

AFWA's Dust Transport Application (DTA) by Using IGrADS

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Description:

The Dust Transport Application is a tactical decision aid for the forecast of dust storms and the prediction of dust concentration in the atmosphere. The incorporation of the DTA into IGrADS greatly expands the pre-staged JAAWIN DTA products by allowing the user to generate two-dimensional forecast maps showing dust concentrations and three-dimensional meteograms and vertical cross sections of dust concentration. On the IGrADS GUI, under **MODEL**, select DTA to enable you to create the IGrADS DTA products. There are four product options available: (1) DTA Meteograms, (2) DTA Vertical Cross-Sections, (3) DTA Multiple Leg Cross-Sections, and (4) DTA Forecast Maps.

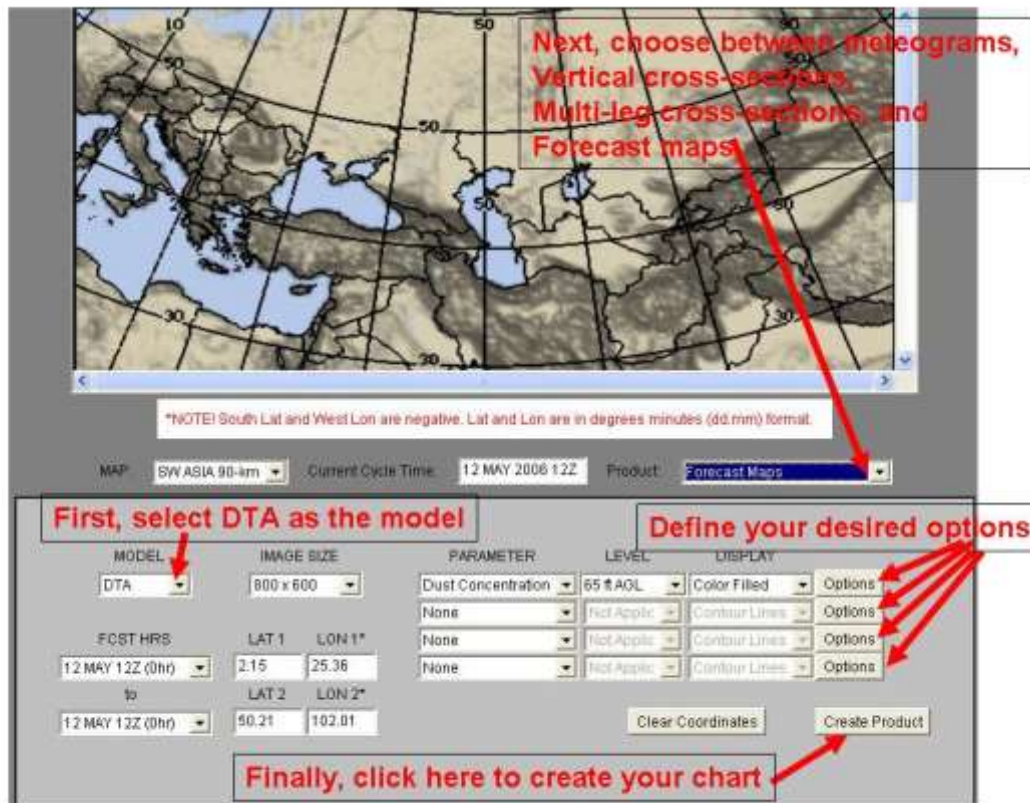


Figure 1. IGrADS DTA Graphical User Interface (GUI)

DTA Background: The DTA model includes the effects of atmospheric stability, winds, dust particle size, and soil moisture in the forecast of dust concentration. Initial dust conditions are estimated in DTA using a 48 hour model "spin-up". The spin-up uses two sets of archived 24 hour MM5 forecast data, automatically generated by earlier DTA model runs. The model then uses the initialized conditions and continues the run cycle through the 72 hour forecast

time making dust concentration predictions every 3 hours. The DTA model is available for three theaters: (1) Northern Africa and the Middle East, (2) Southwest Asia, including Iraq, Afghanistan, Iran and Pakistan and (3) China and East Asia.

