

Operation of MMS RASS Wind Profiler at the University of Houston Coastal Center

Case Study on the Interaction of Land-Sea
Breeze with Evolving Coastal Boundary Layer

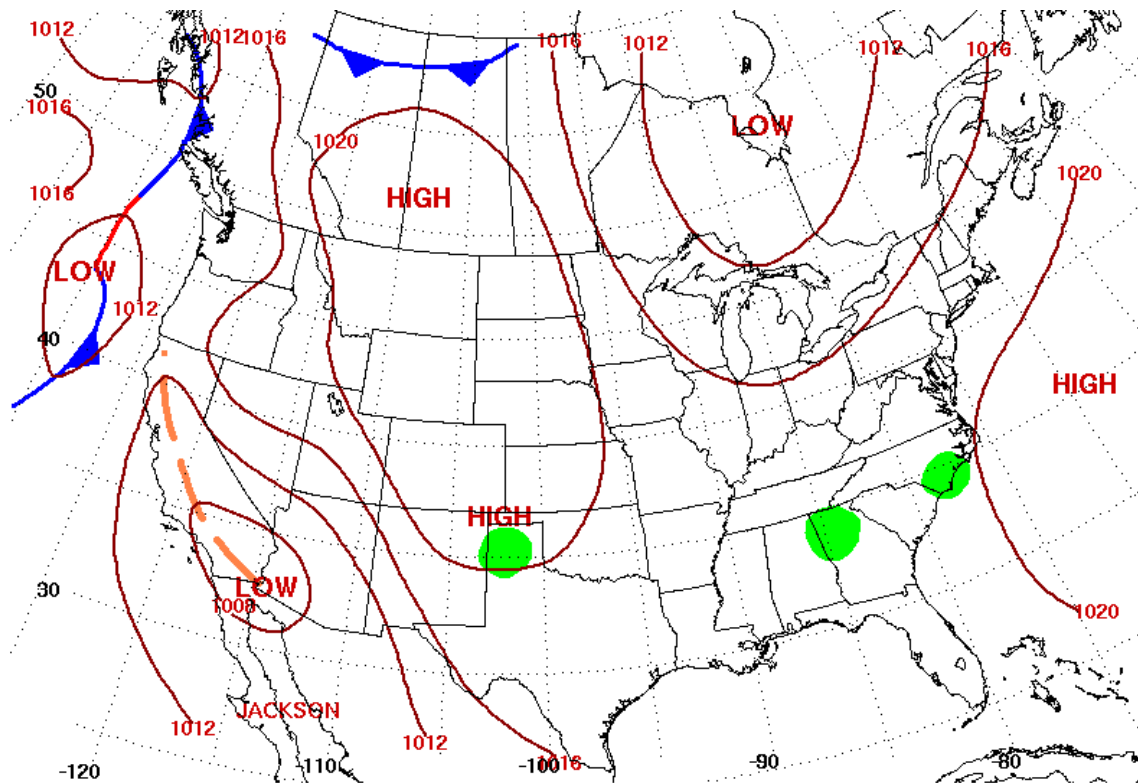
Daewon W. Byun
Barry Lefer
University of Houston

University of Houston and Minerals Management Services (MMS) RASS at UH Coastal Center



Photograph of the Radar Wind Profiler system installed on 19 January 2007 north of the laboratory building. The system is a Vaisala Inc., LAP-3000 with RASS

http://www.hpc.ncep.noaa.gov/dailywxmap/index_20080621.html



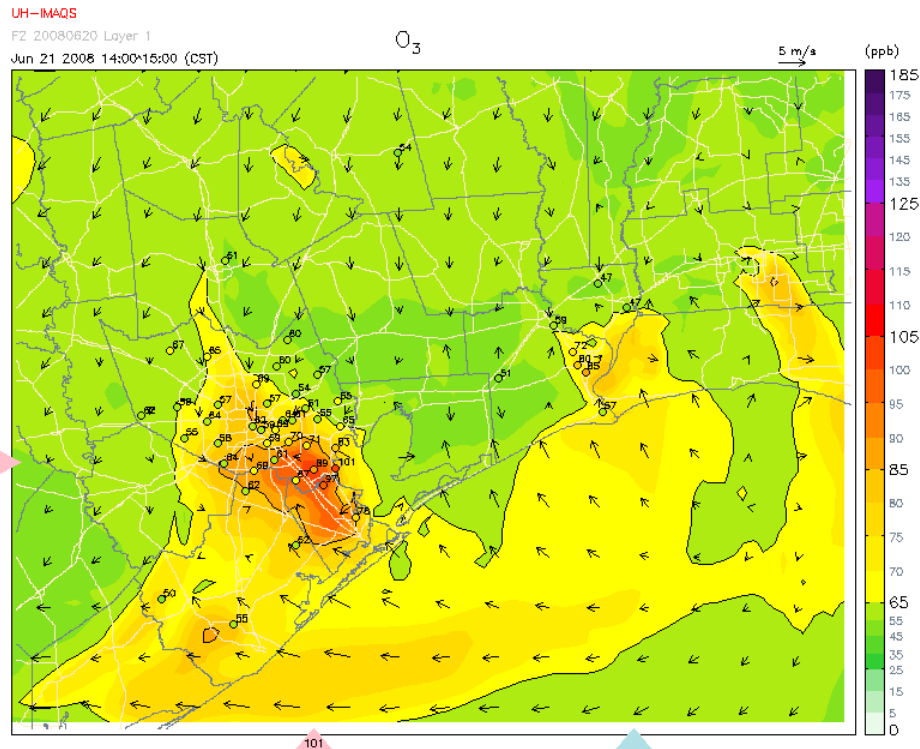
Surface Weather Map at 7:00 A.M. E.S.T.

Aim 1.2 Atmospheric Boundary Layer Measurement

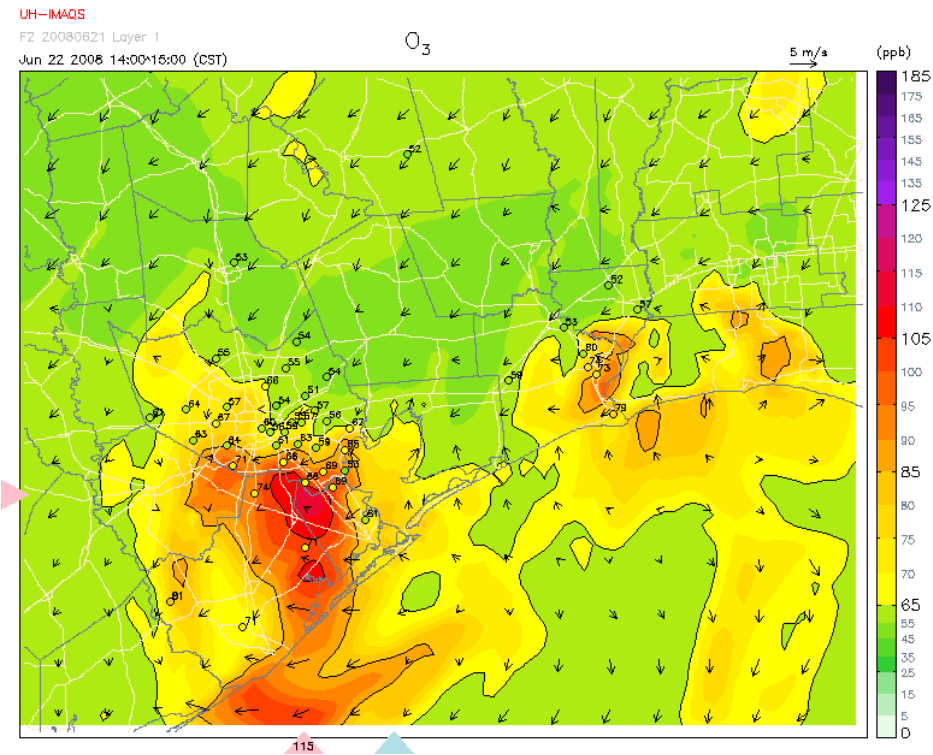
Recent Air Pollution Events: 21 – 23 June 2008

