Updated MM5 Simulations:

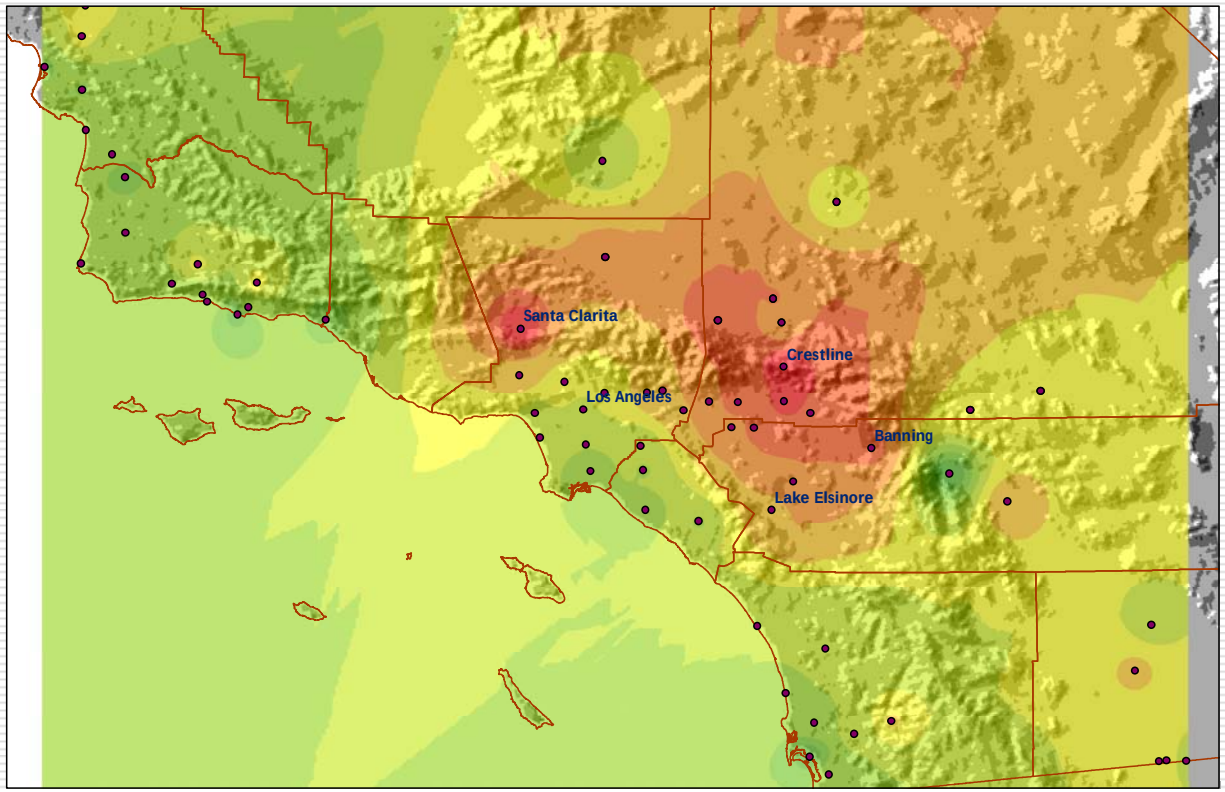
Flow toward Santa Clarita areas

March 14, 2007

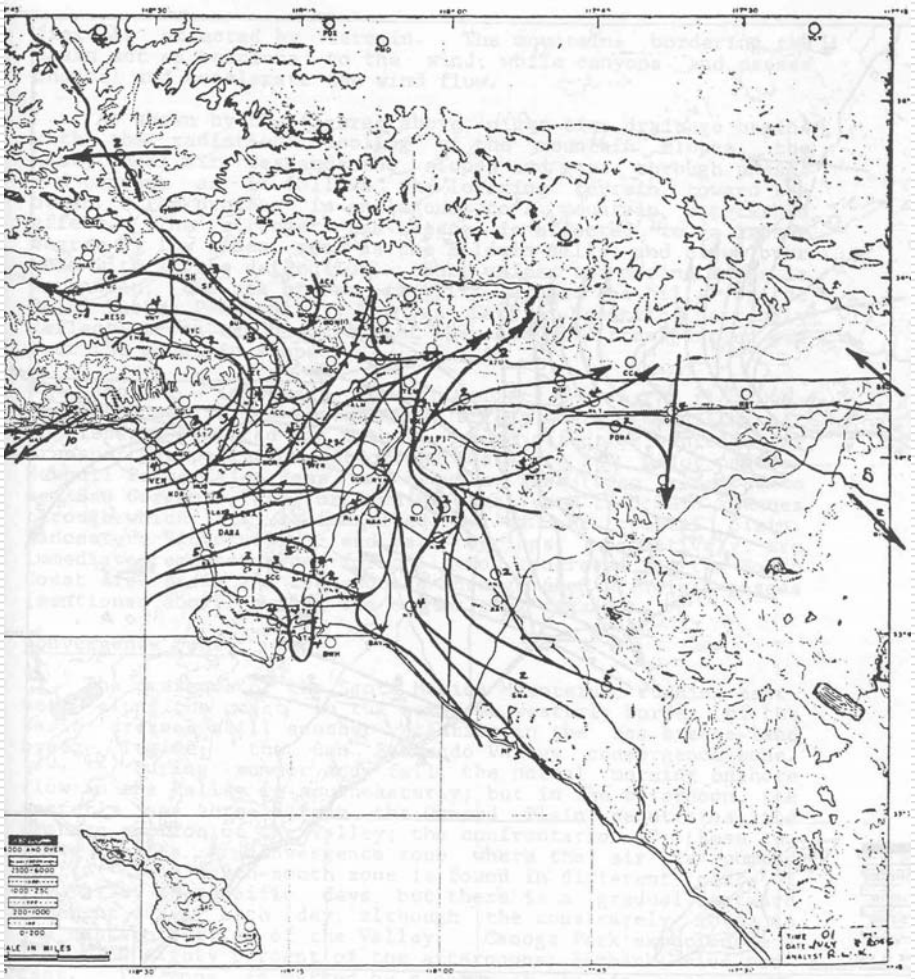
Ozone double peak pattern

Max 1-hr O_3 on July 16th, 2005: 173 ppb at SCLR