DTA Strengths:

- Excellent at forecasting synoptic scale dust events
 - Warm and cold air advection induced events associated with frontal systems
 - Dust events generated by strong pressure gradient winds
- Overall Probability of Detection is between 55-70%
- Ginoux source model data is largely representative of the observed environmental source regions
- Successfully transports dust from source regions to non-source regions and as expected reduces the forecast concentration as the dust is advected over bodies of water or other non-source regions
- Excellent forecast capability with southwestern Afghanistan dust events; very low false alarm rates.
- Highest forecast skill over north central Africa where there are significant and well defined source regions
- Projects track of dust clouds over both land and sea providing key information on potential warfighter impacts

Forecast Limitations:

- DTA not designed to forecast microscale-to-mesoscale dust events that are generated by convective downdrafts and outflow. Always consider the potential for convectively-driven dust storms.
- Ginoux source regions are rather coarse with $1^{\circ} \times 1^{\circ}$ resolution to provide some of the fine details, as will 45km MM5 data with meteorological information
- Tends to under-forecast dust events in Jordan, Israel, Oman, Yemen, central and western Saudi Arabia, and the Amudarya valley of northern Afghanistan
- Under-forecasts dust transport across large bodies of water
- Tended to over-forecast dust events in Turkmenistan, western Iraq, and the Lut desert of southeastern Iran
- Accounts for dust concentrations alone and can not be directly correlated to visibility although visibility hindrance and operational impacts can be inferred (DTA visibility product being tested now—Spring 2006)
- Although output across Pakistan and western India is very accurate in the short term (6-12hrs), the 30-60 hour forecast accuracy drops off more rapidly across this region than across other regions studied

Forecast Tips:

- A DTA forecast of red or orange indicates a susceptibility to blowing dust significant enough to be noticed on satellite imagery. In addition, blowing dust will likely cause visibilities to fall to 3 miles or less and visibilities may even fall to less than 1 mile.
- A DTA forecast of yellow indicates a susceptibility to blowing dust that may or may not be significant enough to be noticed on satellite imagery. In addition, there is a heightened

potential of visibilities falling to less than 3 miles due to blowing dust and visibilities of 6 miles or less is likely.

- A DTA forecast of green indicates a susceptibility to a dusty haze that causes only minor reduction of visibilities.
- DTA's forecasting skill was high in the short-term forecasts (6-12hrs) while decreasing only slightly in the medium range (30-36hrs) and long range forecasts (54-60hrs)

More complete information about the DTA algorithm is located at this website:

[DTA TUTORIAL from JAAWIN](#)

