Real-Time Monitoring of Gases and Aerosols Reveals Source Contributions

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Imagine

- Strategically located monitoring site(s)
- Real-time back trajectory modeling
- Continuous gas and aerosol monitoring
- Signal processing to update frequently known and unknown source location and emission rates

Case Study: Coal Fired Power Plant

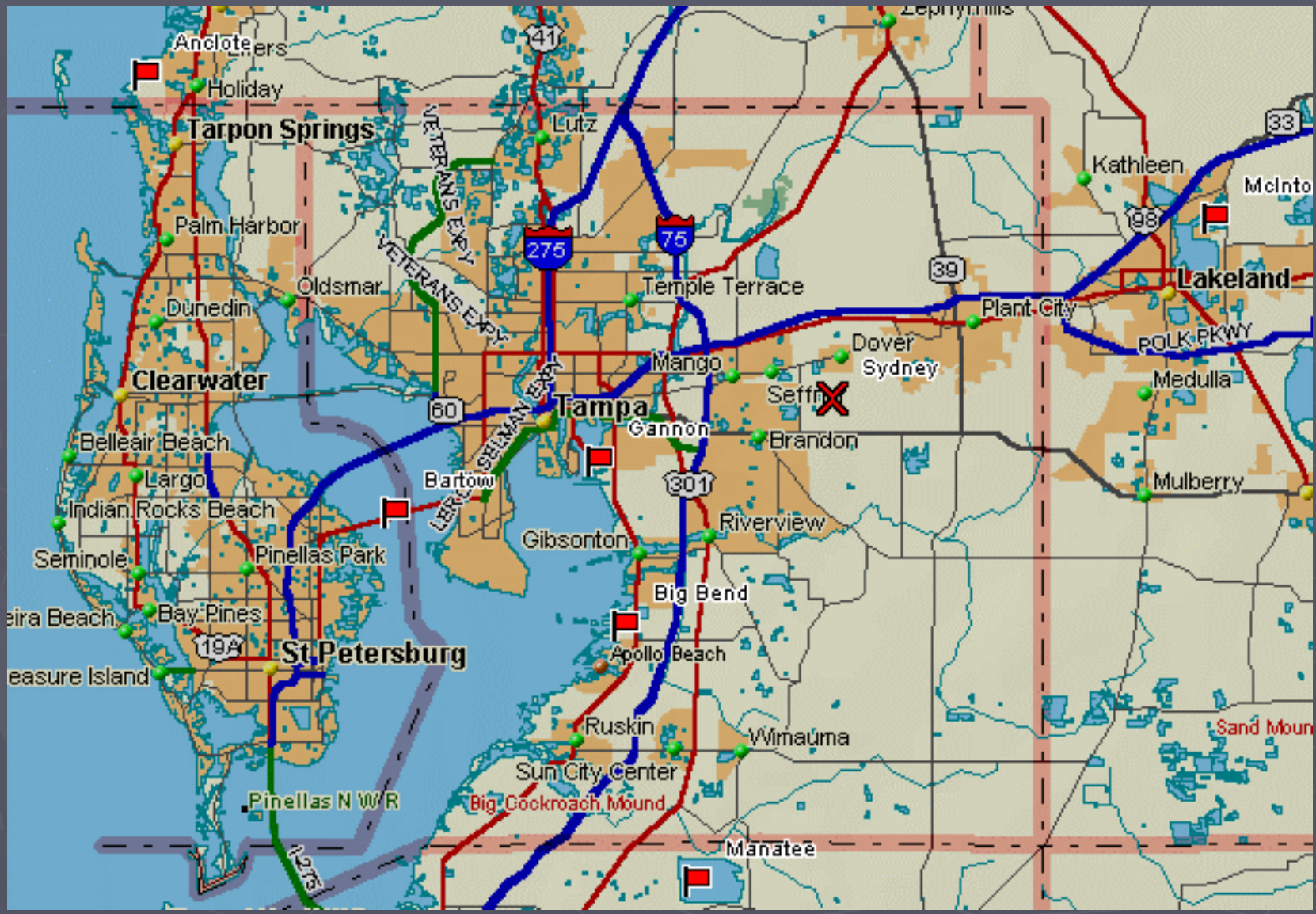
- Review time series data for SO_2 spike and verify that spike is highly correlated with NO_y and HCl
- Review gas and aerosol correlations to help identify plume
- Calculate a dispersion factor χ/Q using receptor SO_2 concentrations and hourly stack emission rate
- Use this χ/Q to estimate stack metals emissions from receptor metals concentrations.
- Corroborate plume identity with air dispersion modeling of SO_2 emissions

Measurements

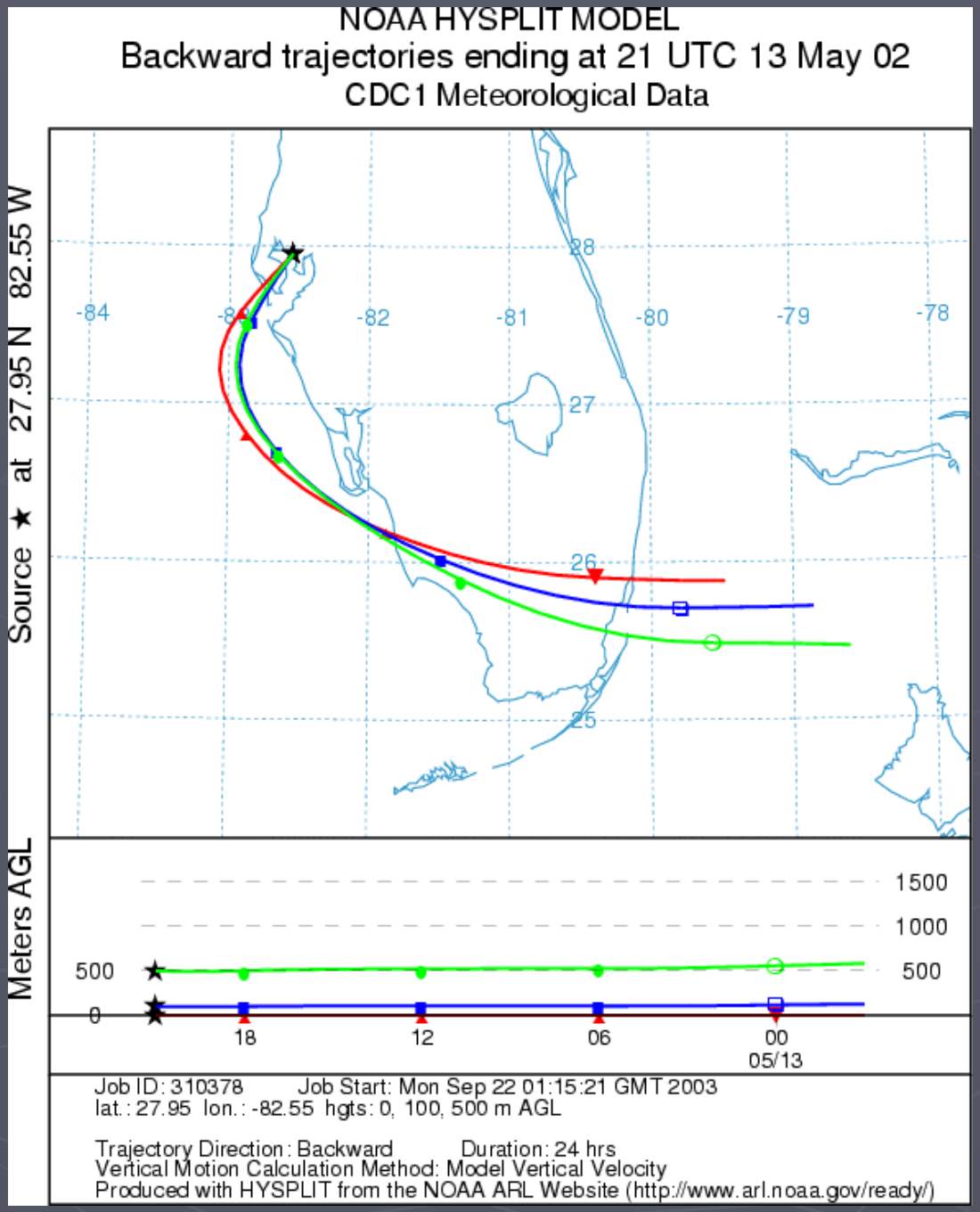
Sydney, Florida
May 2002

30-min Al, As, Cd, Cu, Cr, Fe, Mn, Ni, Pb, Se, Zn
15-min Cl, NO_2, NO_3, SO_4, oxalate, NH_4
15-min HCl, HONO, HNO_3, SO_2, oxalic acid, NH_3
1-min SO_2, NO, NO_2, NO_x, NO_y, HNO_3
2-min meteorology

