Wild fires in North and Central America as extra-CONUS-domain intermittent sources for NAQFC

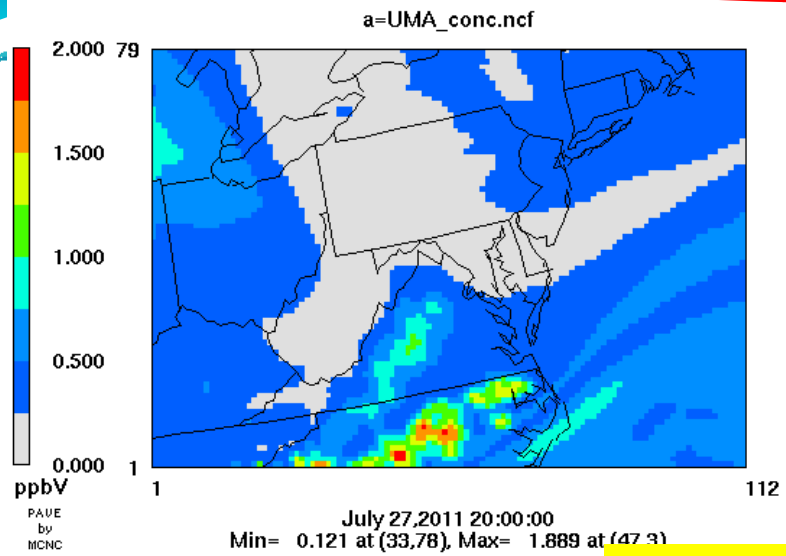
Pius Lee[1*], Hyuncheol Kim[2], Tianfeng Chai[2], Yunsoo Choi[2], Li Pan[2],

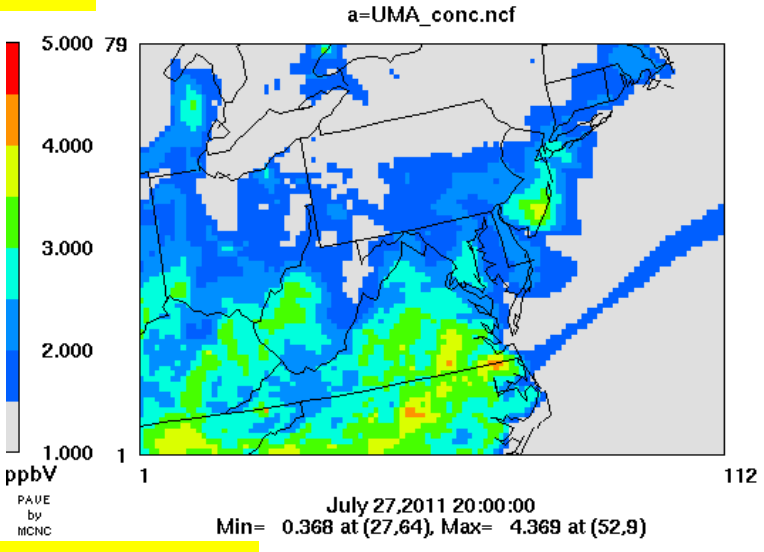
Youhua Tang[3], Ariel Stein[2],

and Ivanka Stajner[4]

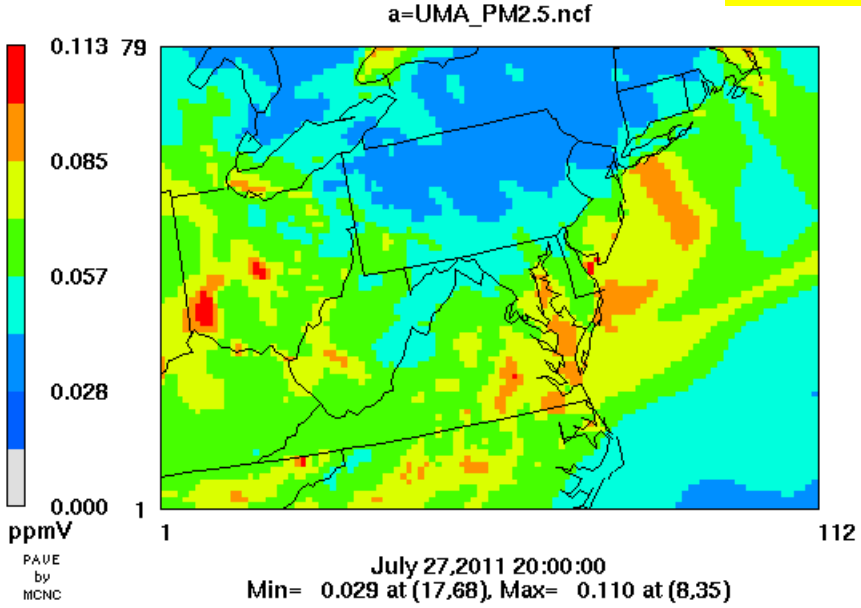
*Corresponding Author Email Address: pius.lee@noaa.gov
[1] Air Resources Laboratory, NOAA, Silver Spring, MD
[2]Earth Resources & Technology Inc., Annapolis Junction, MD
[3] I.M. Systems Group, Inc. Rockville, MD 20852.
[4] Office of Science and Technology, National Weather Service, NOAA, Silver Spring, MD.

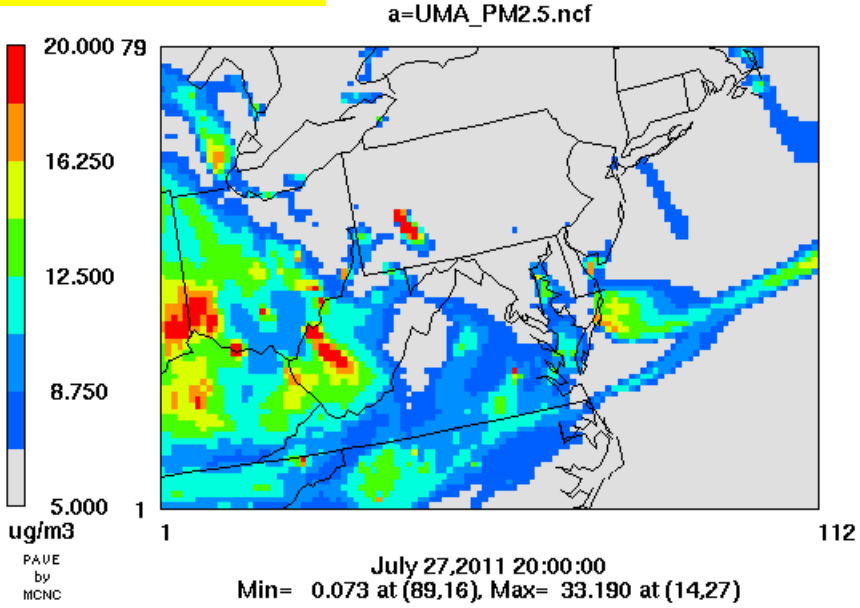
C(z)





C(Sfc),
or column integrated





Graphics posting of species overlaid with wind barb ~ **2:30pm EDT**

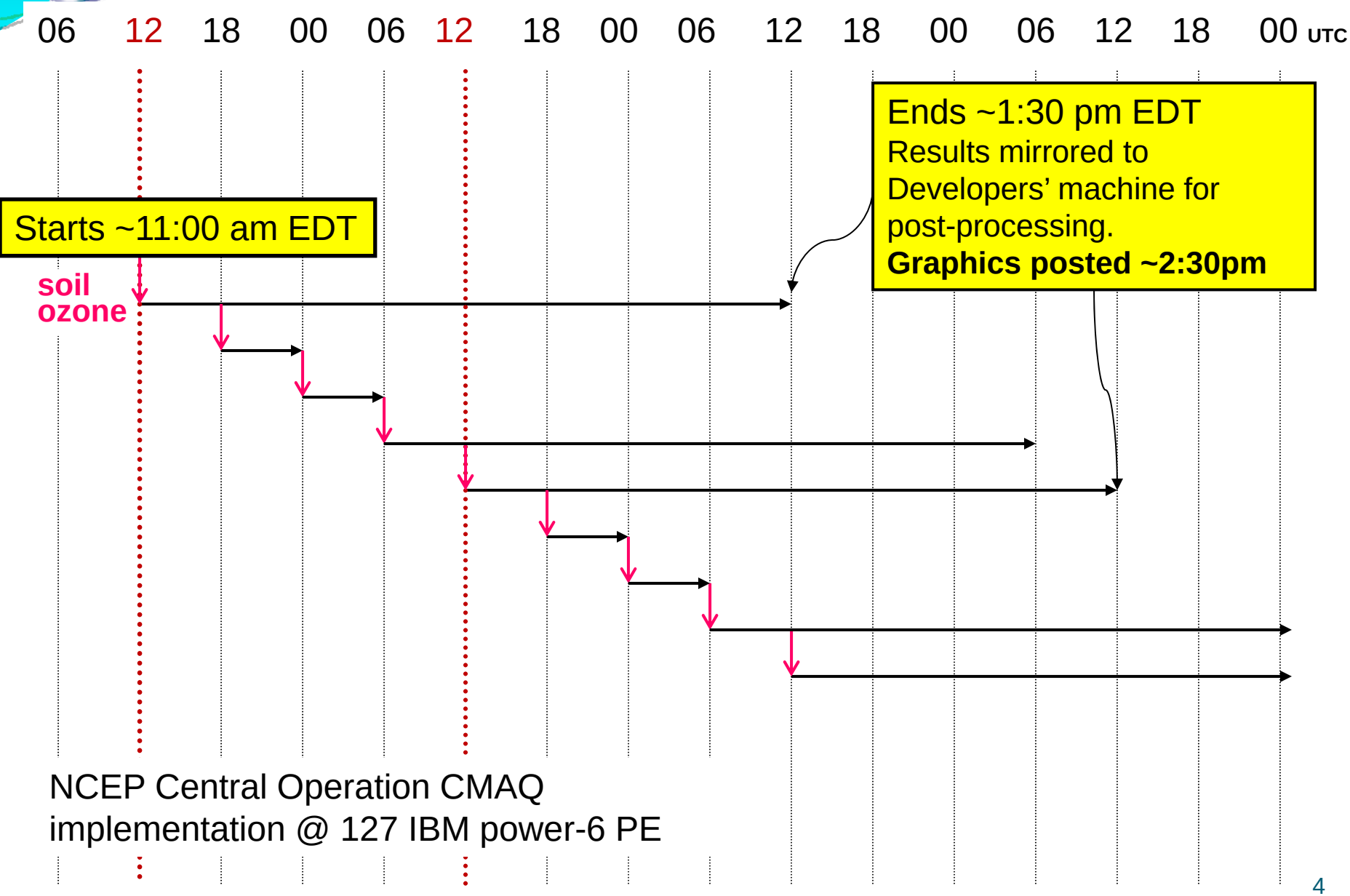
3D variables	**O3**	**NO2**	**SO2**	**CO**	**FORM**