21 June 2008 14-15 CST

22 June 2008 14-15 CST



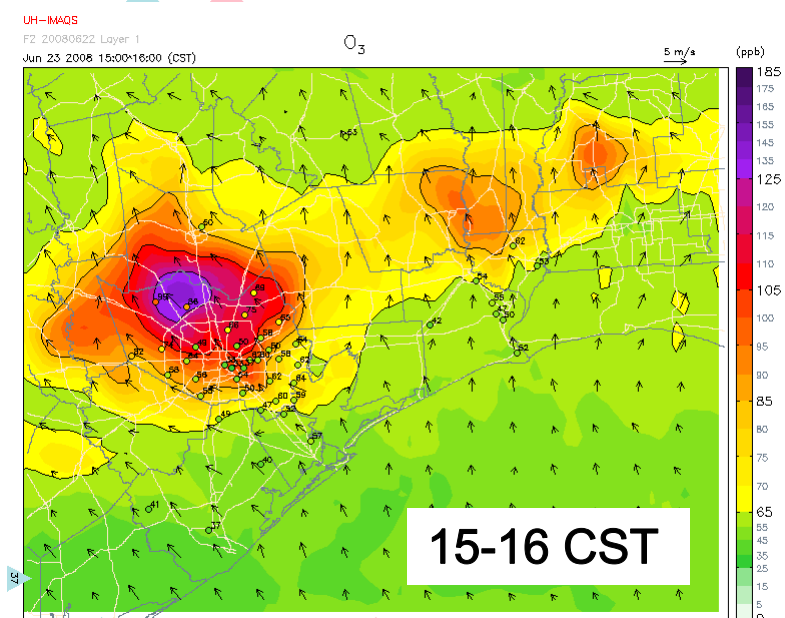
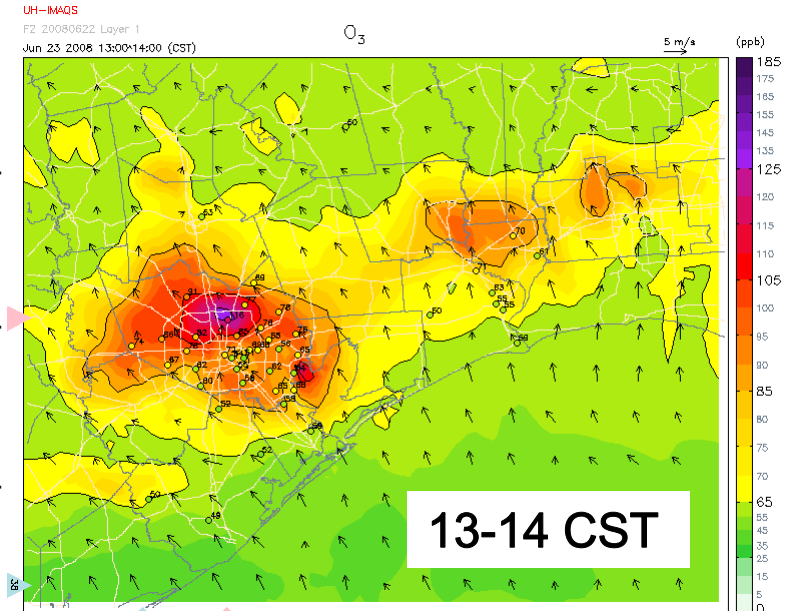
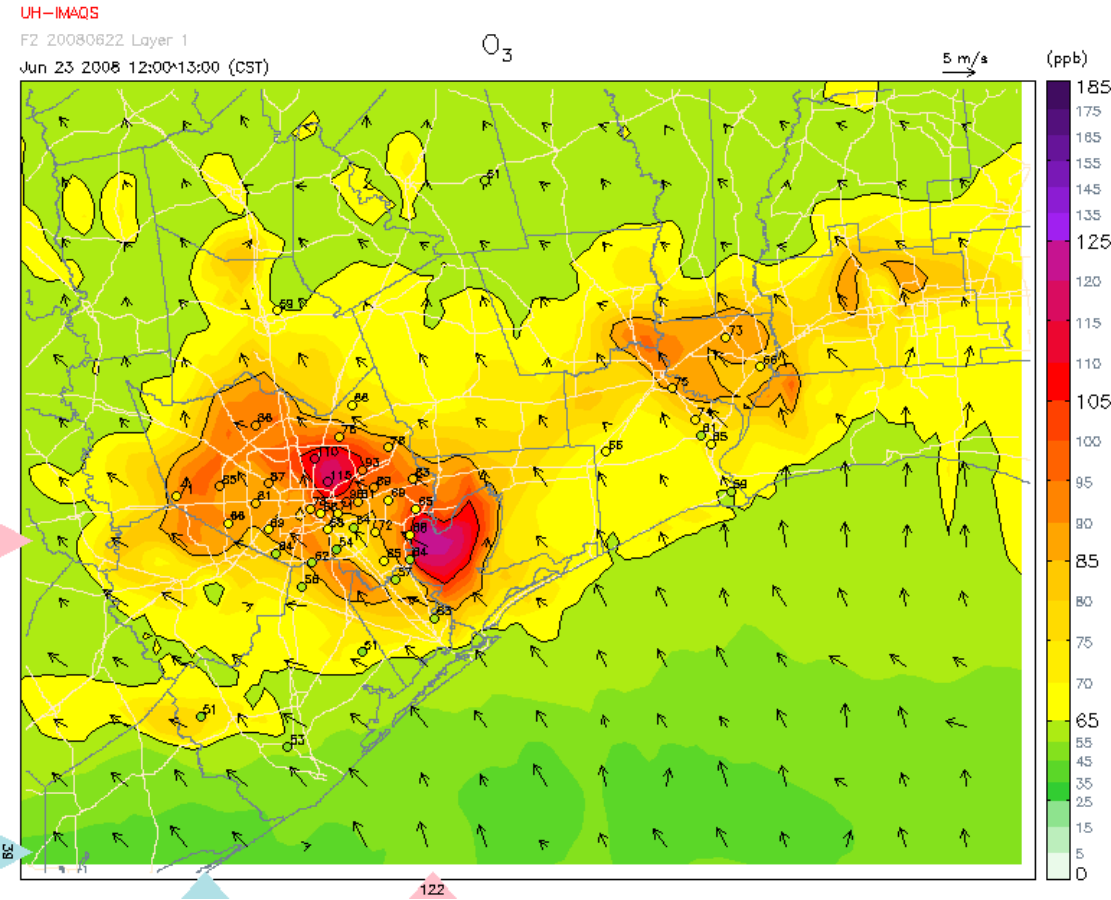
Build up of a multi-day ozone event



Over-prediction of build up, due to cloudiness

Recent Air Pollution Events: 21 – 23 June 2008

23 June 2008 12-13 CST

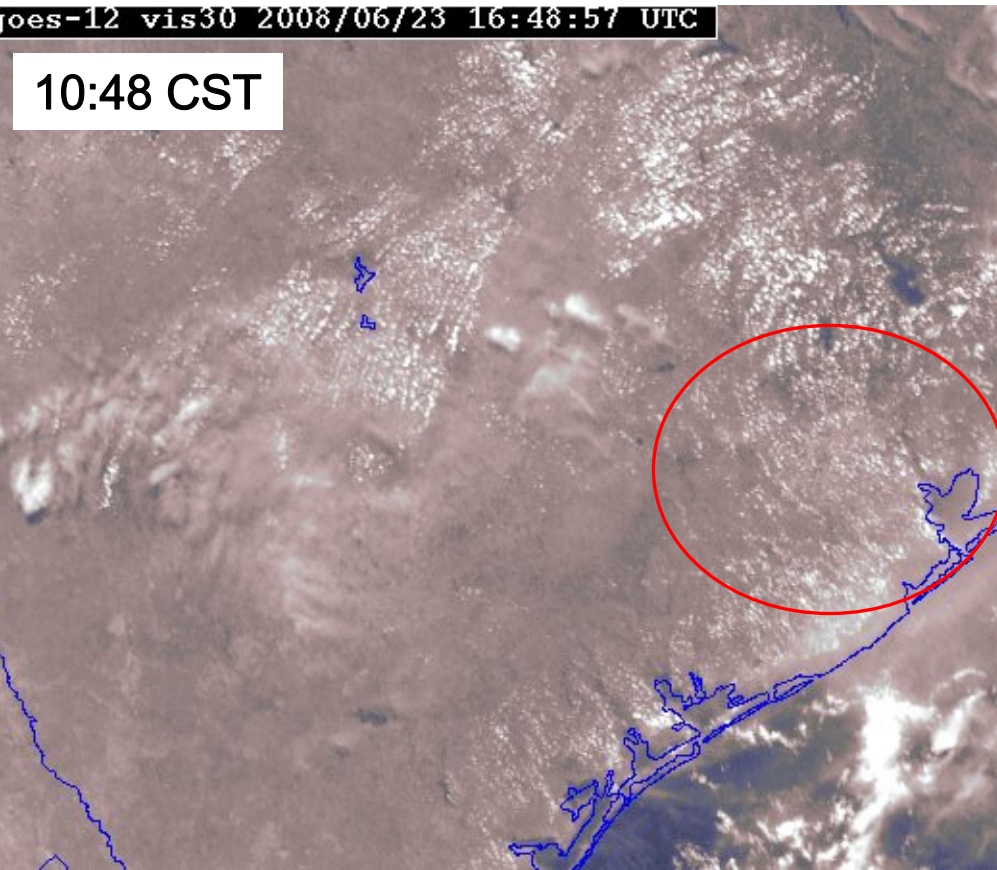


O3 well developed at noon already and kept increasing until thunderstorms developed