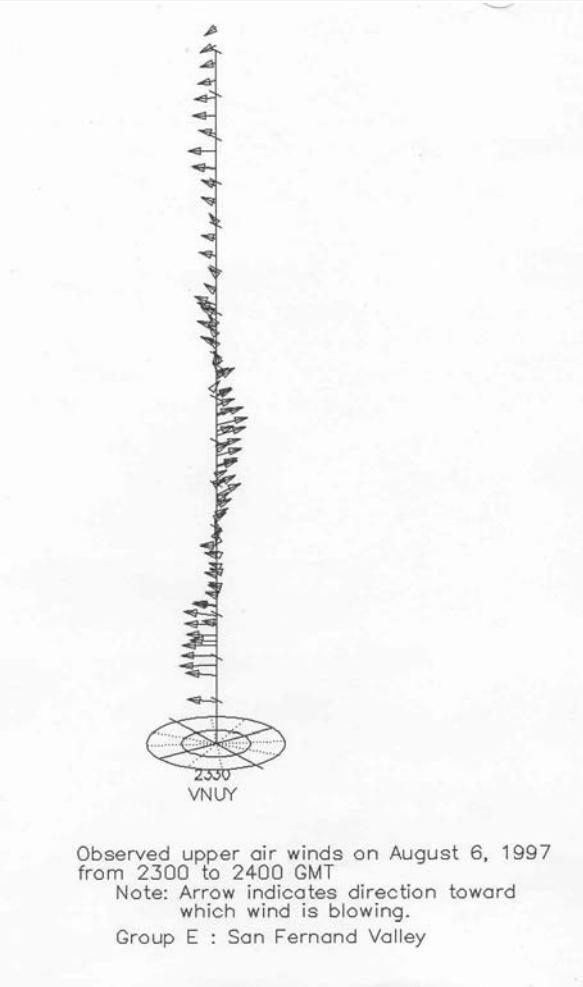
July 16



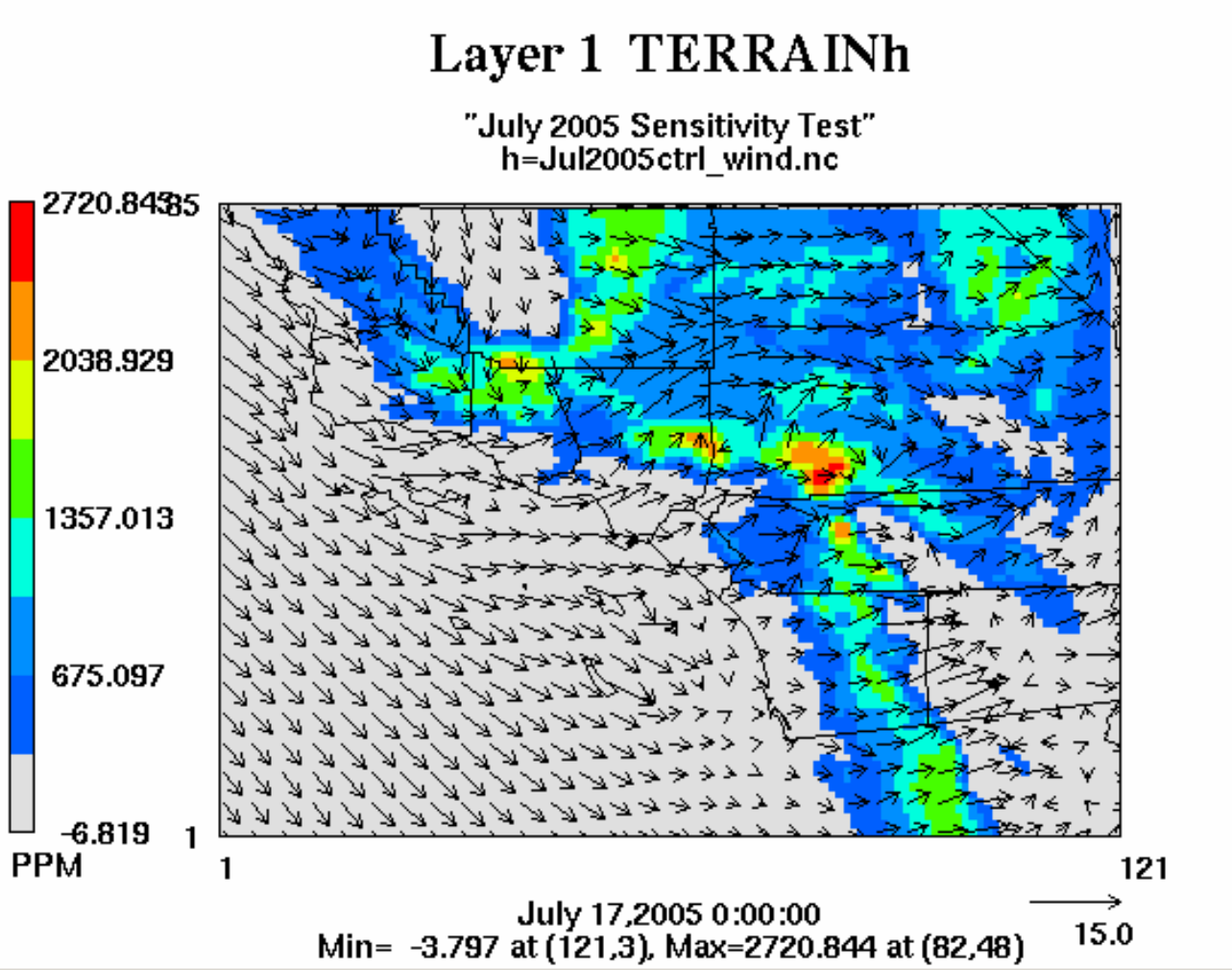
Flow Characteristics



The most frequent basin wind flow during July at 0100 PST (A Climatological Air Quality Profile, California South Coast Air Basin)



