

Assessment of Dust Storms within UAE Using Observational Data and CMAQ-WRF Modeling Framework

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Objectives of the Study

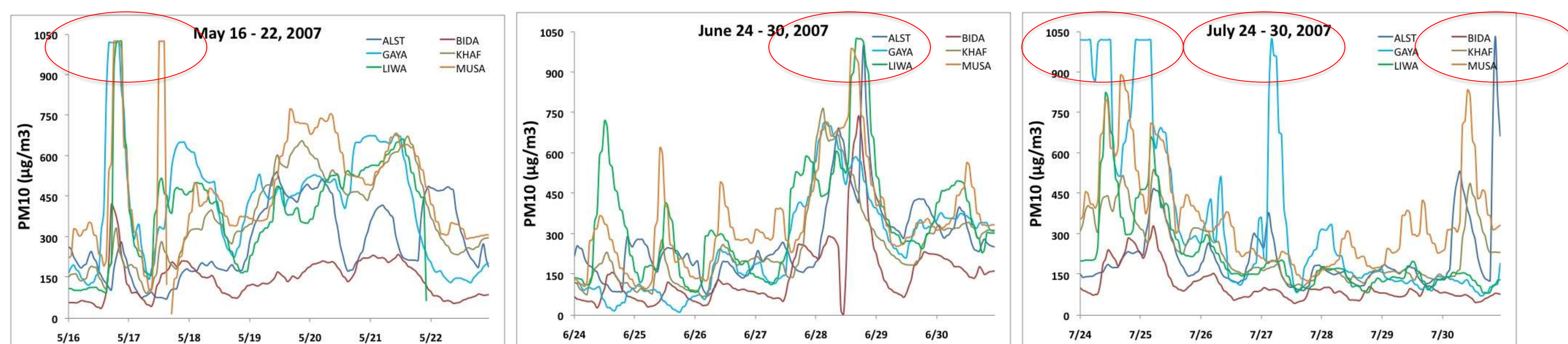
- To identify dust storms/dust events during summer modeling period in 2007 using surface observed and satellite data.
- To study the characteristics of identified high PM10 episodes using observed data.
- To find the sources of PM10 transport for the peak concentrations during identified dust events.
- To analyze CMAQ-WRF air quality model ability to capture peak surface PM10 concentrations during dust storms.

Episode Selection

- Peak daily average PM10 concentrations were considered with cut-off $500 \mu\text{g}/\text{m}^3$.
- Maximum number of sites with daily average PM10 $> 500 \mu\text{g}/\text{m}^3$ were considered.
- Minimum 3 consecutive days with above criteria and maximum of 7 days were considered as high PM10 episode.

