

# Dust storms: numerical simulations

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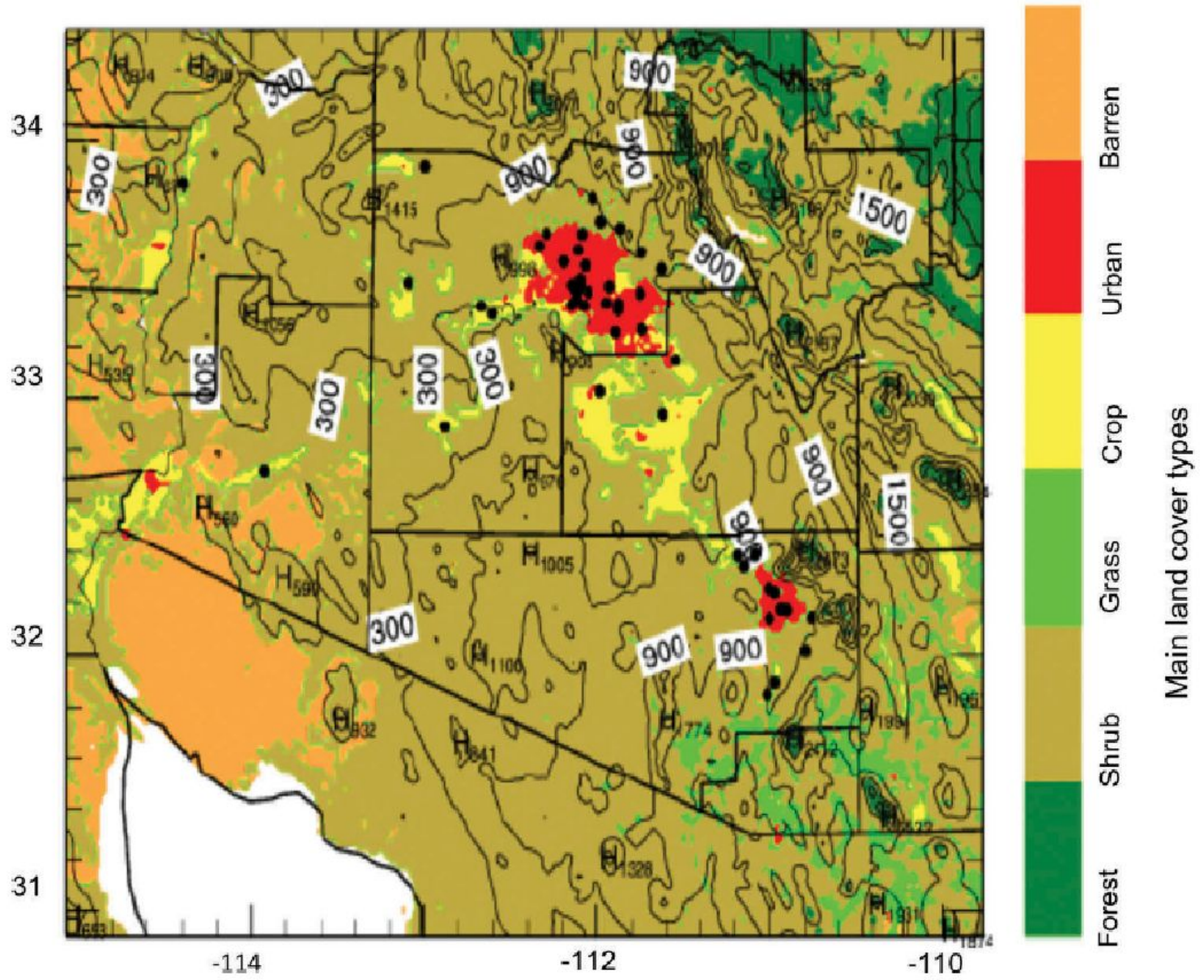
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Simulating the meteorology and PM<sub>10</sub>  
concentrations in Arizona dust storms with the  
Weather Research and Forecasting model with  
Chemistry (Wrf-Chem)

# Models employed

- Dust emissions model: U.S. Air Force
- Transport and chemistry model: Weather Research and Forecasting model with chemistry WRF-chem

