



Sand and Dust Storm Monitoring, Forecasting and Early Warning Course



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Introduction:

Sand and dust storm monitoring, forecasting and early warning is a 5-day course for forecasting, air quality, aviation weather, public health and emergency planning staff that ends with a Dust Storm Early Warning and Sectoral Response Plan for a case organisation. Haboobs and dust plumes close runways, cause highway collisions, fill emergency departments with respiratory cases and cut solar output, yet many organisations act on dust forecasts too late. Nominees already read weather products or coordinate operational response and practise through a time-pressured dust event simulation. CoreConcept Training Center delivers this sand and dust storm early warning course.

Course Objectives:

- Map dust source areas and explain saltation, suspension and transport conditions that turn wind events into sand and dust storms
- Interpret satellite dust RGB imagery, aerosol optical depth retrievals, ceilometer and lidar backscatter and sun photometer readings for a dust event
- Specify a surface dust observation network of visibility sensors and PM10 and PM2.5 monitors with siting and data quality checks
- Compare dust transport model forecasts and multi-model ensemble products and judge their confidence for a forecast area
- Set impact-based dust warning levels with trigger thresholds, warning messages and dissemination channels agreed with user sectors
- Prepare sector response actions for airports, highways, hospitals and solar plants within a Dust Storm Early Warning and Sectoral Response Plan

Target Audience:

- Staff responsible for preparing weather and dust forecasts at meteorological and environmental services
 - Staff responsible for operating air quality stations and reporting particulate pollution episodes
 - Staff responsible for aviation weather briefings, airfield visibility reporting and airport operations decisions
 - Staff responsible for public health alerts, hospital surge readiness and advice to vulnerable groups
 - Staff responsible for civil protection planning, road safety coordination and emergency communications
 - Staff responsible for operating solar plants, ports and outdoor infrastructure exposed to blowing dust
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Course Outline:

Day 1: Dust Storm Hazard, Source Areas and Current-State Review

- Haboob, Frontal and Synoptic Wind Dust Event Meteorology Compared
- Saltation, Suspension and Threshold Friction Velocity in Dust Emission
- Dust Source Area Mapping From Dry Lakebeds and Alluvial Plains
- METAR and SYNOP Present Weather Codes for Blowing Dust
- Dust Hazard Exposure Profile and Warning Service Gap Review

Day 2: Satellite, Lidar and Ground Observation Systems for Dust

- Geostationary Dust RGB Imagery for Plume Detection and Tracking
- Aerosol Optical Depth Retrievals From Polar-Orbiting Satellite Sensors
- Sun Photometer Network Readings and Aerosol Optical Depth Validation
- Ceilometer and Lidar Backscatter Profiles for Dust Layer Height
- PM10 and PM2.5 Monitor and Visibility Sensor Network Siting

Day 3: Dust Transport Forecasting and Ensemble Interpretation

- Dust Transport Model Physics From Emission to Dry Deposition
- Sand and Dust Storm Warning Advisory Centre Forecast Products
- Multi-Model Ensemble Dust Forecasts and Spread Interpretation
- Forecast Verification Using Visibility Reports and Particulate Observations
- Nowcasting Dust Fronts With Radar Outflow Boundaries and Satellite Loops

Day 4: Impact-Based Warnings, Dissemination and Sector Risk

- Impact-Based Warning Matrix of Likelihood Against Dust Impact
- Visibility and Particulate Trigger Thresholds for Each Warning Level
- Early Warnings for All Dissemination Channels and Message Templates
- Airport Low Visibility Procedures and Highway Closure Triggers
- Hospital Respiratory Surge Plans and Solar Panel Soiling Response

Day 5: Simulation Exercise and Dust Storm Early Warning Plan

- Case Dust Event Data Pack With Satellite and Station Records
 - Timed Forecast Desk Simulation From First Plume Detection
 - Warning Issue and Sector Briefing Under Changing Forecast Confidence
 - Post-Event Debrief Against Observed Visibility and Particulate Peaks
 - Dust Storm Early Warning and Sectoral Response Plan Completion
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Skills You Will Gain:

- Dust Source Area Mapping
- Dust RGB Image Interpretation
- Aerosol Optical Depth Analysis
- Lidar Dust Layer Profiling
- Particulate Network Design
- Ensemble Dust Forecast Judgement
- Impact-Based Warning Design
- Multi-Agency Dust Response Coordination

Why Attend This Course:

- Deliver a Dust Storm Early Warning and Sectoral Response Plan to the head of forecasting, the emergency management lead or the operations director for approval
- Decide when a dust forecast justifies a warning upgrade, a runway or road restriction, or a hospital surge alert
- Avoid late warnings, false alarms and uncoordinated closures that cost flights, road safety, patient care and solar generation
- Brief forecasters, duty officers and sector liaison staff on the dust products, thresholds and message templates behind each warning level

Conclusion:

Back at work, the participant presents the Dust Storm Early Warning and Sectoral Response Plan to the head of forecasting, the emergency management lead and the sector partners who act on dust warnings. The plan supports decisions on which observation and model products to rely on, the visibility and particulate thresholds for each warning level and the actions each airport, highway authority, hospital and solar operator takes. After the first dust season, the unit should compare warning lead times, false alarms and sector actions against observed impacts and adjust thresholds and messages.

Frequently Asked Questions FAQ:

What should participants know before the sand and dust storm monitoring, forecasting and early warning course?

Participants should already read weather charts, air quality data or operational alerts in their own role. No programming or modelling skill is expected. Bringing local dust event records, station data or existing warning procedures helps them apply the simulation to their own service.

How does sand and dust storm monitoring, forecasting and early warning differ from a general environmental monitoring or remote sensing course?

It follows one hazard from source to warning: dust emission, plume detection, transport forecasts, warning thresholds and sector response. General environmental monitoring courses cover industrial emissions, water and soil sampling, while remote sensing courses map land cover and long-term change.

Why do impact-based warnings matter in sand and dust storm early warning?

Impact-based warnings tell each user what a dust event will do to them, not only how dusty it will be. Linking visibility and particulate forecasts to runway, road, hospital and solar plant consequences lets each sector act early and in proportion to the risk.

What do participants take back from the sand and dust storm monitoring, forecasting and early warning course?

Participants take back a Dust Storm Early Warning and Sectoral Response Plan for a case organisation, with observation and forecast products, warning levels and thresholds, message templates and sector actions for airports, highways, hospitals and solar plants, ready to adapt to their own service.