Typical MM5 simulation results



Proposed Methodology

Increase surface drag via z_0

- Default z_0 values
  - Over the water: Charnock (1955) formula

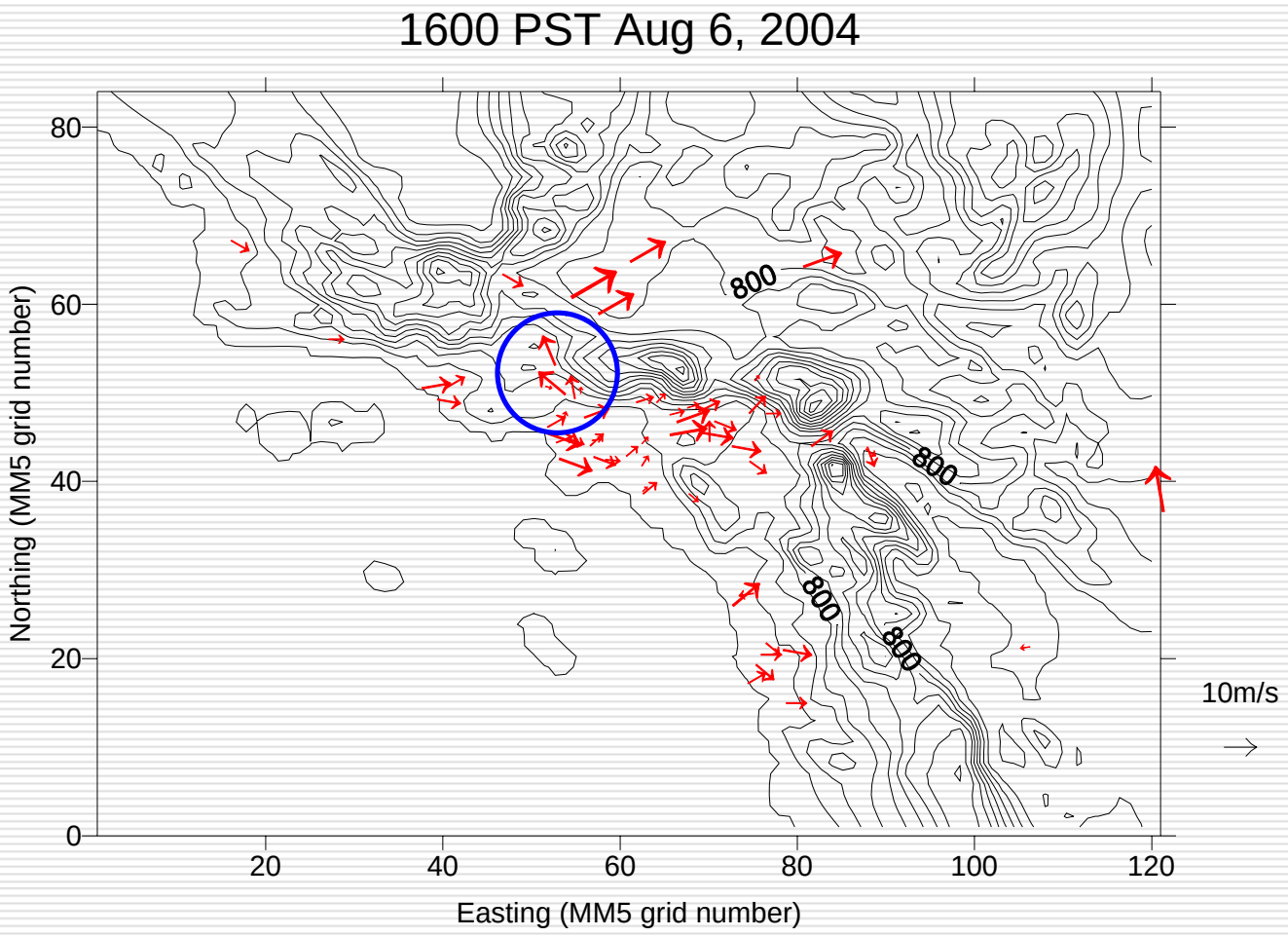
$$z_0 = 0.032 u_*^2 / g$$

  - For the episode cases, z_0 ~ O(0.01) cm
  - Urban = 0.5 m
- Modifications
  - water: z_0= 0.1 cm
  - urban =1.5 m
  - The rest of LU categories: increased by two times

Increase soil layer moisture availability

- Other studies:
  - Chen et al. 2001: additional term to account for water usage in urban area
  - TAPM simulation for LA area indicated the need to increase soil moisture content (paper in preparation).
- Modifications
  - Urban: increased by three times
  - The rest LU categories: increased by two times