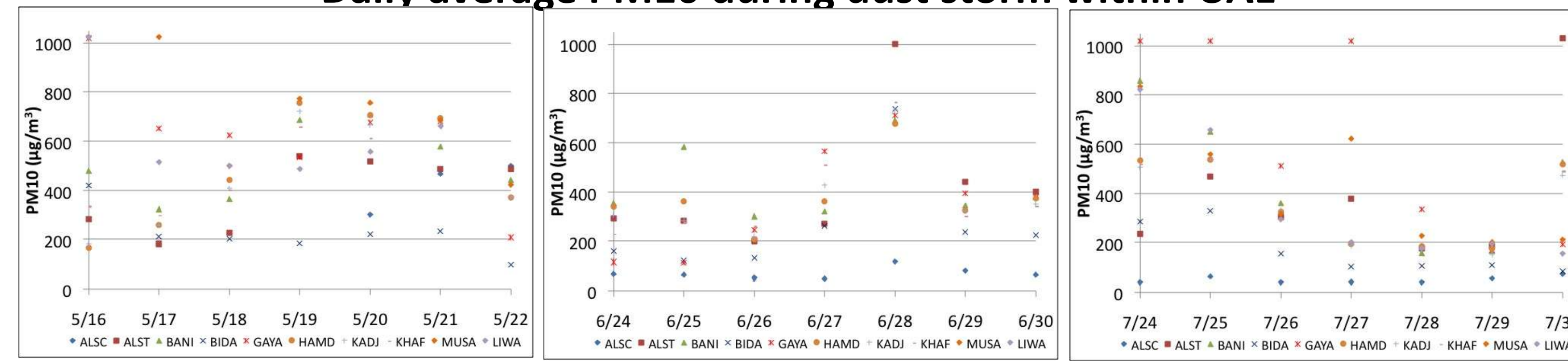


Monitoring stations within UAE



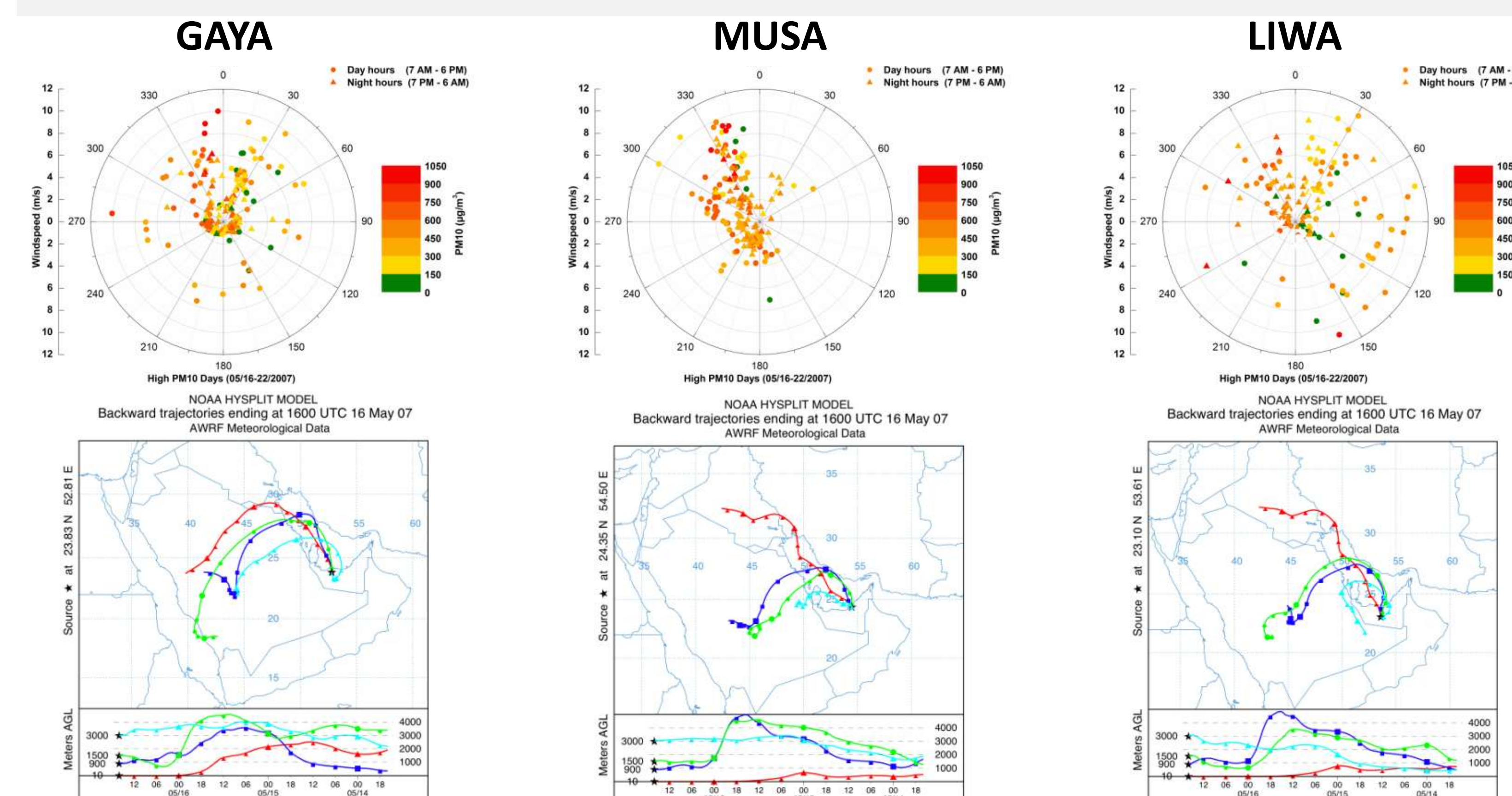
PM10 during identified episode days

Daily average PM10 during dust storm within UAE



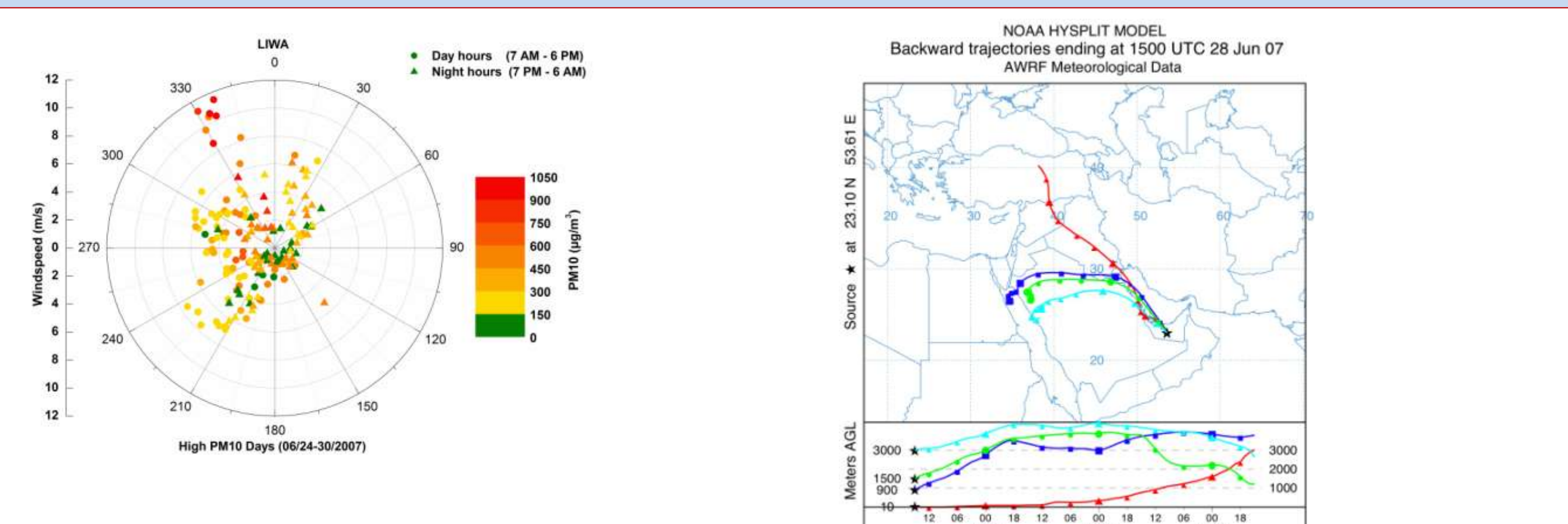
Episode 05/16-22/2007

- Pollution-rose plots showing day-hour and night-hour