



WRF Meteorological Modeling Status for Houston

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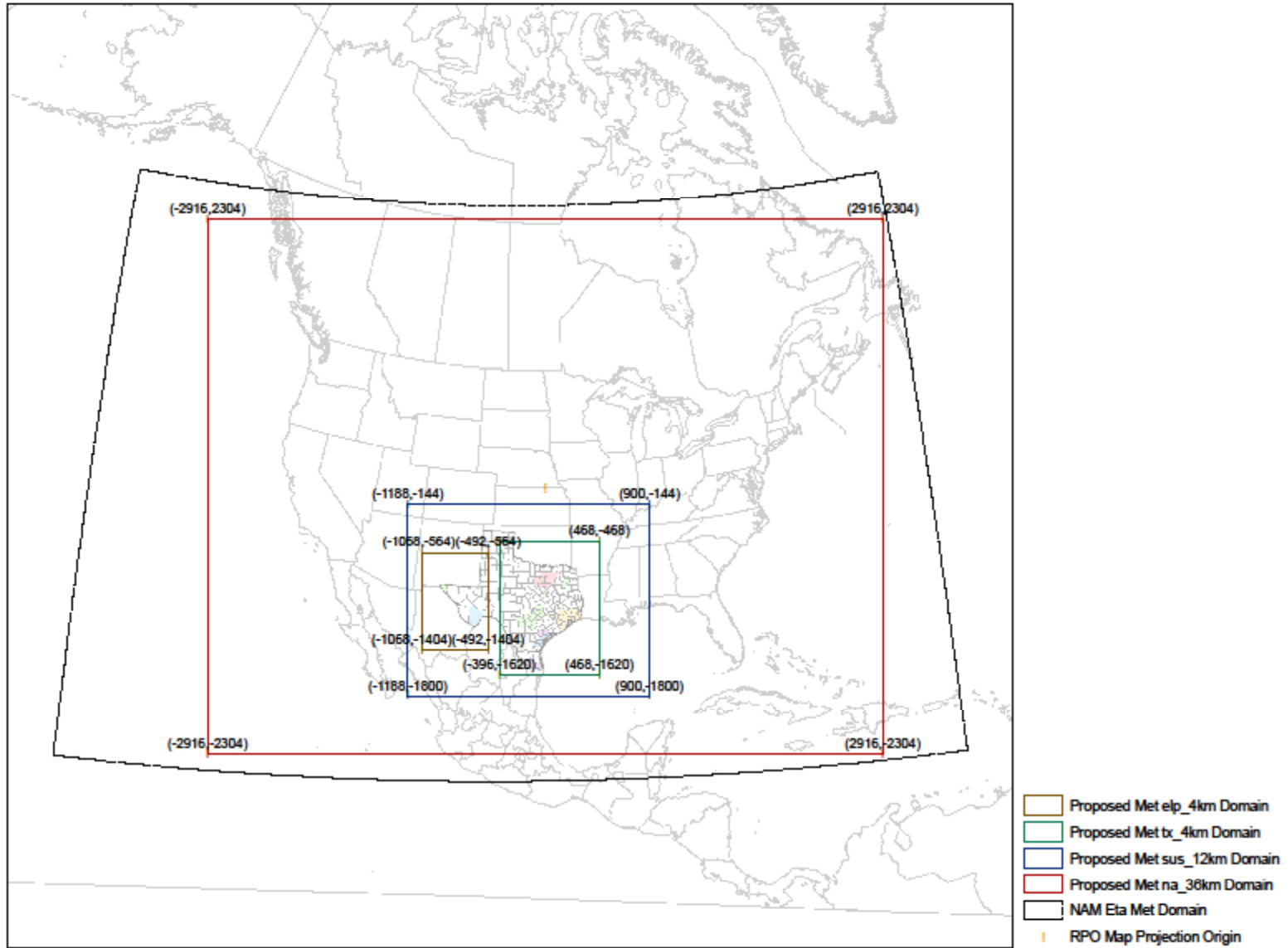


Outline

- WRF configuration
- Preliminary WRF performance statistics
- Additional evaluation
- Future work
- Conclusions
- Questions



Texas Modeling Domains on RPO Map Projection





What is WRF, Again?

- WRF is the Weather Research and Forecast Model.
- WRF replaces the Fifth Generation Mesoscale Meteorological Model (MM5).



WRF Configuration

- New RPO map projection and new grids
- Physics options include:
 - YSU PBL scheme
 - Kain-Fritsch cumulus parameterization
 - WSM 6 microphysics
 - 5 layer thermal diffusion
- Nudging options include:
 - Gridded analysis nudging
 - Observational profiler nudging
 - Surface nudging



WRF Configuration and Testing

- Over 18 major runs and additional minor runs
- PBL options have included:
 - MYJ turbulent kinetic energy (1.5 order)
 - MYNN TKE (2.5 order)
 - YSU
- Cumulus schemes have included:
 - Grell-Devenyi (cumulus ensemble)
 - “New” Grell
 - Kain-Fritsch
- Land-use options have included:
 - NOAH LSM – including MODIS data
 - RUC
 - 5 layer thermal diffusion



Two Major Episodes

- Extended June 2006 – May 28 through July 3
 - Selected for high ozone days across several metropolitan areas
- The 2006 Intensive – in four pieces below:
 - 2006ep1a (August 13 through August 23)
 - 2006ep1b (August 27 through September 16)
 - 2006ep1c (September 16 through September 29)
 - 2006ep1d (October 1 through October 12)



Daily Maximum Eight-Hour Ozone

May 29 through June 15, 2006

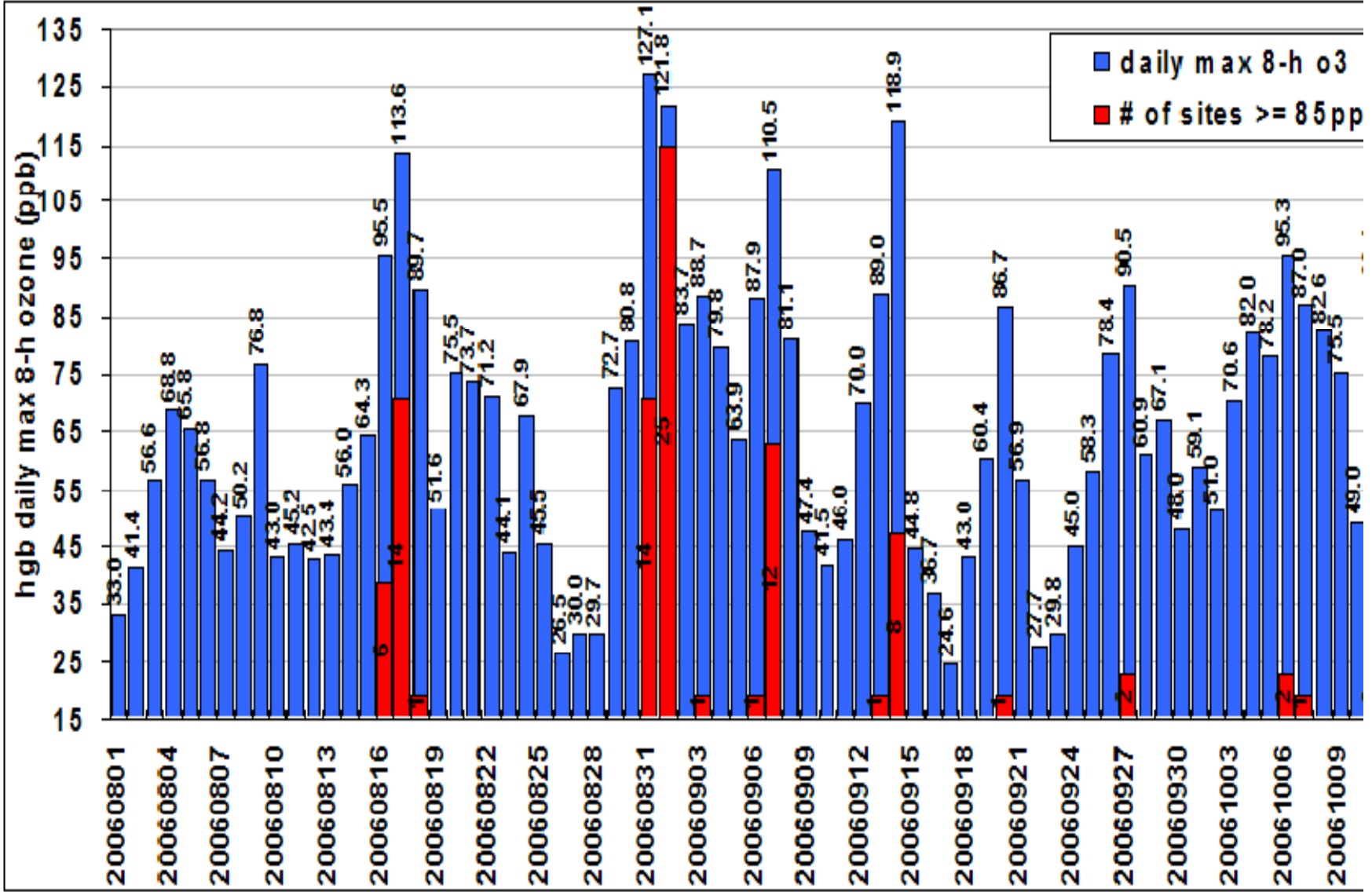
Date	DFW	TLM	BPA	HGB	Austin	SAT	VCT	CC	El Paso
05/29/06	45	50	32	53	38	48	31	32	52
05/30/06	52	45	45	35	47	58	31	36	55
05/31/06	56	56	64	55	36	43	37	36	64
06/01/06	68	65	51	48	51	56	36	36	61
06/02/06	74	62	69	94	65	66	43	34	75
06/03/06	88	78	68	84	81	80	62	55	89
06/04/06	87	68	93	111	72	73	44	30	82
06/05/06	76	65	85	109	64	63	62	38	75
06/06/06	92	78	89	110	67	68	66	45	69
06/07/06	93	82	77	86	73	76	61	52	58
06/08/06	96	79	81	122	88	84	61	52	60
06/09/06	106	83	84	106	81	77	65	52	66
06/10/06	86	77	81	95	76	71	63	52	72
06/11/06	74	75	78	79	60	64	55	51	61
06/12/06	101	90	68	101	71	70	45	32	73
06/13/06	98	78	80	90	82	93	60	47	78
06/14/06	107	82	90	119	83	90	64	69	58
06/15/06	89	81	67	93	69	69	69	67	56