Nudging observational wind field



1-way Nesting

Domain 1 | Domain 2 | Domain 3

Default options

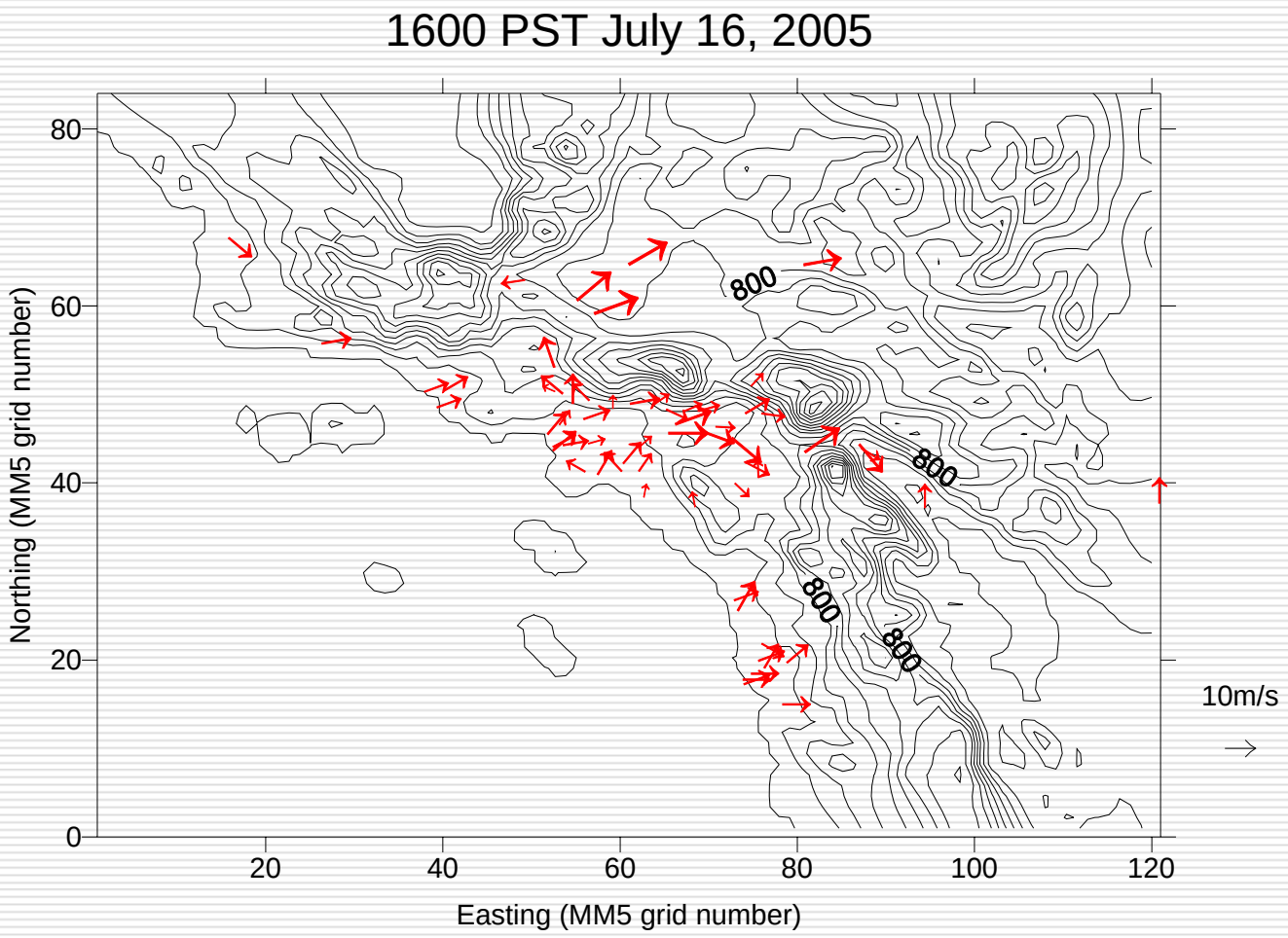
- Two-way nesting
- 3-D & Surface analysis nudging
- no modifications on surface characteristics

Modified Runs

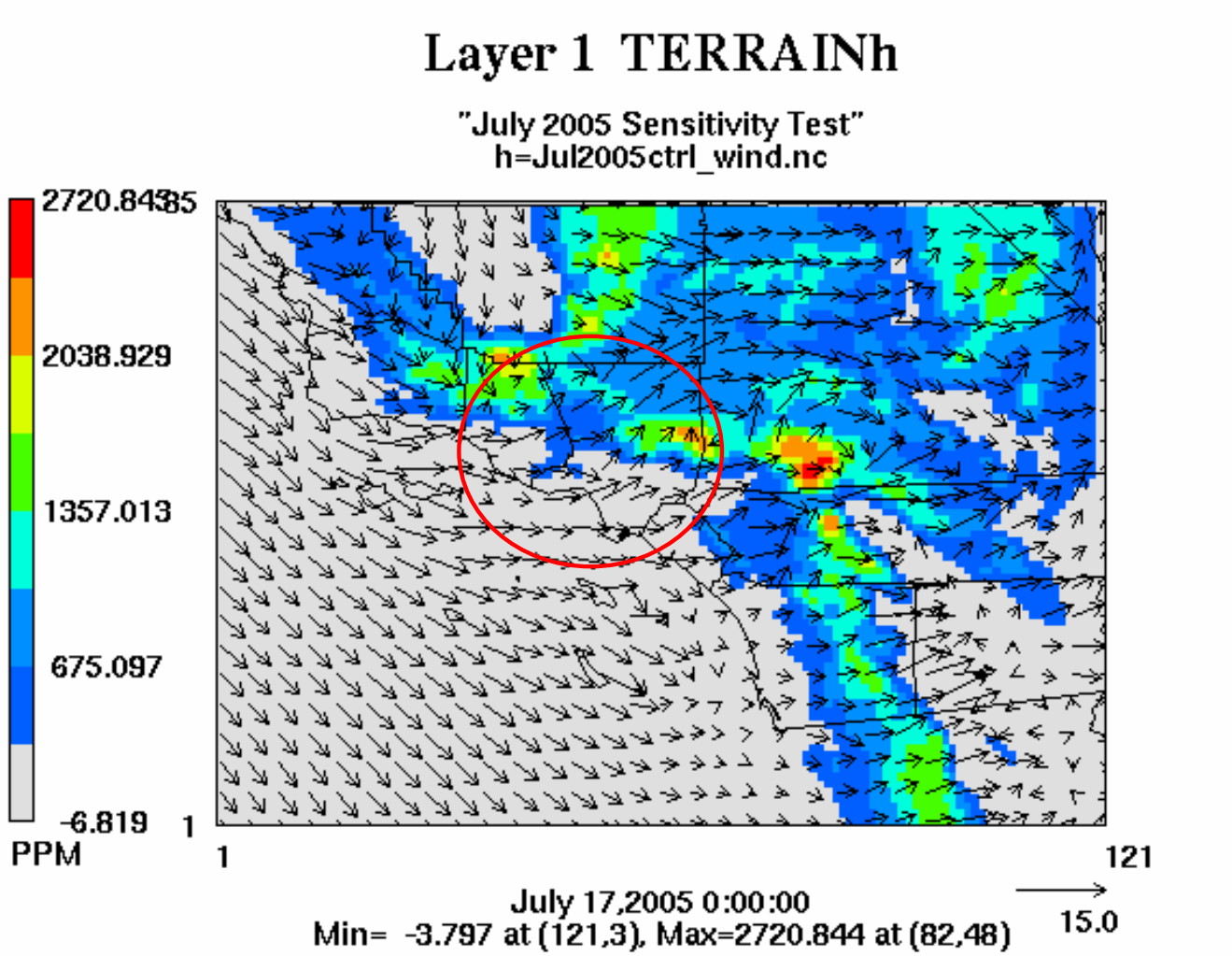
- One-way nesting
- surface observational nudging
- modified surface characteristics