Geography


Anclote
Holiday
Tarpon Springs
Palm Harbor
Dunedin
Clearwater
Belleair Beach
Largo
Indian Rocks Beach
Seminole
Bay Pines
St Petersburg
Pinellas Park
Oldsmar
Lutz
Temple Terrace
Tampa
Gannon
Bartow
Gibsonton
Riverview
Big Bend
Apollo Beach
Ruskin
Sun City Center
Big Cockroach Mound
Pinellas N W/R
Manatee
Dover
Sydney
Mango
Seffner
Brandon
Plant City
Lakeland
Kathleen
Medulla
Mulberry
Sand Mound
41
275
75
60
301
39
98
33
19A
VETERANS EXPY
CROSS-SELMAN EXPY
POLK PKWY

Wind Trajectories



Acknowledgment
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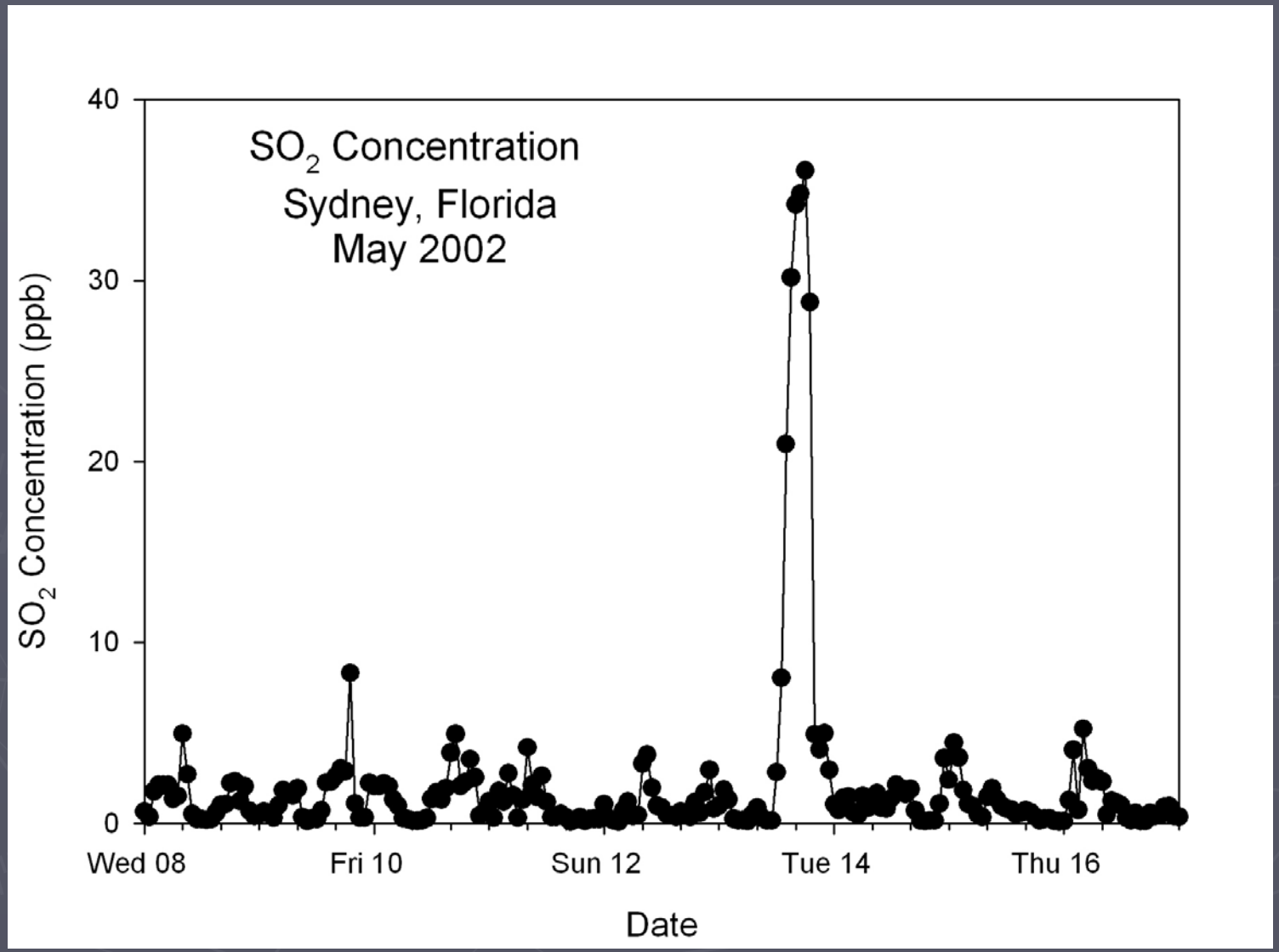
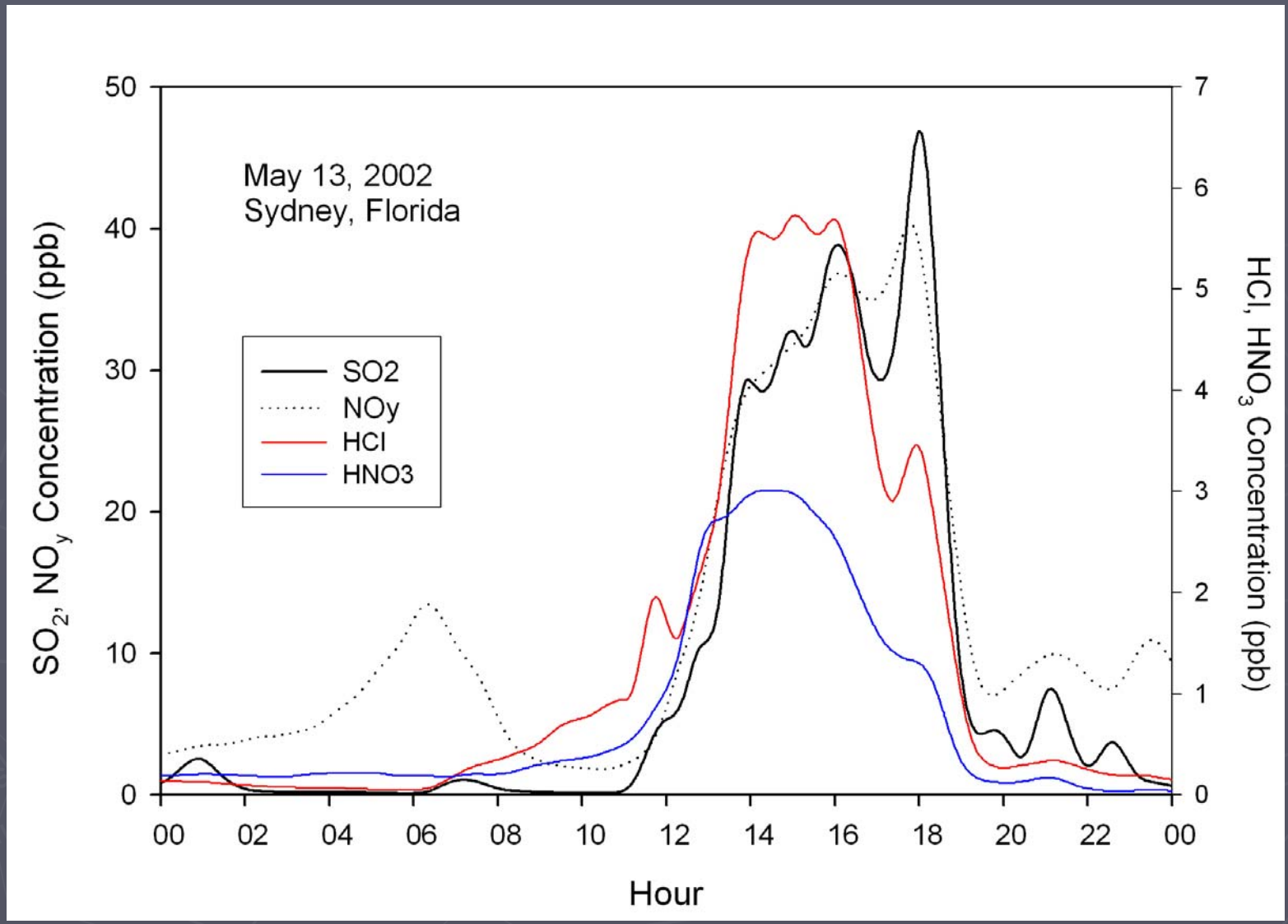
Power Plant Plume?



Power Plant Plume?