Daily Maximum Eight-Hour Ozone

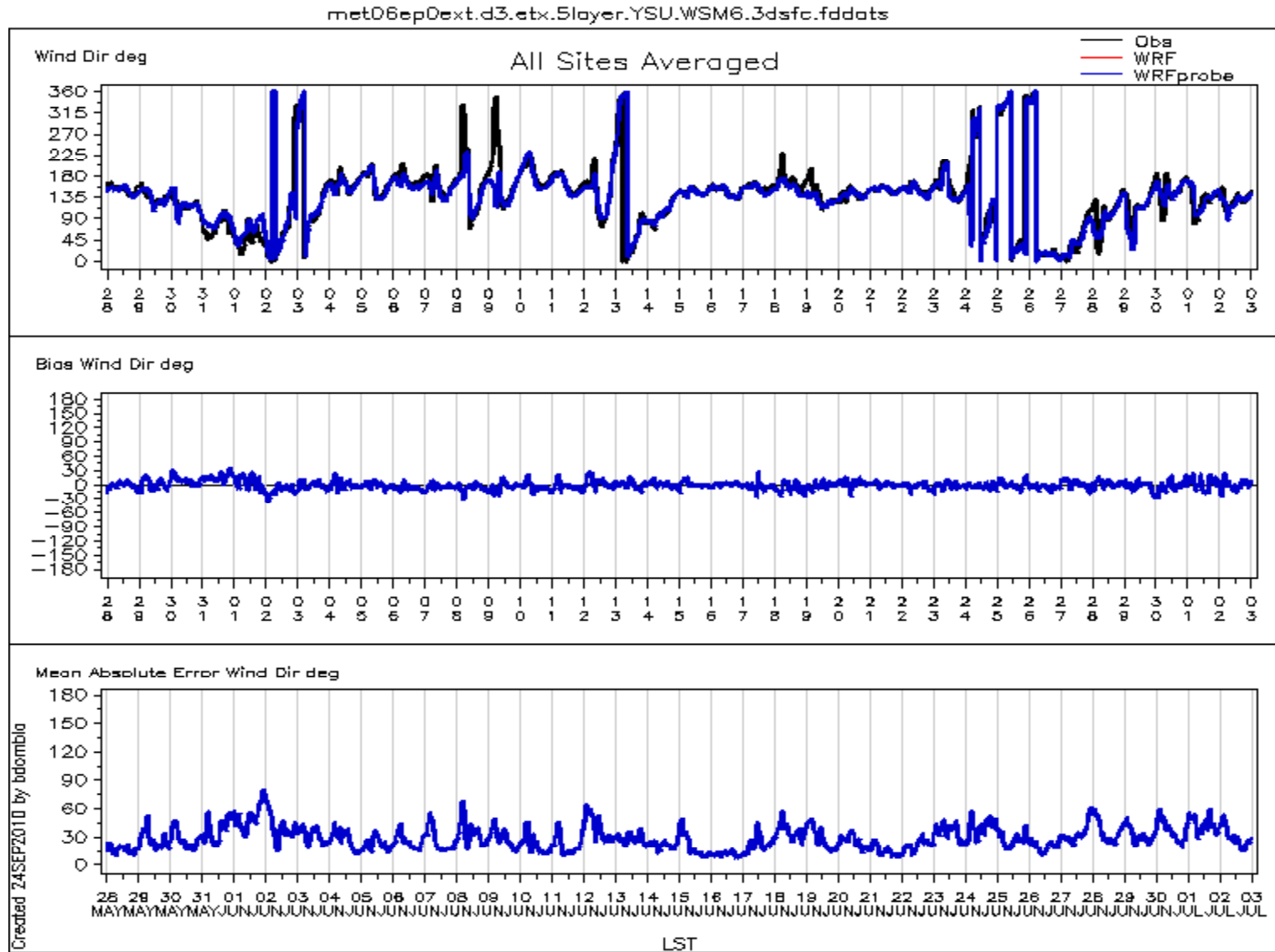
June 16 through July 2, 2006

Date	DFW	TLM	BPA	HGB	Austin	SAT	VCT	CC	El Paso
06/16/06	45	41	21	35	35	35	21	22	67
06/17/06	70	38	36	38	60	44	24	19	75
06/18/06	97	68	25	44	77	71	36	25	94
06/19/06	76	51	33	49	65	65	32	18	69
06/20/06	42	57	34	36	28	29	31	19	75
06/21/06	41	50	22	47	29	32	19	21	65
06/22/06	48	37	33	39	36	36	27	20	73
06/23/06	55	58	56	71	45	50	30	22	60
06/24/06	73	50	65	88	40	45	31	25	69
06/25/06	68	73	62	73	69	65	61	58	66
06/26/06	66	67	64	83	71	78	90	68	64
06/27/06	91	64	82	94	72	88	76	82	72
06/28/06	98	79	82	108	79	90	76	78	67
06/29/06	91	84	95	121	91	91	70	66	75
06/30/06	102	85	91	85	89	71	50	26	76
07/01/06	85	87	55	55	42	38	28	27	72
07/02/06	54	58	38	42	34	26	30	29	63