Modeling Results

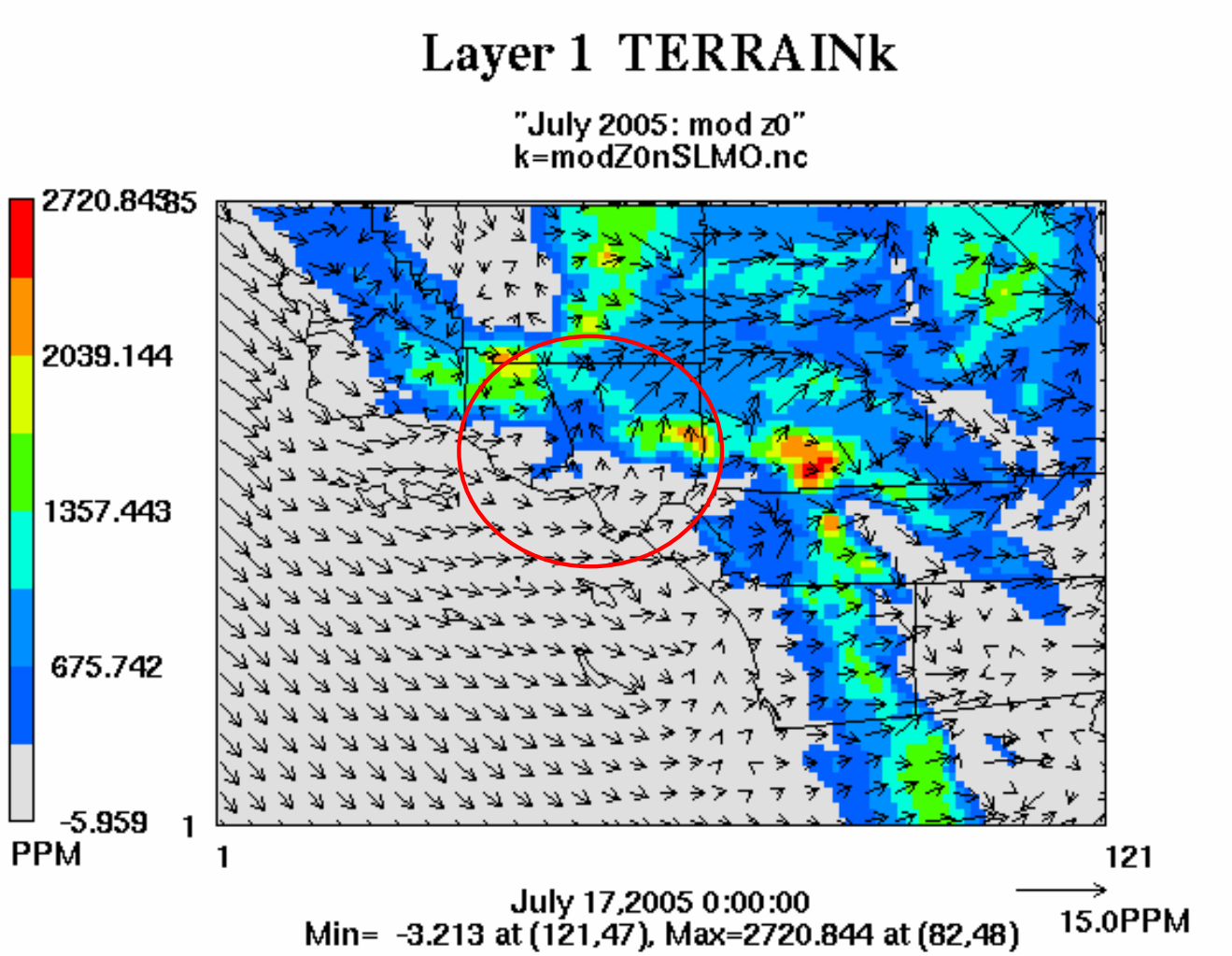
Observed Surface Wind Field



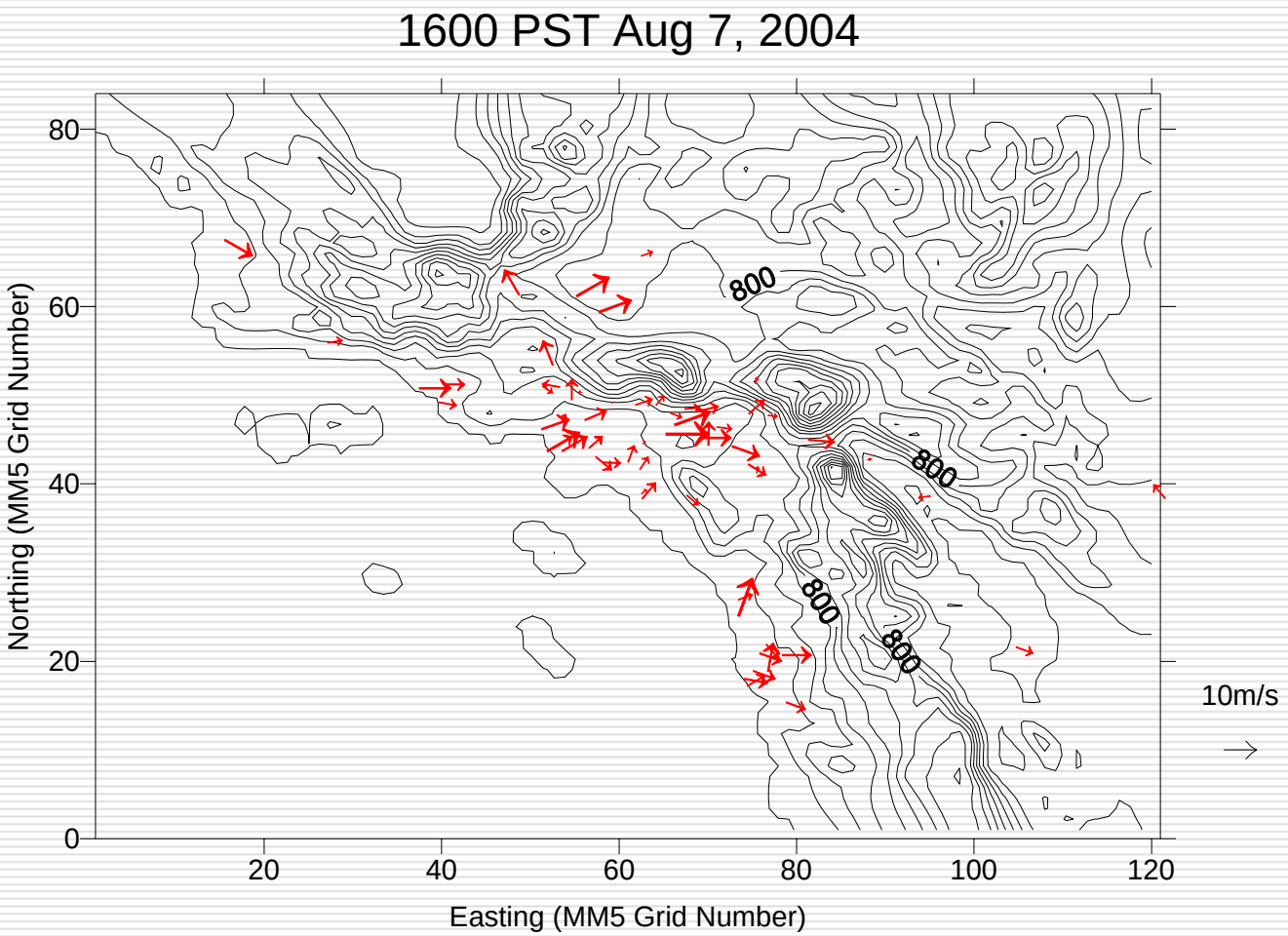
MM5 Base Run


Layer 1 TERRAINh
"July 2005 Sensitivity Test"
h=Jul2005ctrl_wind.nc
2720.84385
2038.929
1357.013
675.097
-6.819
PPM
1
1
121
July 17,2005 0:00:00
Min= -3.797 at (121,3), Max=2720.844 at (82,48)
15.0