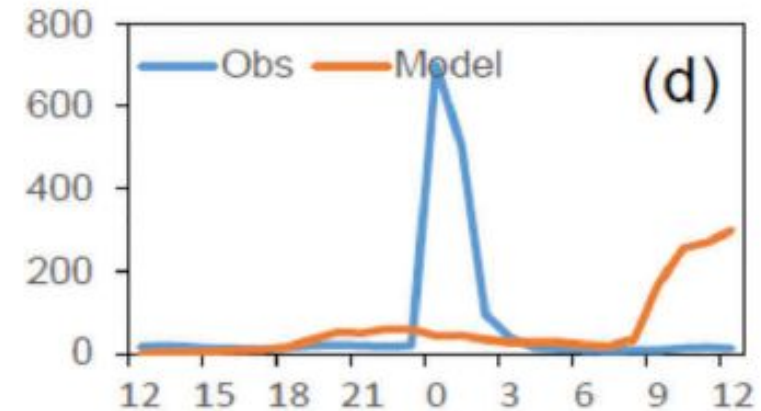
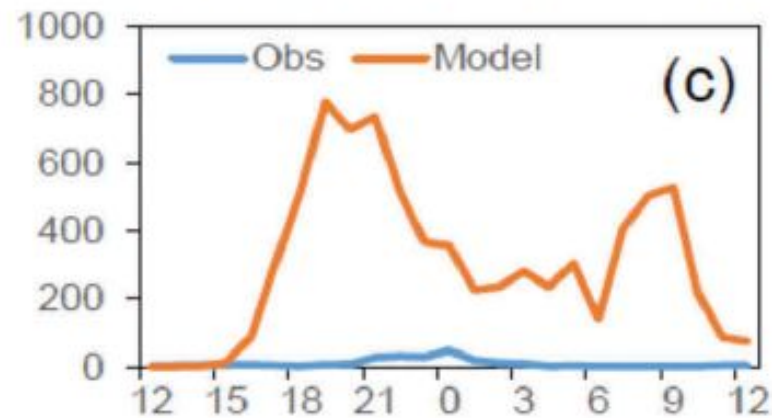
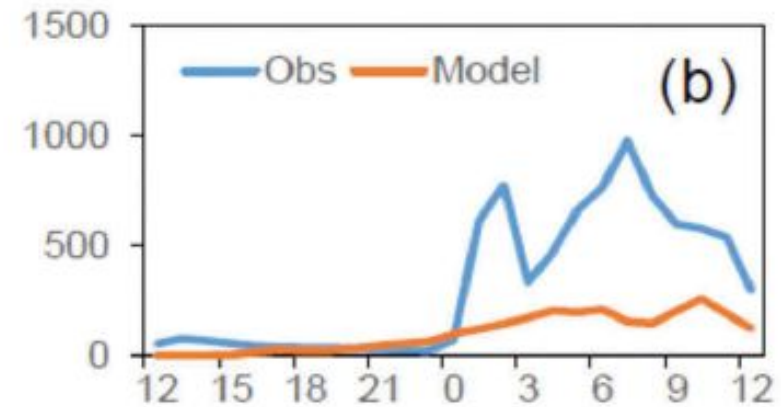
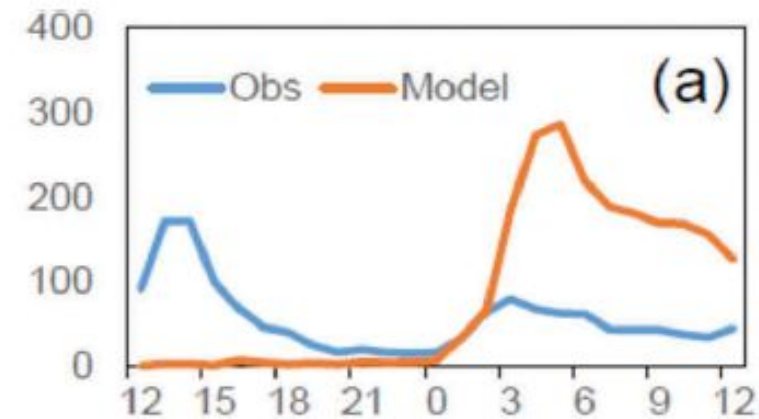


**Dust storms: note 24-hr [PM10], O, observed; M, modeled; health standard is 150 ug/m<sup>3</sup>**

| Date      | Type           | Maximum hourly wind speed (m/sec) |       | 24-hr |      |
|-----------|----------------|-----------------------------------|-------|-------|------|
|           |                | O                                 | M     | O     | M    |
| 4/14/2006 | Dry cold front | 21/29                             | 12/14 | 725   | 337  |
| 7/12/2009 | Monsoon        | 13/30                             | 6/10  | 1386  | 45   |
| 1/21/2010 | Dry cold front | 12/30                             | 16/19 | 1689  | 230  |
| 7/5/2011  | Monsoon        | 8/26                              | 12/16 | 1972  | 156  |
| 6/30/2013 | Monsoon        | 14/23                             | 12/11 | 139   | 31   |
| 7/21/2012 | Monsoon        | 8/18                              | 14/12 | 884   | 1696 |
| 7/3/2014  | Monsoon        | 12/22                             | 14/15 | 282   | 526  |
| 7/8/2014  | Monsoon        | 7/21                              | 9/10  | 899   | 25   |
| 6/28/2015 | Monsoon        | 19/25                             | 9/12  | 271   | 78   |



Pinal County: hourly PM10 measurements and simulated values: a and c are dry cold fronts; b and d are monsoon storms (avg of 8 – 13 sites)



# Conclusions

- [PM10] can be quite elevated in dust storms, as much as 10X the health standard (these are measurements, not simulated values)
- [PM10] in dust storms is difficult to simulate
  - The storms themselves are extremely turbulent, so the dust concentrations change rapidly with time and throughout space
  - Co-located air pollution monitors often have widely different concentrations.
  - Land cover and rainfall estimates vary widely from the actual conditions
- The efforts to better simulate these storms could lead to better predictive tools that would improve public safety.

# Thank you for your time and attention

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