CMAQ Layers	**sfc**	**8**	**11**	**13**	**14**	**16**	**19**
Pres-lev (hPa)	**~1013**	**950**	**900**	**850**	**800**	**750**	**500**

Sfc or column variables	**AOD**	**Pm2.5**

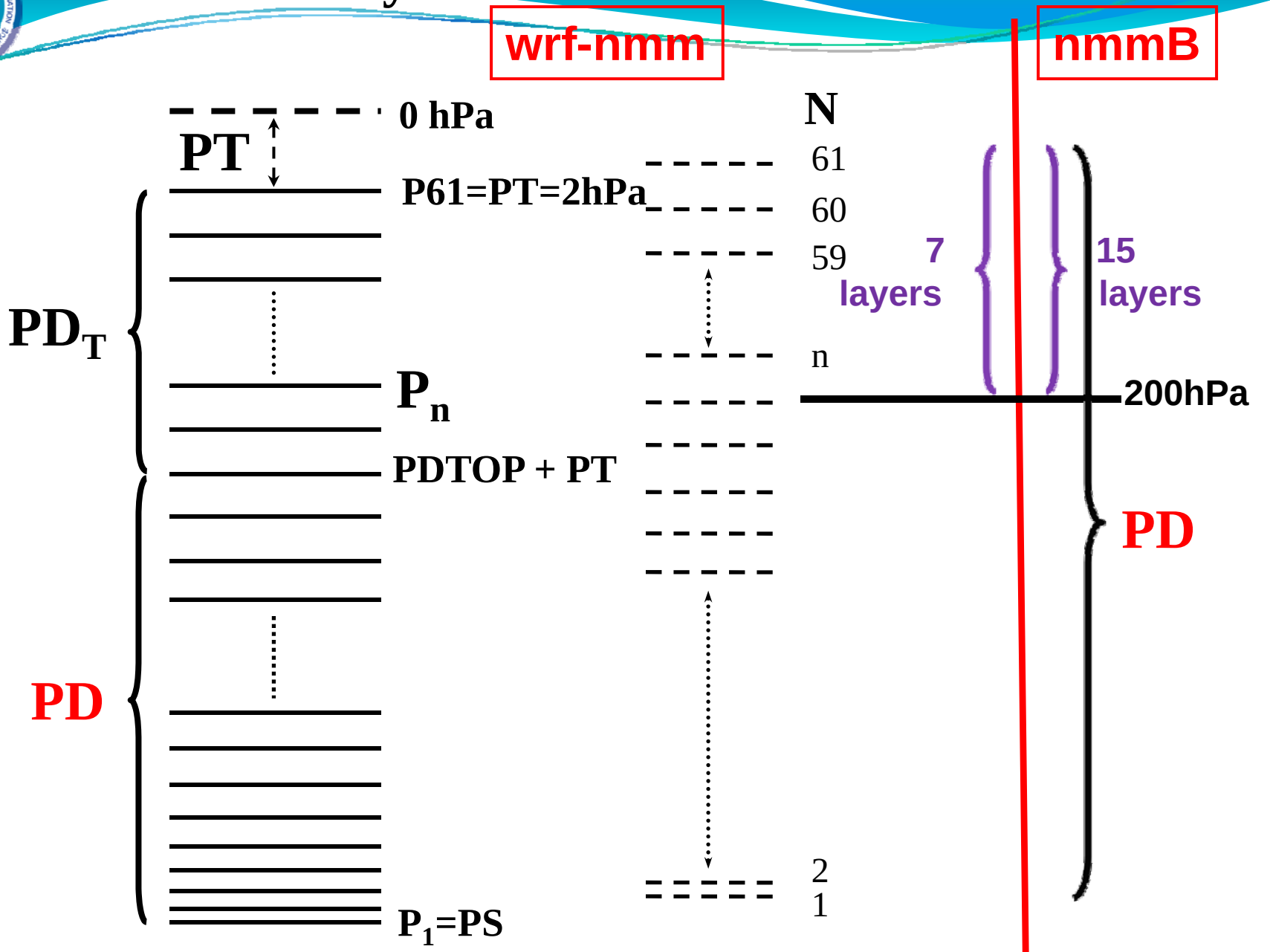
file	**48 h worth of hourly value**
aconc	**O3, NO2, NO, NO3, N2O5, HNO3, HONO, PNA, CO, FORM, ALD2, PAN, NTR, XO2N, SO2 ASO4I ASO4J ANH4I ANH**
conc	**O3, NO2, NO, NO3, N2O5, HNO3, HONO, PNA, CO, FORM, ALD2, PAN, NTR, XO2N, SO2 ASO4I ASO4J ANH4I ANH4J ANO3I ANO3J AORGAI AORGAJ AORGPAI AORGPAJ AORGBI AORGBJ AECI AECJ A25I A25J NUMATKN NUMACC SRFATKN SRFACC AH2OI AH2OJ ACLI ACLJ ANAI ANAJ**
PBL	**PRSFC TEMPG TEMP2 WSPD10 WDIR10 CFRAC PBL2**
wind	**UWIND VWIND**