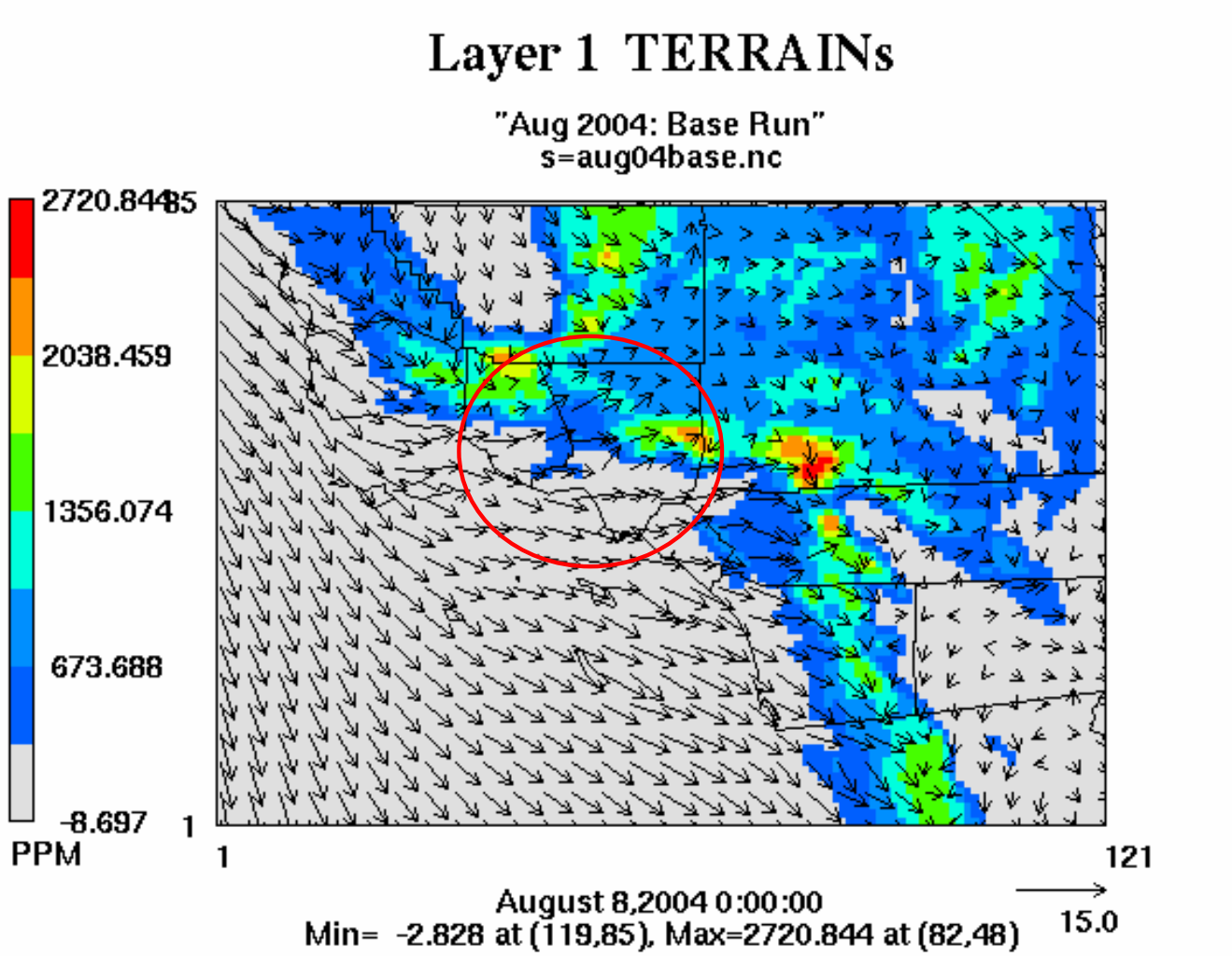
MM5 simulation results: Modified Run



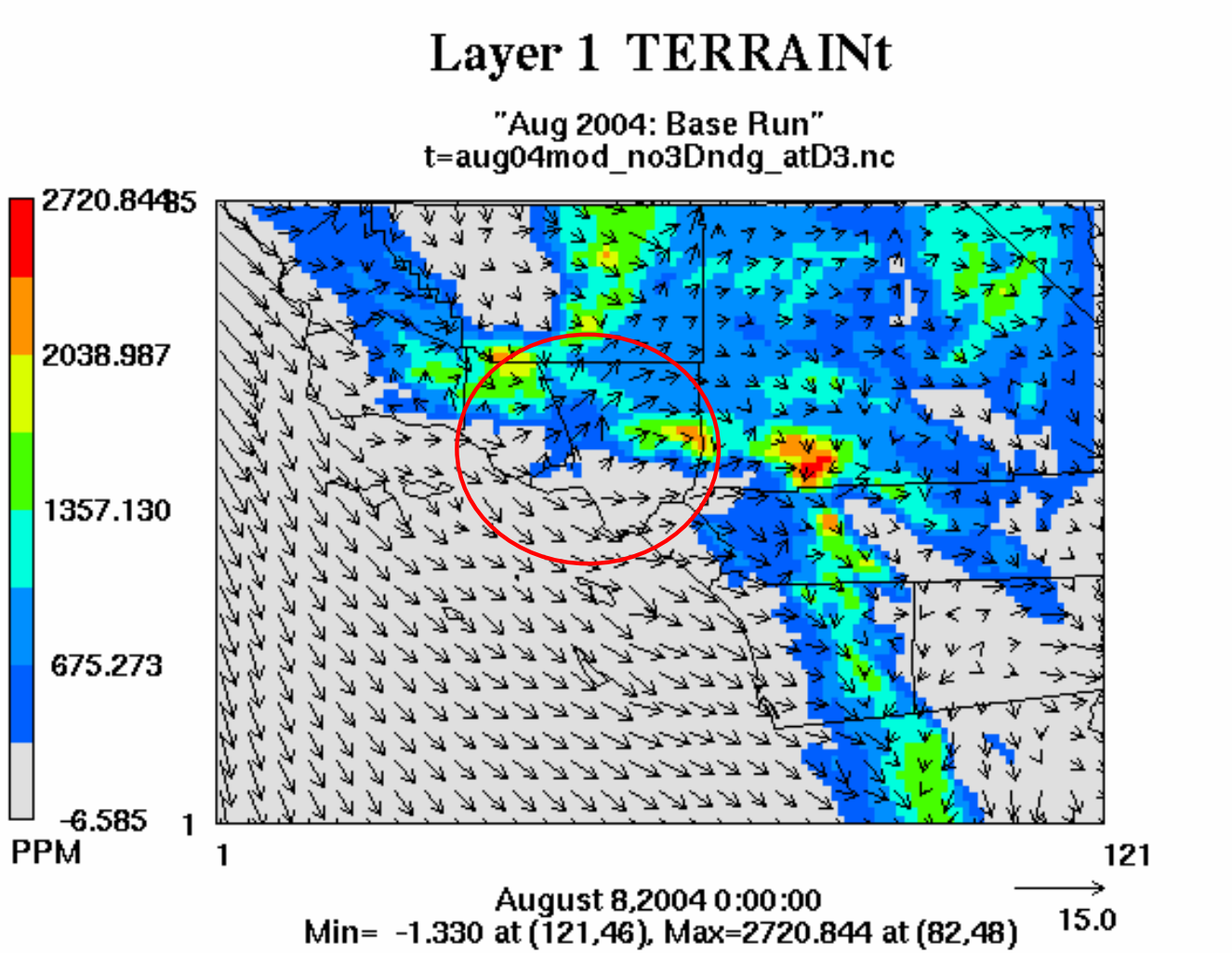
Observed Surface Wind Field



MM5 Base Run

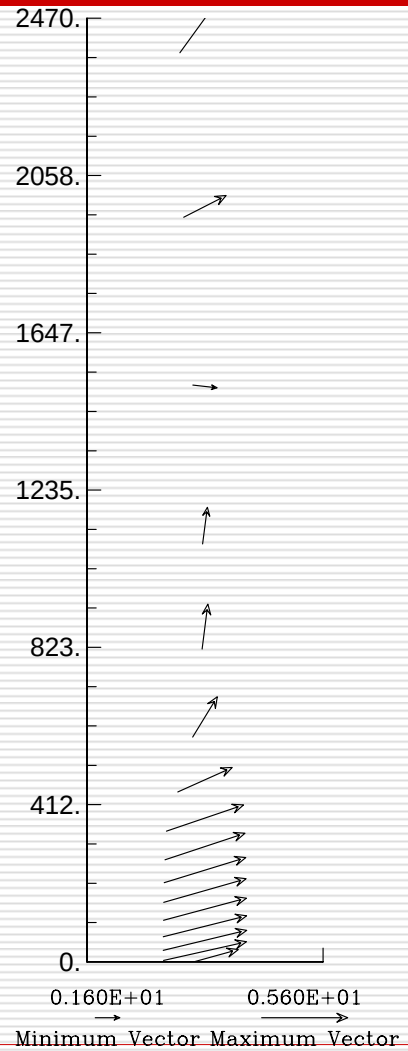

Layer 1 TERRAINs
"Aug 2004: Base Run"
s=aug04base.nc
2720.844
2038.459
1356.074
673.688
-8.697
PPM
85
1
1
121
August 8,2004 0:00:00
Min= -2.828 at (119,85), Max=2720.844 at (82,48)
15.0

