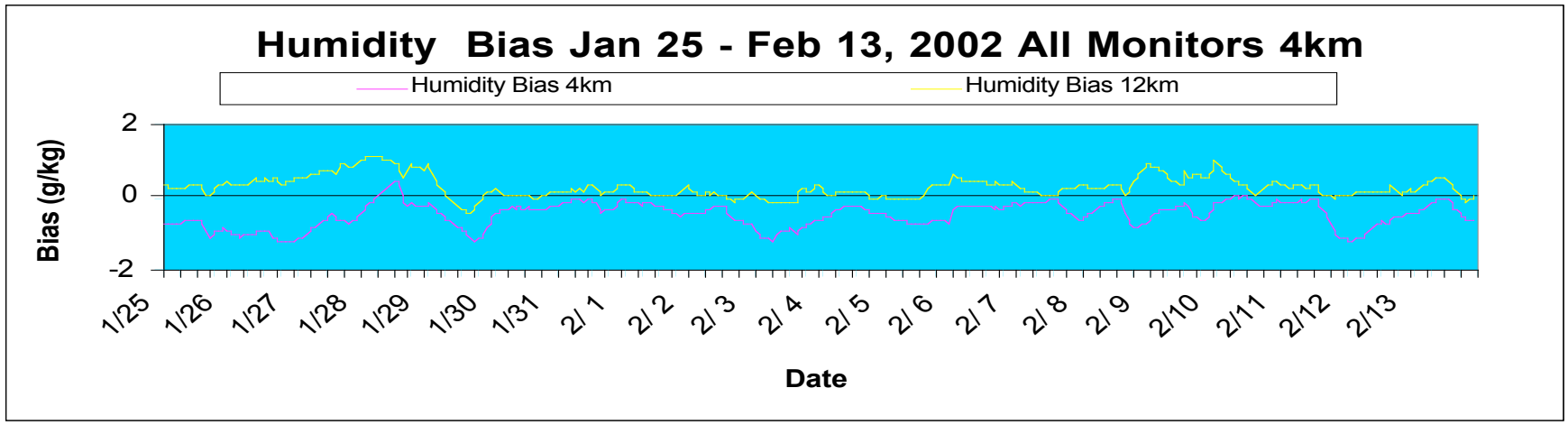
Wind Speed/Direction Bias Entire 4km Domain