Operational timings of CMAQ during DISCOVER-AQ



NCEP Central Operation CMAQ implementation @ 127 IBM power-6 PE

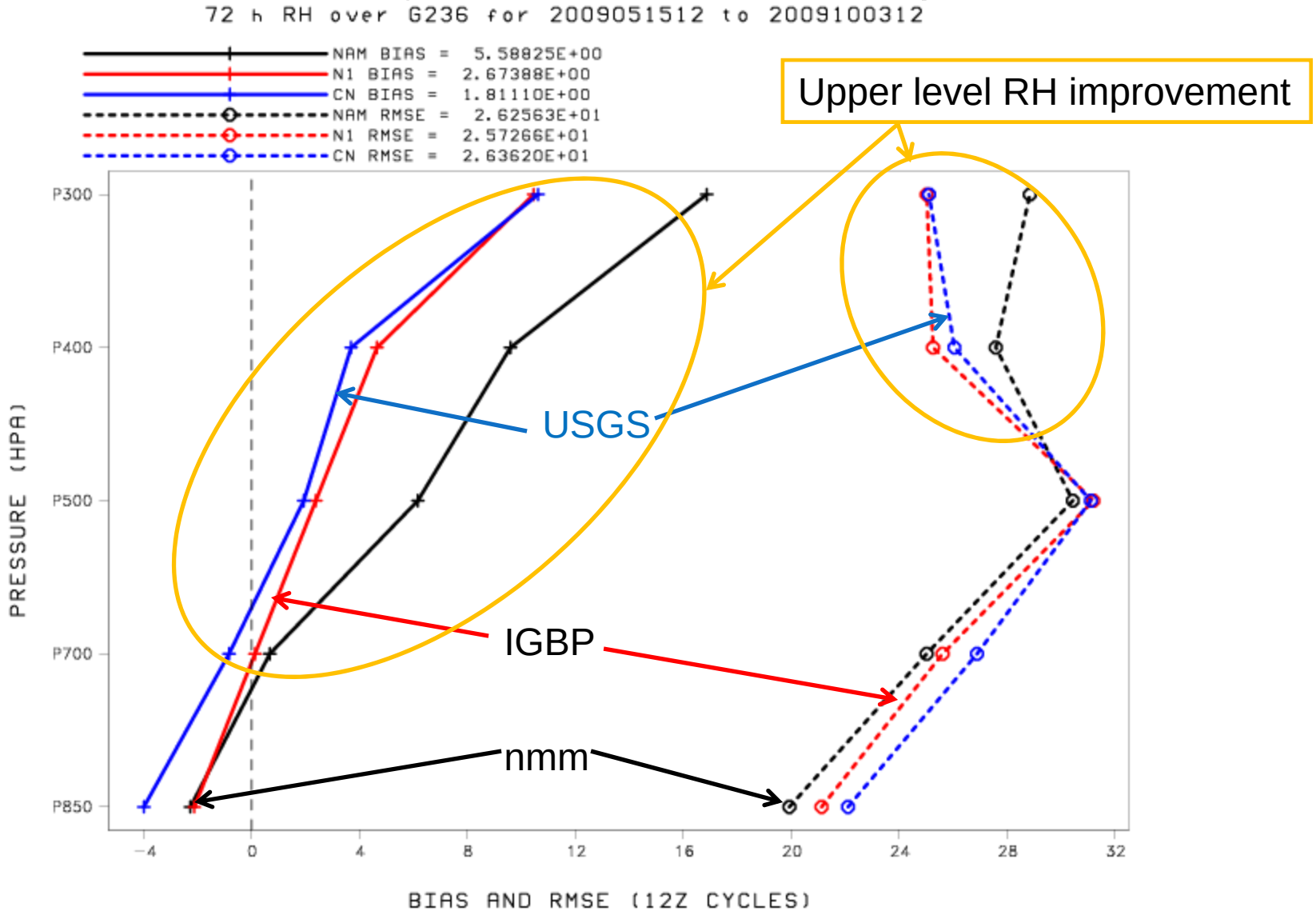
Hybrid Vertical Coordinate



Physics Coupling

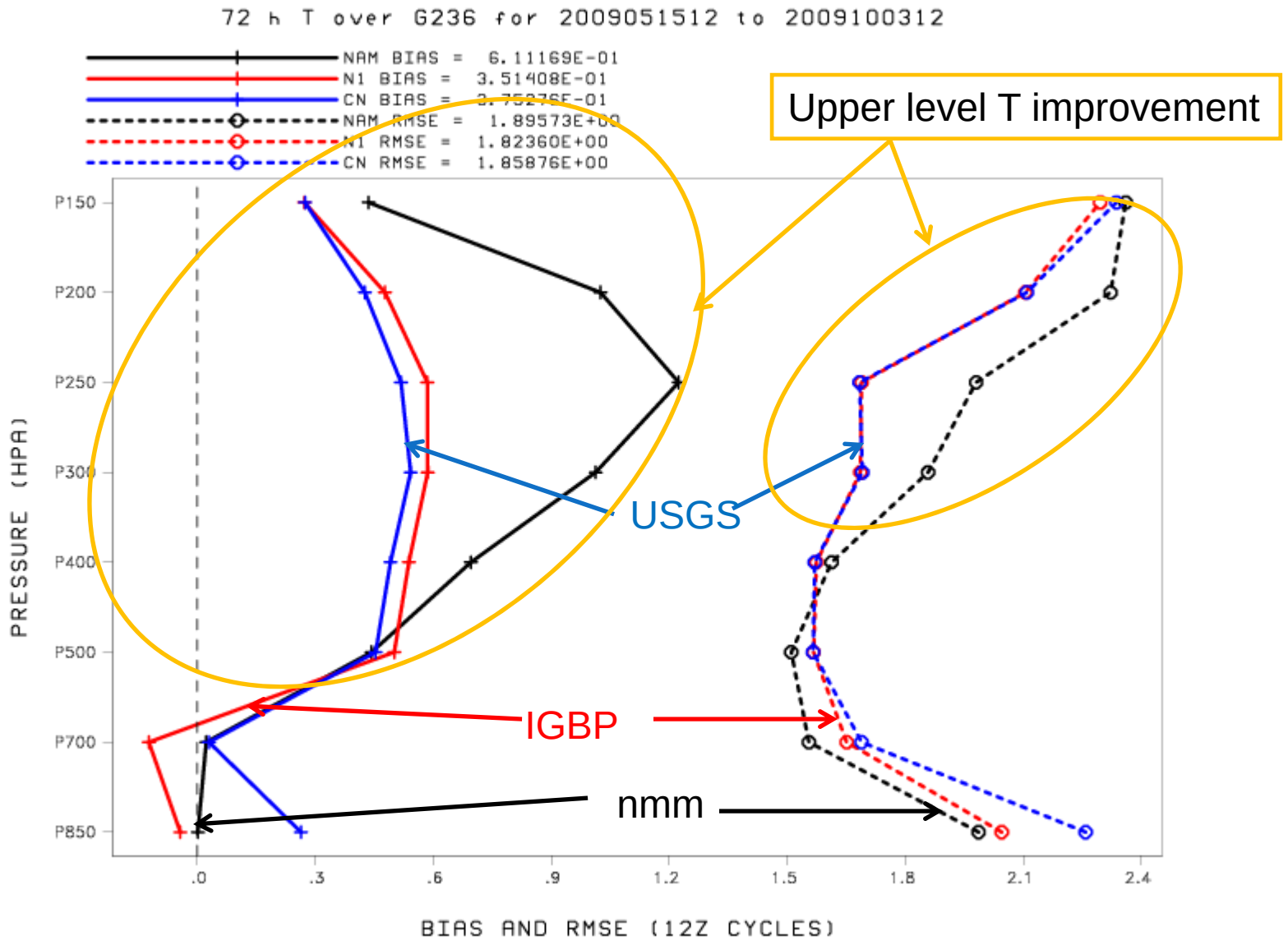
	Met Model (NMMB)	AQ Model (CMAQ)
Core/Dynamics	Rotated Lat-Lon E Hybrid sigma-P	Arakawa C Grid Sigma-P
Cloud micro-physics	Full Ferrier Cloud Microphysics	rh-based cloud-column for aqueous chemistry
Convective mixing	Betts-Miller Janjic	*ACM Non-local mixing scheme*
Radiation	Lacis-Hansen SW & LW	*CMAQ J Tables*
PBL	Mellor-Yamada TKE	NAM PBL height for Pleim-Xiu 1st order closure PBL
Land Surface	NOAH common	NAM canopy conductance terms for Pleim-Xiu LSM

Relative Humidity Bias & Root-mean-square Error



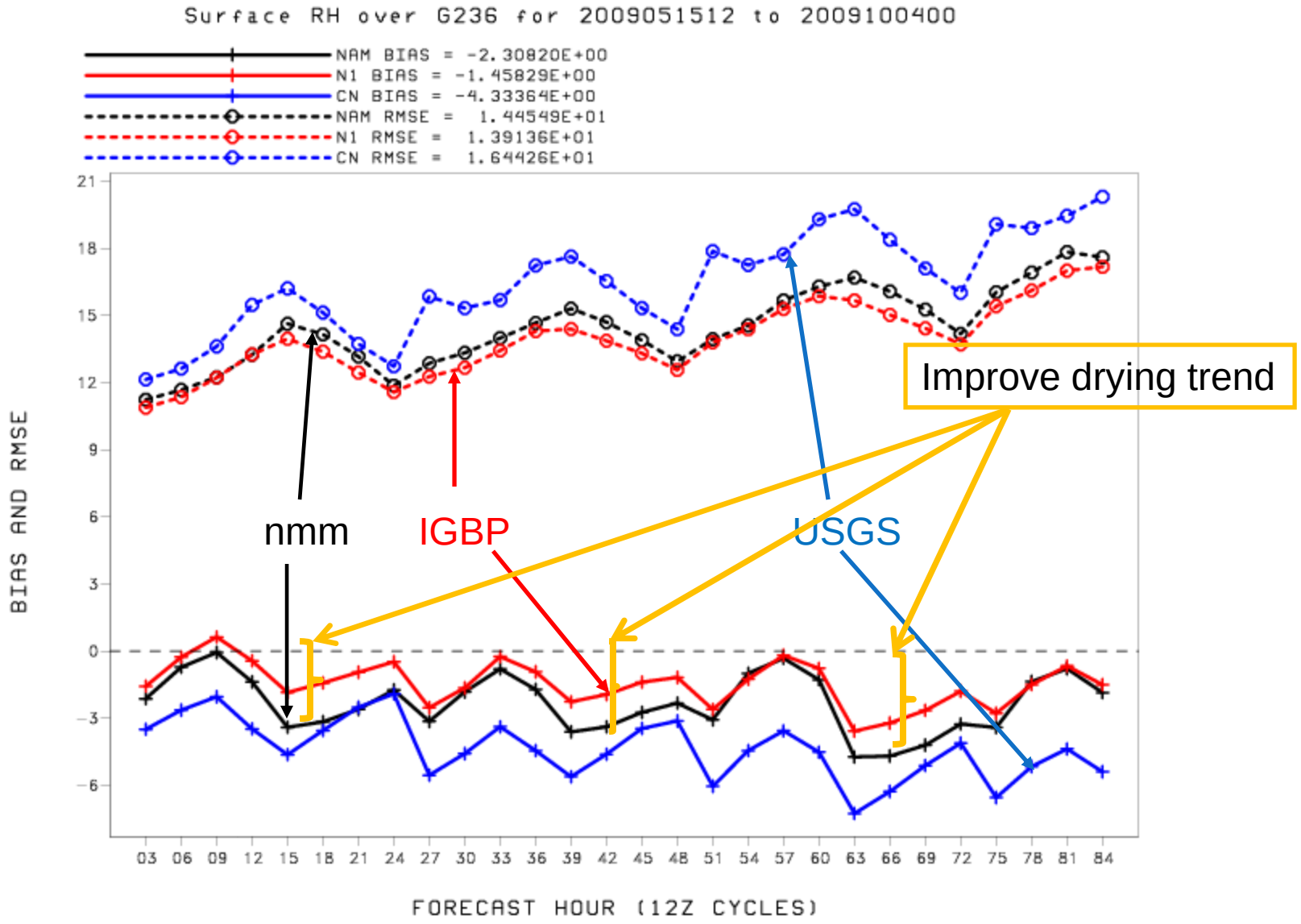
Courtesy: Vince Wong and Mike Ek (NCEP)

Temperature Bias & Root-mean-square Error



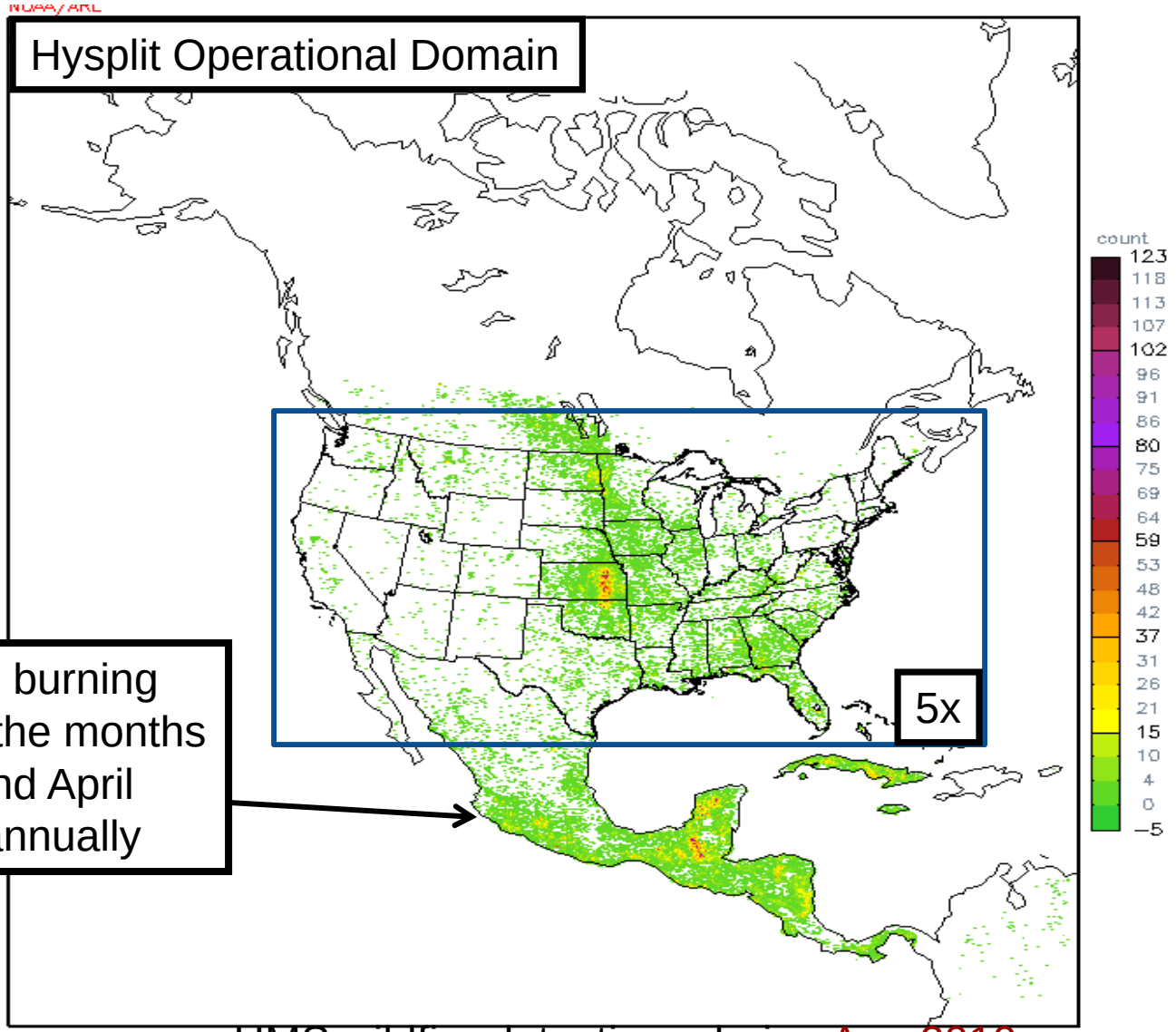
Courtesy: Vince Wong and Mike Ek (NCEP)