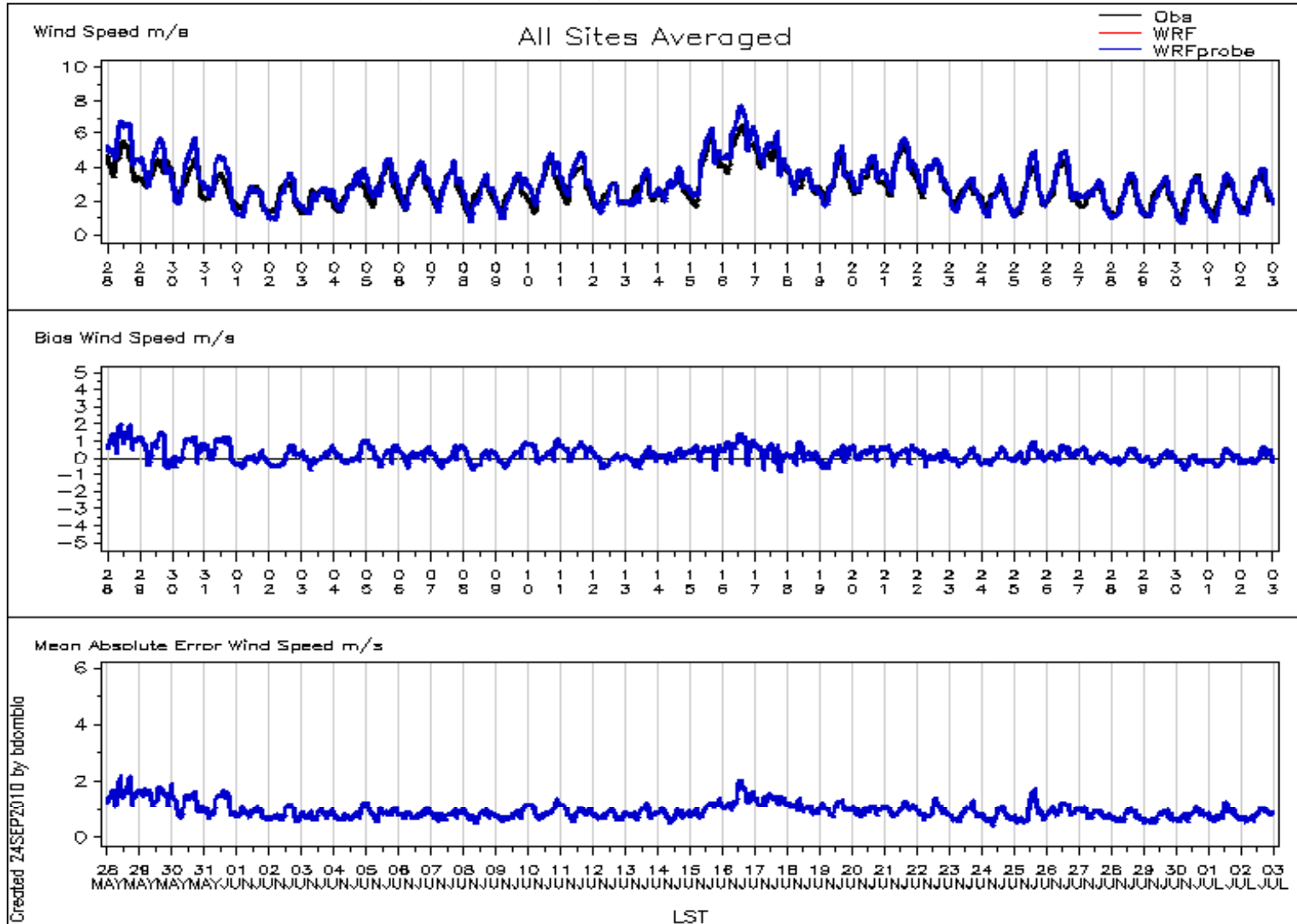
Wind Direction





Wind Speed

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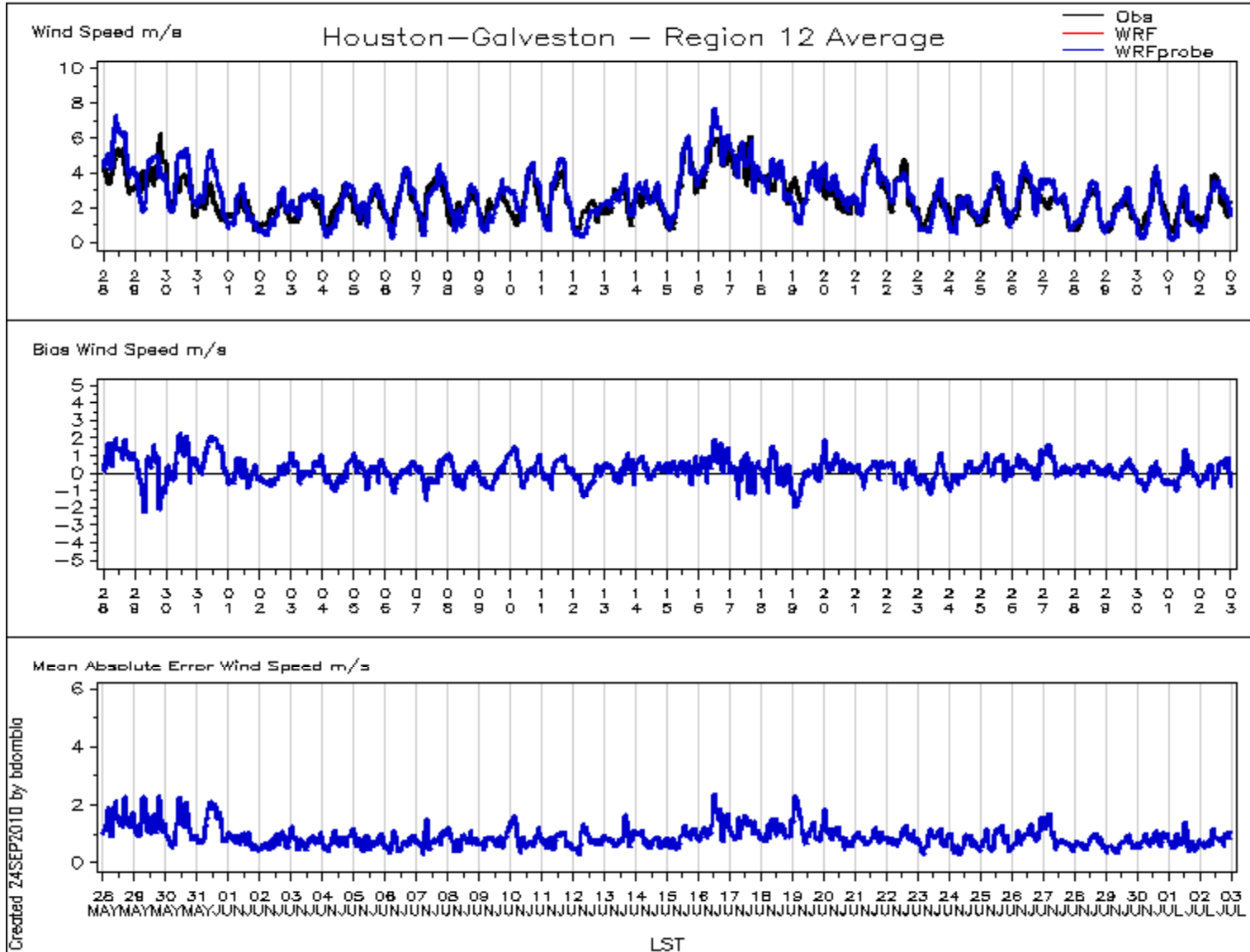


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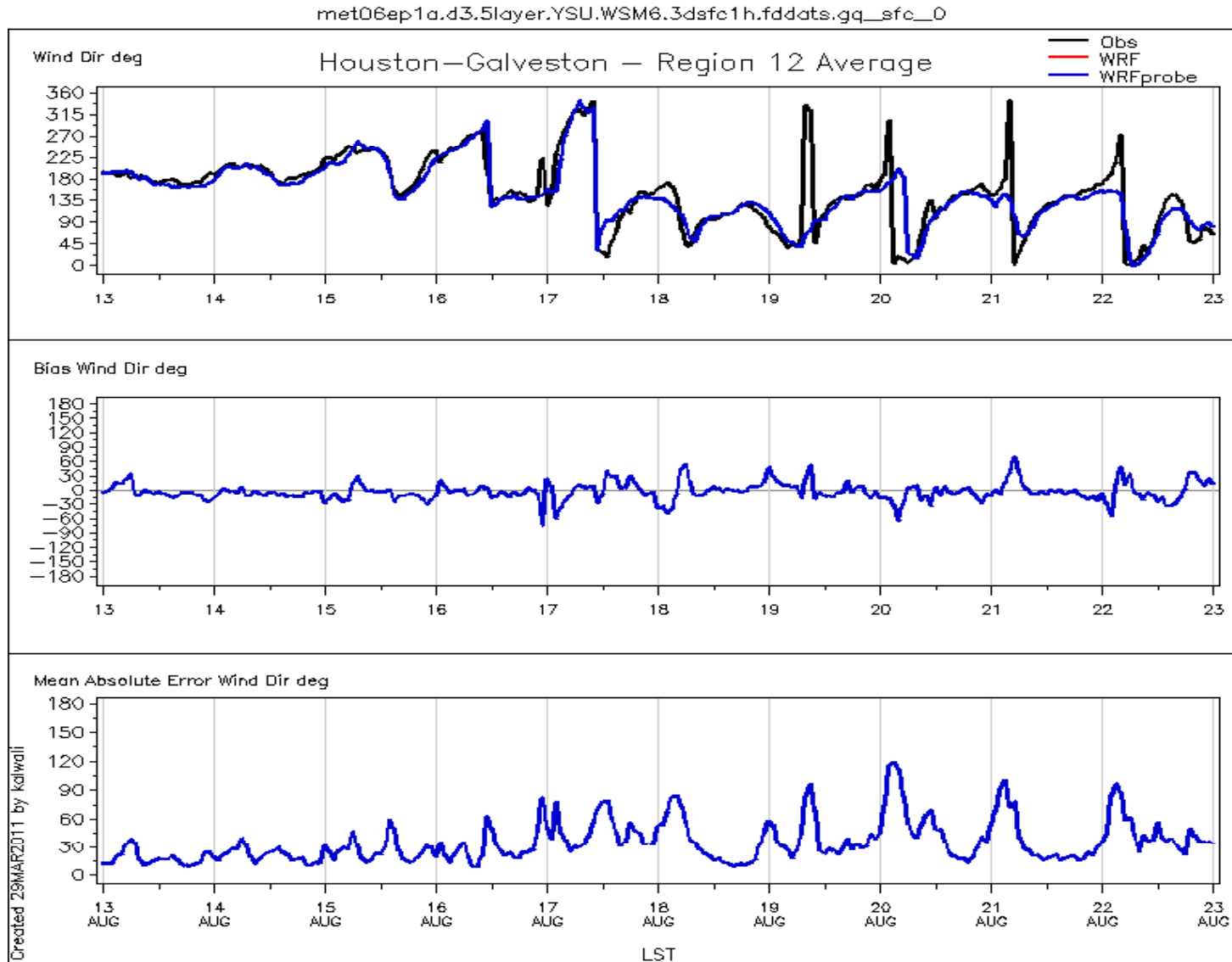
HGB Wind Speed