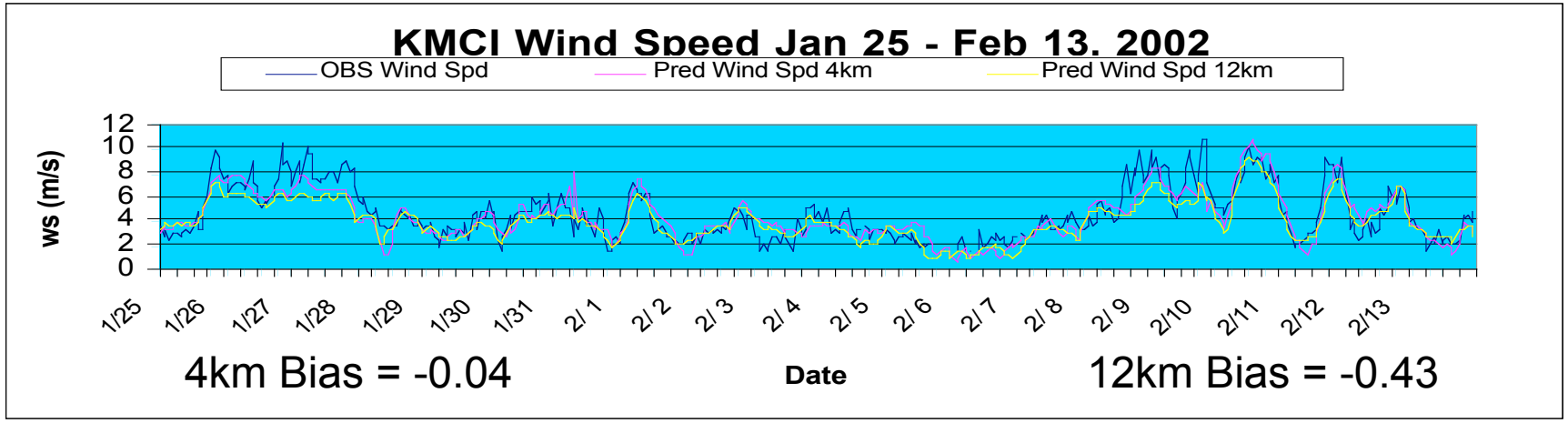


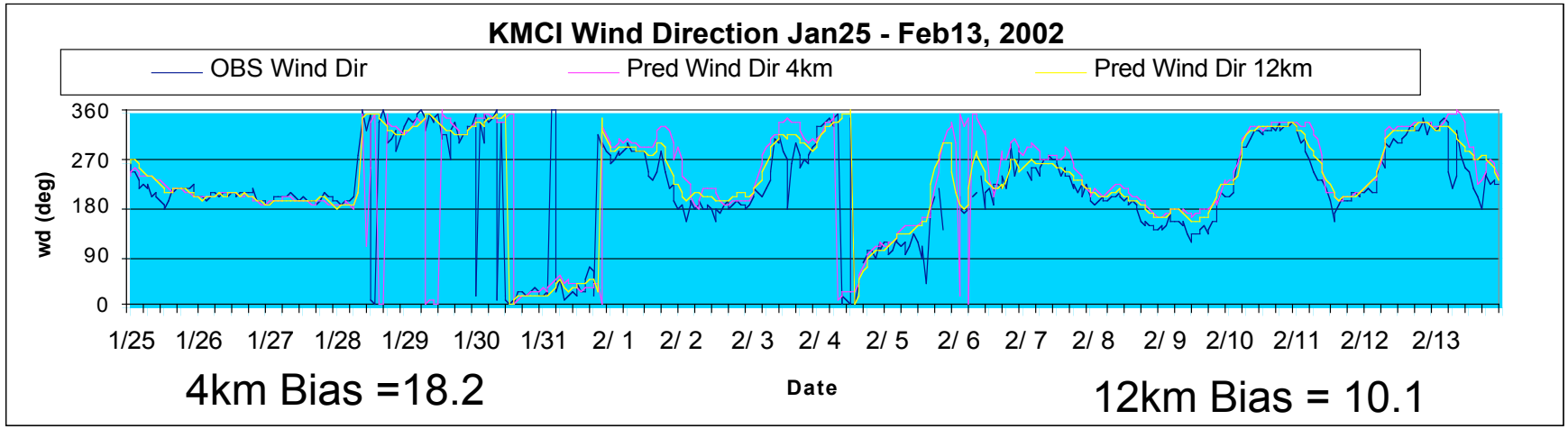
Temperature/Moisture Bias Entire 4km Domain