Surface Relative Humidity Bias & Root-mean-square Error



Courtesy: Vince Wong and Mike Ek (NCEP)

Emission should include Exo- and intra-domain wild fires



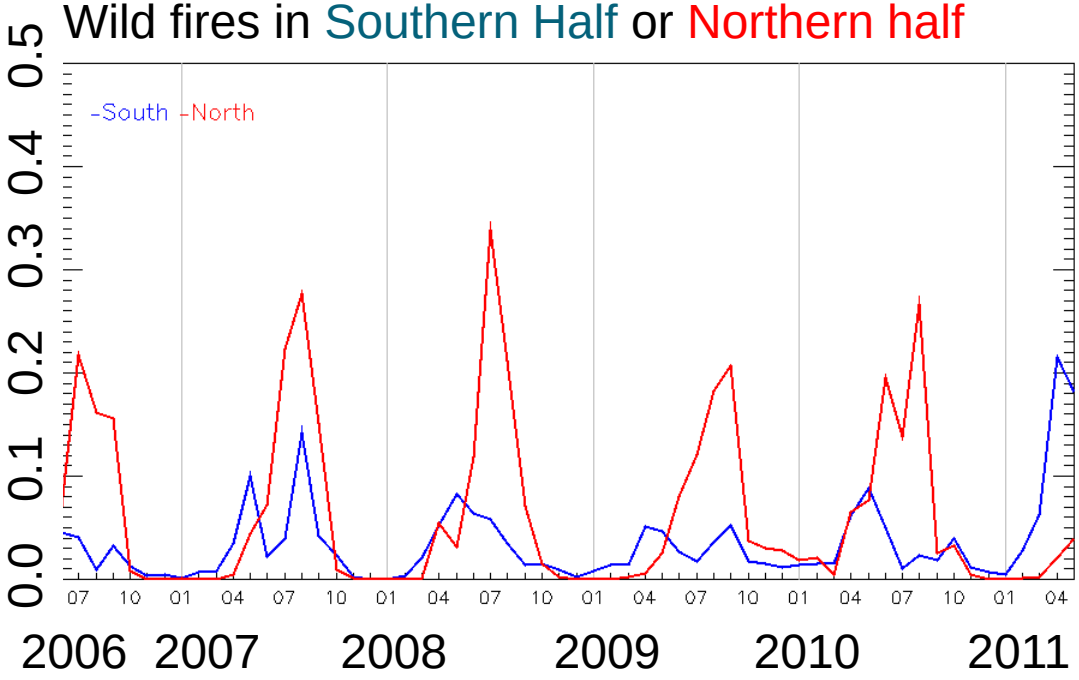
Agricultural burning prevails in the months of March and April in Mexico annually

HMS wildfire detections during Apr. 2010

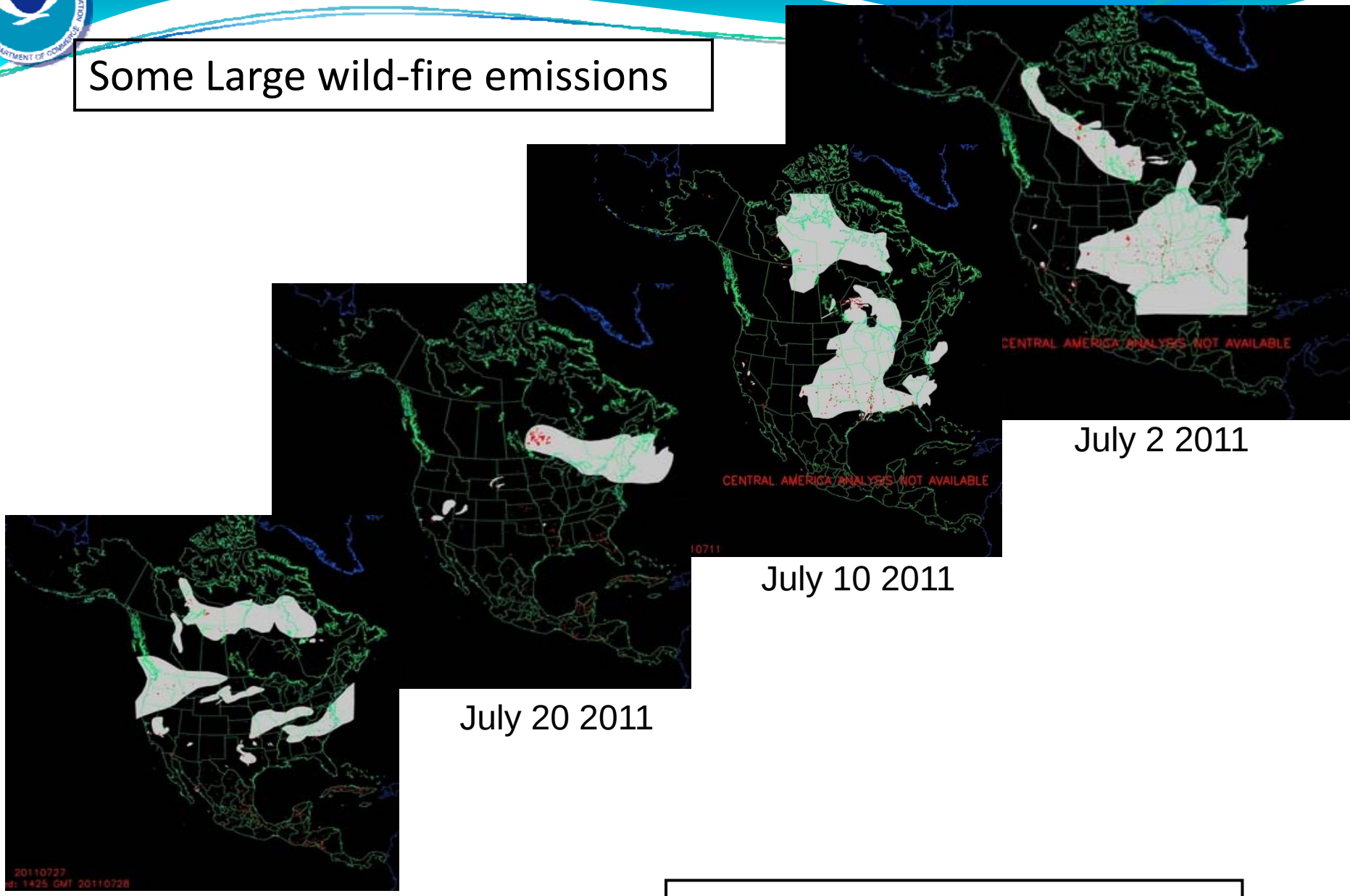
Intra-domain wild fire emissions

Time series of monthly mean event-count HMS/smoke fraction inside CONUS domain. Blue lines indicates bottom half of domain, and red color indicates upper half of the CONUS domain

Hms/Bluesky/Smoke monthly mean fraction owing to Wild fires in Southern Half or Northern half