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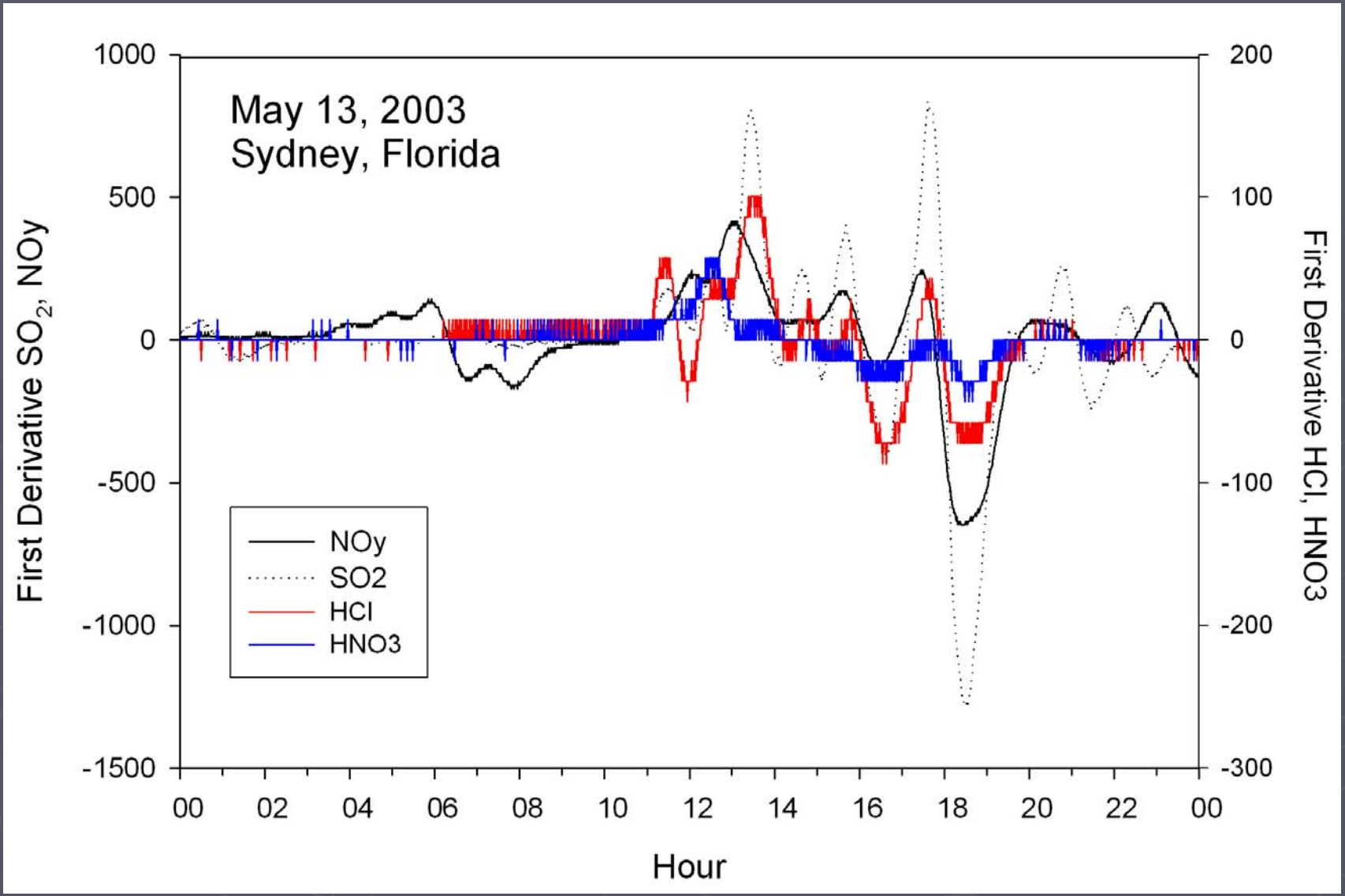
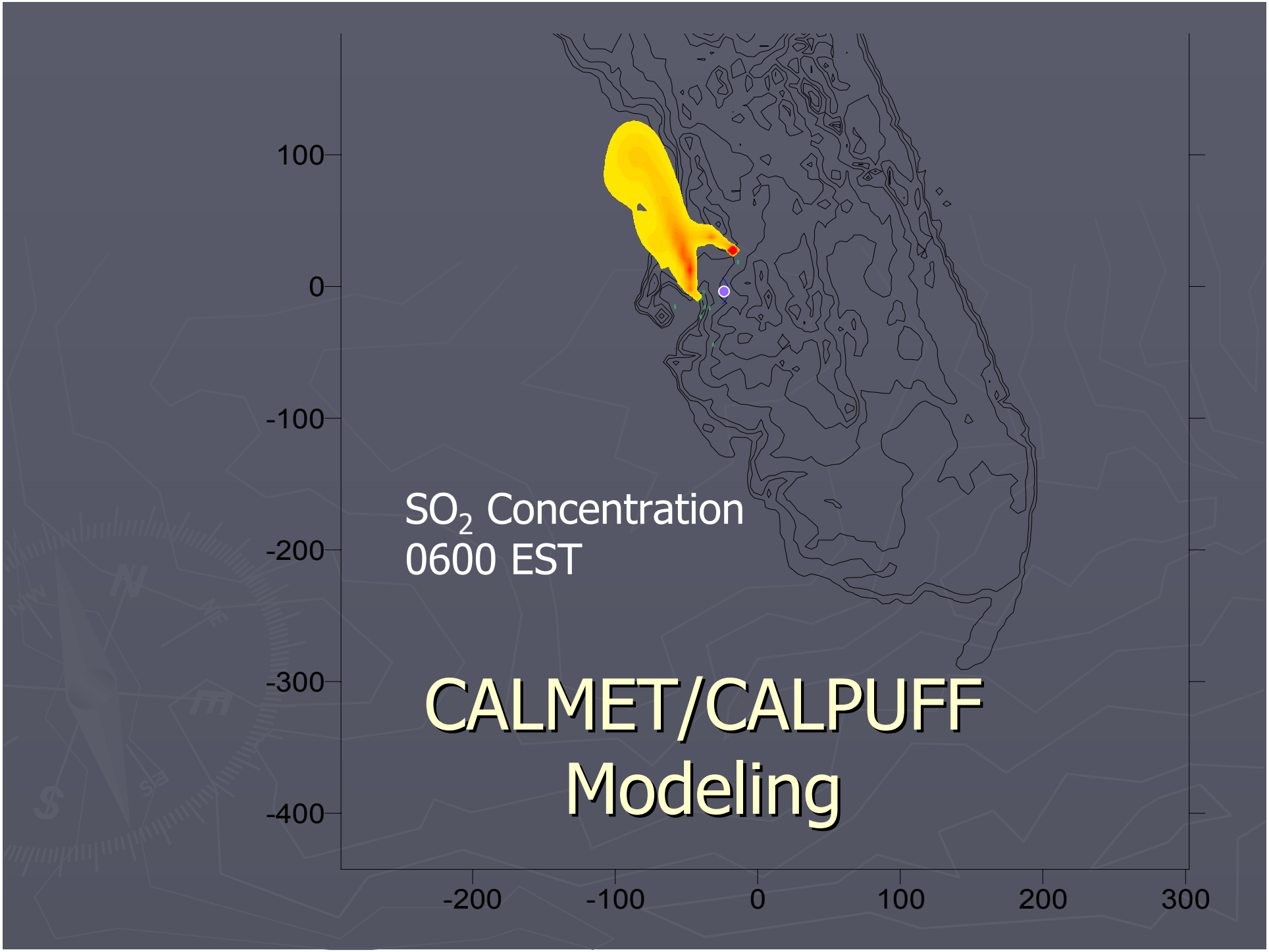
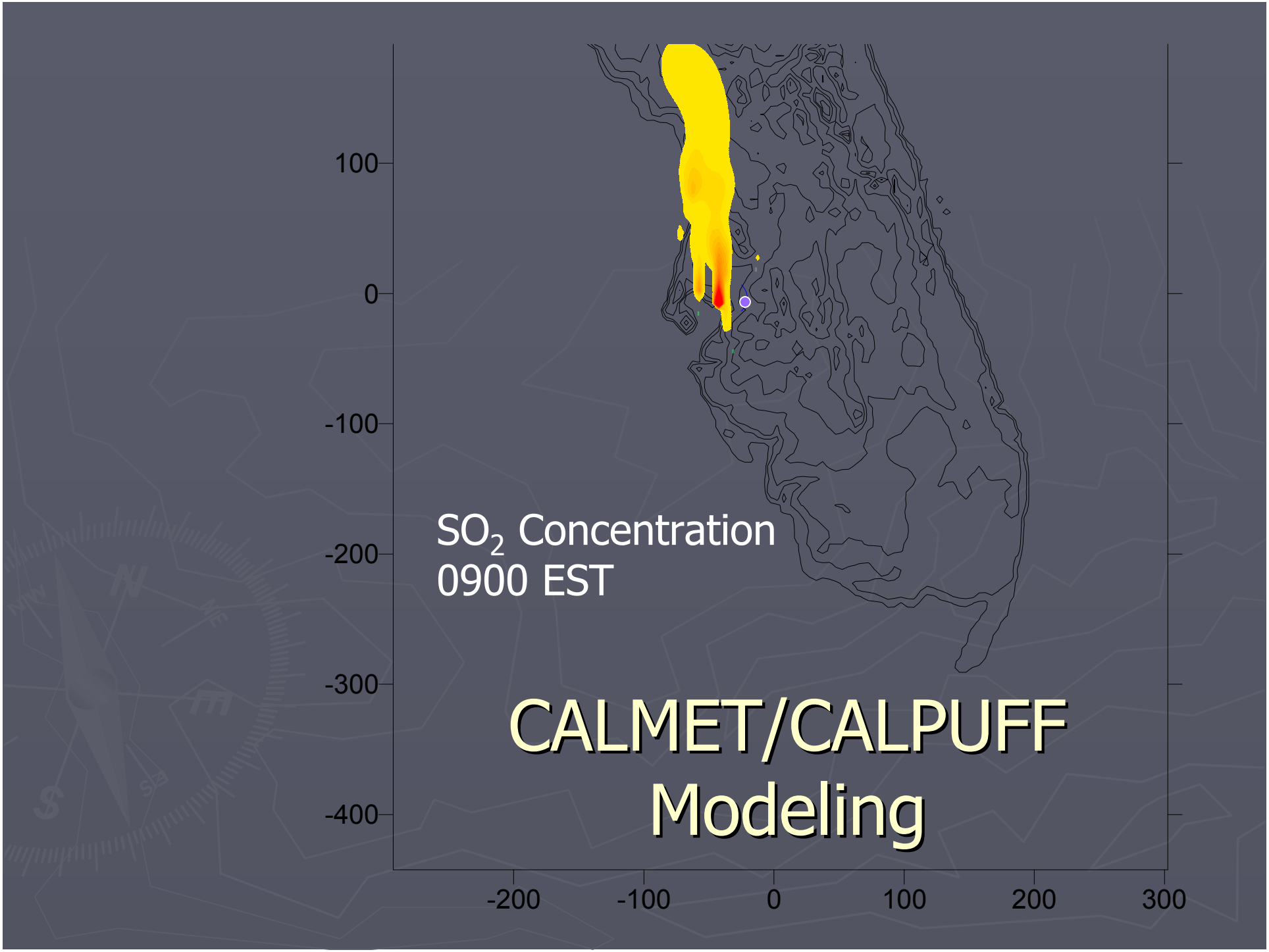
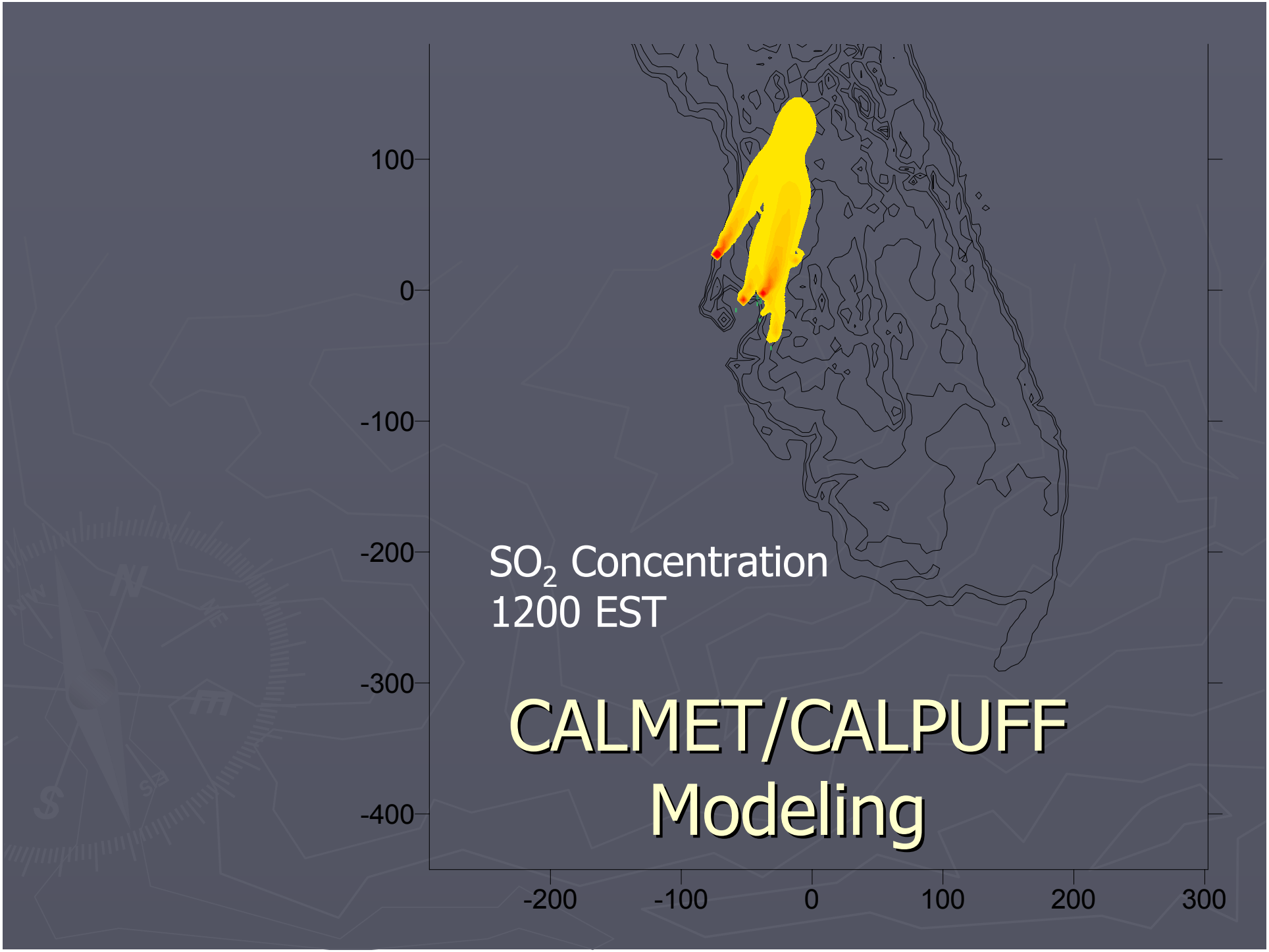