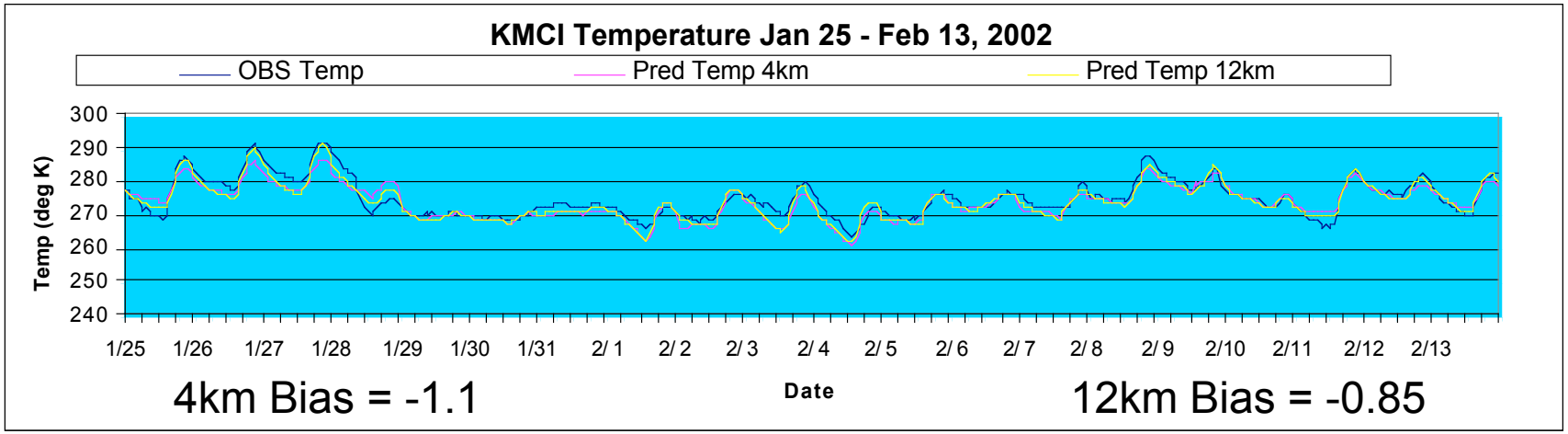


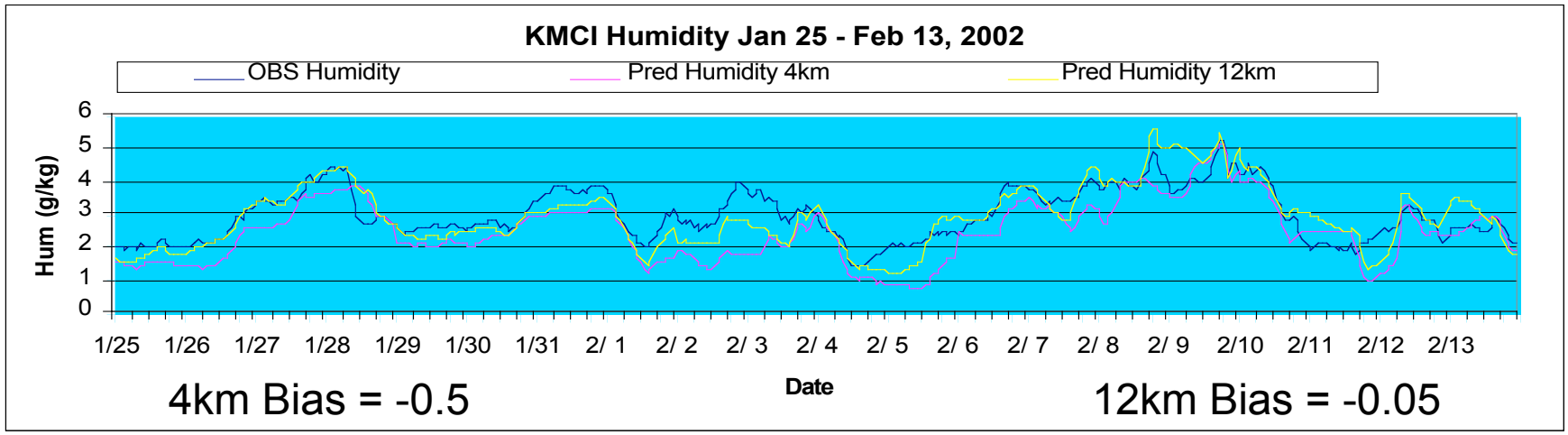
Wind Speed/Direction for KMCI



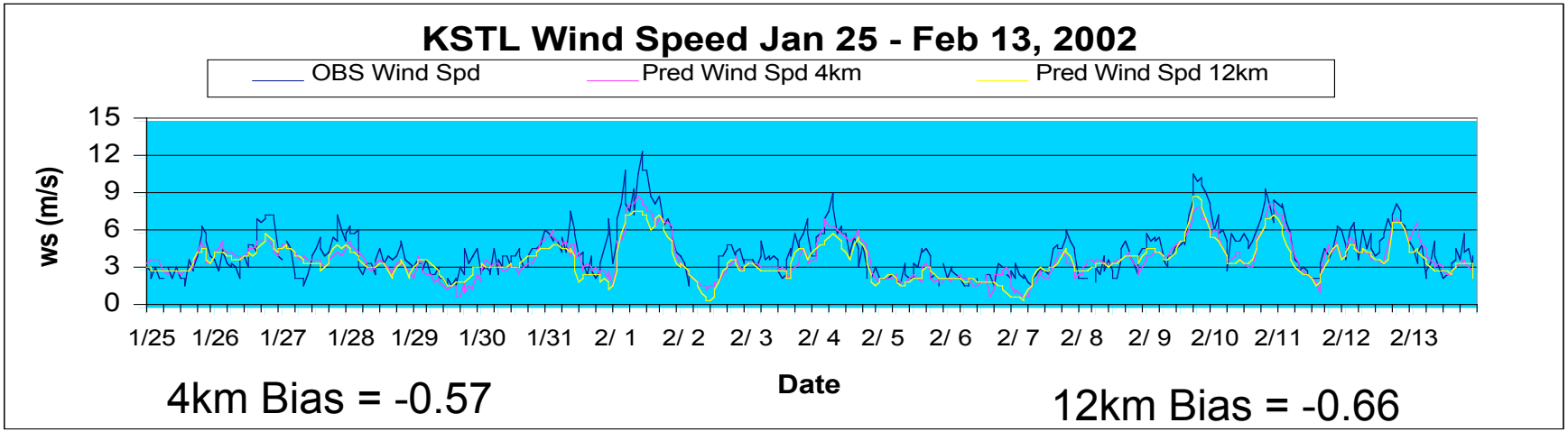


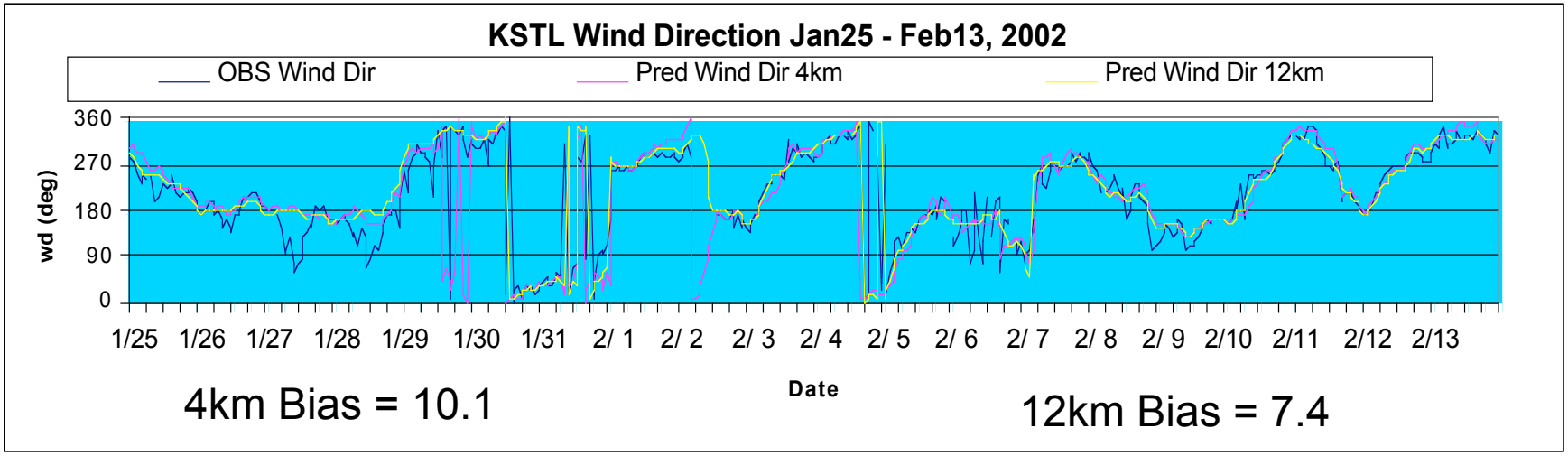
Temperature/Moisture for KMCI