Some Large wild-fire emissions



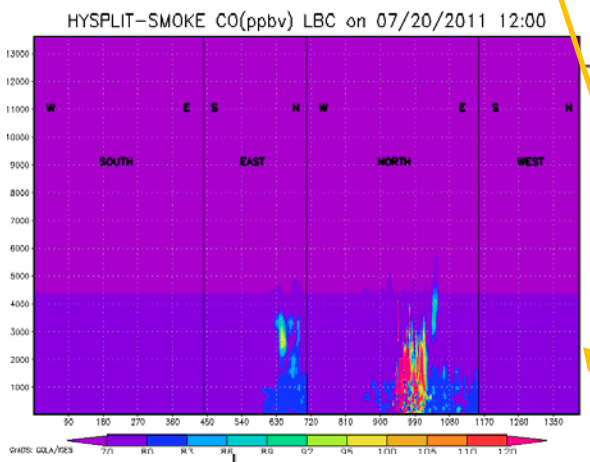
July 2 2011

July 10 2011

July 20 2011

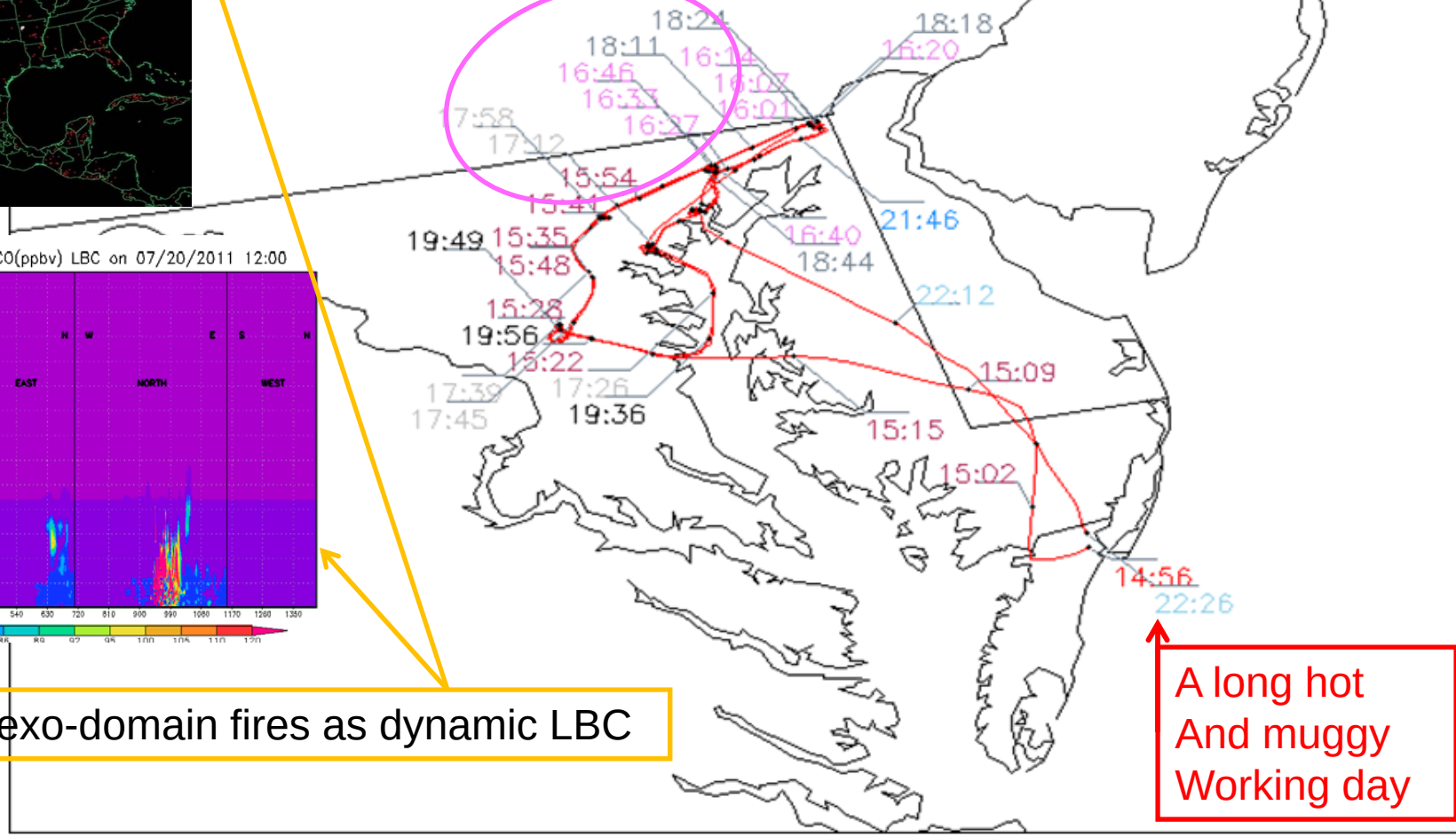
July 27 2011

Courtesy: Hysplit team, ARL/NOAA
http://ready.arl.noaa.gov



Flight track: July 20, 2011

Spirals over Wilmington and Edgewood



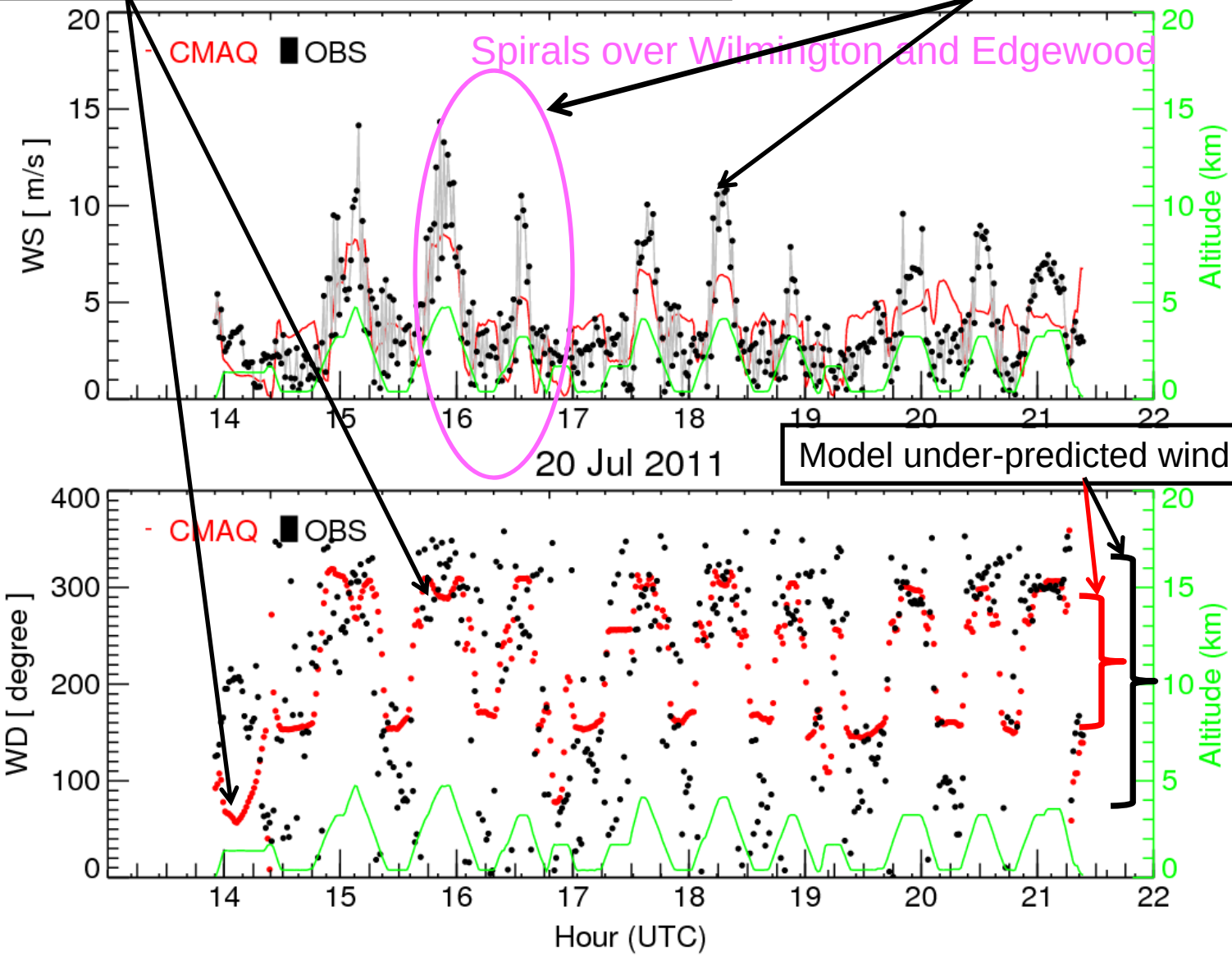
Ingesting exo-domain fires as dynamic LBC

A long hot
And muggy
Working day

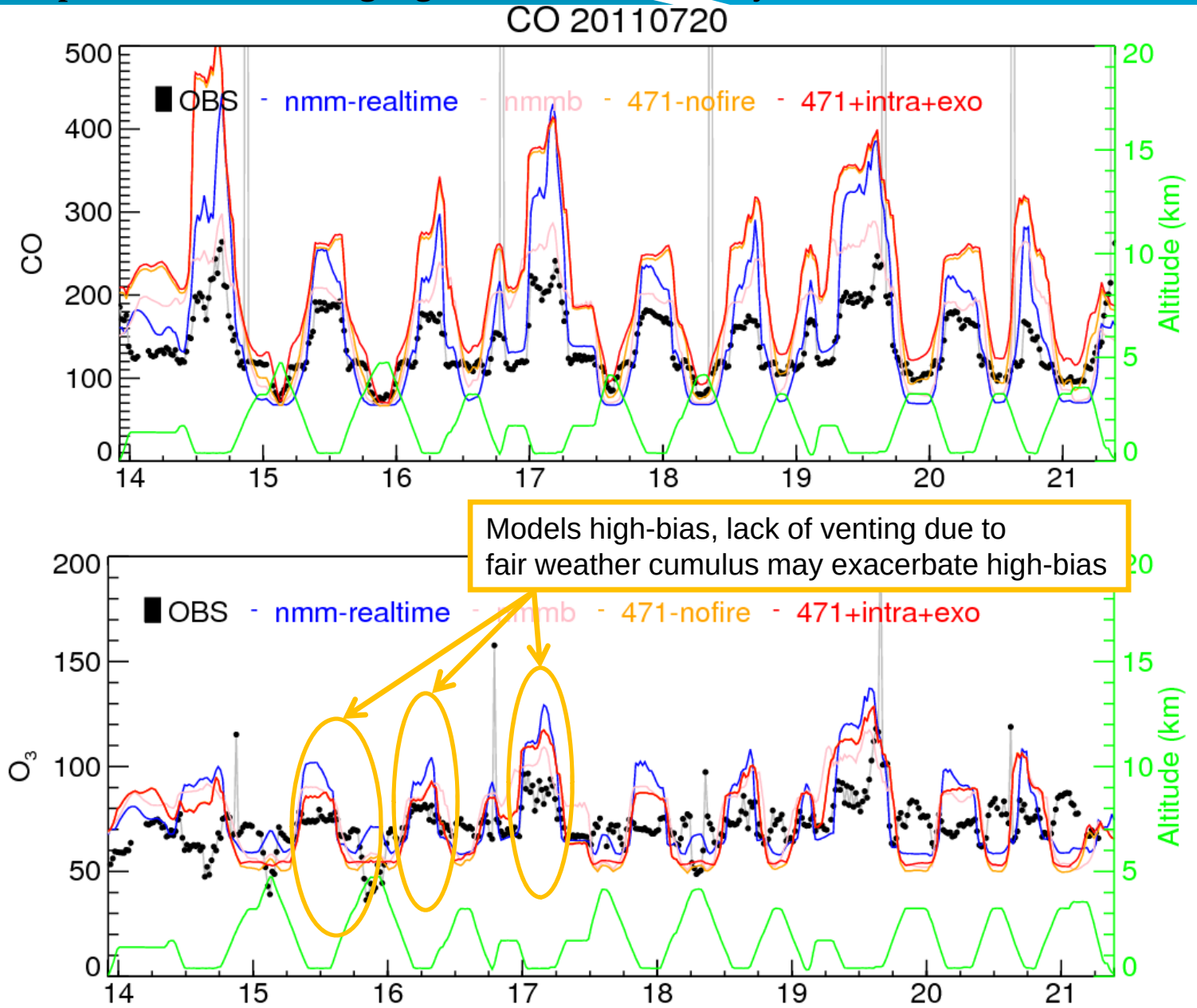
Comparison of Wind along flight track of P3B on July 20 2011

Less turbulence may not matter as PBL well-mixed, shallow-convection may matter.