CALMET/CALPUFF Modeling


100
0
-100
-200
-300
-400
-200
-100
0
100
200
300
SO_2 Concentration
0900 EST
CALMET/CALPUFF
Modeling



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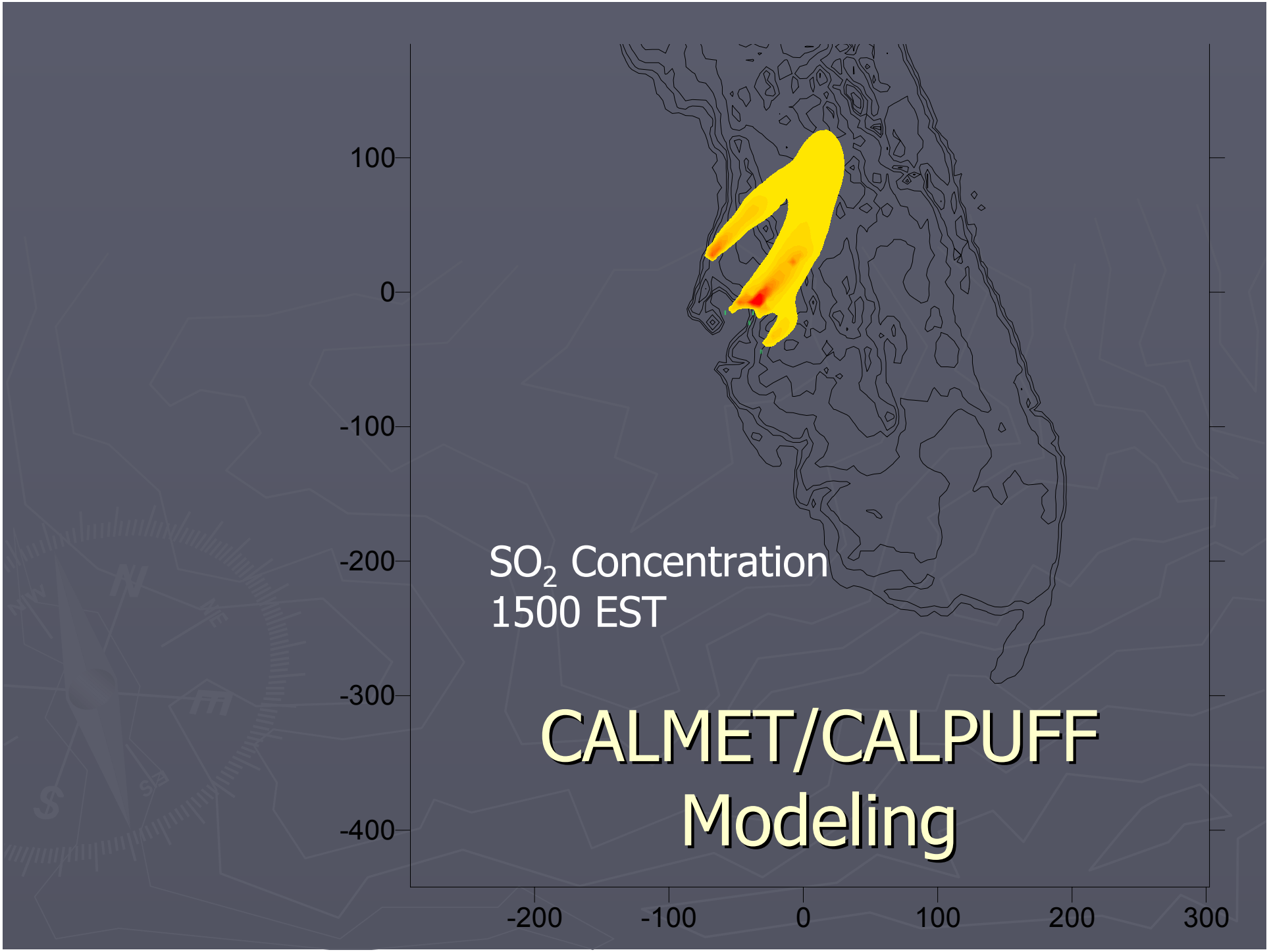