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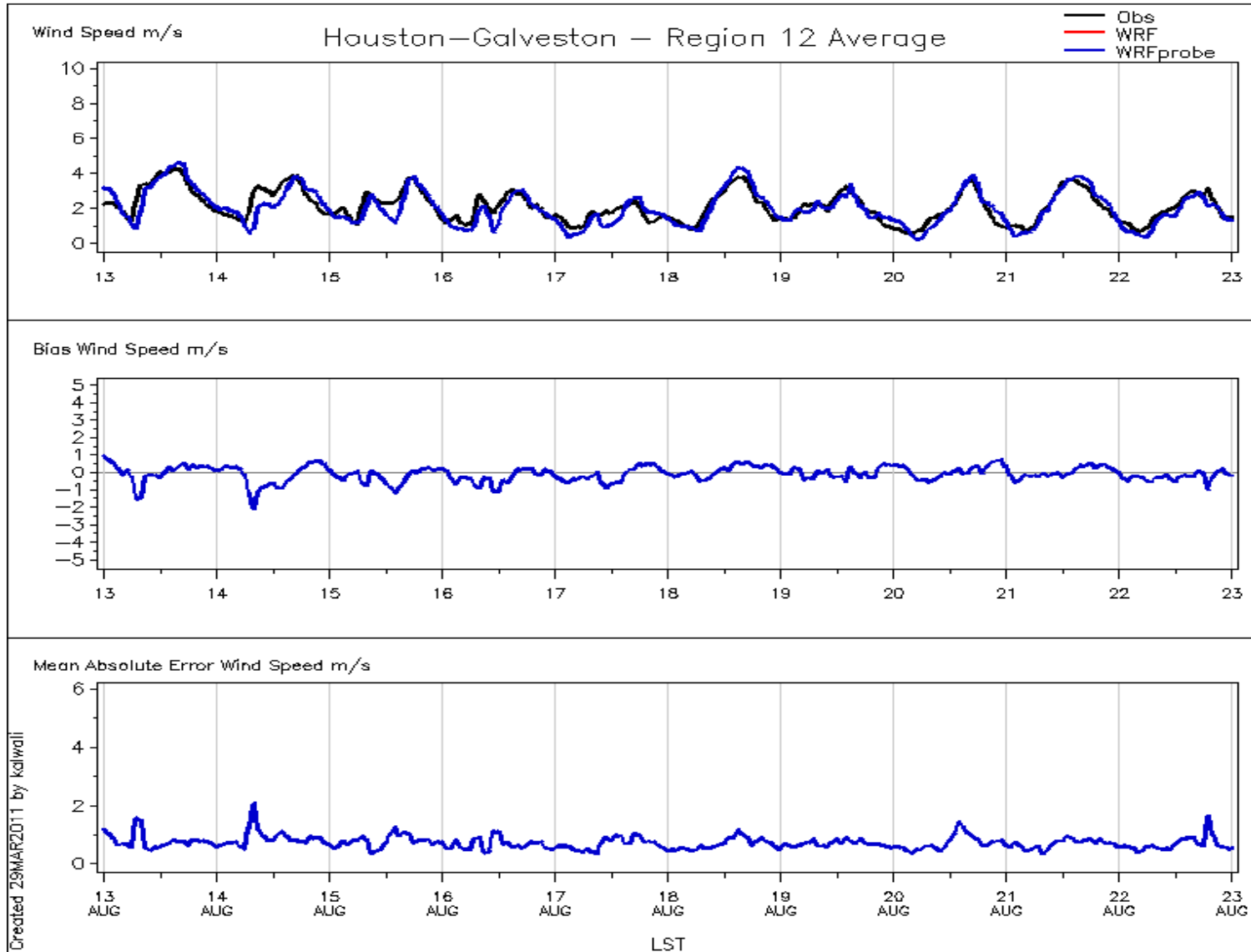
HGB Wind Direction 2006ep1a





HGB Wind Speed 2006ep1a

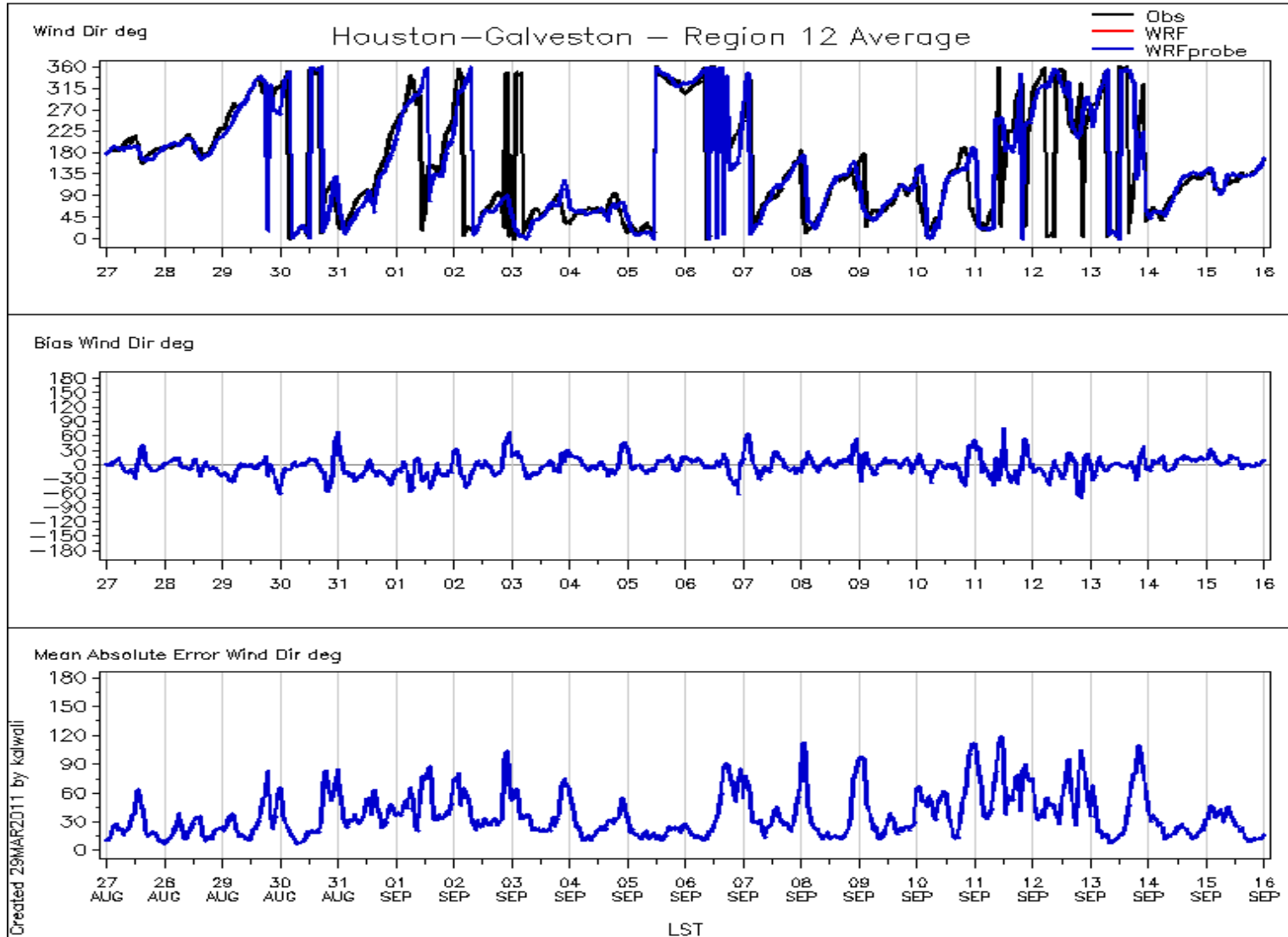
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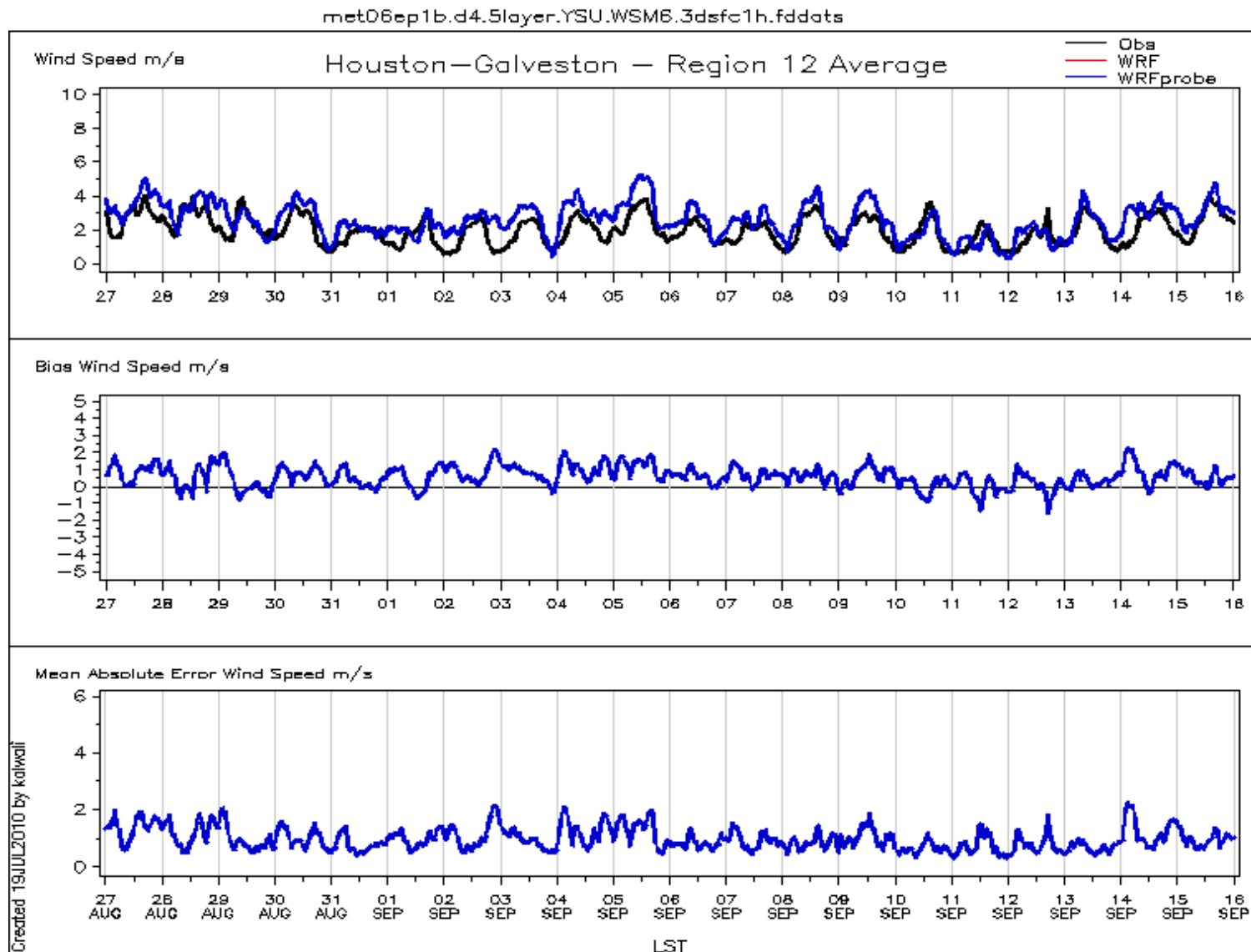
HGB Wind Direction 2006ep1b