The Three DTA Theaters and Sample Pre- Staged Charts

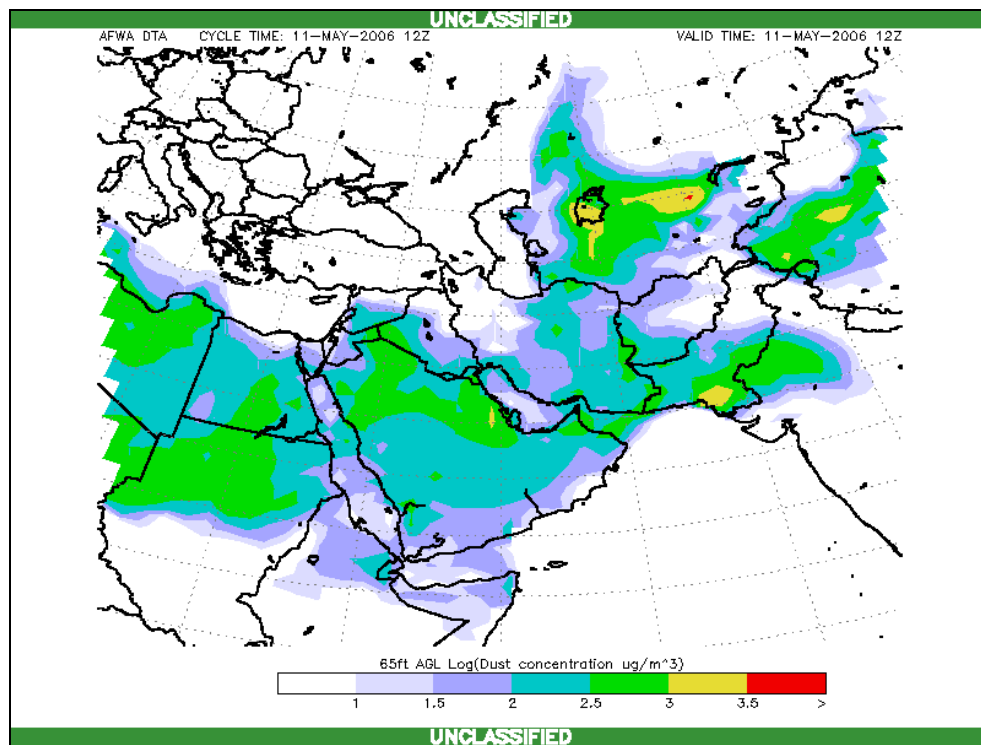


Figure 2. Sample SW Asia 90-km Theater Forecast Map

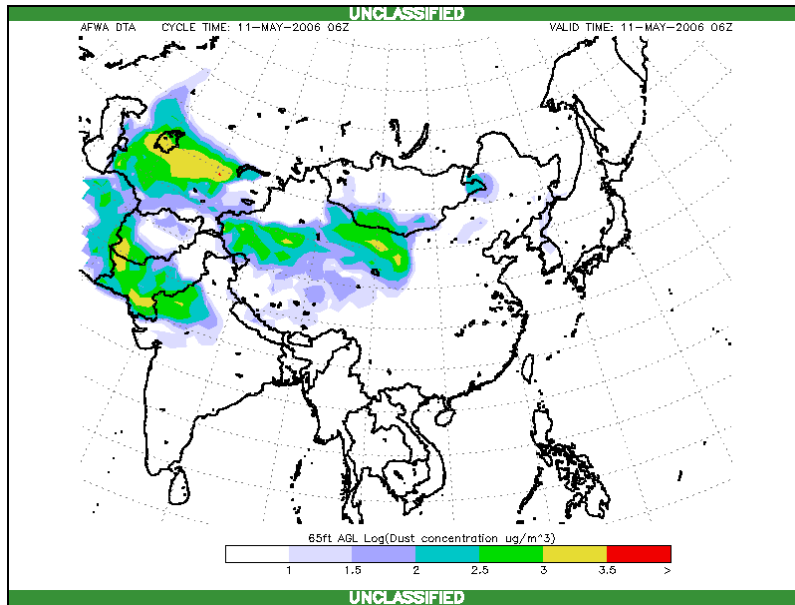
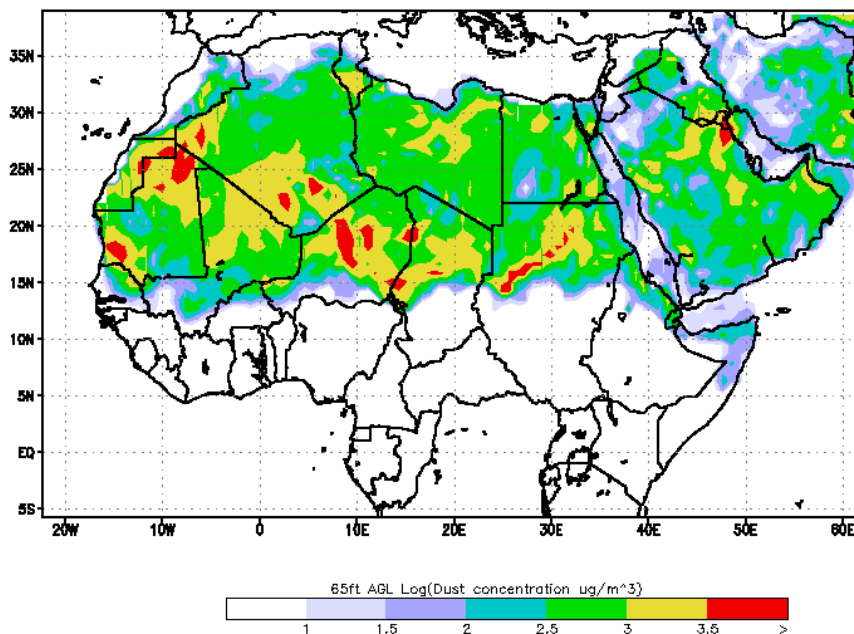


Figure 3. Sample Asia 90-km Theater Forecast Map

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AFWA DTA CYCLE TIME: 11-MAY-2006 00Z VALID TIME: 11-MAY-2006 00Z



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Figure 4. Sample Africa 90-km Theater Forecast Map

The IGrADS DTA Meteogram

Description:

IGrADS DTA meteograms are unique because they display dust concentration, in addition to most of the variables contained in a standard meteogram. Because dust concentration is displayed as a vertical profile, for clarity, RH and clouds are not displayed. Meteograms are

available by entering an ICAO, latitude and longitude, or by clicking at the desired point on the theater map. The meteogram produced for the user displays information at the nearest model grid point. The surface pressure at that grid point dictates the lowest level of data shown. Only the standard meteogram type is available for the DTA data.