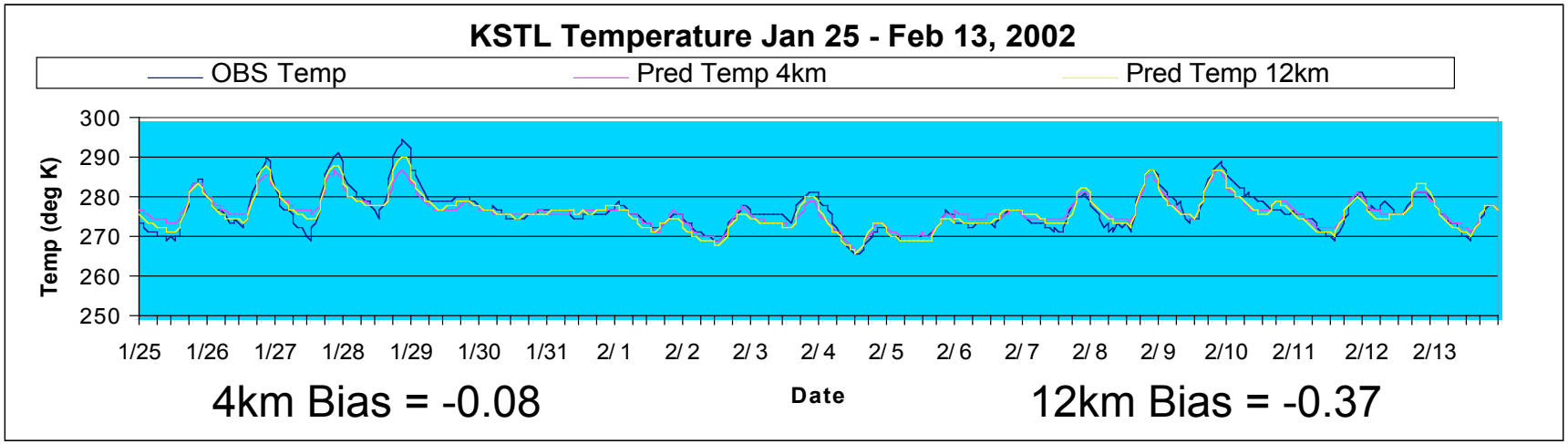


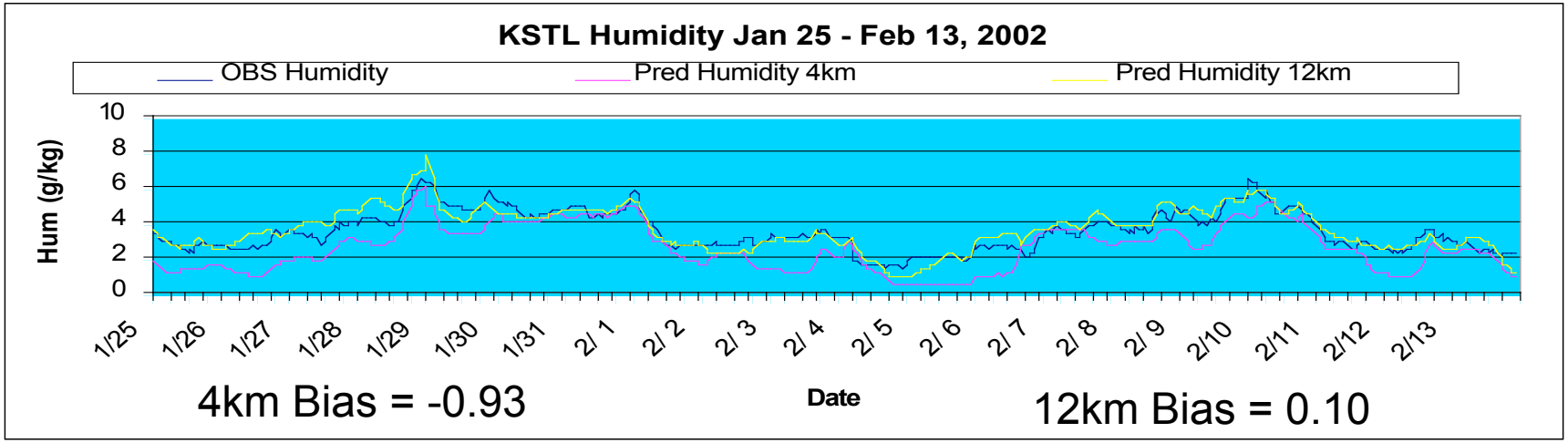
Wind Speed/Direction for KSTL



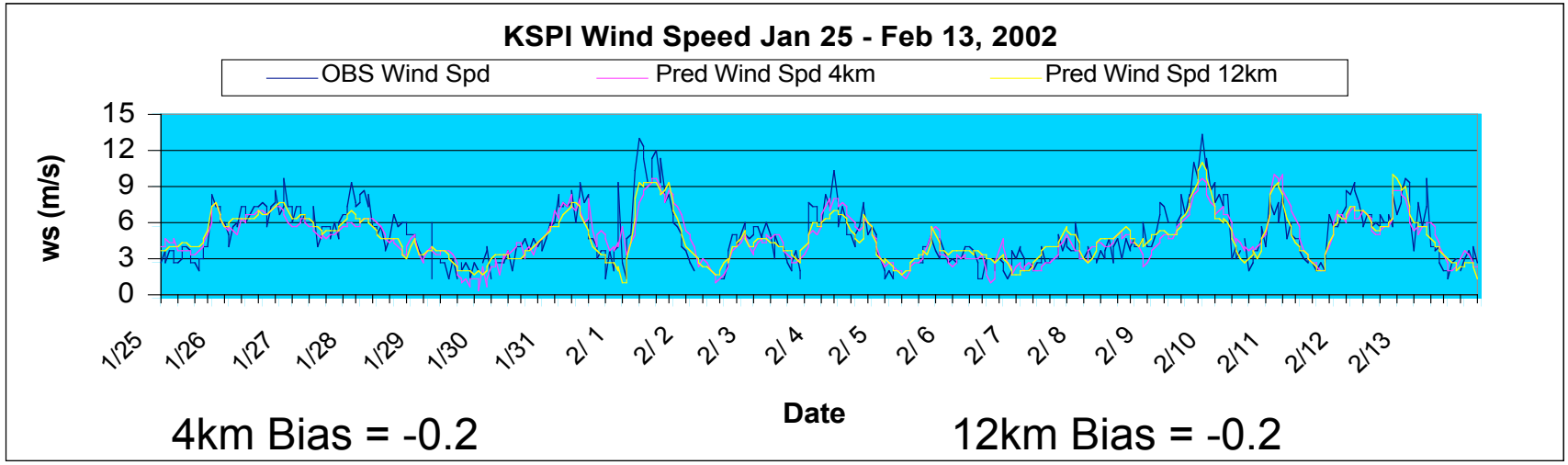


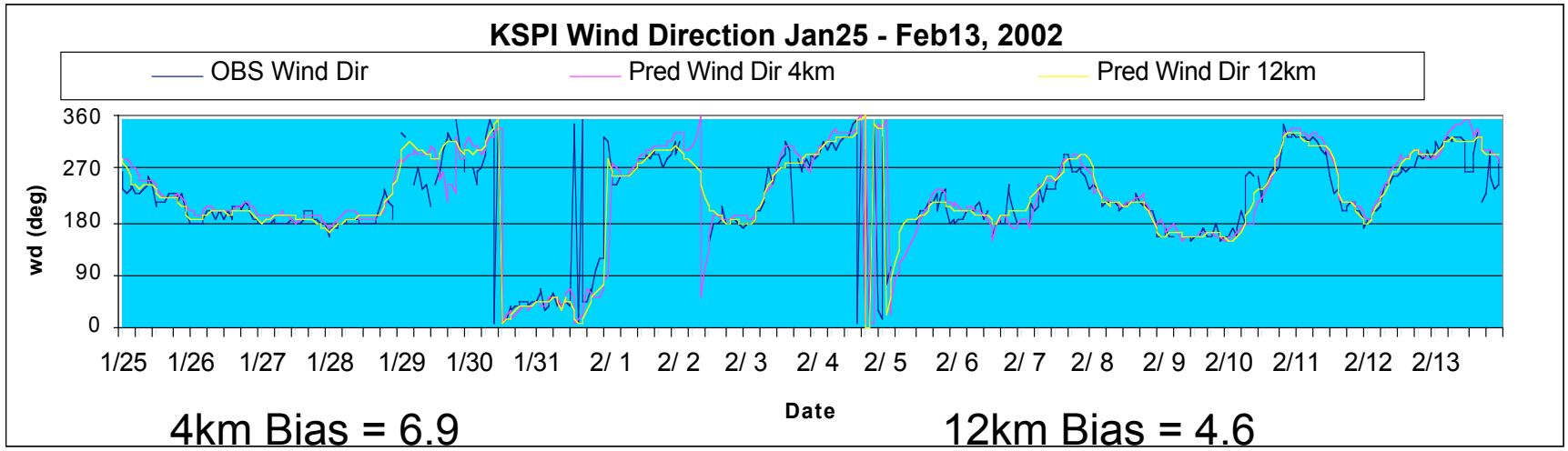
Temperature/Moisture for KSTL