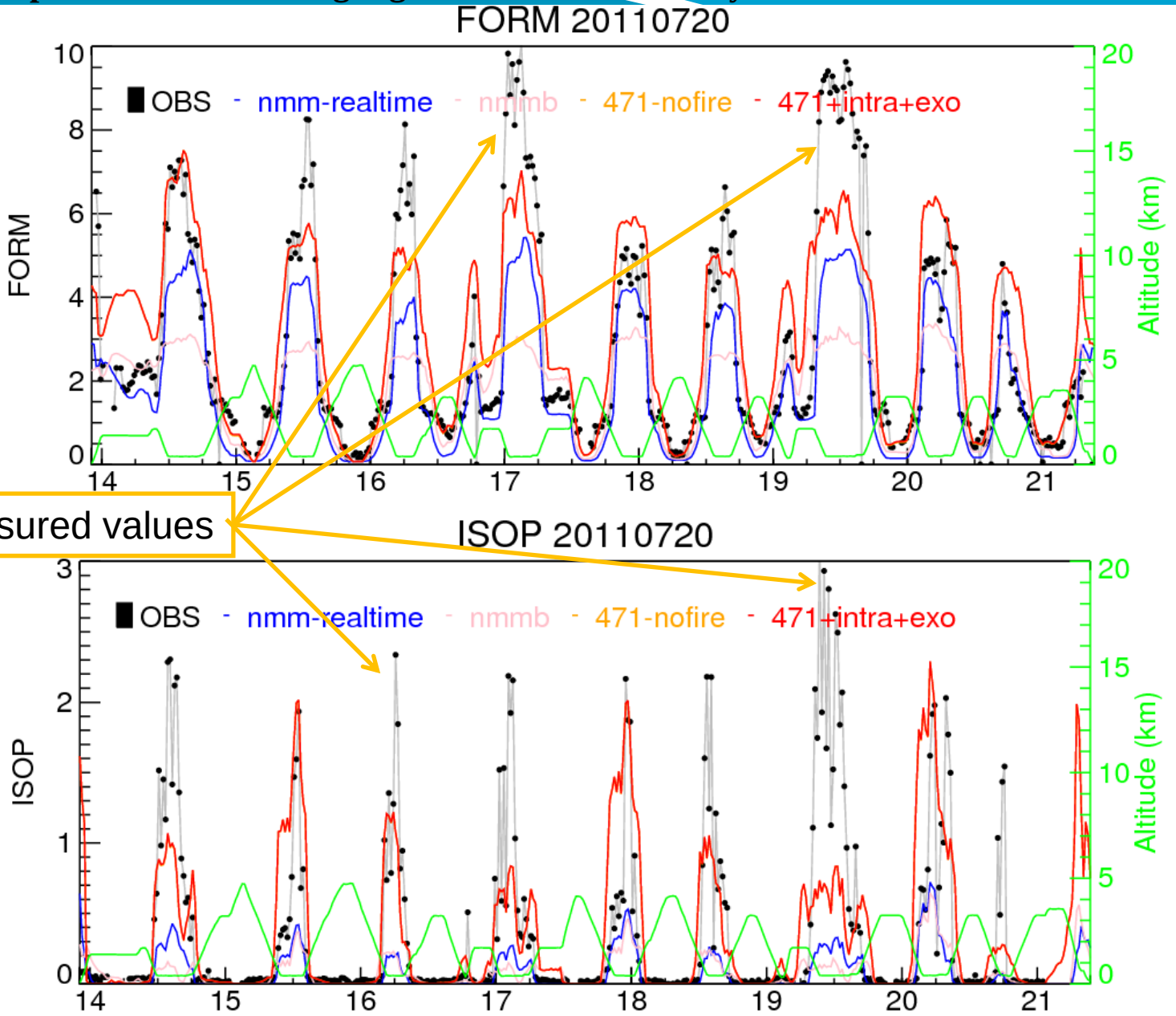
More frequent low Bias in higher altitudes



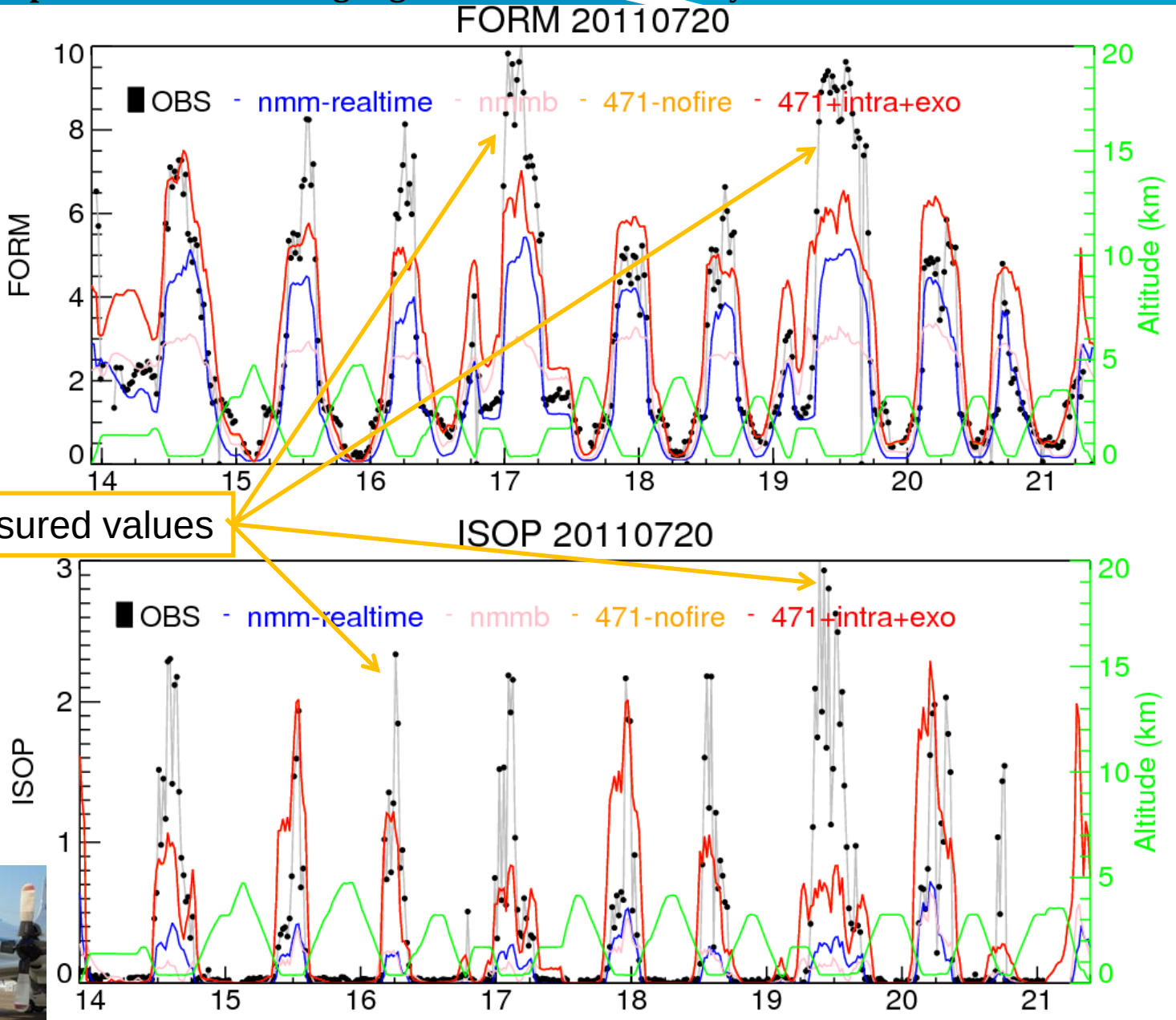
Comparison of Conc along flight track of P3B on July 20 2011