Development of the sea breeze front around 12:00-13:00, 23 June 2008

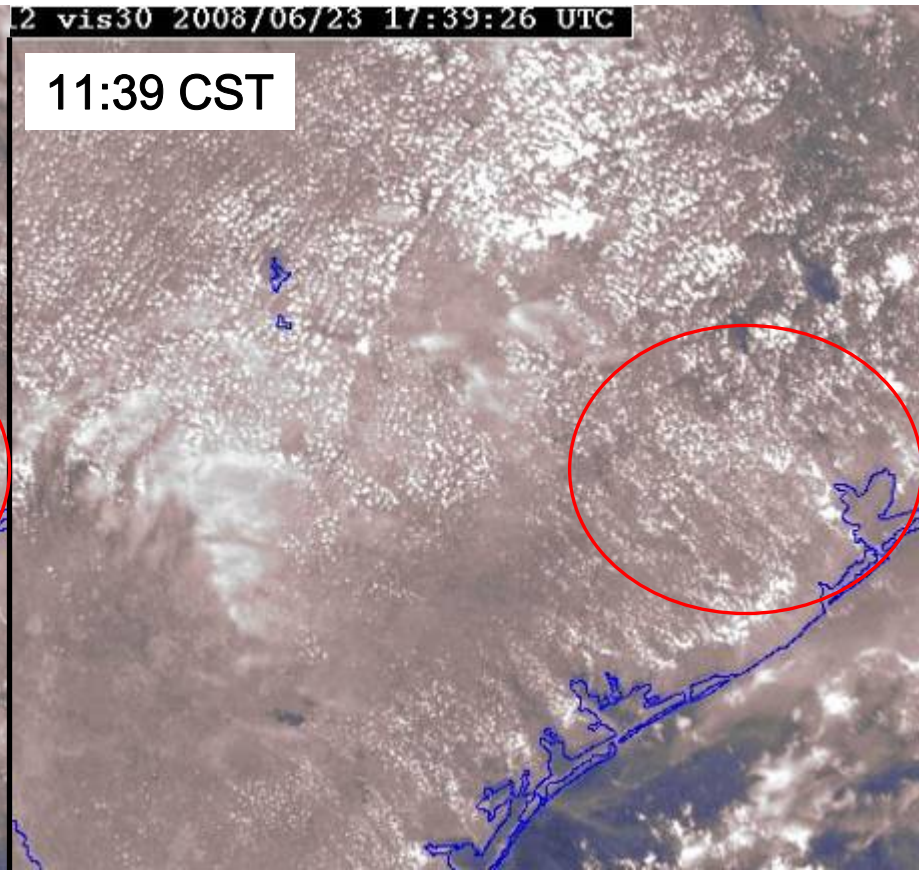
oes-12 vis30 2008/06/23 16:48:57 UTC

10:48 CST



2 vis30 2008/06/23 17:39:26 UTC

11:39 CST

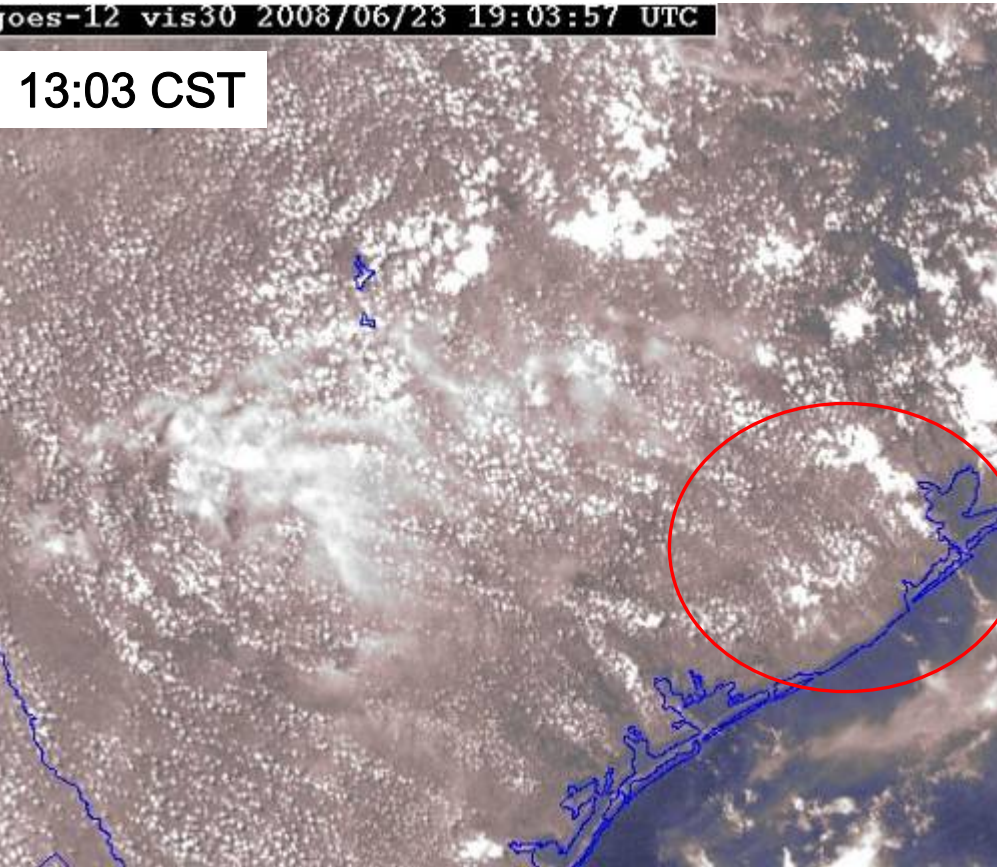


O3 well developed at noon until 1:00 PM CST

Development of the sea breeze front & thunderstorms around 13:00-14:00, 23 June 2008

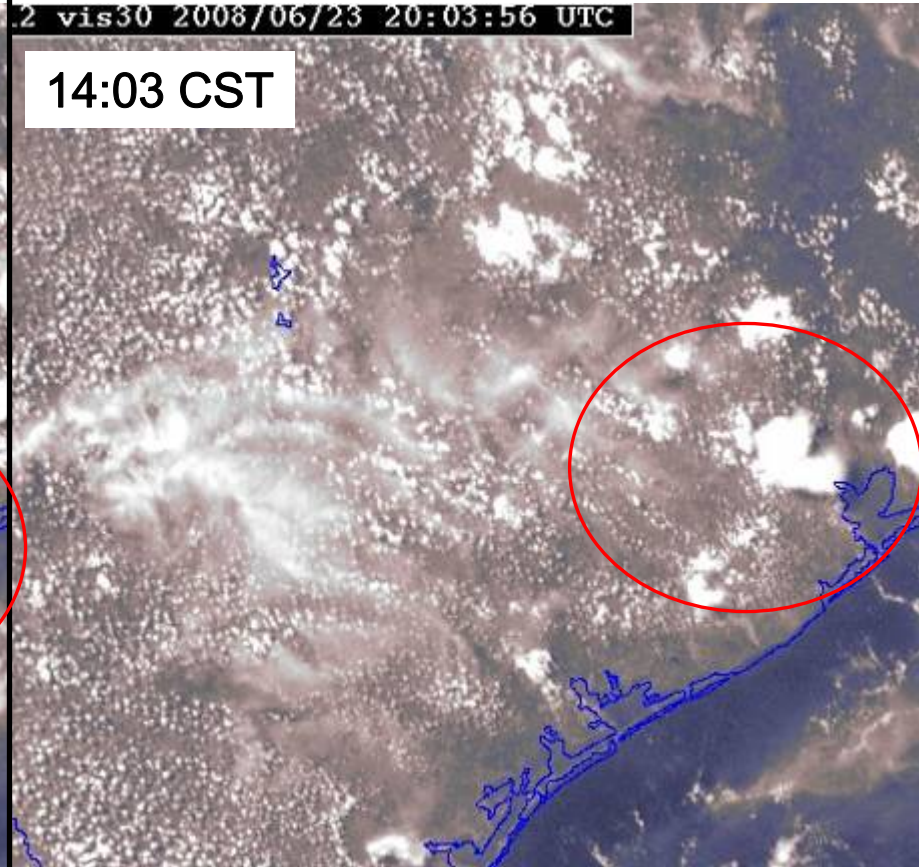
goes-12 vis30 2008/06/23 19:03:57 UTC

13:03 CST



goes-12 vis30 2008/06/23 20:03:56 UTC

14:03 CST



Observed O₃ stopped increasing as
thunderstorms developed

Conceptual Models of Sea-Breeze and Air Quality

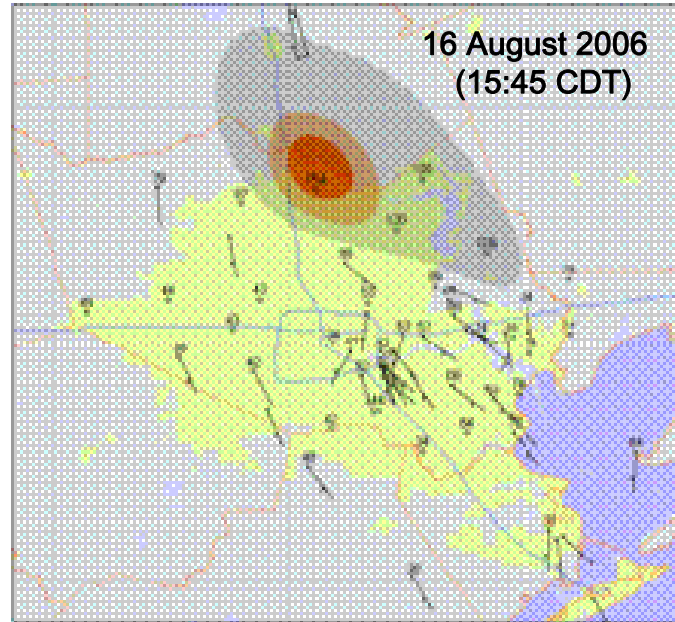
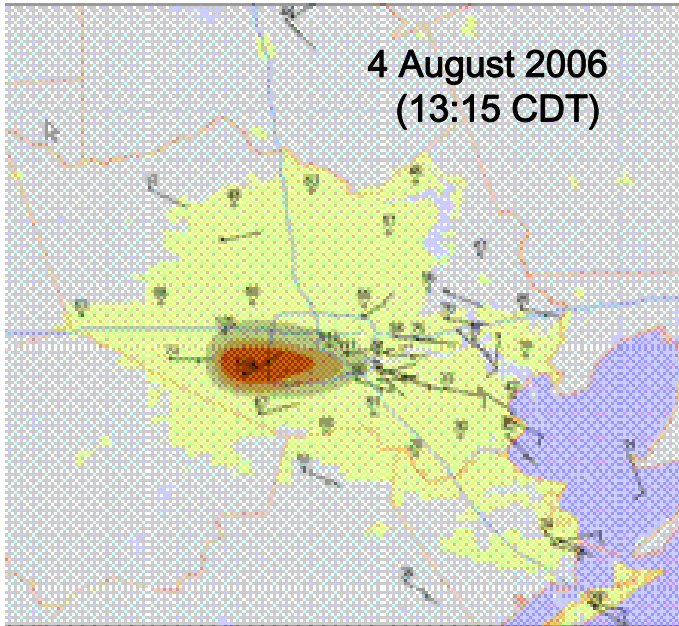


Figure 1. 15-min. average peak ozone observed for 8/4/2006 (at 13:15 CDT) and 8/16/2006 (at 15:45 CDT). Graphics provided by TCEQ.

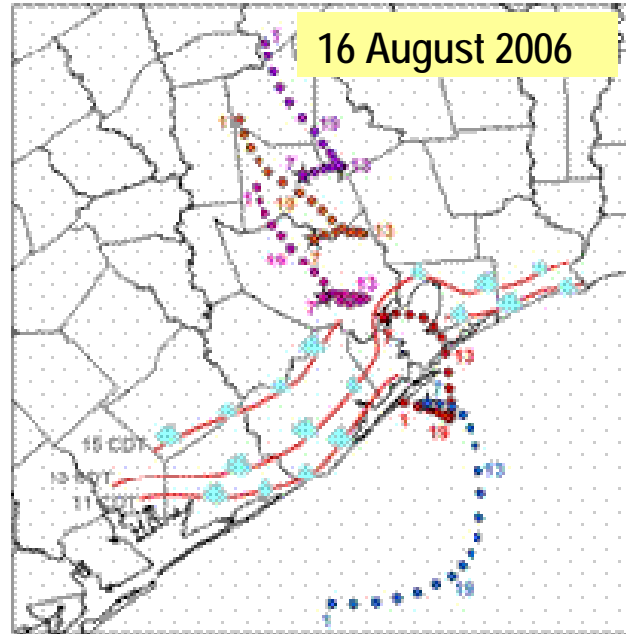
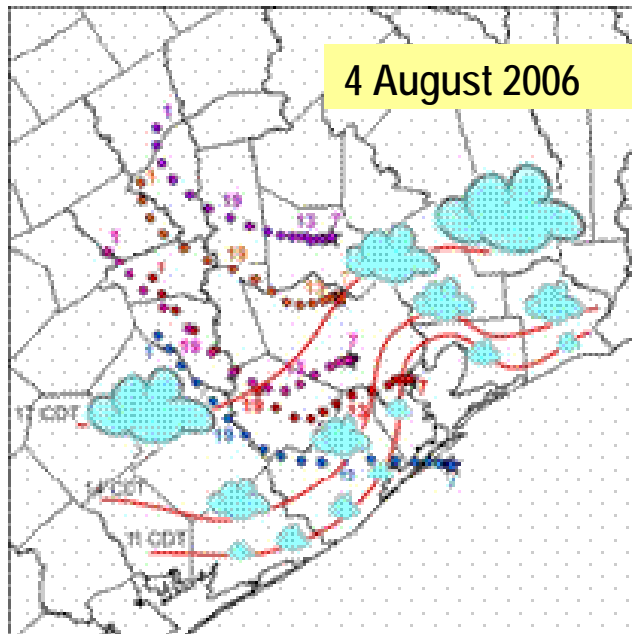
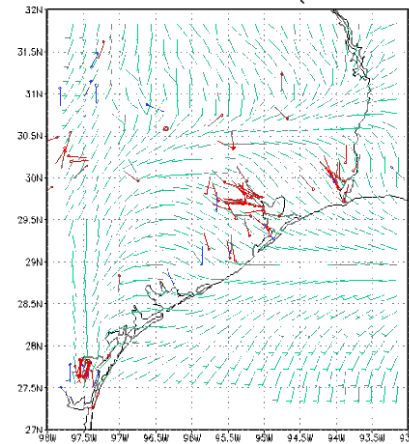