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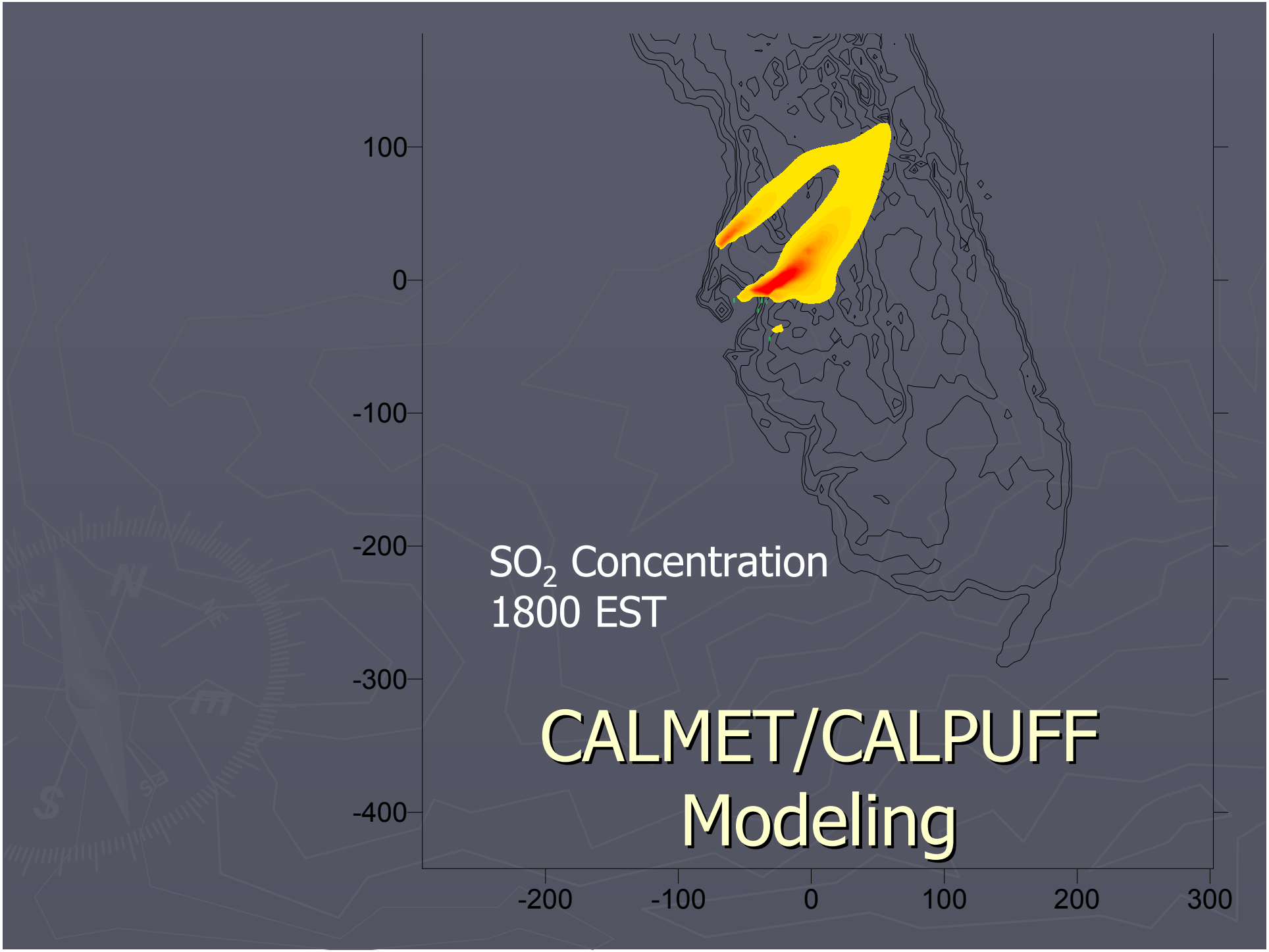