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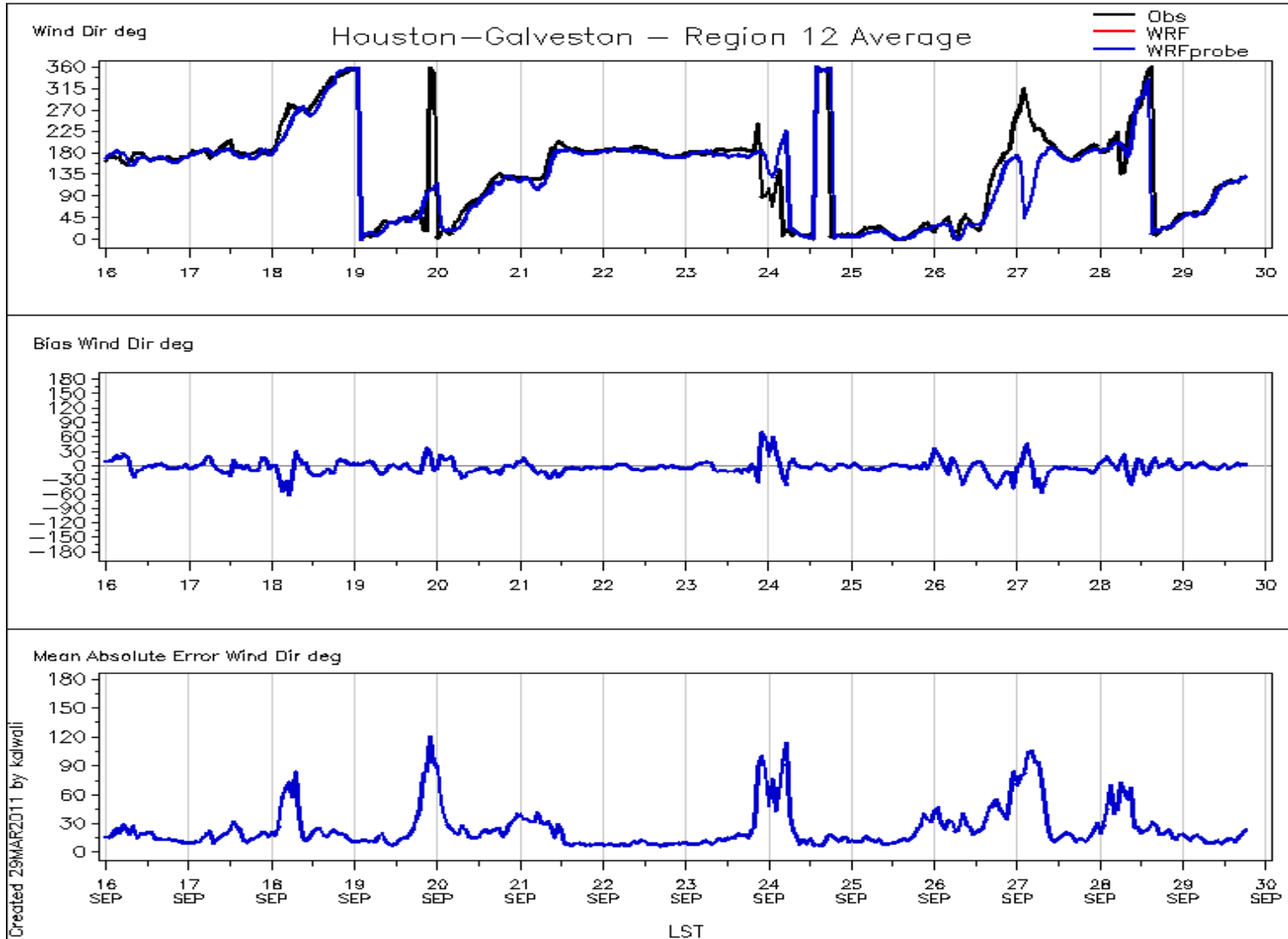
HGB Wind Speed 2006ep1b