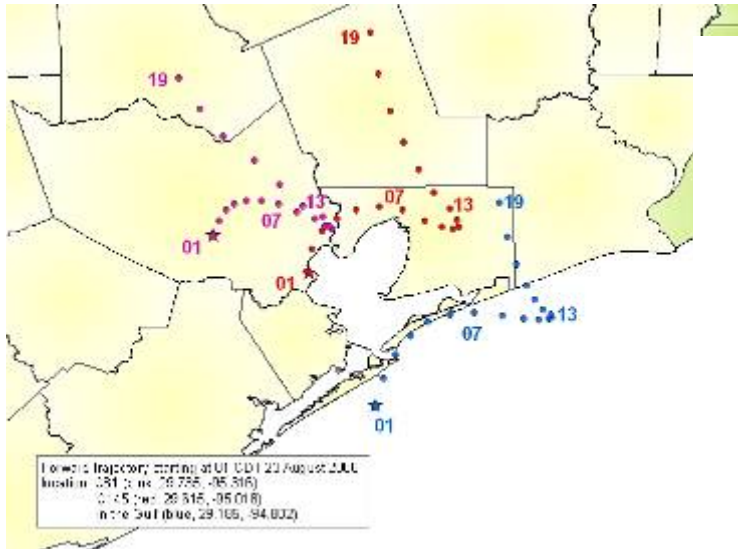
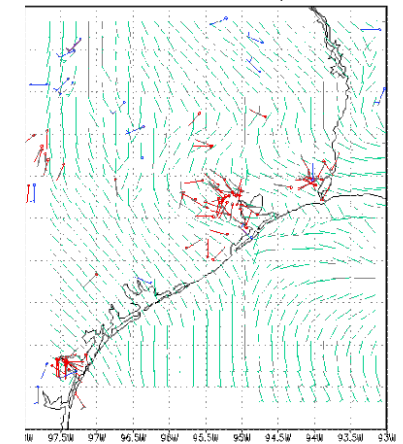
Figure 2. Schematics of the advancement of sea breeze front with development of thunderstorms (8/4/2006) and without (8/16/2006). The self-intersecting forward trajectories, started at 7 CDT are often related with bad air quality

Easterly winds caused by the development of the Galveston Bay breeze around 10:00 AM CST and developing sea breeze from the Gulf induces convective activities around 1:00PM that developed into strong thunder storm activities around 2:00 PM CST, 23 June

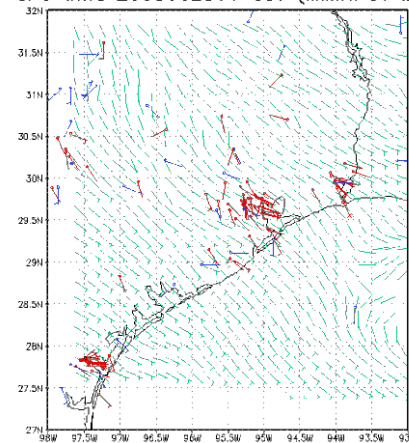
SFC wind 2008062307 CST (MMINPUT ID4)



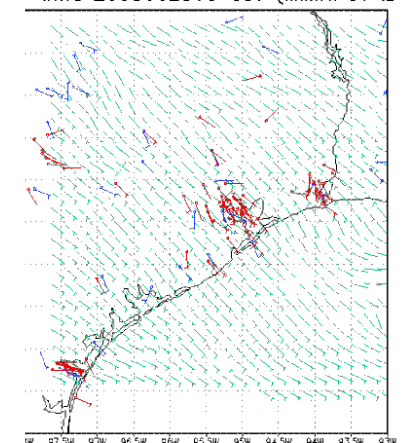
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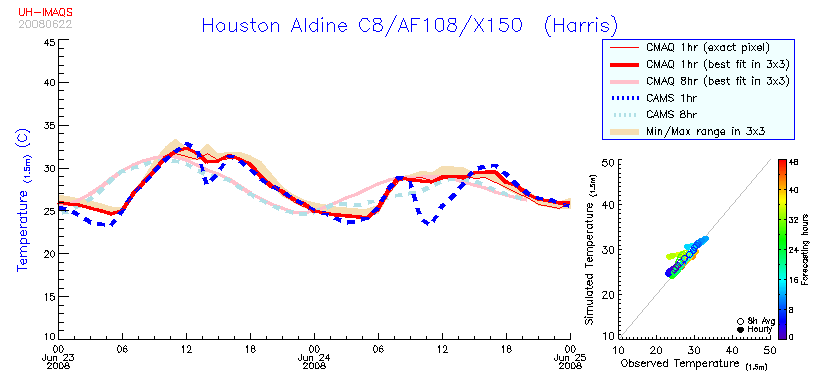
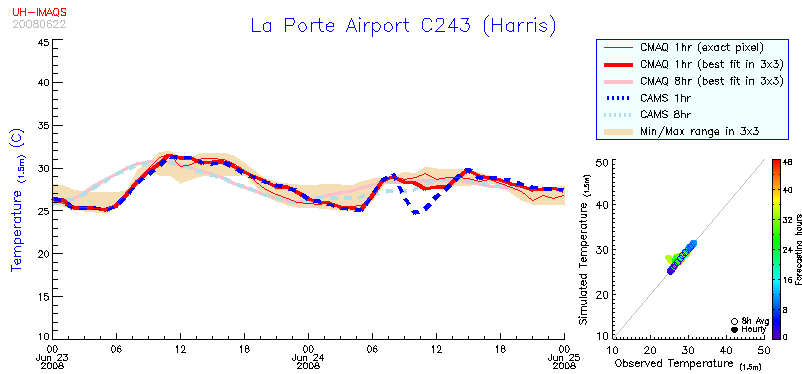
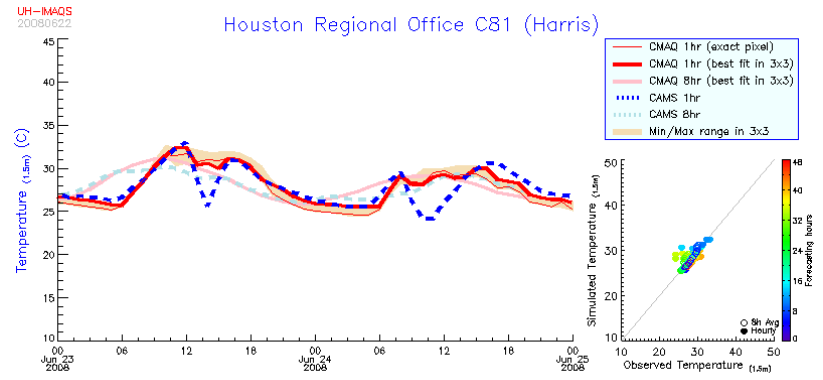
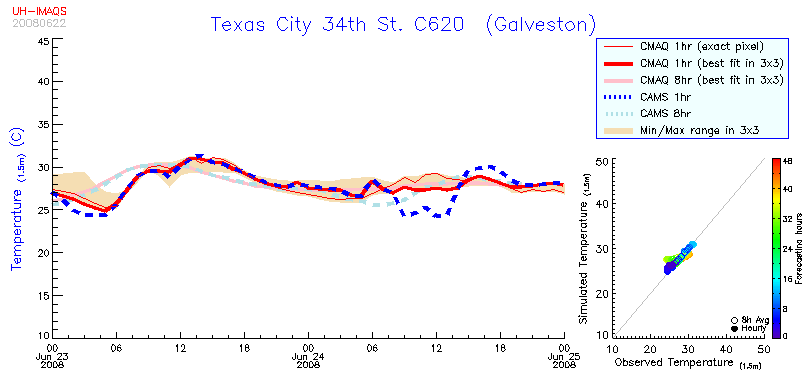