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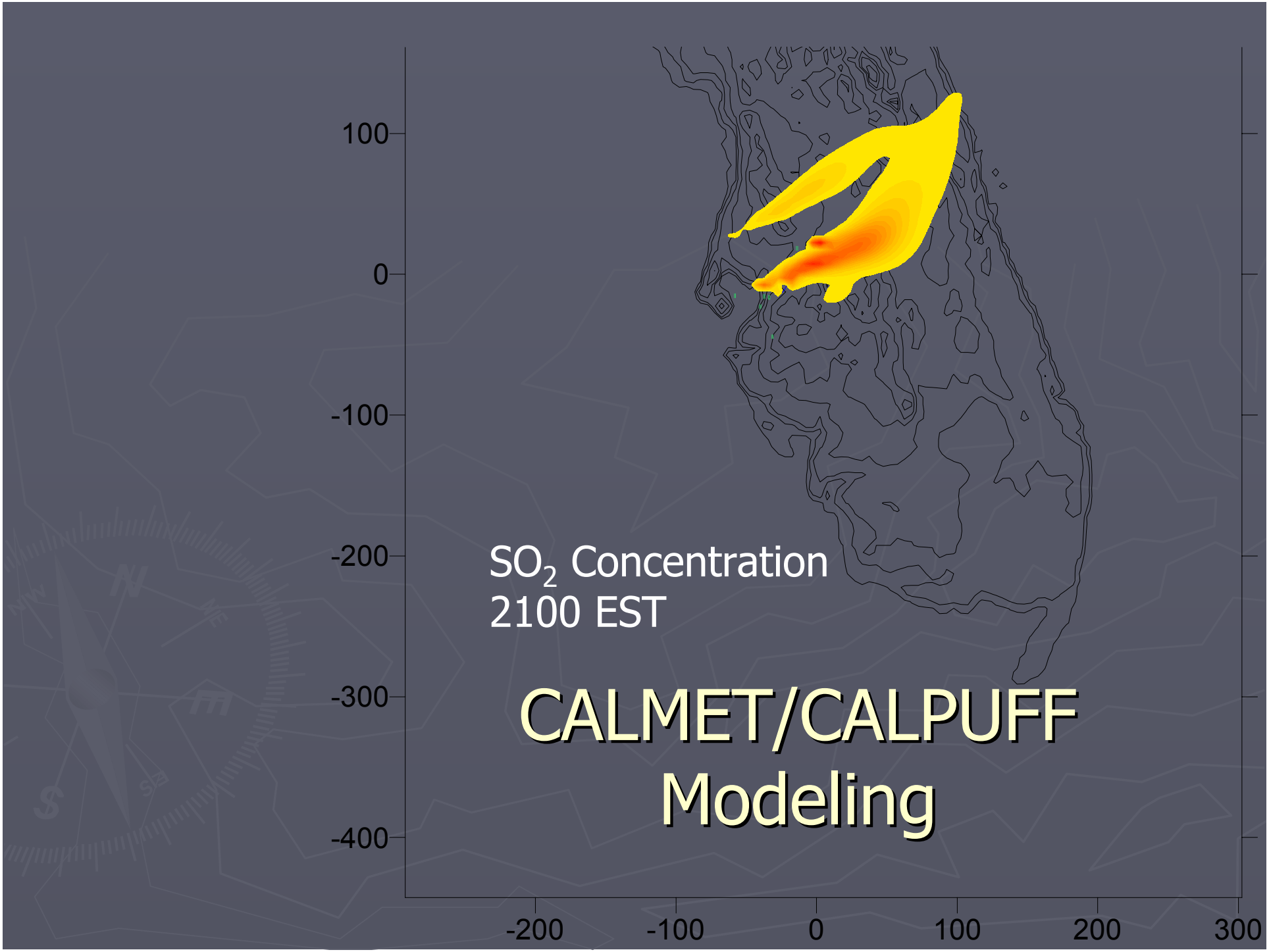
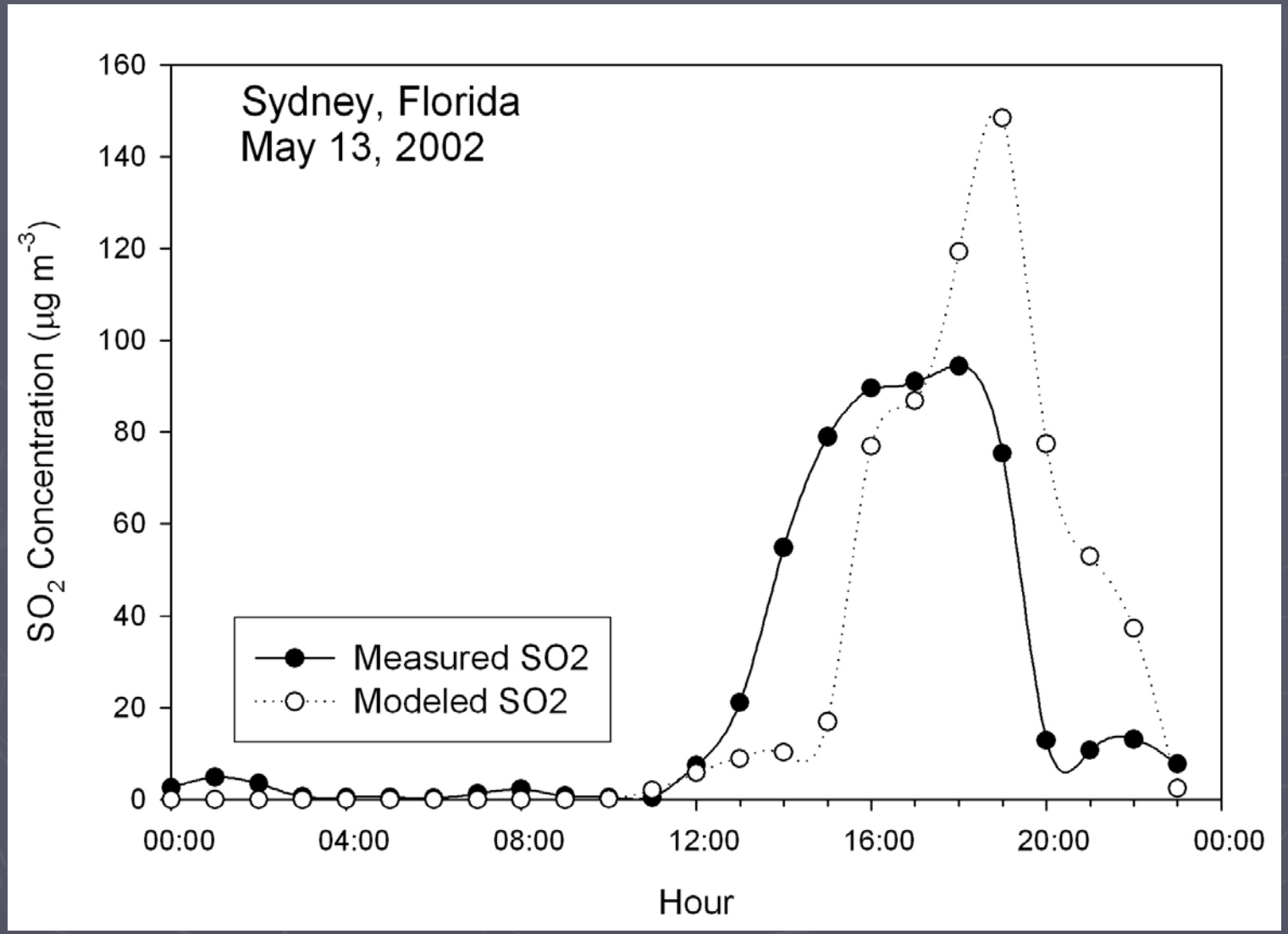
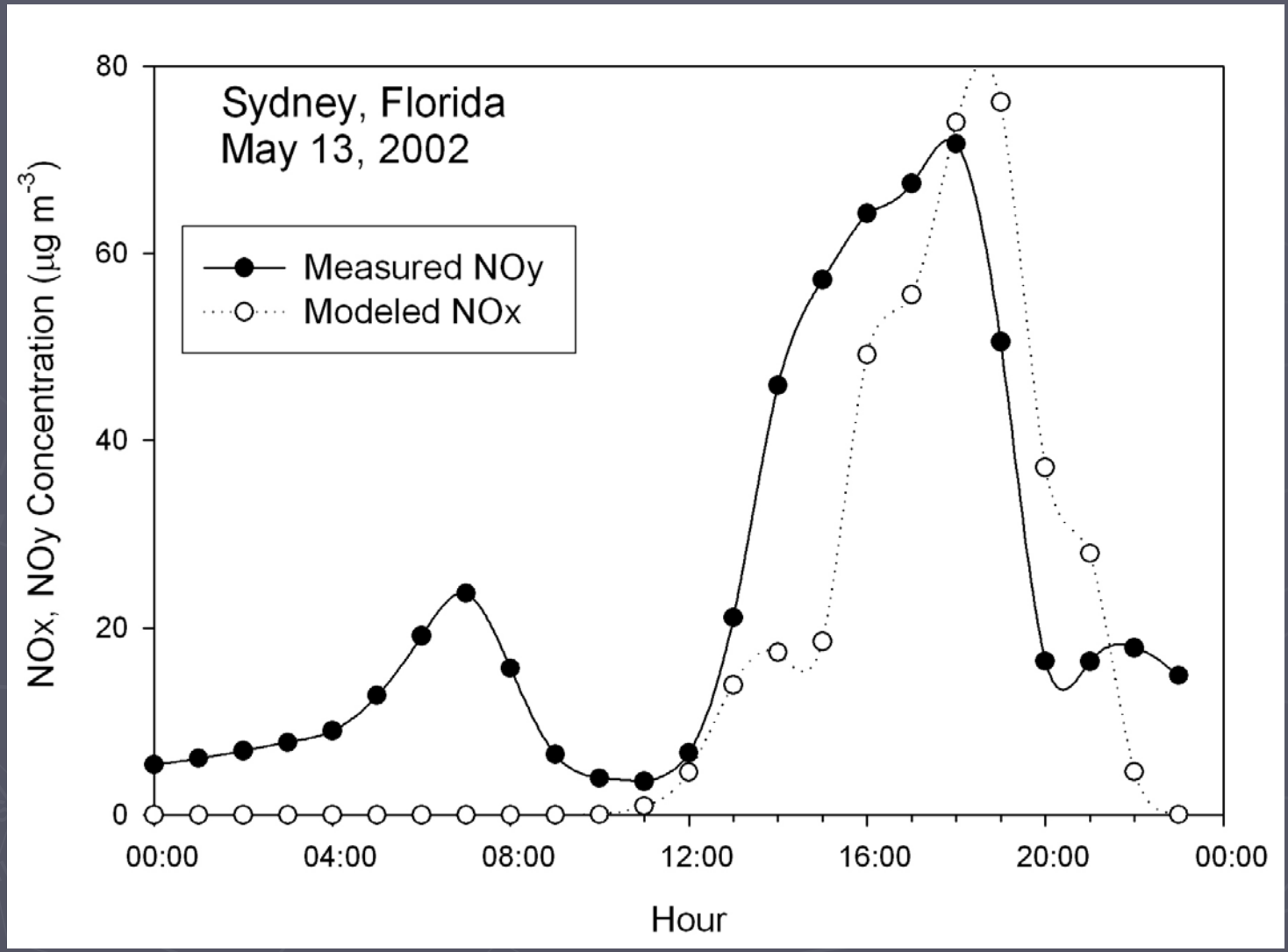