MM5 Modified Run

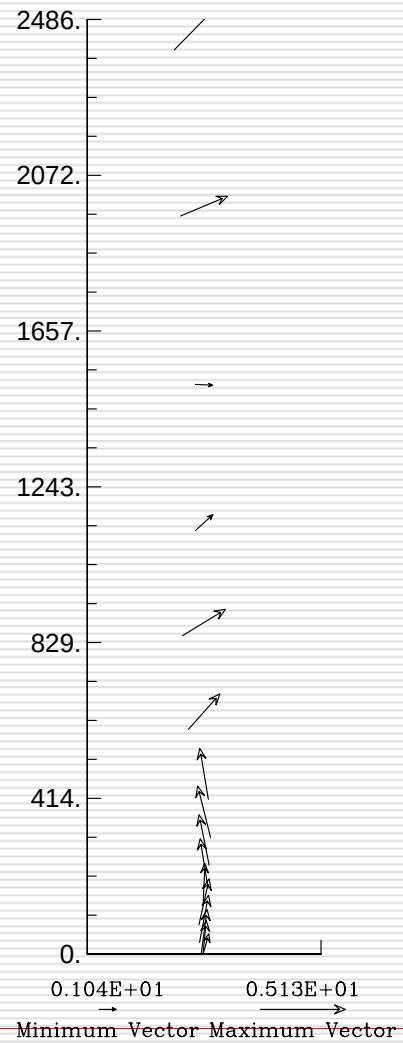


MM5 simulated Wind Profiles:

0000 UTC July 17, 2005



Base

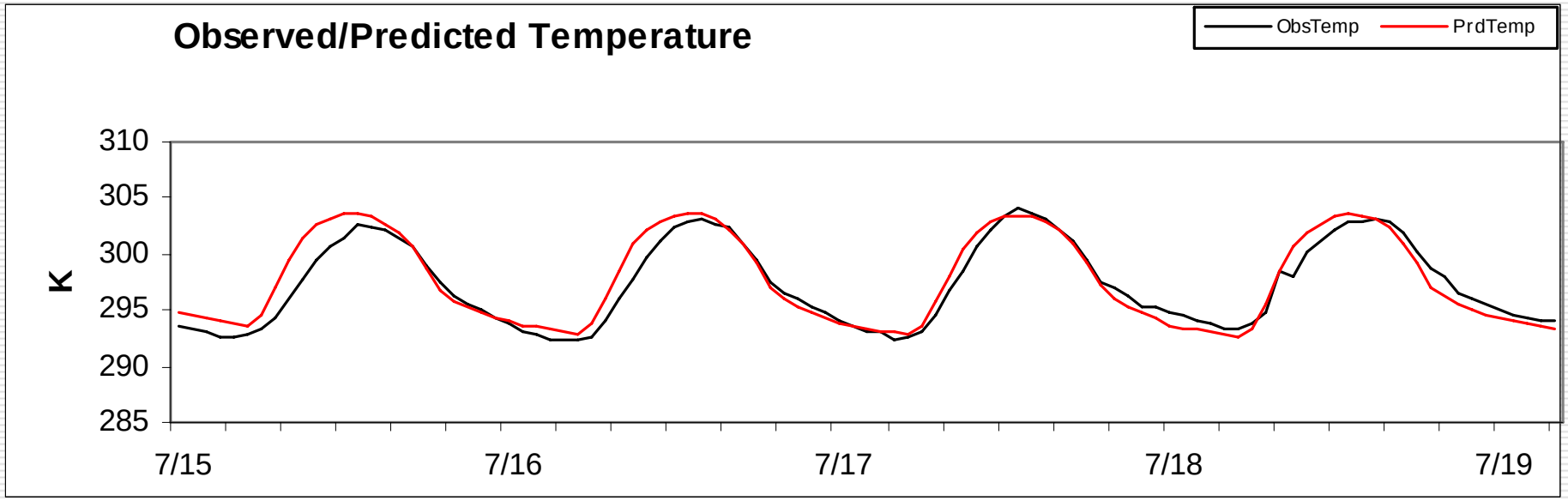


Modified

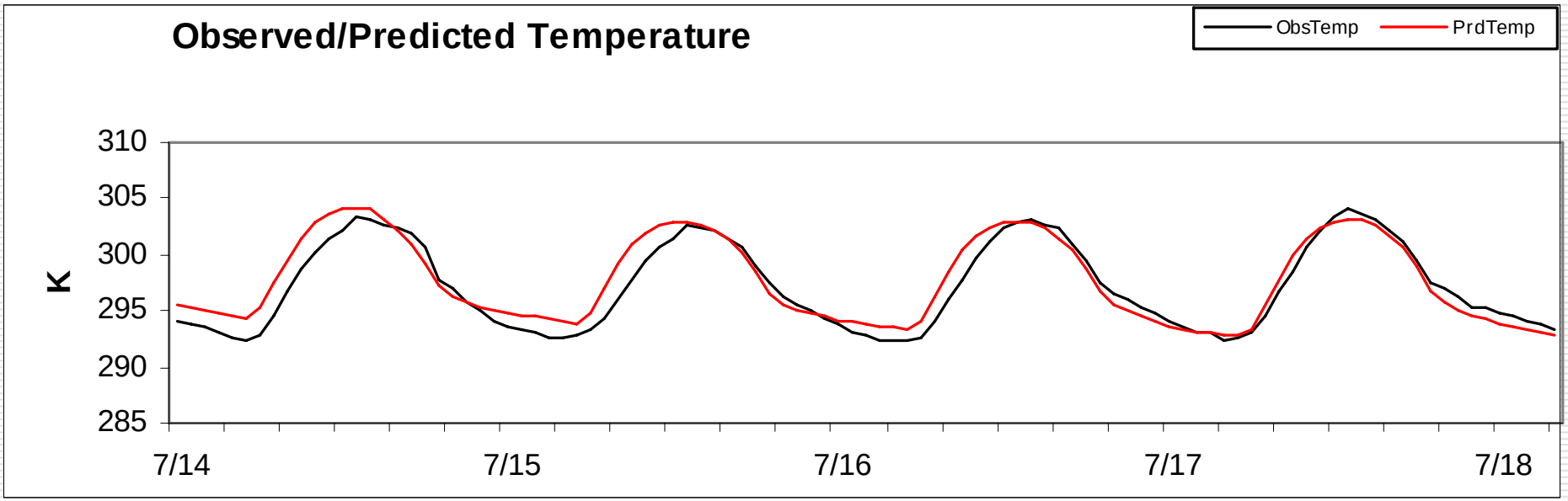
N

4

Basin-wide Averaged Temp: MM5 Base



Basin-wide Avg Temp: increased z0 & SLMO



Summary

- Preliminary study showed that the proposed methodology can be effective to simulate flow turning toward Santa Clarita area.
- Comprehensive study on surface and land use characteristics will be helpful for further improvements.