PM10 concentration with wind-speed and wind-direction at selected site with PM10 $> 1000 \mu\text{g}/\text{m}^3$ during each episode.
- 72-hour back trajectory using WRF output at observed peak PM10 concentration.



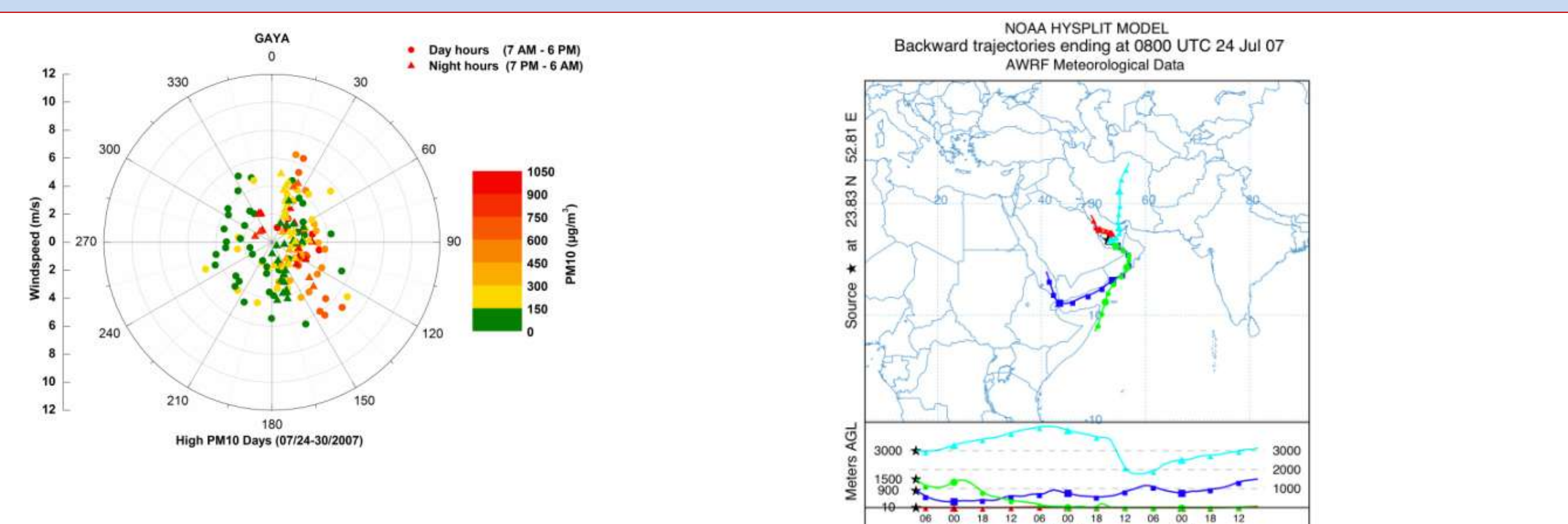
Pollution-rose and 72-hr back trajectory (May 16, 2007 20:00 UAE time)