CALMET/CALPUFF Modeling

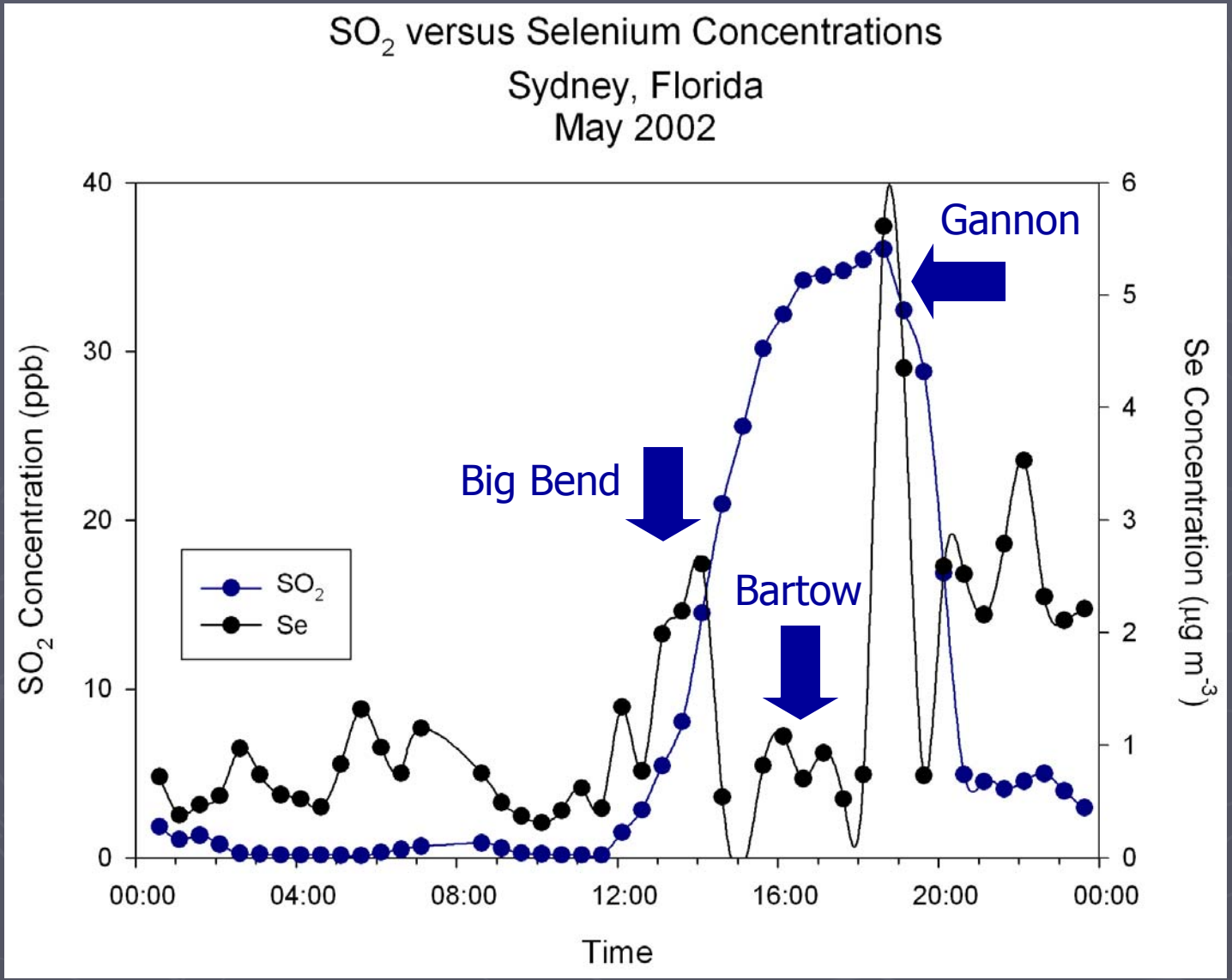
Modeled vs. Measured SO_2



Modeled vs. Measured NOx



Power Plant Plume?



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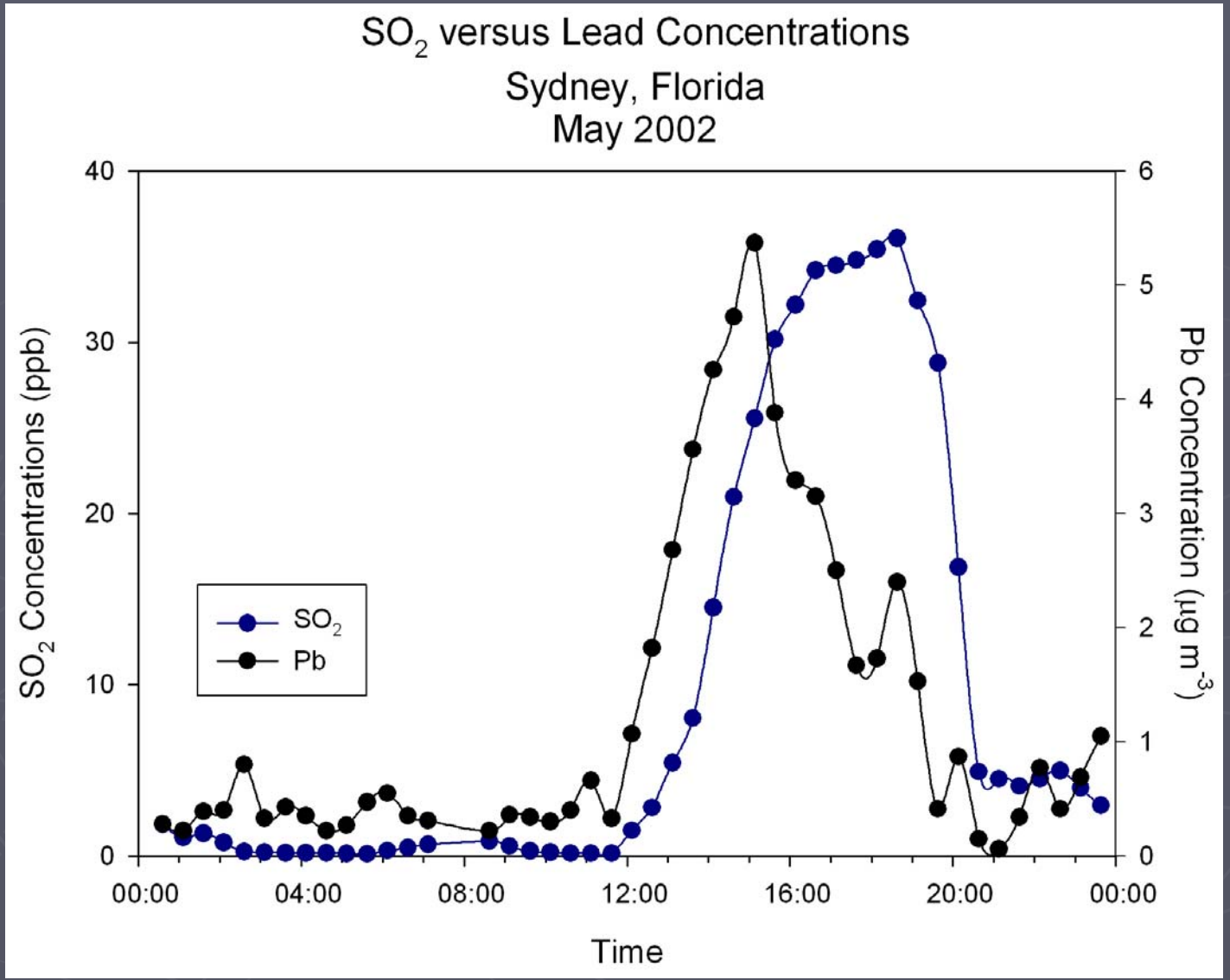

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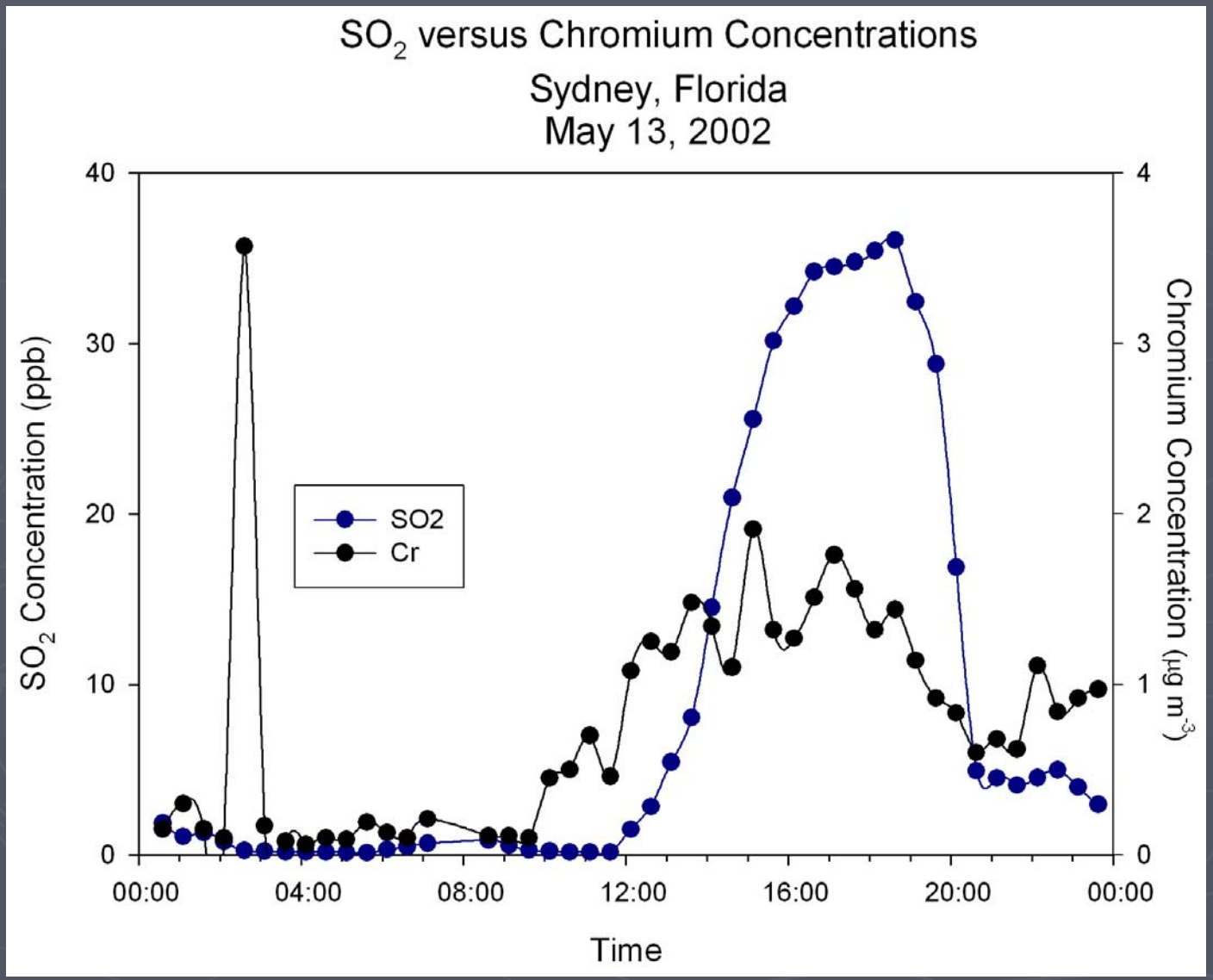