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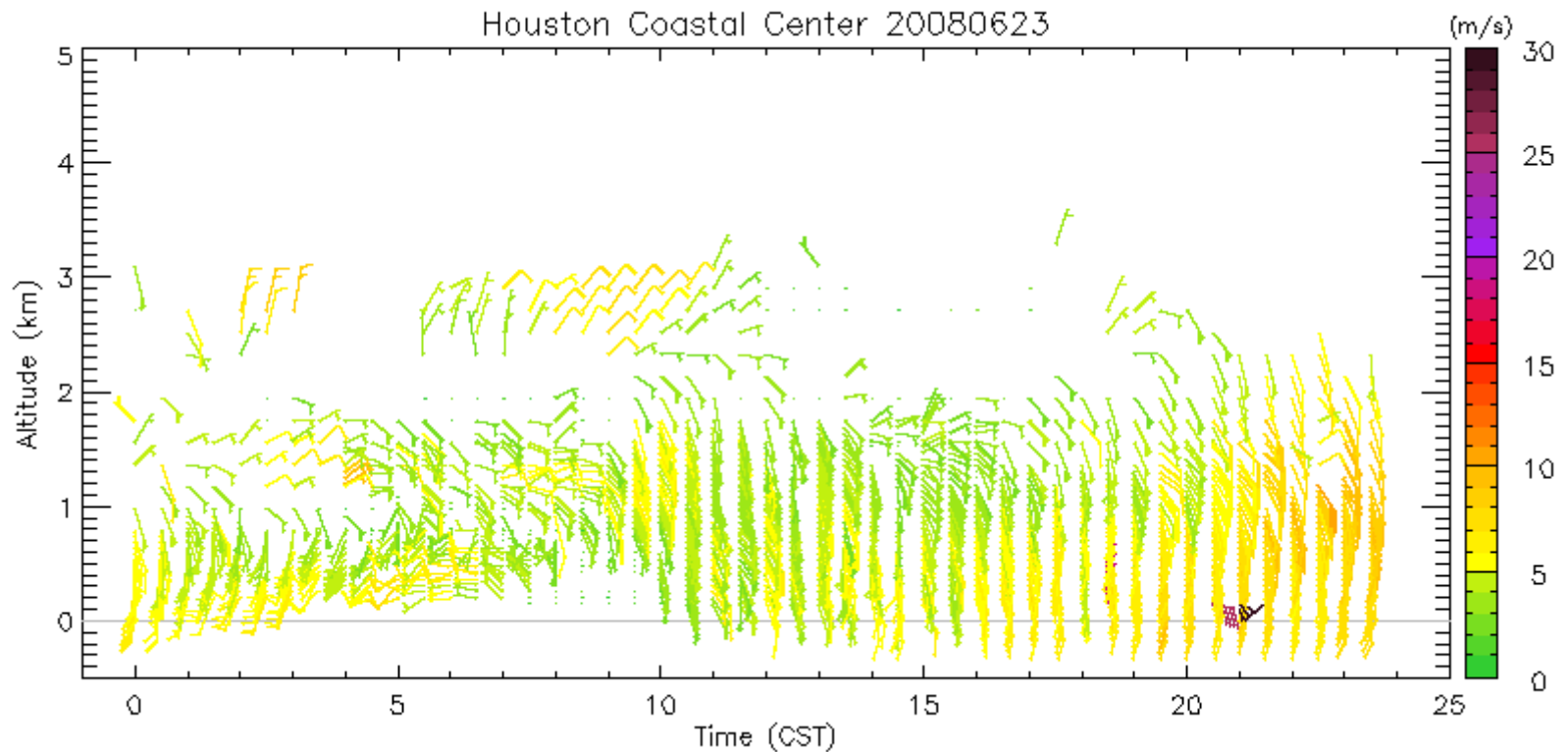
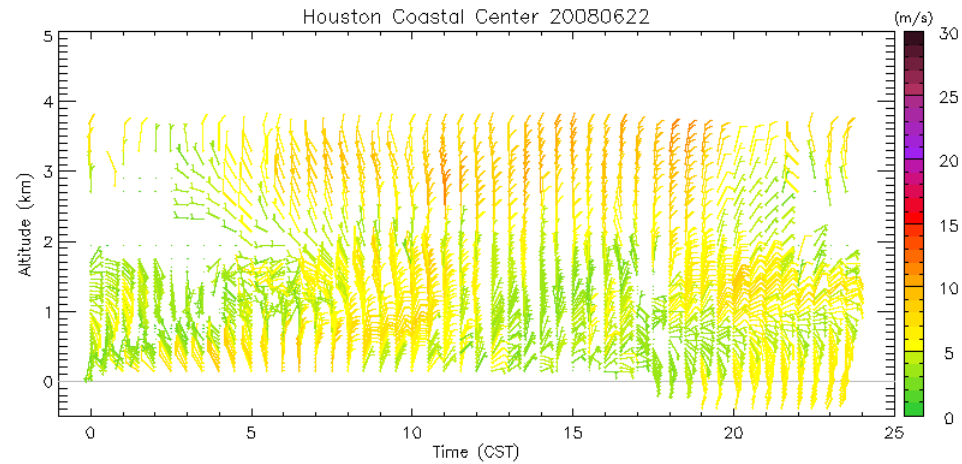
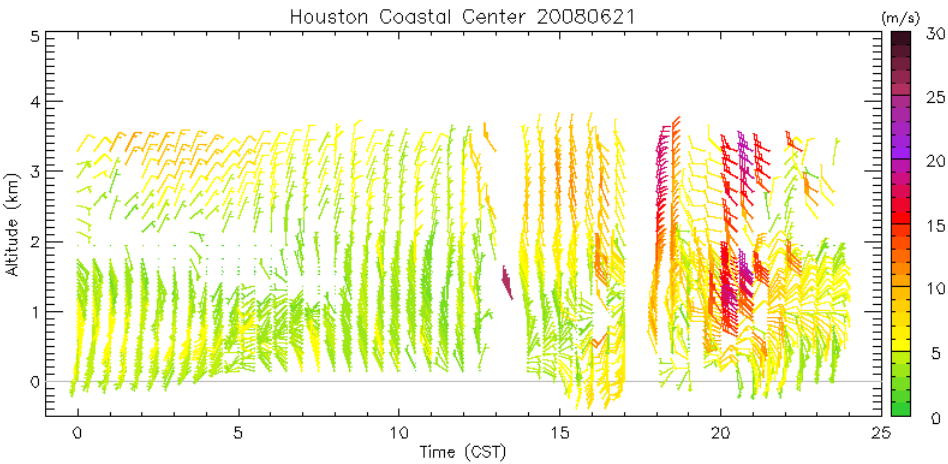
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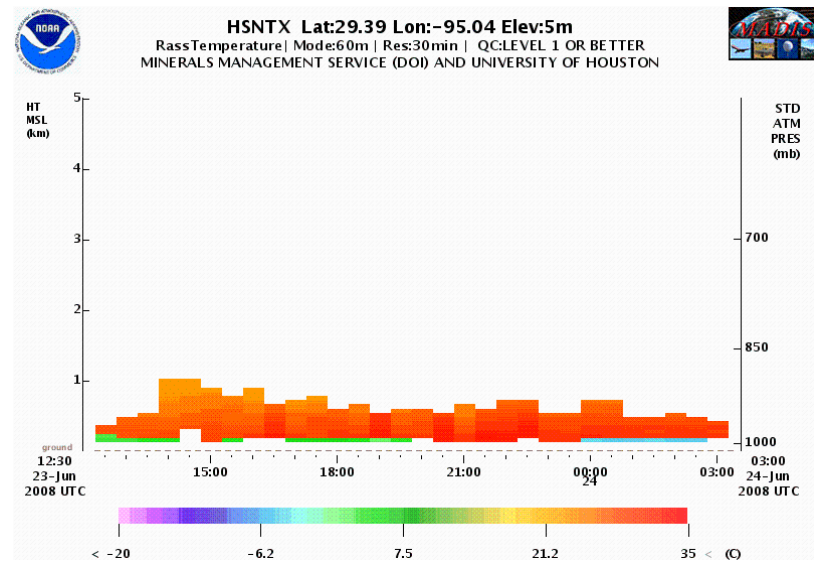
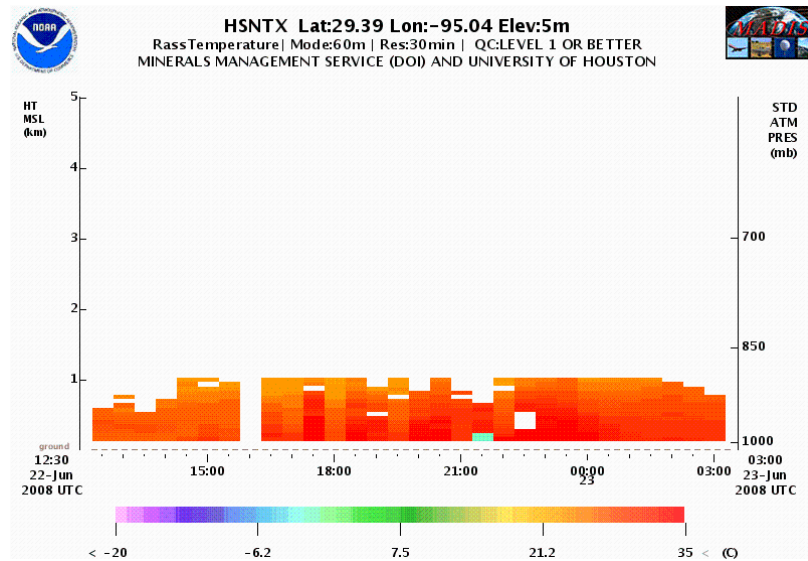
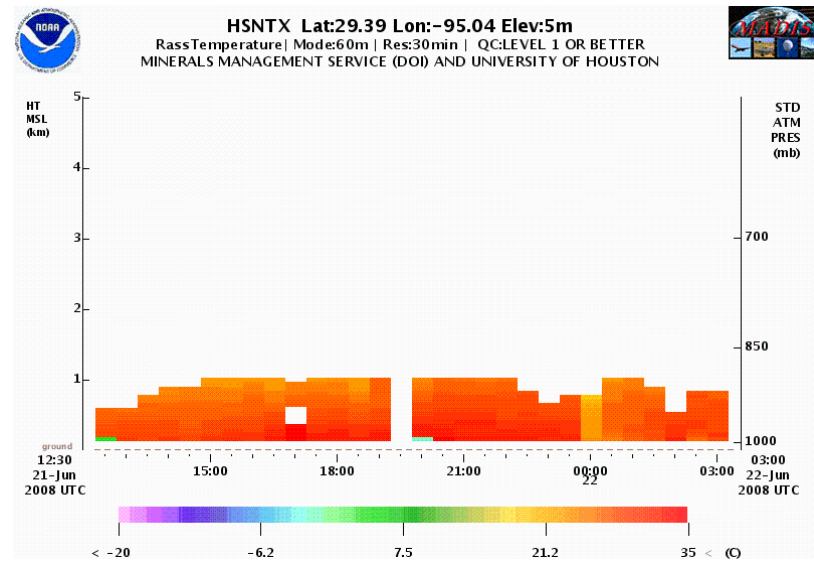


Time series of the surface temperature measured at the TCEQ CAMS sites from south to north:
 (a) Texas City, (b) La Porte, (c) Houston Regional Office, and (d) Aldine for 23--24 June 2008

Wind Profiles: 21 – 23 June 2008




Temperature Profiles: 21 – 23 June 2008



Temperature profiles at UH Coastal Center, Texas.

On 23 June, the surface was cool due to overnight radiative cooling. As the sun rose, strong convection developed.

Around 11:00AM, clouds moved in and the surface was cooled again due to increased cloudiness and light precipitation until 2:00PM CST.