HGB Wind Direction 2006ep1c

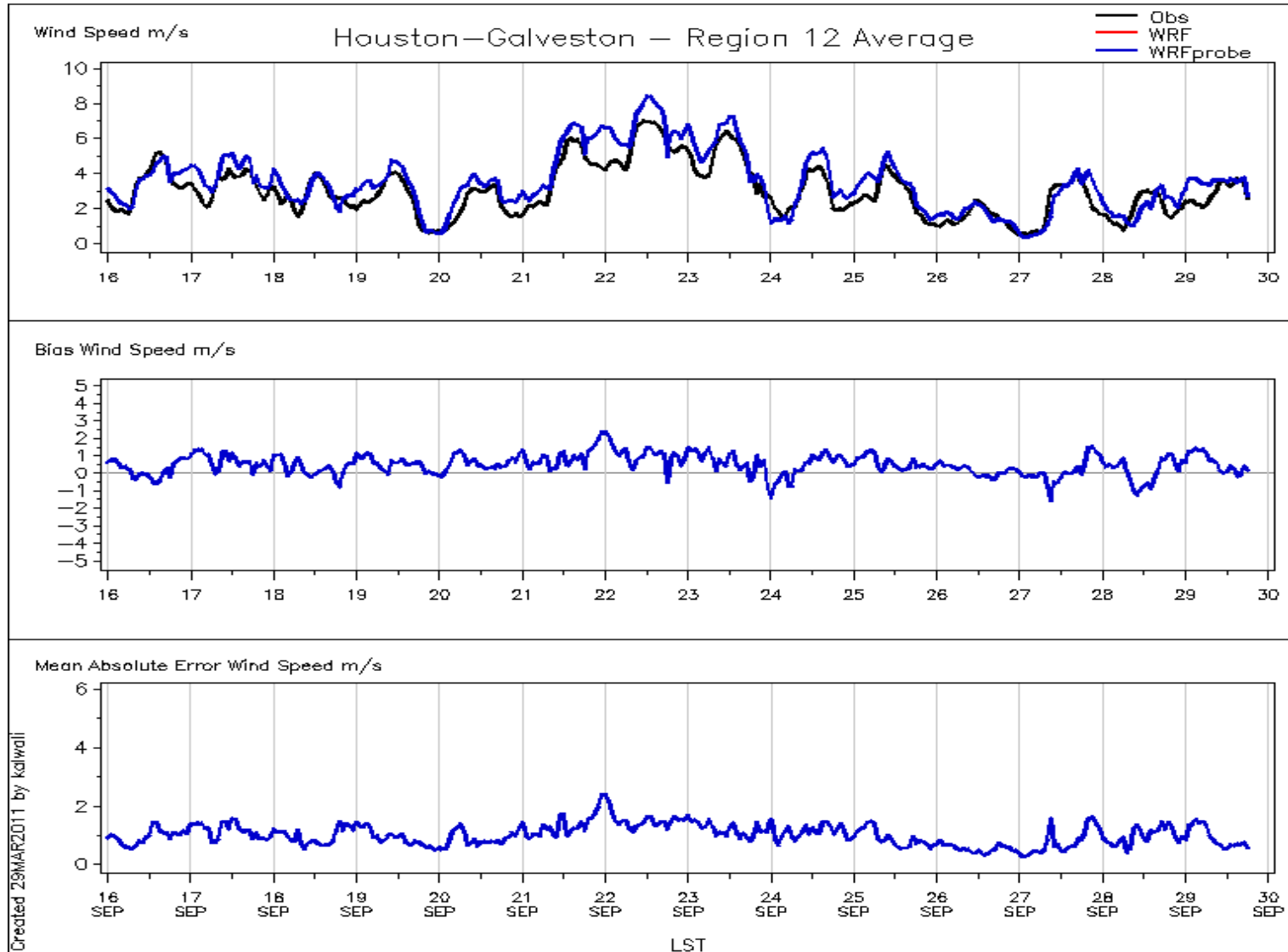
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HGB Wind Speed 2006ep1c

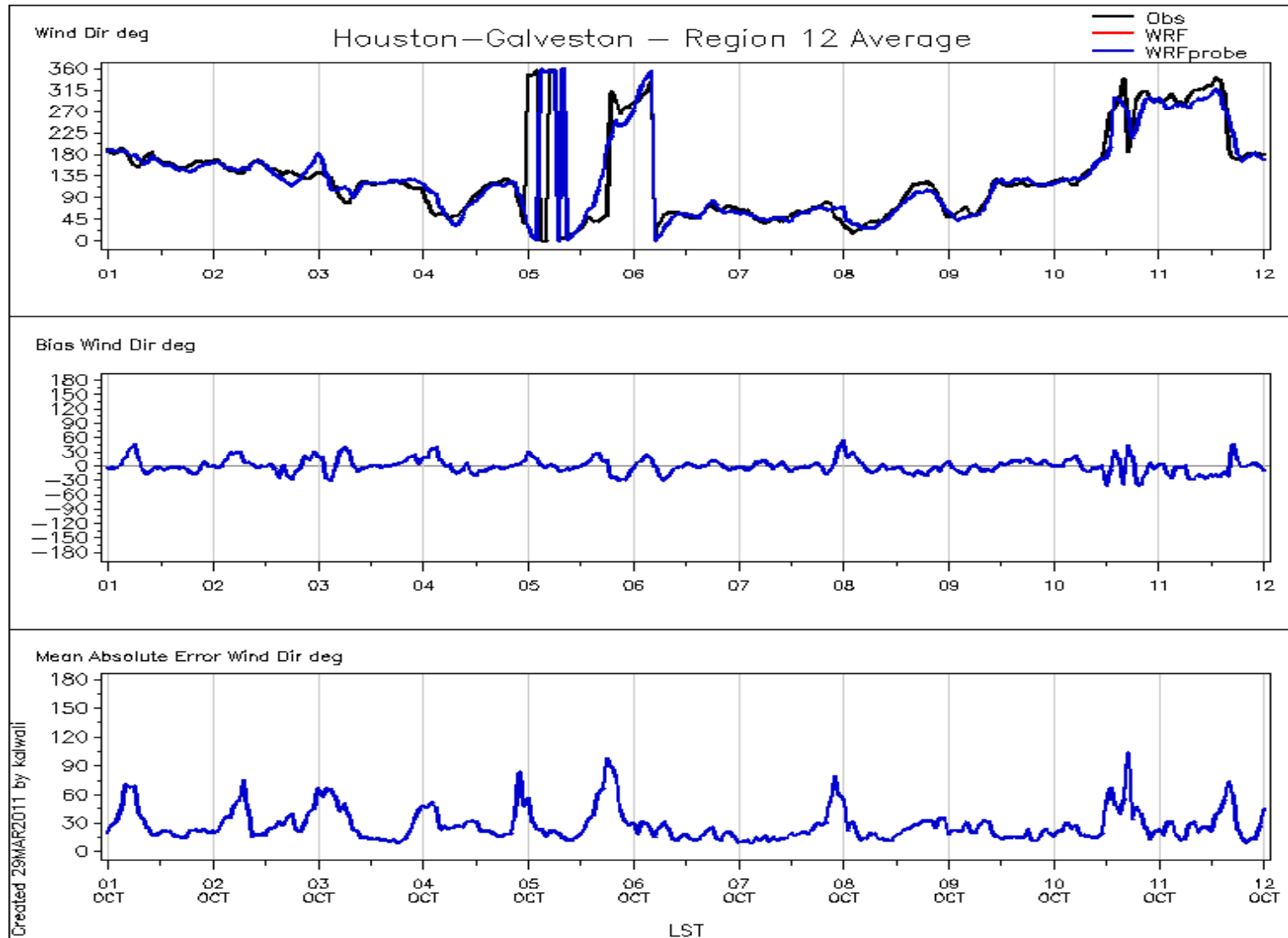
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HGB Wind Direction 2006ep1d

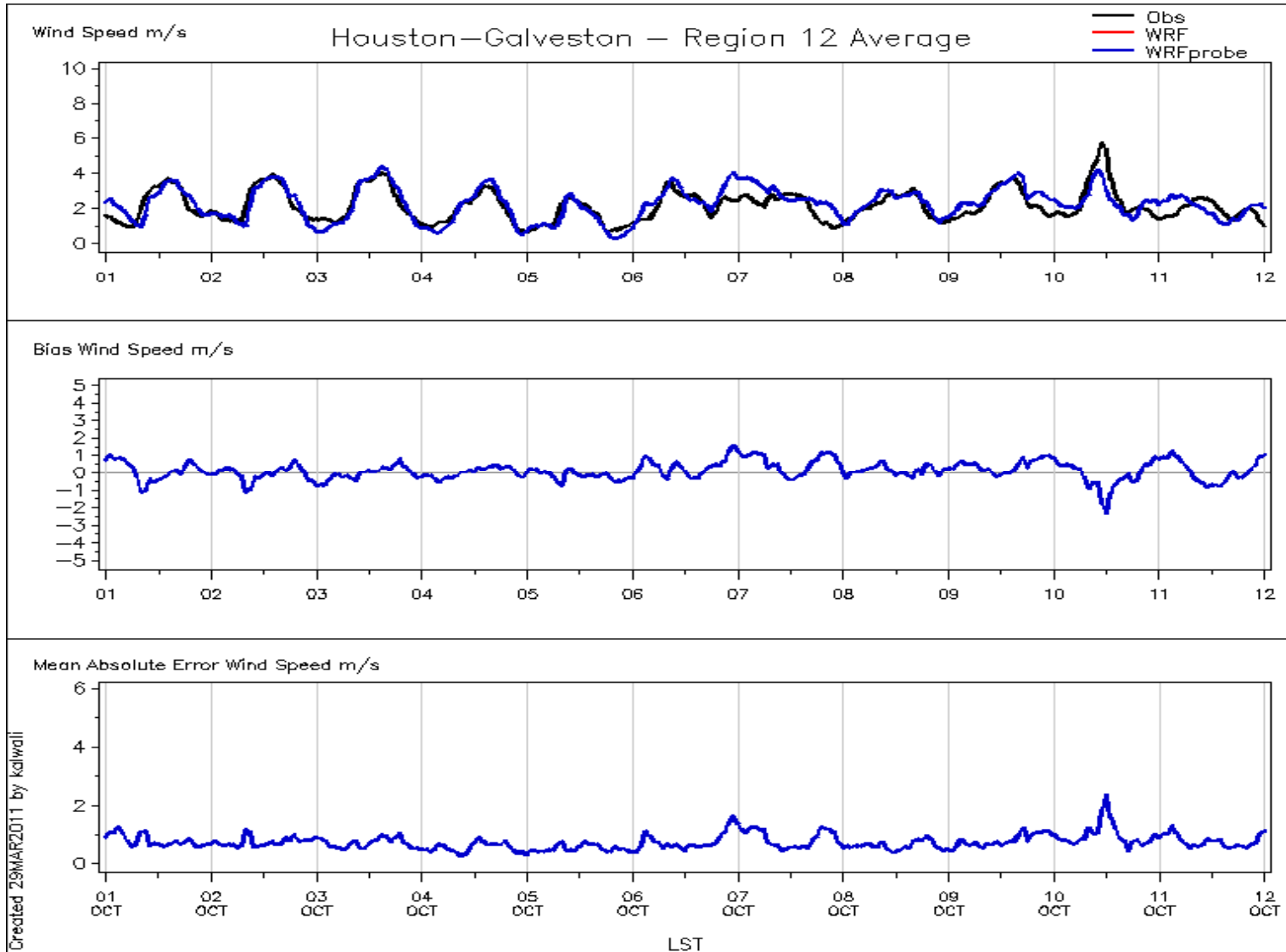
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HGB Wind Speed 2006ep1d