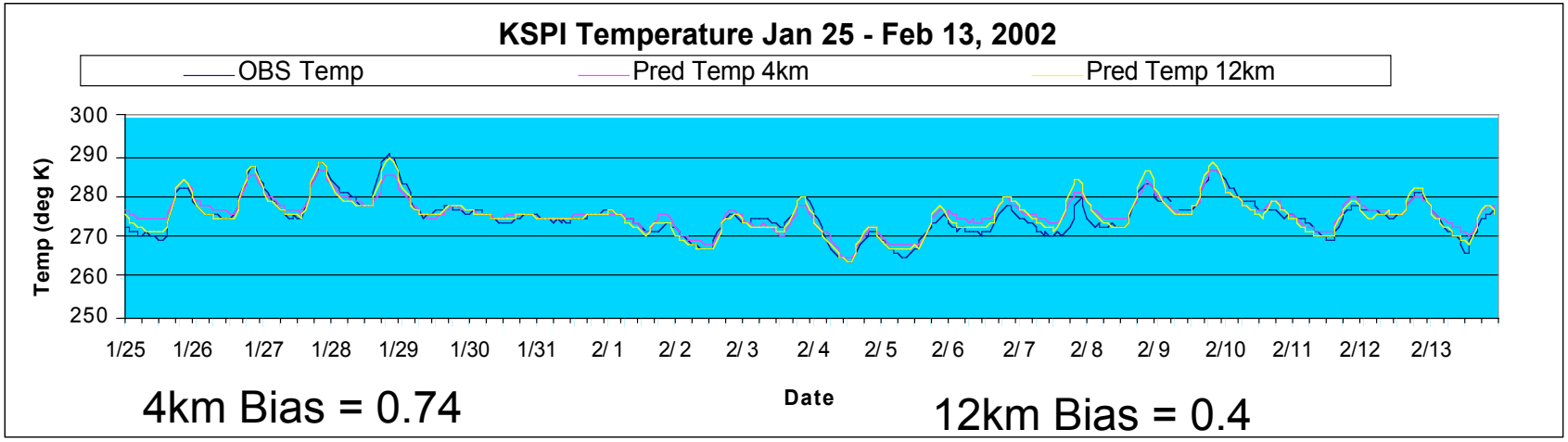


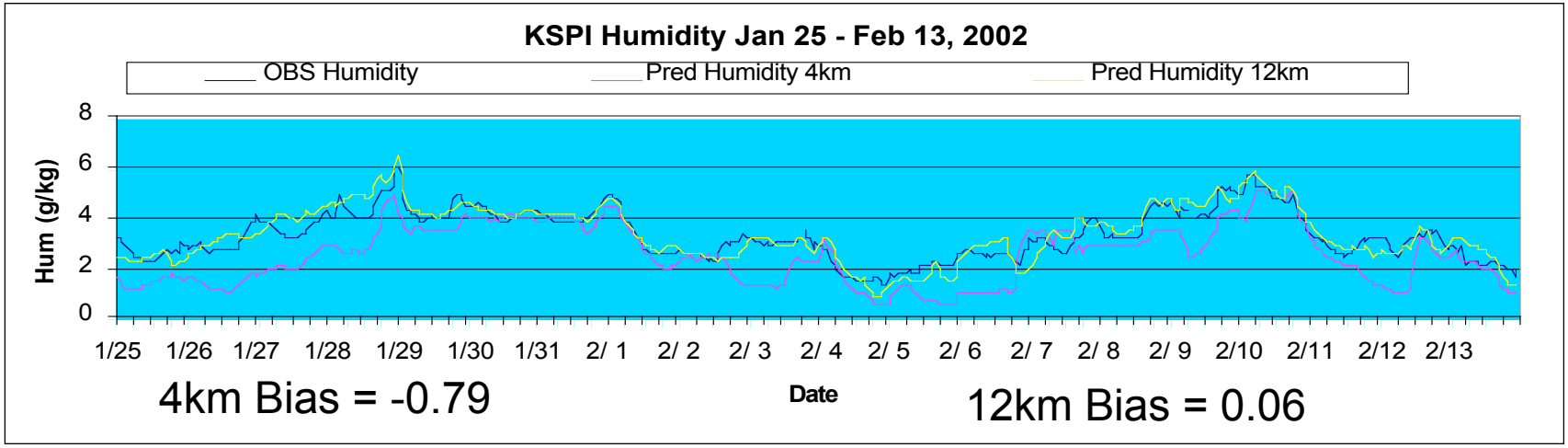
Wind Speed/Direction for KSPI



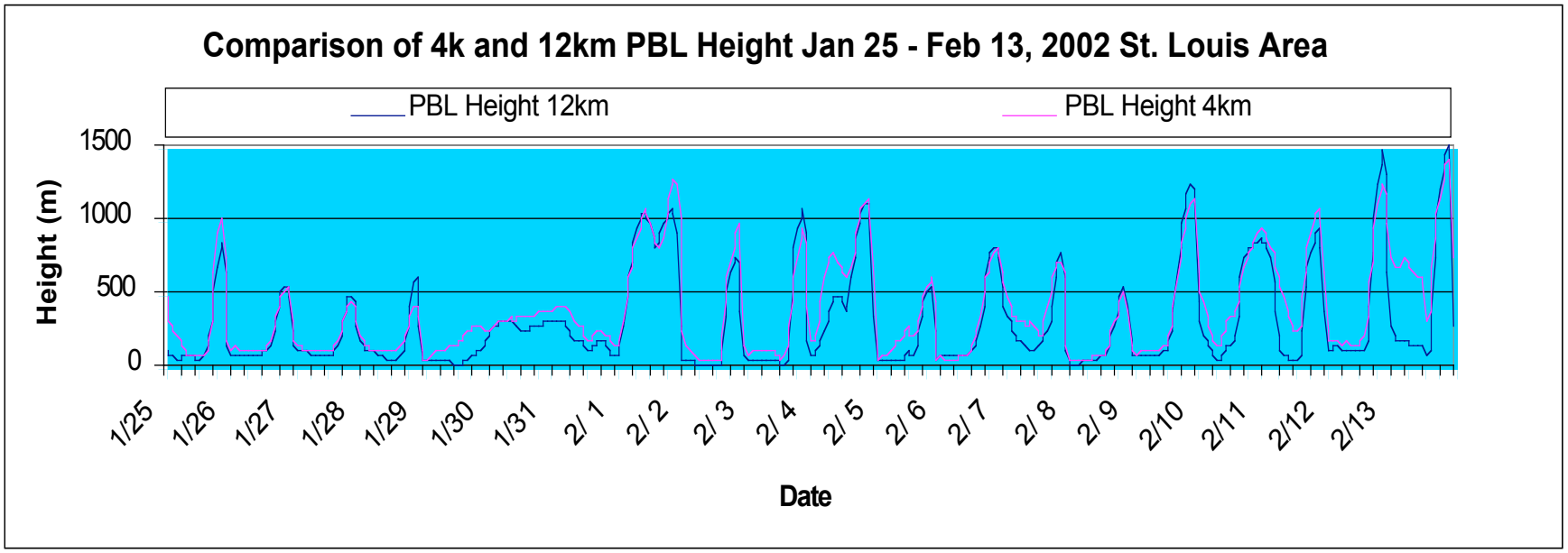


Temperature/Moisture for KSPI