**NOAA ESRL-GSD/MADIS
CAP PROFILER
Real-time Data Display**

CAP GSD ESRL NOAA

Basic Display Options
[View Advanced Display Options](#) [Help](#)

Name:

Resolution:

Profiles:

Mode:

Time Direction:

Periods:

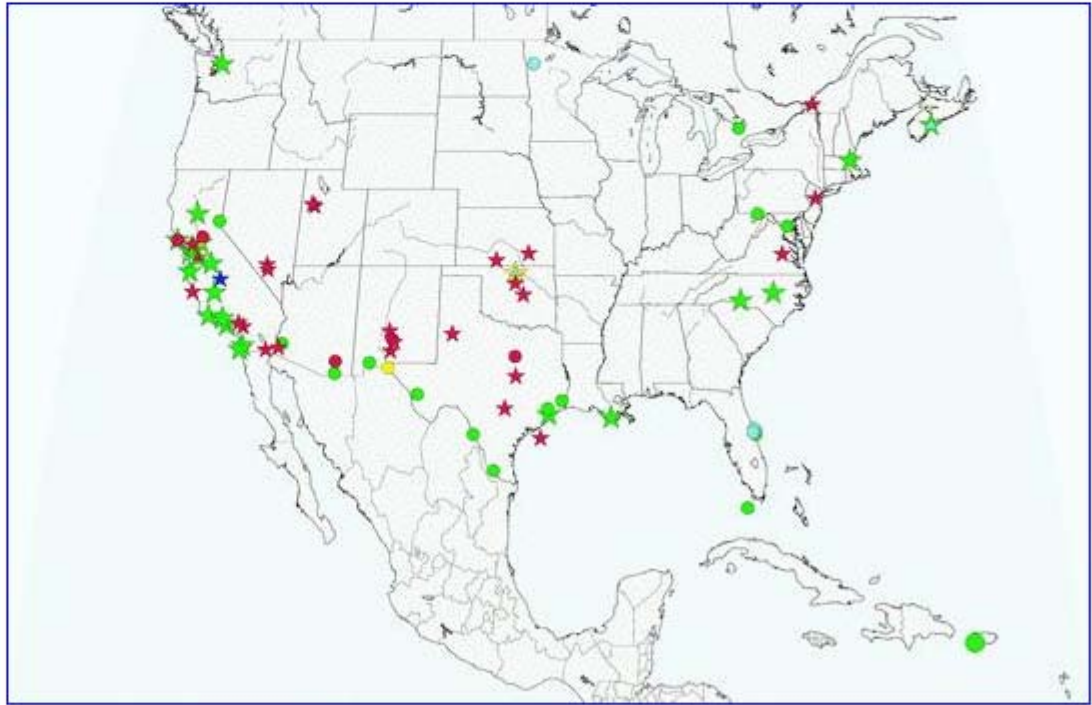
Size:

Image Quality:

	Current Data Available
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	WIND & RASS
	WIND
	RASS



Show Decommissioned:



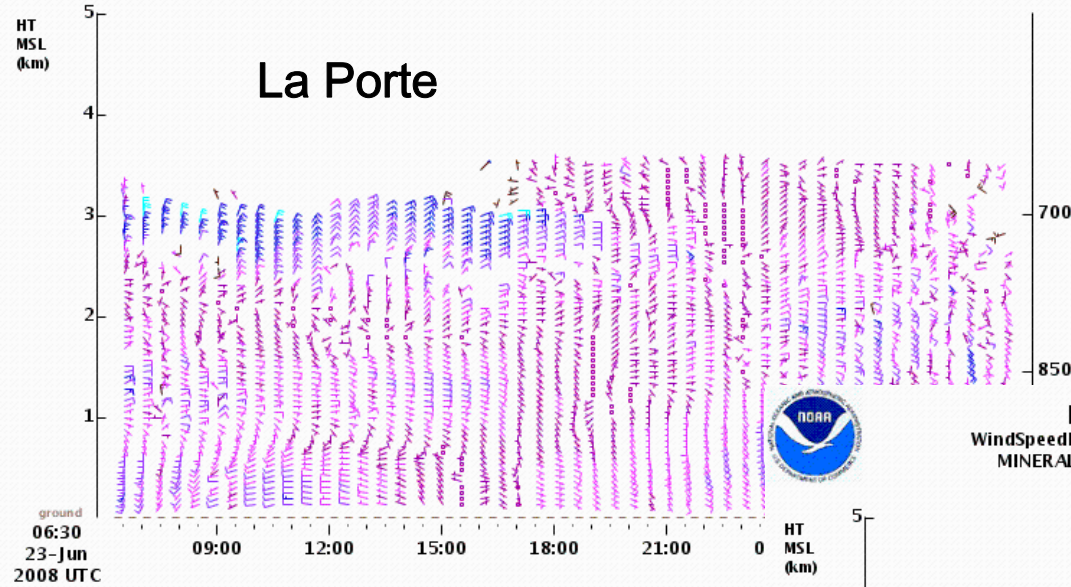
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State: Lat: Lon: Elev:

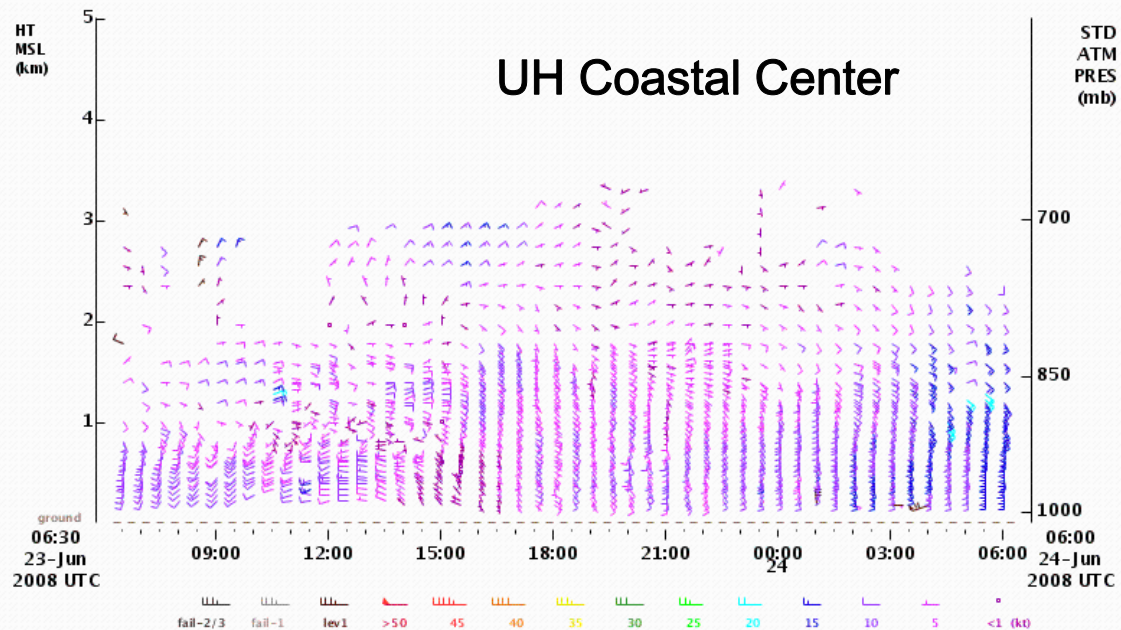
Wind Profiles: 23 June 2008



LPTTX Lat:29.7 Lon:-95.1 Elev:8m
 WindSpeedDirection | Mode:63m | Res:30min | QC:LEVEL 1 OR BETTER
 TEXAS COMMISSION ON ENVIRONMENTAL QUALITY



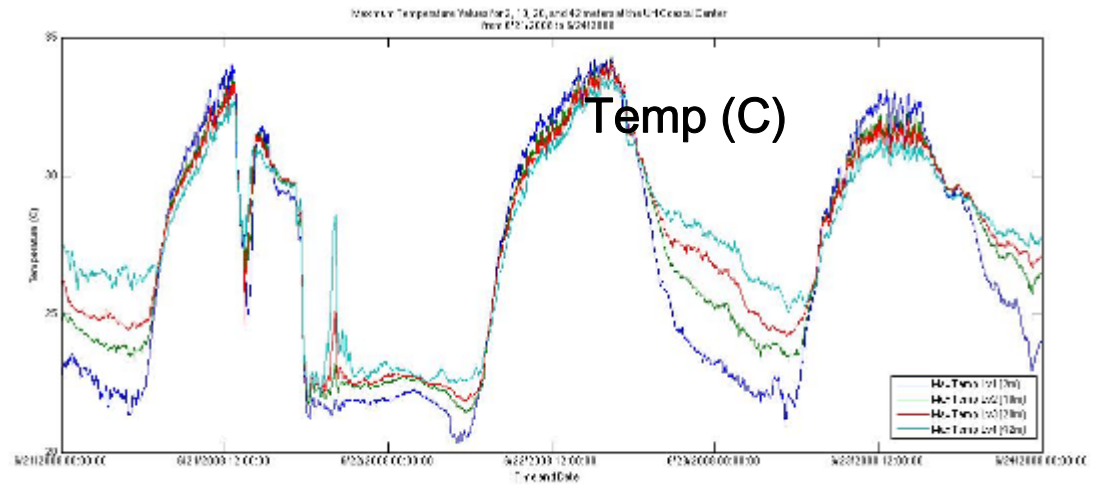
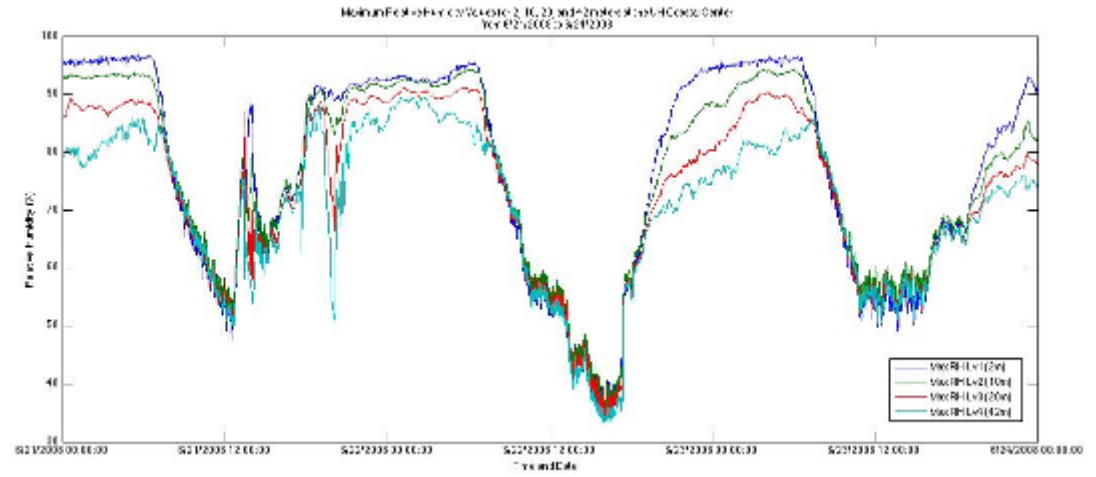
HSNTX Lat:29.39 Lon:-95.04 Elev:5m
 WindSpeedDirection | Mode:105m,420m | Res:30min | QC:LEVEL 1 OR BETTER
 MINERALS MANAGEMENT SERVICE (DO) AND UNIVERSITY OF HOUSTON