Episode 06/24-30/2007



Pollution-rose and 72-hr back trajectory (June 28, 2007 19:00 UAE time)

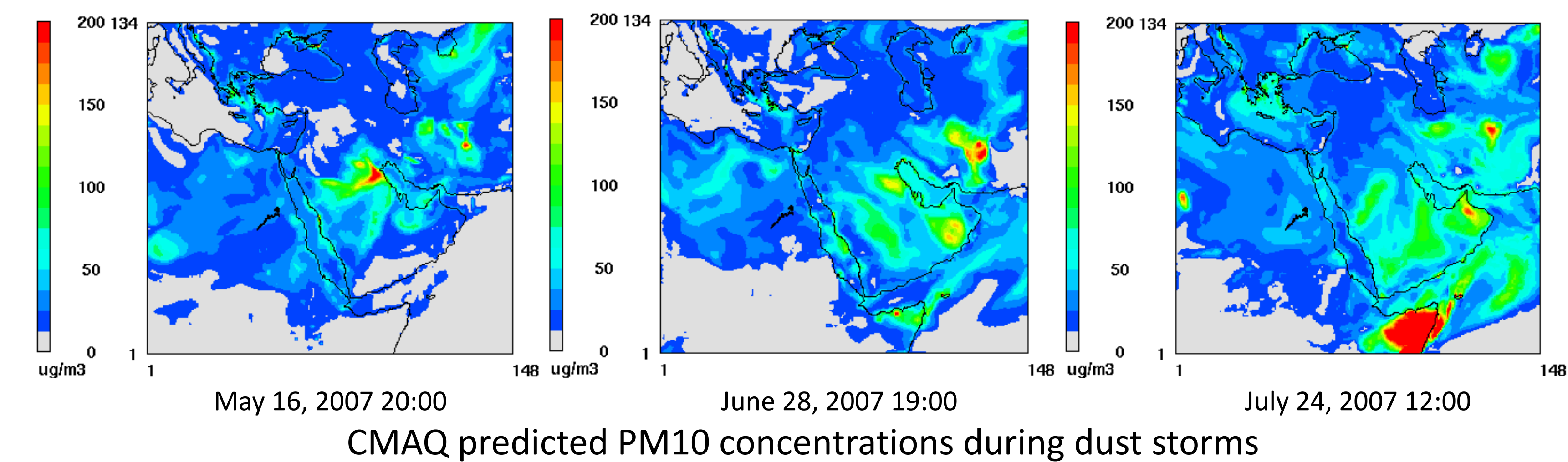
Episode 07/24-30/2007



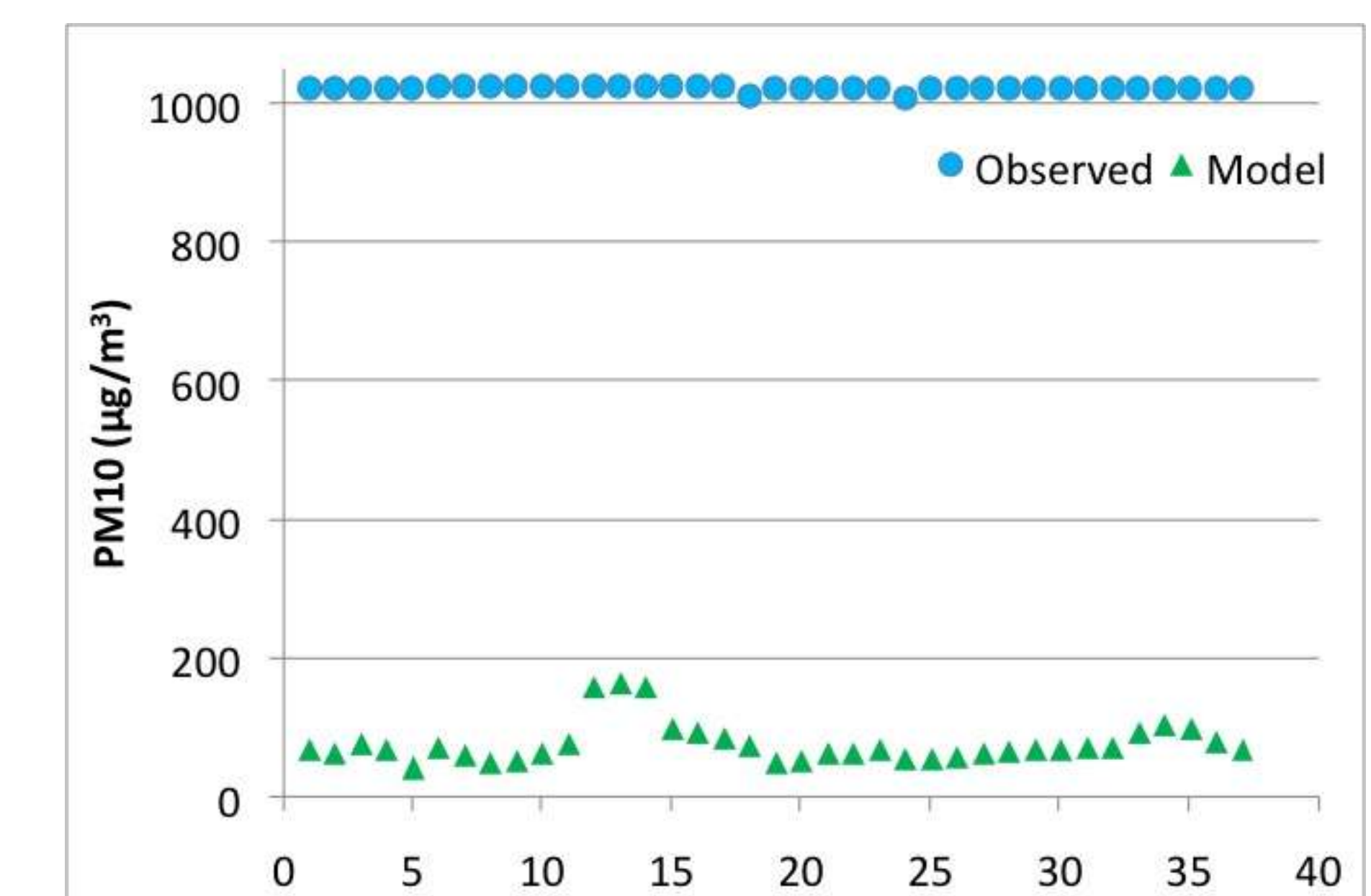
Pollution-rose and 72-hr back trajectory (July 24, 2007 12:00 UAE time)

CMAQ-WRF

- CMAQ-WRF air quality modeling framework has been developed for burden of disease assessment over UAE.
- Global and other emission inventory has been used as little emission information is available for the region.
- Model's ability to predict peak PM10 concentrations during dust storms has been assessed and shown in following figures..



Model PM10 at observed PM10 $> 1000 \mu\text{g}/\text{m}^3$ at all monitoring sites during dust storm



Summary and Future Work

- During dust storms high PM10 concentration ($> 1000 \mu\text{g}/\text{m}^3$) was measured across Abu Dhabi Emirate.
- Mostly dust storms were caused by *Shamal* or northern wind.
- Back trajectory analysis demonstrated trans-boundary transport of PM10 within Arabian Peninsula.
- CMAQ-WRF model could not capture peak PM10 concentrations during dust storms.
- Satellite aerosol data will be used to evaluate model during peak PM10 concentrations.