Comparison of Conc along flight track of P3B on July 20 2011



Comparison of Conc along flight track of P3B on July 20 2011



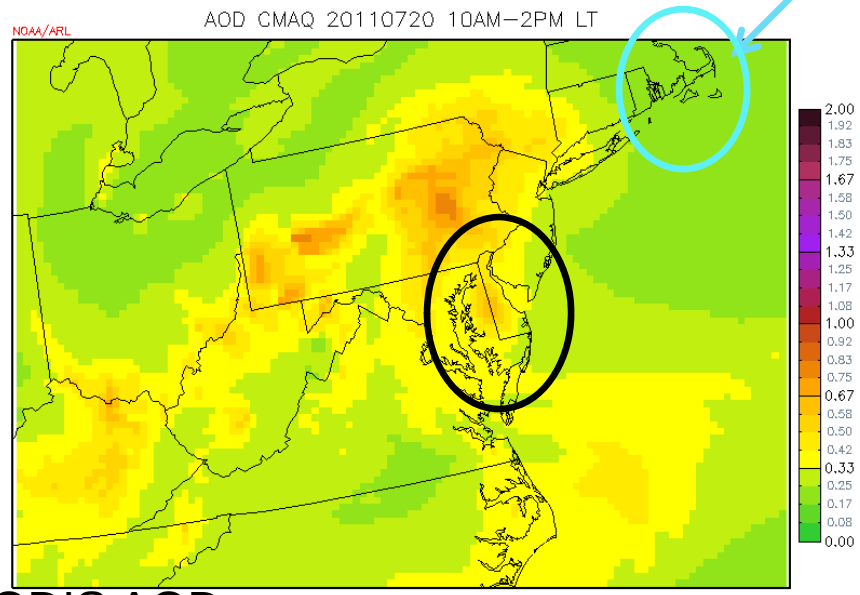
High measured values

Poster on other experiments: Tang et al,

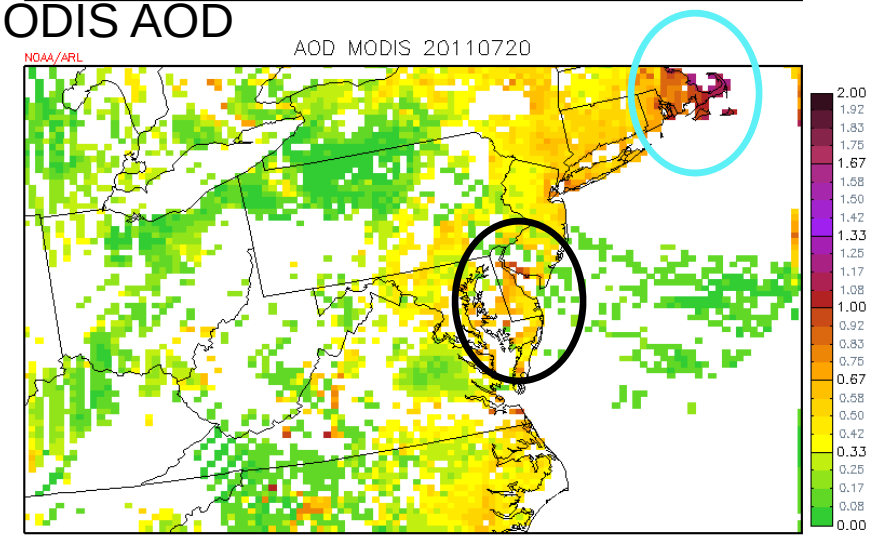
Spatial distribution of hourly avg. column-integrated AOD 7/20

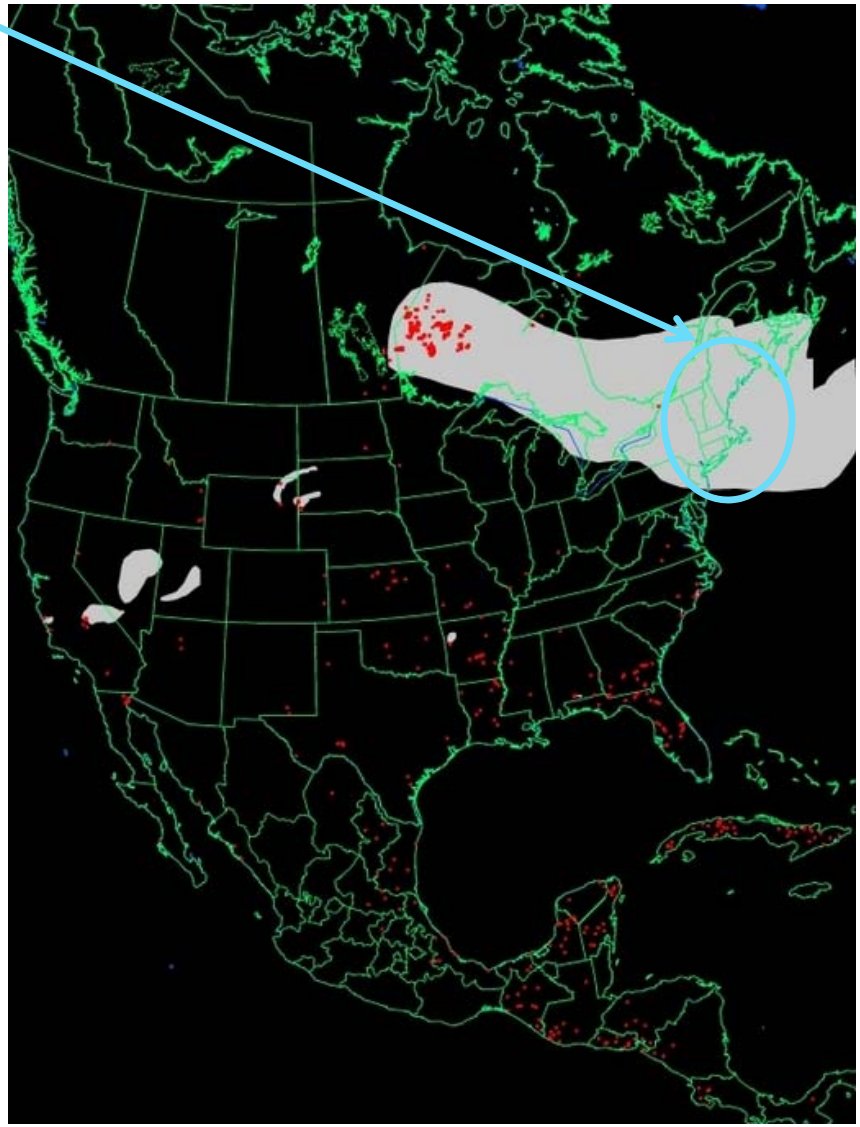
Satellite data was also attempted

CMAQ471 no_hms_fire AOD



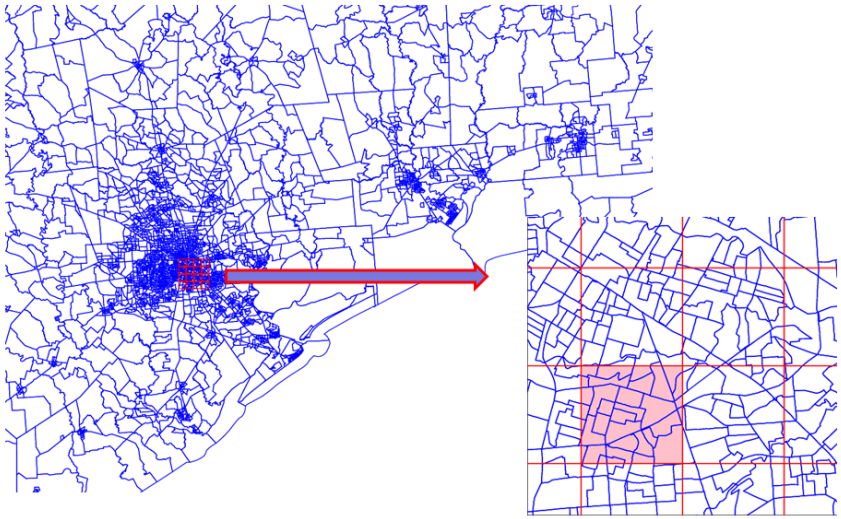
MODIS AOD

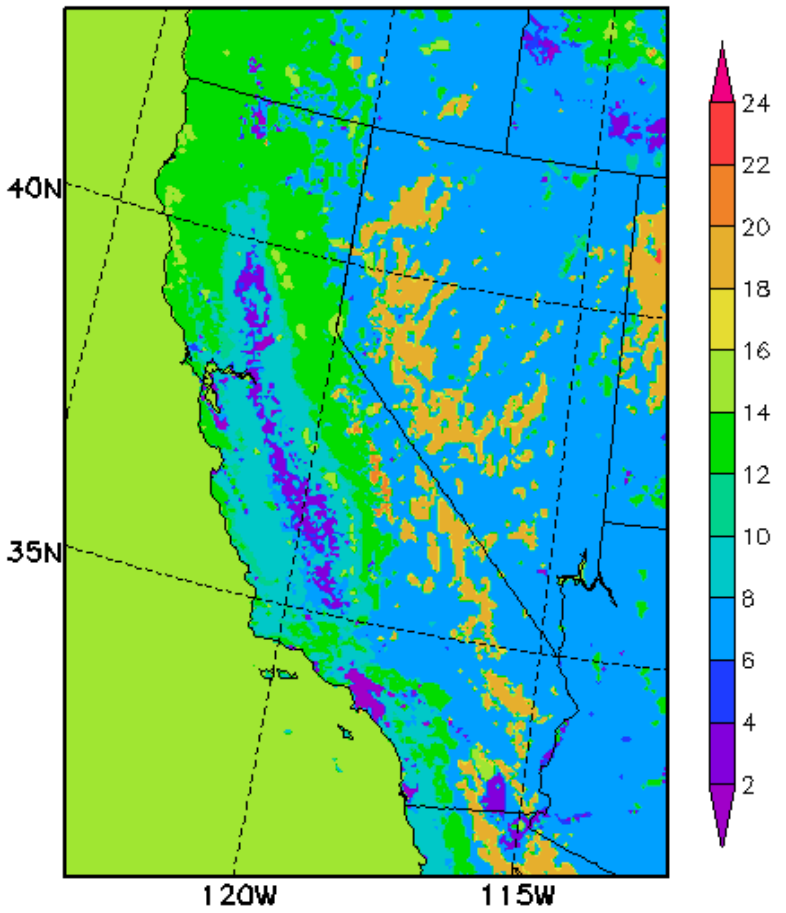




Gearing up for 4km forecasting for CA and TX

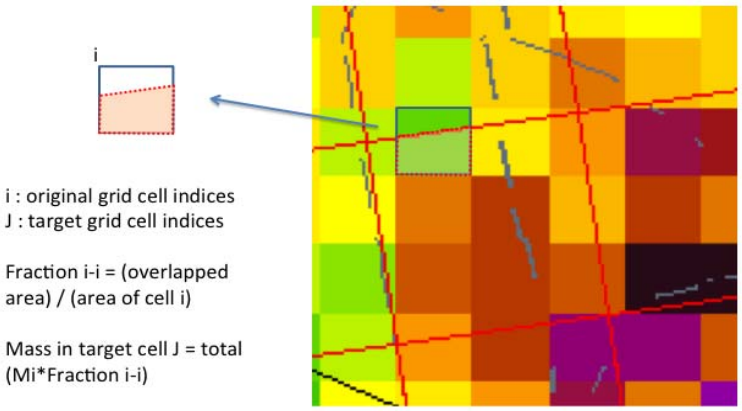
In order to generate “surrogate” files for emission processing, spatial allocator is an essential tool.