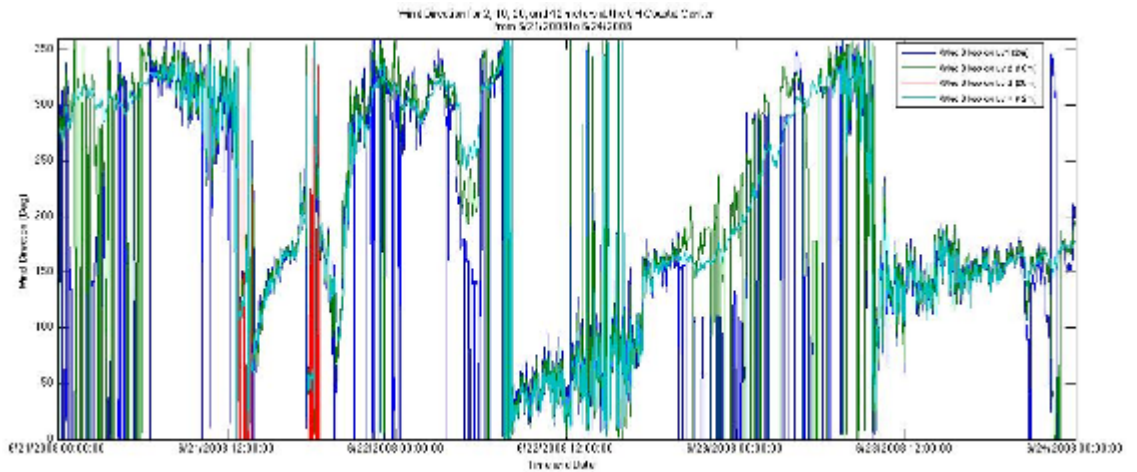
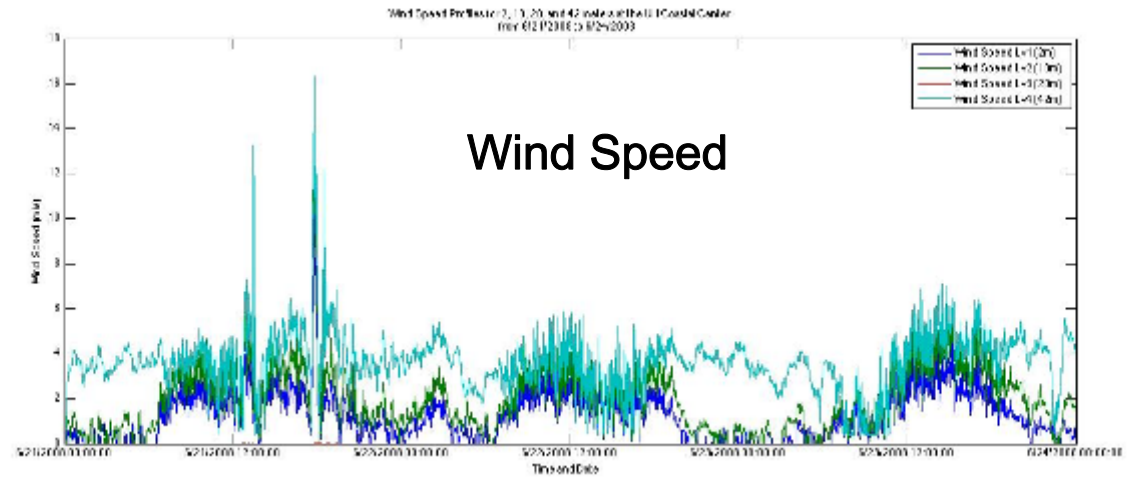
42-m Micrometeorological Tower at UHCC



RH (%)