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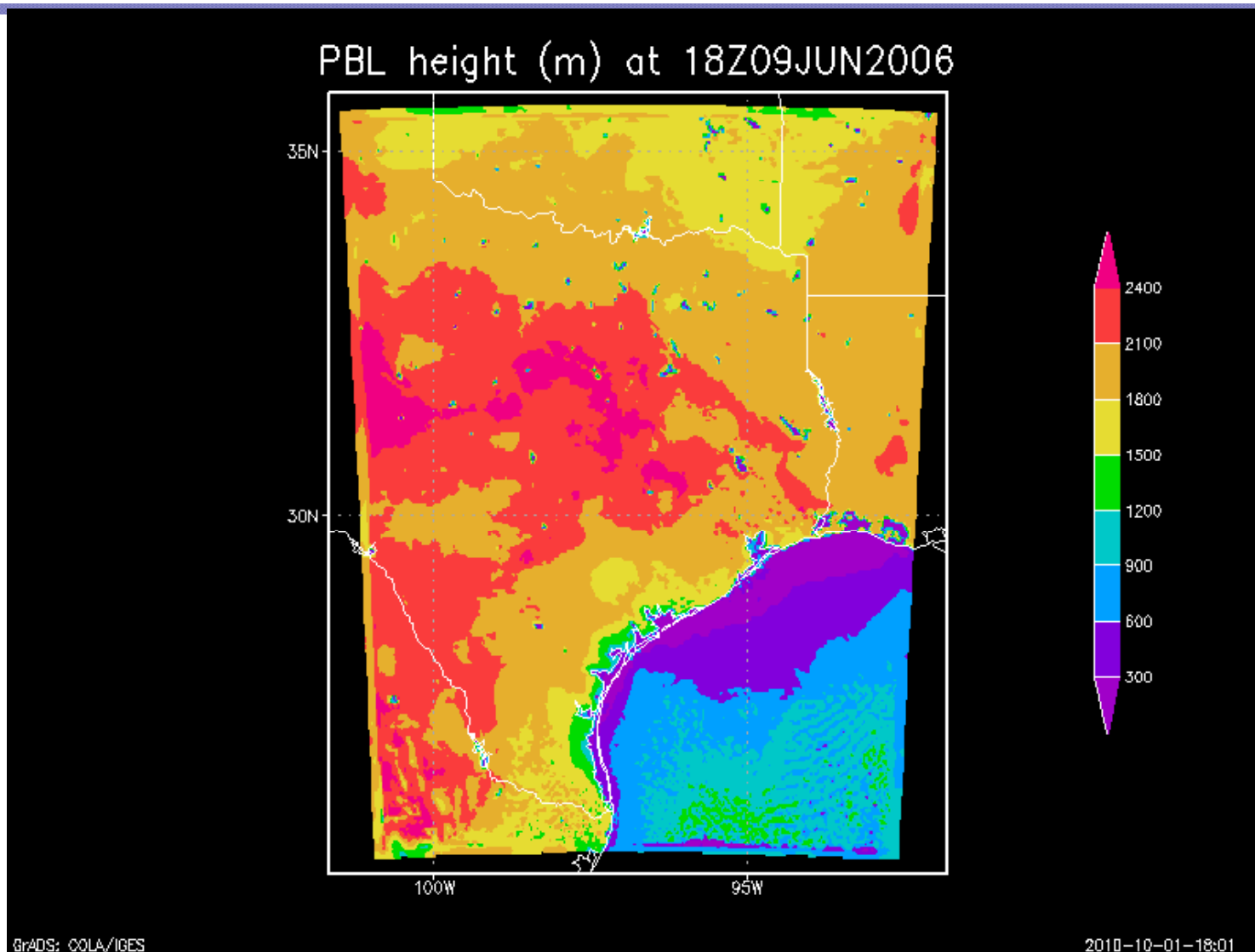


Future Work

- Preliminary analysis of regional statistics and focus on wind speed and direction are well underway.
- Evaluation will shift to daily specific performance at key monitors.
- Evaluation will expand to clouds, precipitation and other variables.