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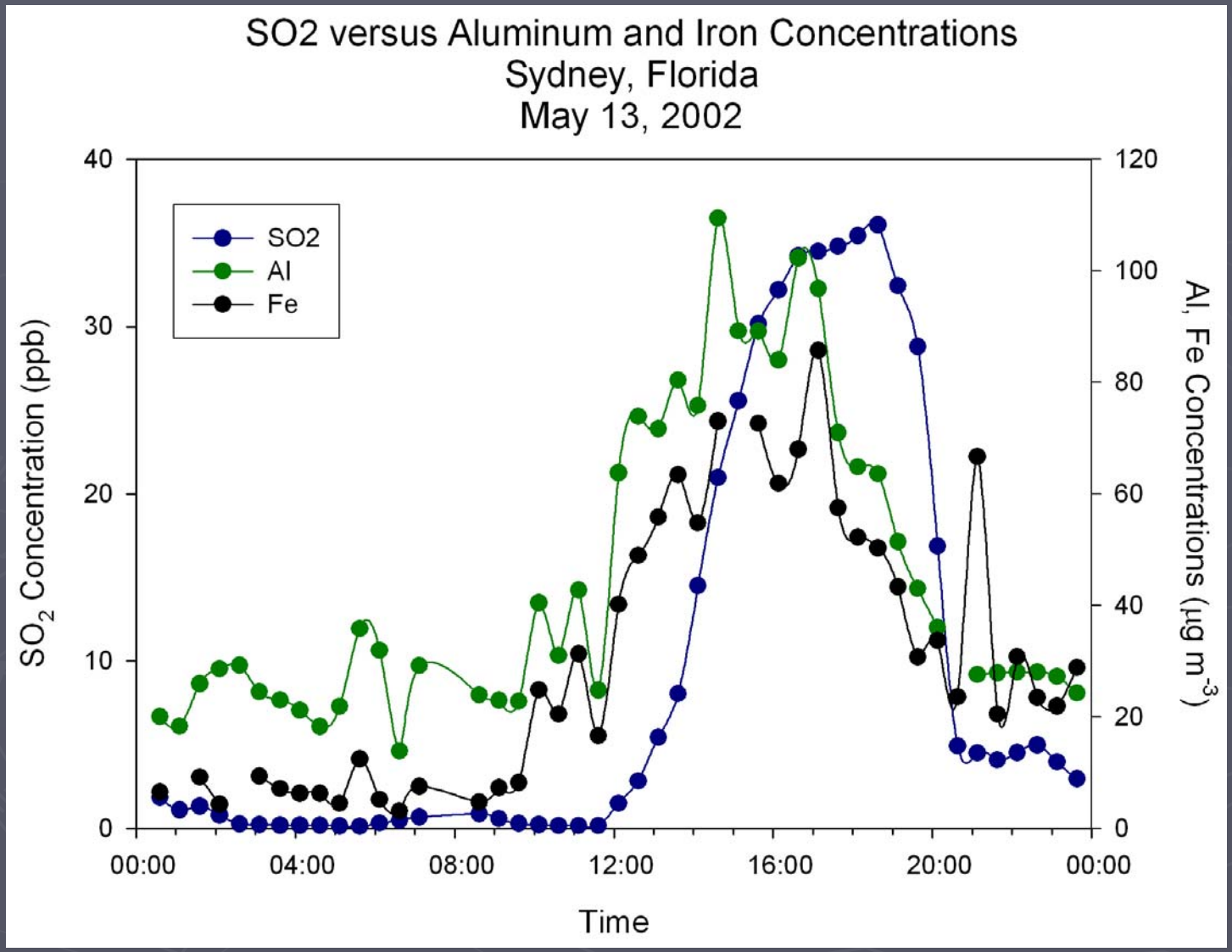
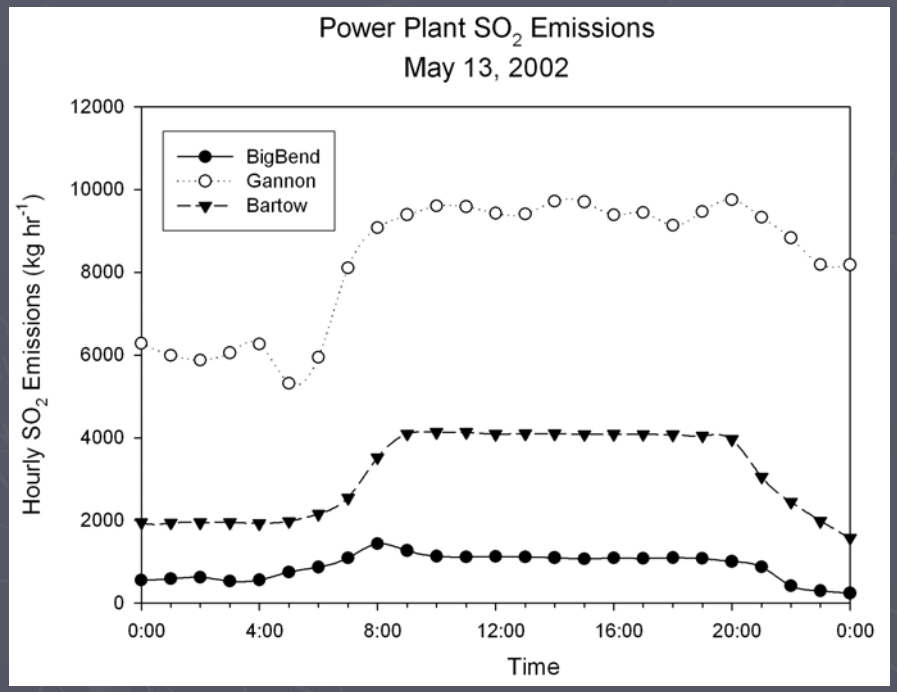
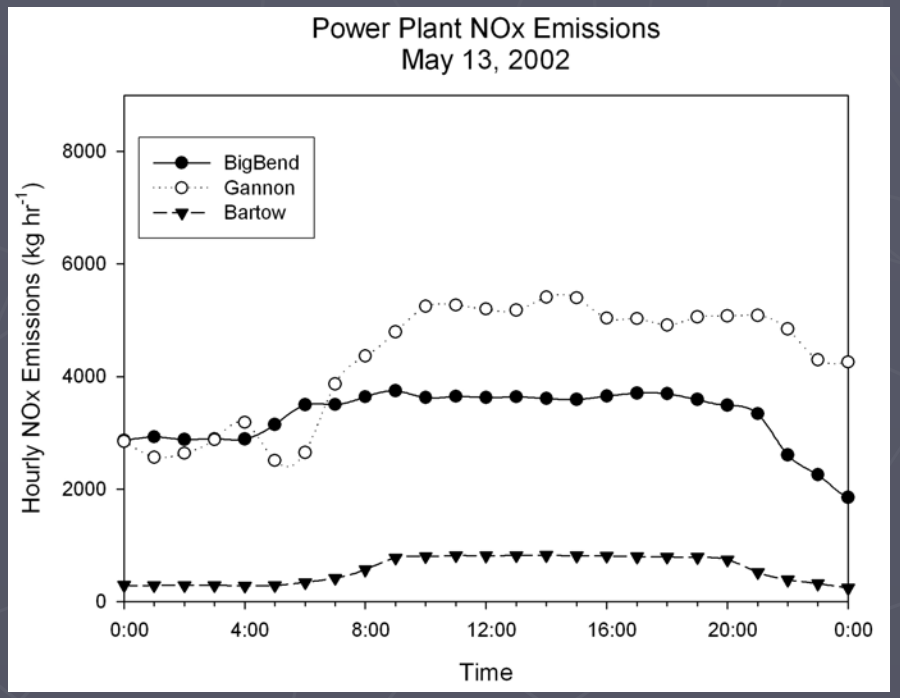


Hourly Power Plant Emissions





Gannon Power Plant

Species	χ (ng m^{-3})	Q (g s^{-1})	χ/Q (s m^{-3})
SO_2	94,000	2,600	3.6E-8
$NO_{y,x}$	72,000	1,400	5.1E-8
Al	63	1.7	3.6E-8
Cr	1.4	0.04	3.6E-8
Cu	1.5	0.04	3.6E-8
Fe	50	1.4	3.6E-8
Mn	0.09	0.002	3.6E-8
Ni	1.4	0.04	3.6E-8
Pb	2.4	0.07	3.6E-8
Zn	4.8	0.13	3.6E-8

Gannon Power Plant Emissions

Metal	Estimated (lbs yr^{-1})	2001 TRI (lbs yr^{-1})
Cr	2,700	740
Cu	2,800	180
Pb	4,600	1,400
Mn	170	1,100
Ni	2,600	700
Zn	9,200	550

Acknowledgements

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