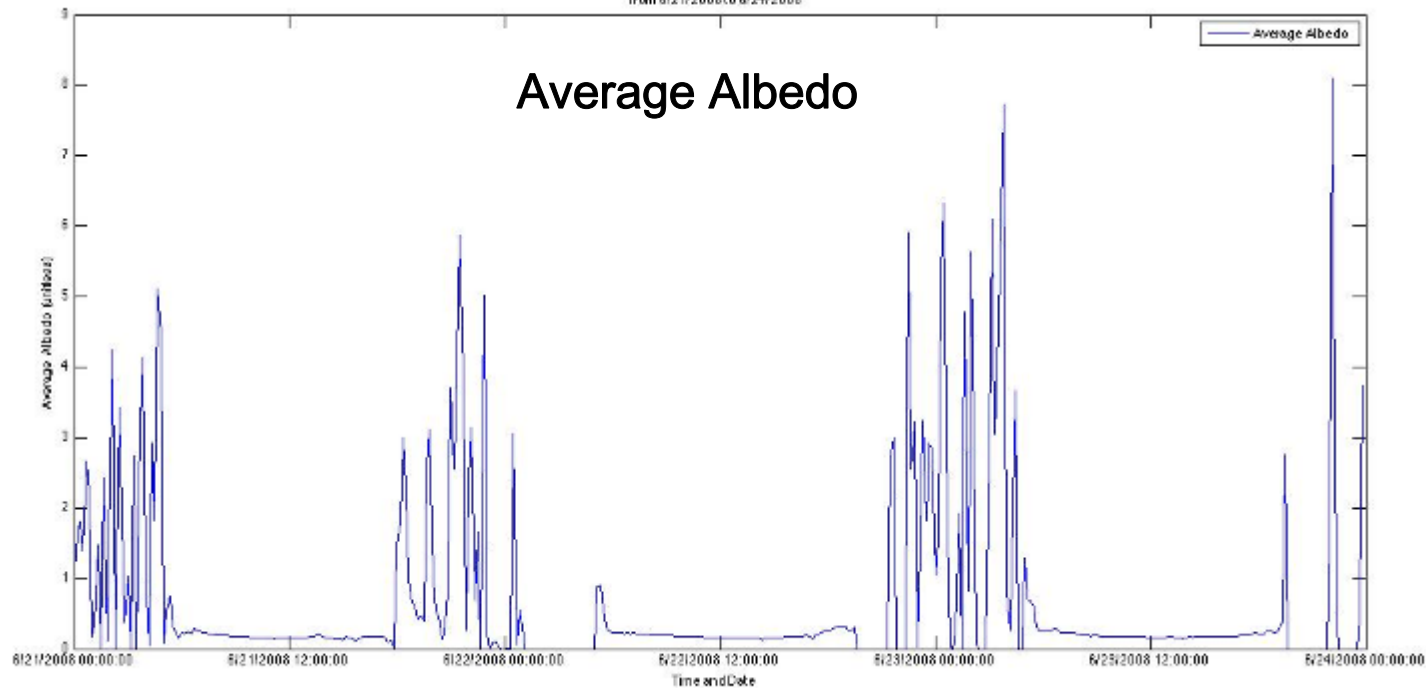


42-m Micrometeorological Tower at UHCC

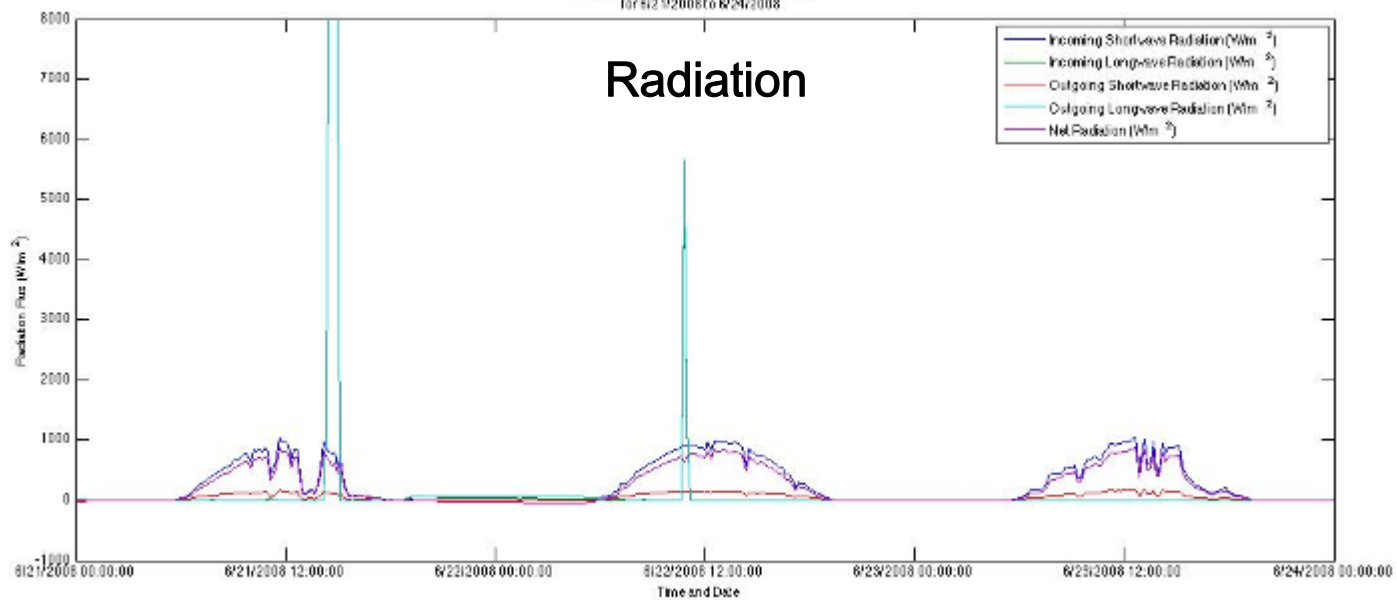


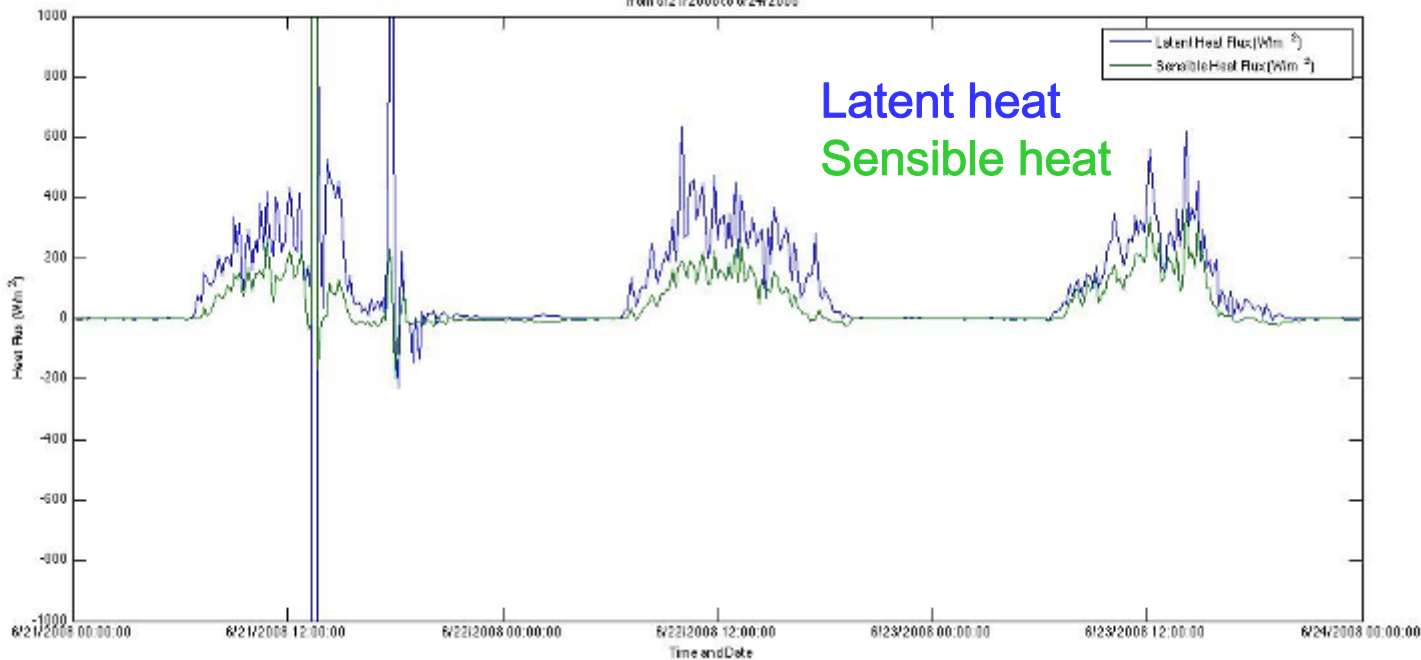
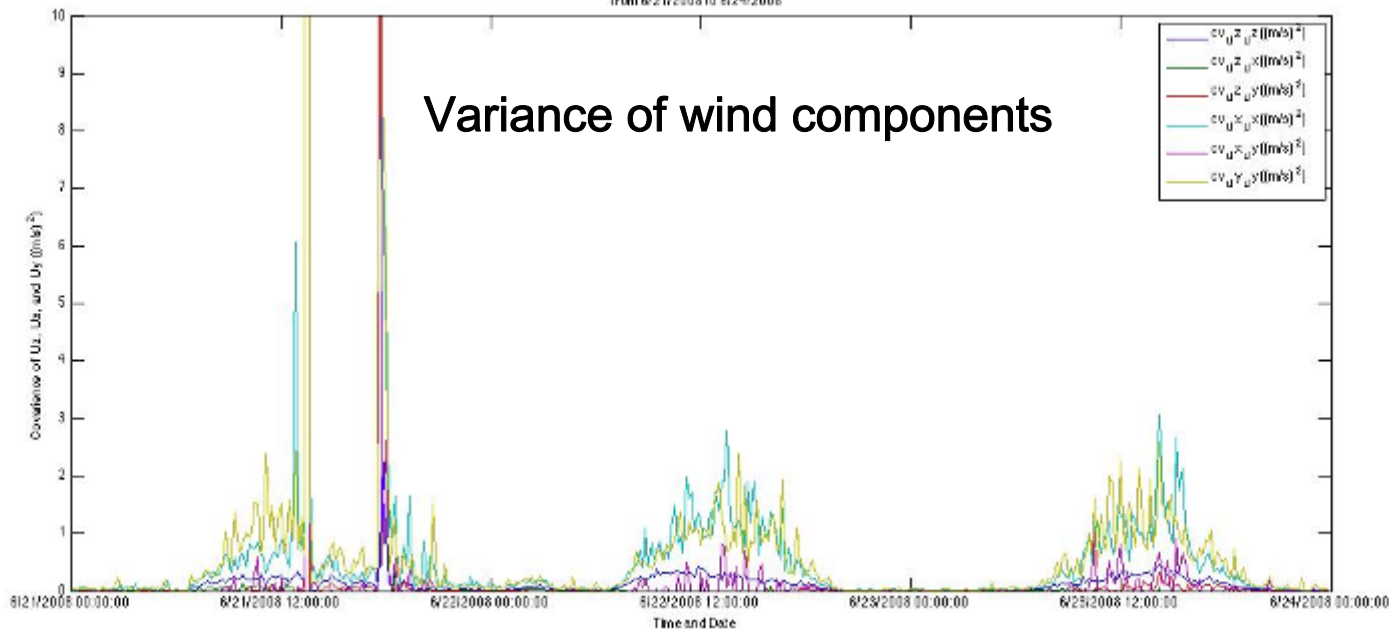
Wind Direction

Average Albedo Measured at the UH Coastal Center
from 6/12/2008 to 6/24/2008

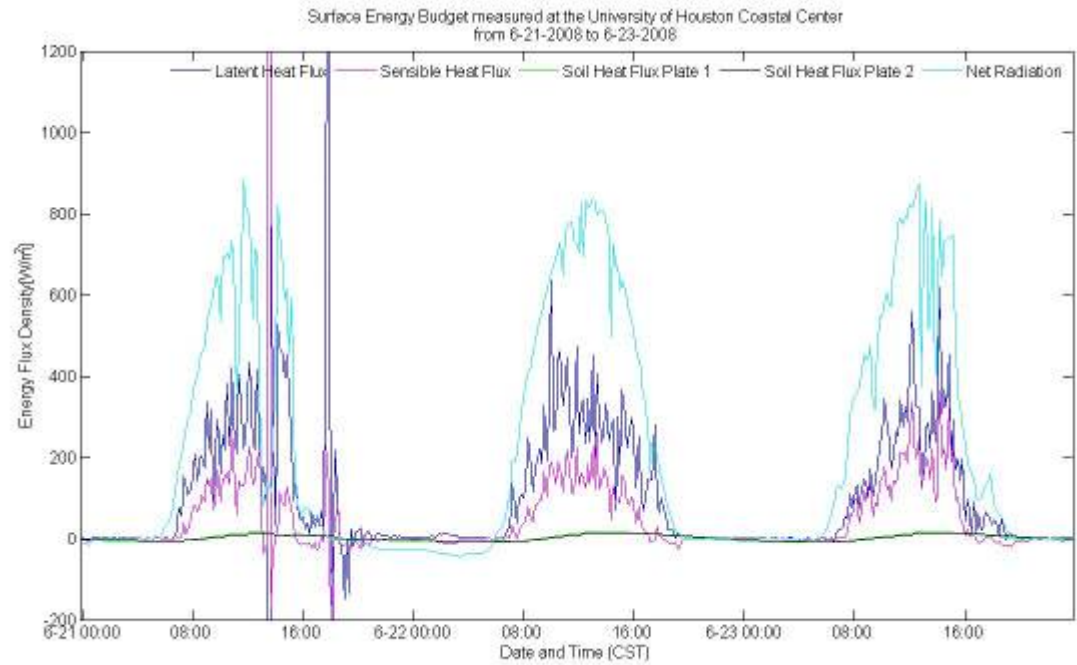


Radiation Budget of the UH Coastal Center
for 6/12/2008 to 6/24/2008

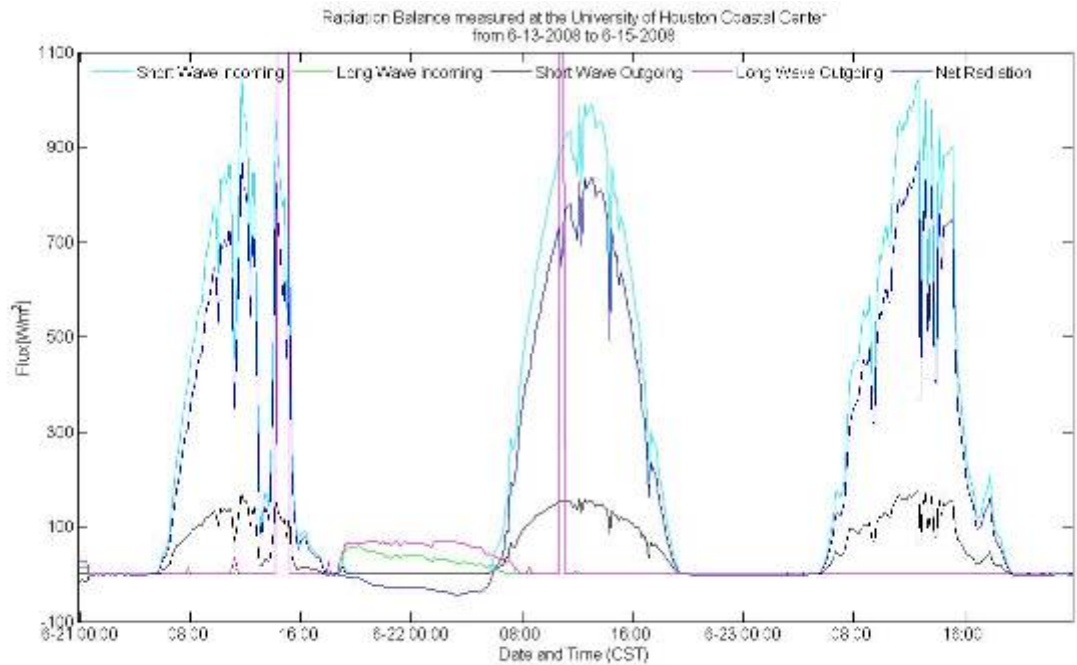




Time series of surface radiation balance at the UHCC micrometeorological tower for 21--23 June 2008.



Time series of surface energy budget at the UHCC micrometeorological tower for 21--23 June 2008.



MMS RASS/Wind Profiler system

- University of Houston has maintained the profiler at the UH Coastal Center, Texas, for last two years
- Vaisala has provided technical support and troubleshooting
- Together with the 42-m micro-meteorological tower and radiative and heat flux sensors, the site provides rare complete boundary layer momentum, heat, and moisture profiles
- The location of RASS at the UH Coastal Center is strategically beneficial in determining the onset of sea breeze front.
- Near-by La Porte site is providing complementing information on the development of the Galveston Bay breeze.
- The combination of Bay breeze and sea breeze often creates convergence zone near the center of Houston. Depending on the atmospheric humidity and stability conditions, the convergence is related with either high ozone events or thunderstorm induced precipitations