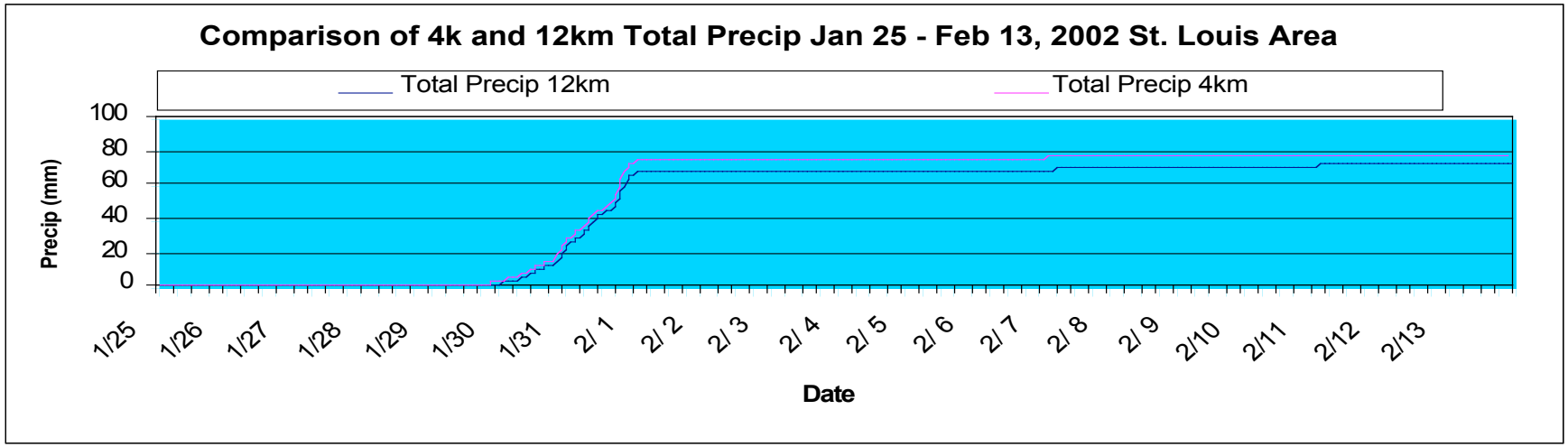


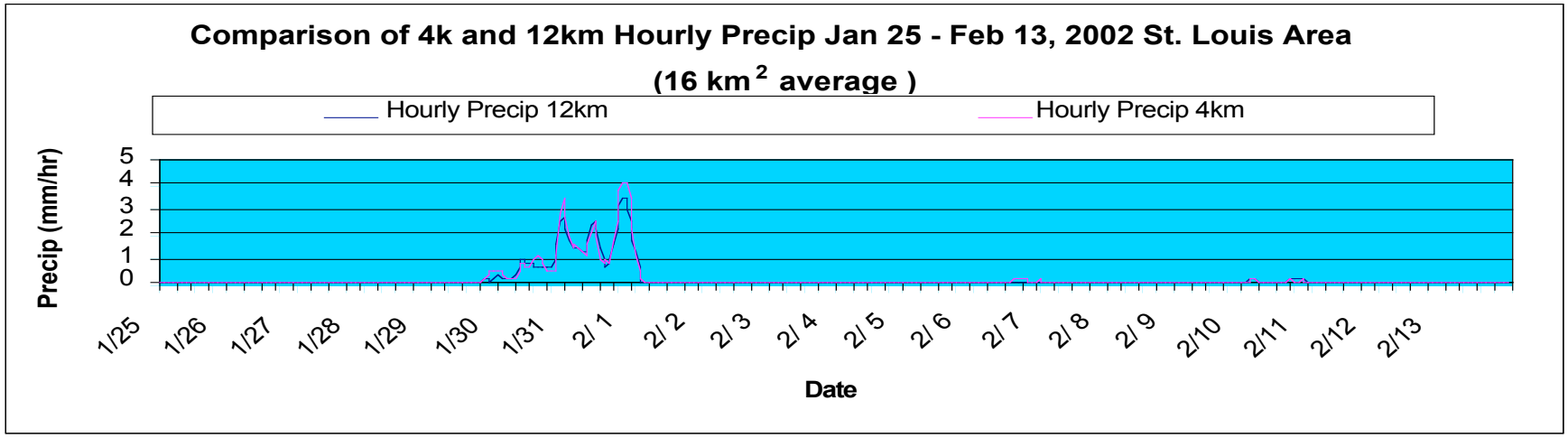


Comparison of PBL Height for the St. Louis Area



Comparison of Precipitation for St. Louis Area





Conclusions for January 25 – February 13, 2002 Episode

- The 4km grid wind speed is generally greater than the 12km, however varies by site and date.
- The 12km grid generally exhibits better wind direction performance with significantly lower bias.
- The 4km grid under estimates humidity and is significantly less than the 12km grid.
- The 4 km grid produces more precipitation with higher peak rates. Precipitation onset is similar for both grids.
- The 12km grid generally has lower morning PBL heights.