PBL Height

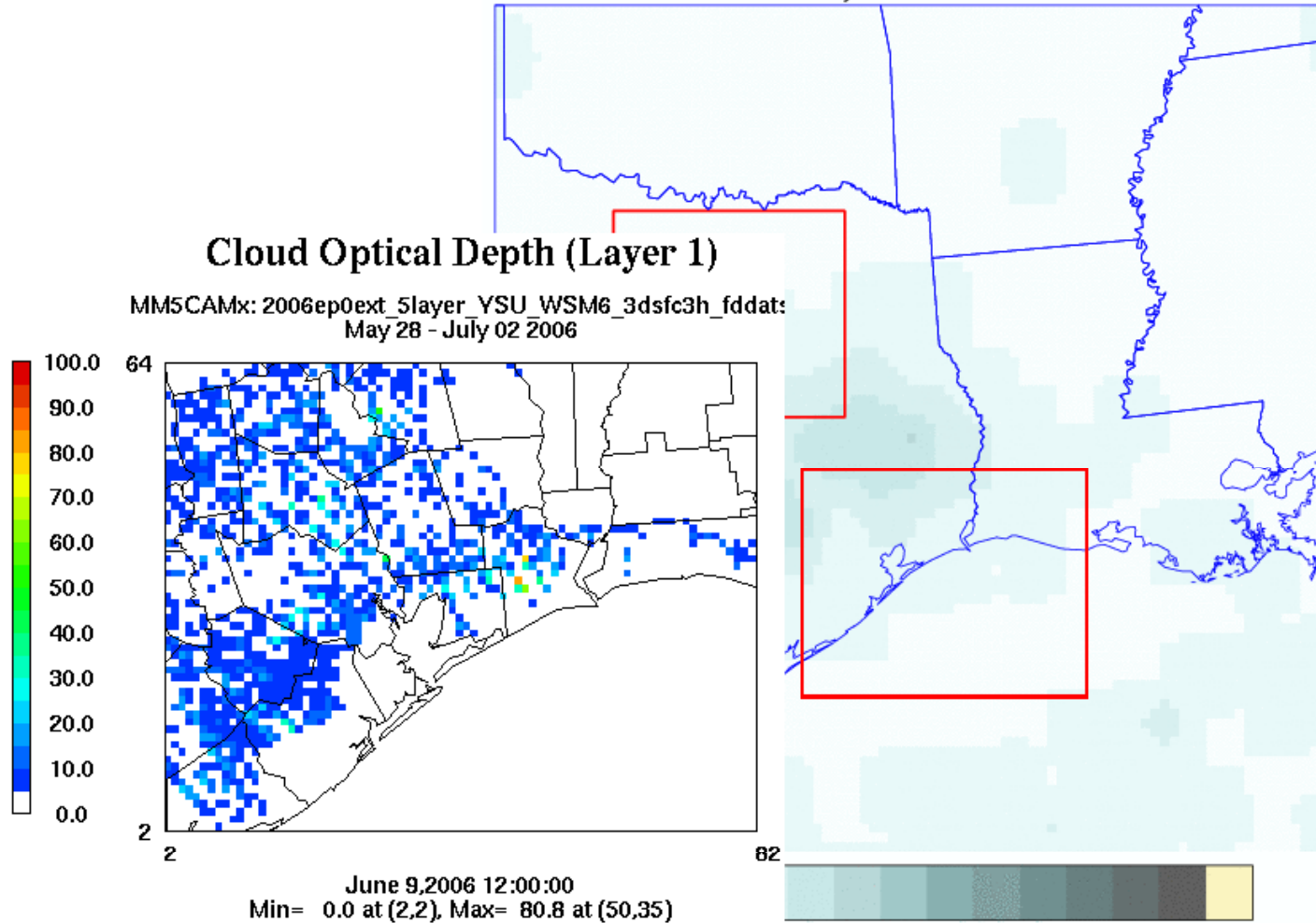




Comparison: Cloud Fraction and Cloud Optical Depth

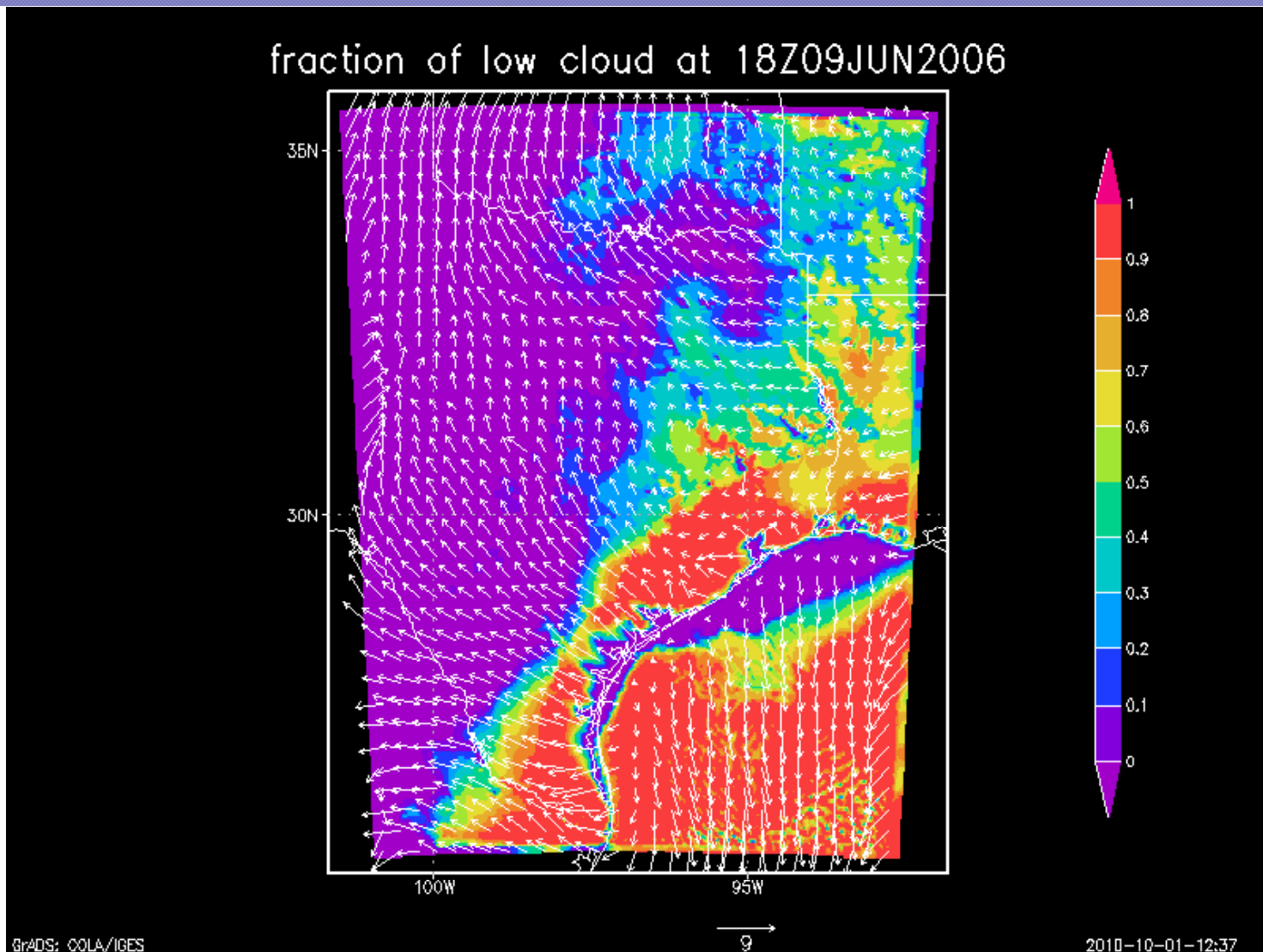
GOES Cloud Cover Fraction

Jun 09, 2006 Hour 12



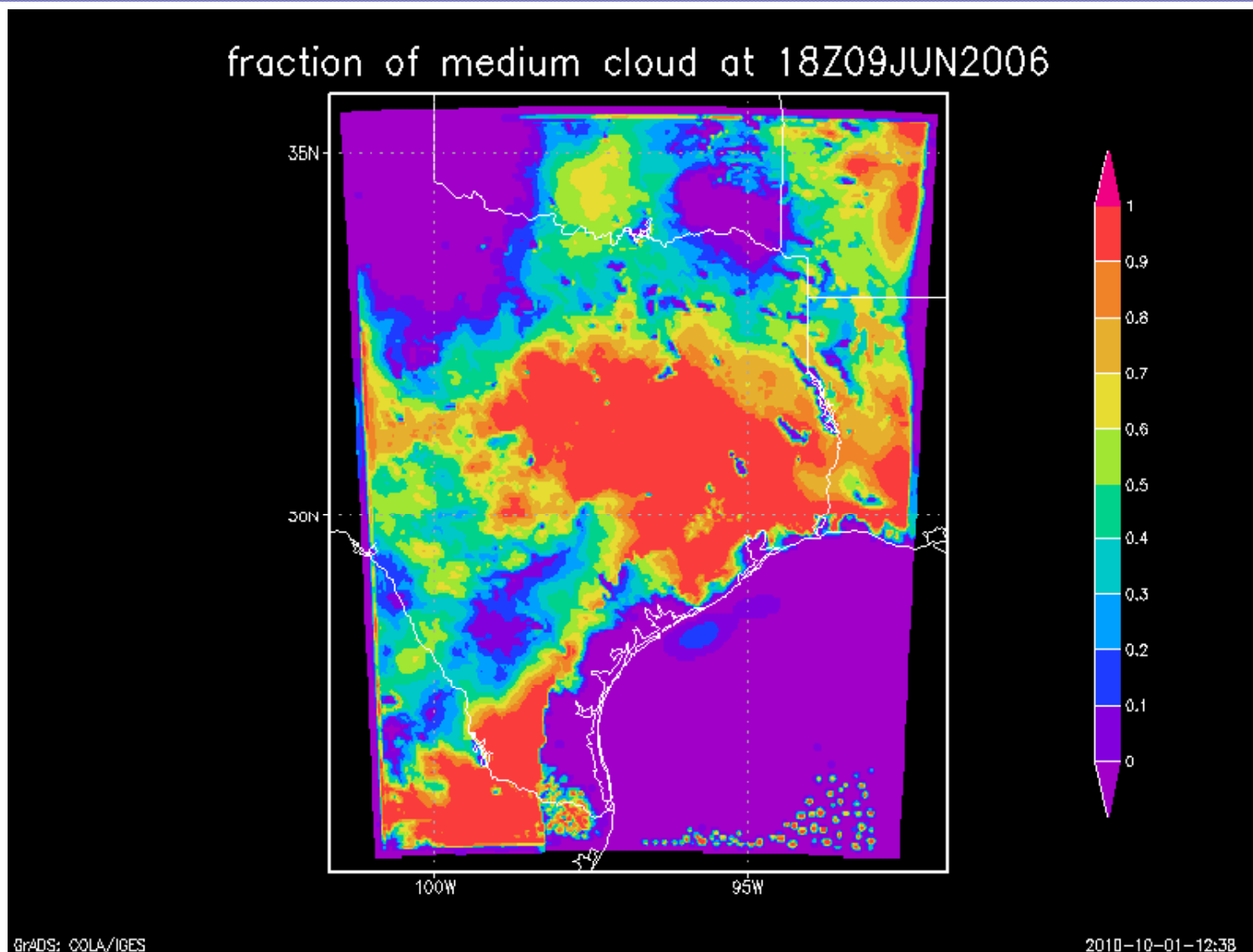


WRF Fractional Cloud Coverage at Low Levels





WRF Fractional Cloud Coverage at Mid Levels





Conclusions

- Several WRF sensitivities testing model configuration and nudging have been performed.
- Updates and improvements will be provided as they become available.
- Thanks to Khalid Al-Wali for several WRF runs focusing on surface nudging sensitivities and graphics.



Questions?

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