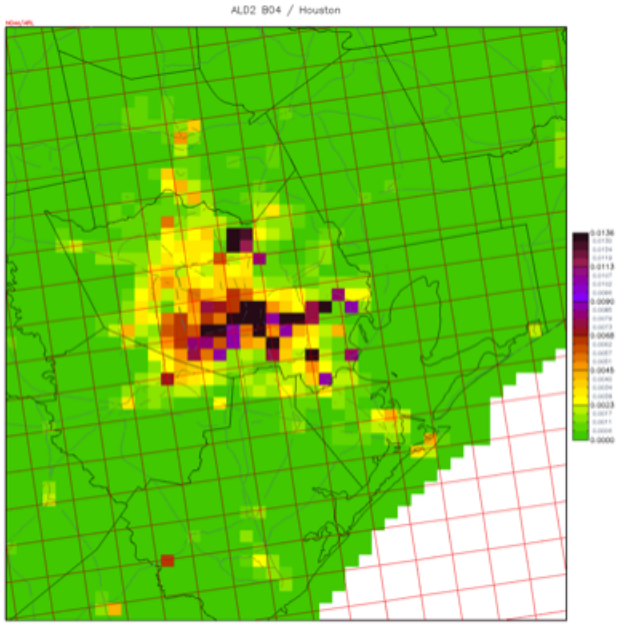
Emission work for RLL 4km grid is Progressing. Vigorous testing and visualization are imperative

Fractional weighting (mass)

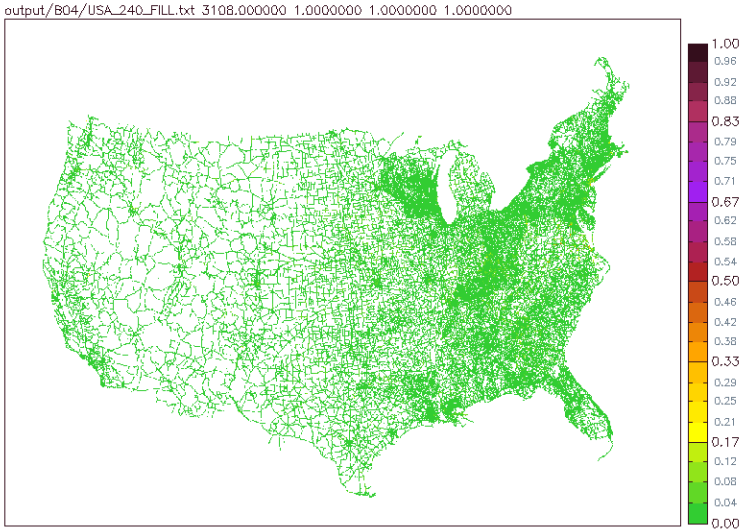


Spatial regridding : B04 → 5X domain

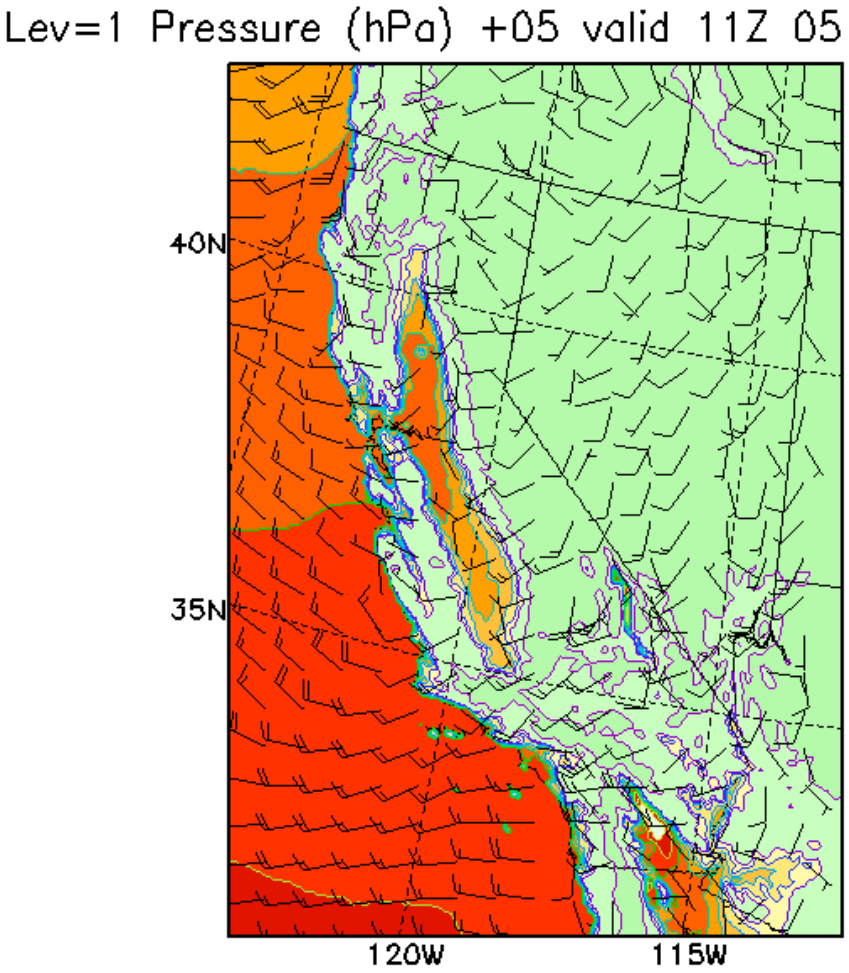
main: ~ 4 km grid



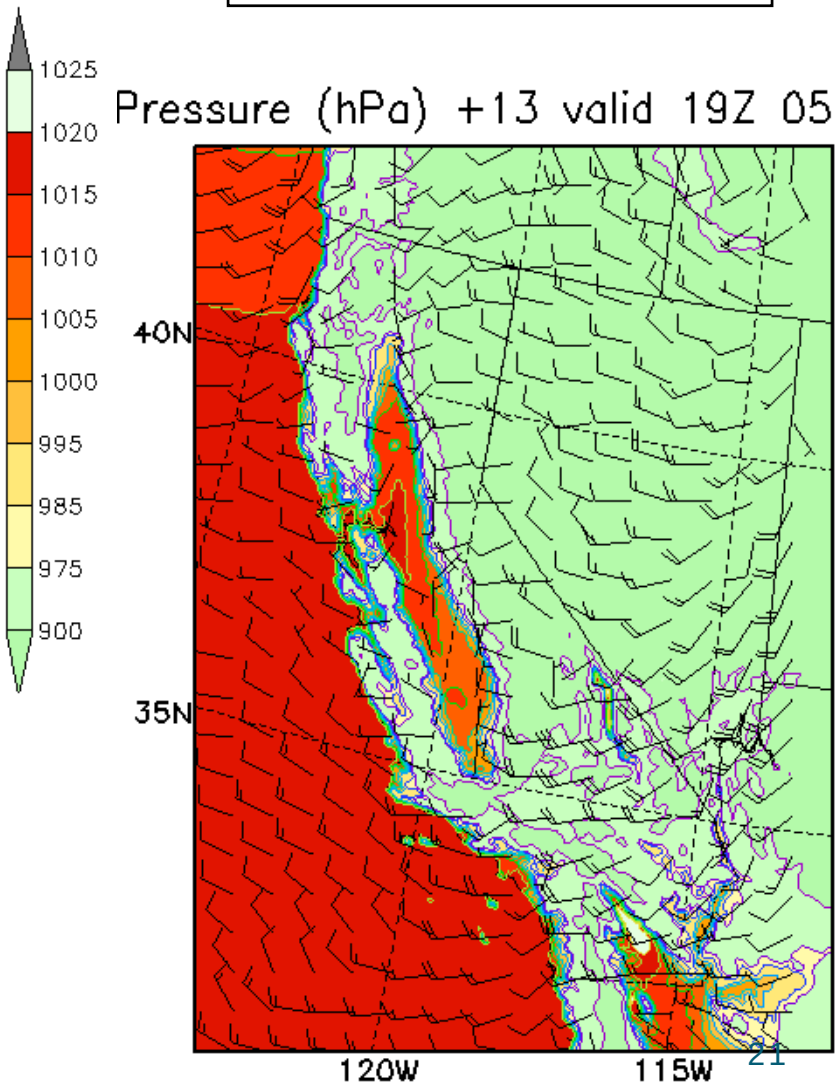
Example of Mobile Emission Surrogate (road-lengths) for 4km grid



Surface pressure and wind barbs; Both verified reasonably well



NMMB launcher run for CalNex period



Summary

- **Highlighted model-configurations and timing of model product support during the campaign**

- **Important to account both intra- and Exo-domain wild fire Emissions:**
  - **Wide-spread in geographical areas and frequent over time**
  - **Real-time ingestion of these information can help next campaign**

- **Gearing up for next campaigns with 4km forecasting capabilbities**

Backup slides

NDAS Assimilates the following important variables

obs data stream	Data acquisition platforms
Wind profiles	Doppler radar, Satellites (QuikScat, ENVIRSAT, ADM, AVHRR,OMI,….), TDWR
Cloud top temperature & Z	AQUA, AIRS
Precipitable water	METNET GPS-based instrument, Satellites (EUMETSAT, IFLOWS..)
Snow cover	MIRS
Skin temperature	Mesonet, MADIS, MIRS
Temperature profile	TAMDAR, ACARS,
Surface emissivity	MIRS,…
radiance	Satellites (ENVIRSAT, METEOSAT,..)
PBL	ACARS, Satellites (GPS-RO)
O3 – column and profile	Satellites (AVHRR, AURA POES, TES, OMI)