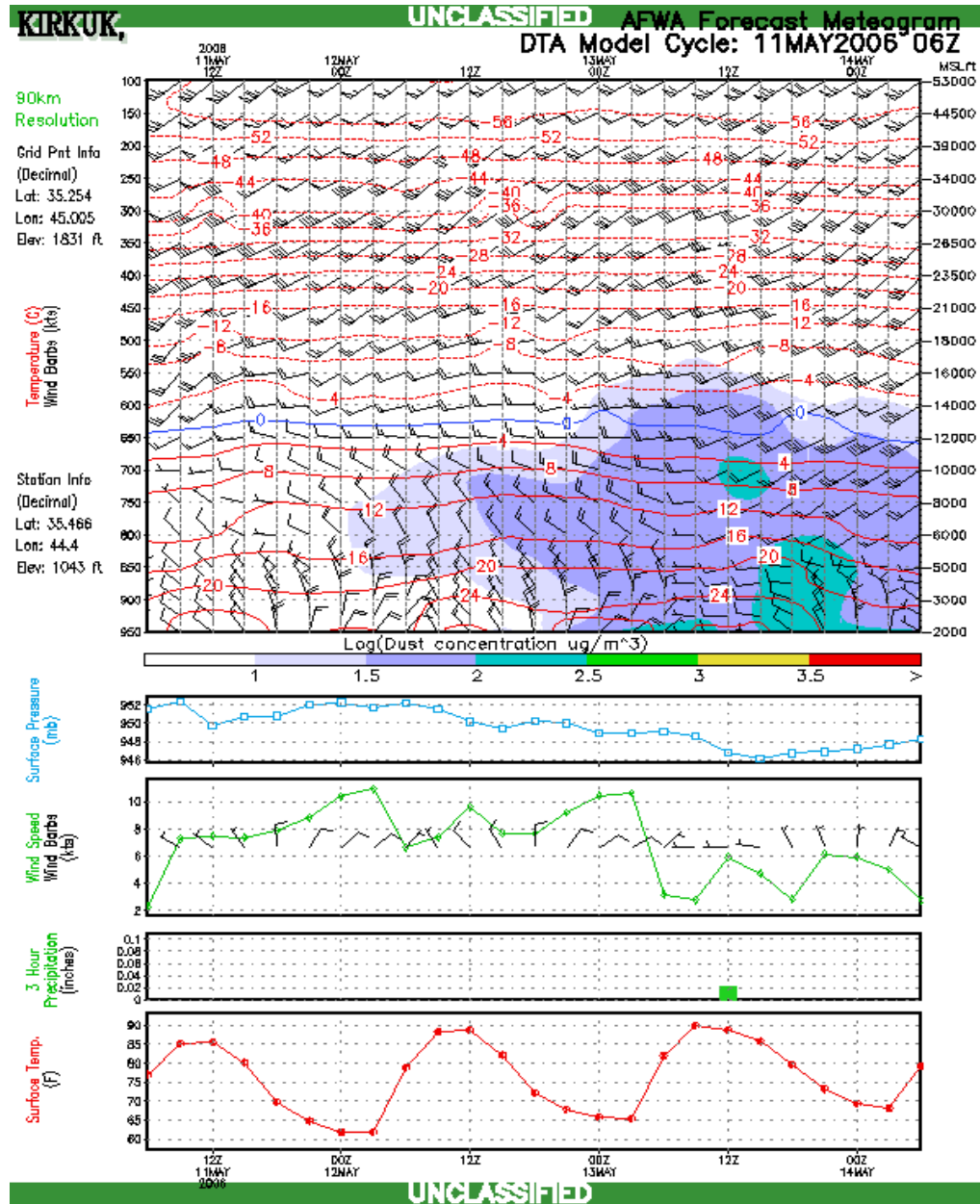


Figure 5. Sample DTA Meteogram

The IGrADS DTA Vertical/Multiple-leg Cross Sections

Description:

IGrADS DTA cross-section products display Dust Concentration, Temperature, Wind and Temperature. Brown terrain is estimated from 45km MM5 model terrain height. Cross section products are created by entering ICAOs, latitude and longitude pairs, or clicking on the desired points on the theater map. The cross section produced for the user displays information from the nearest model grid points.

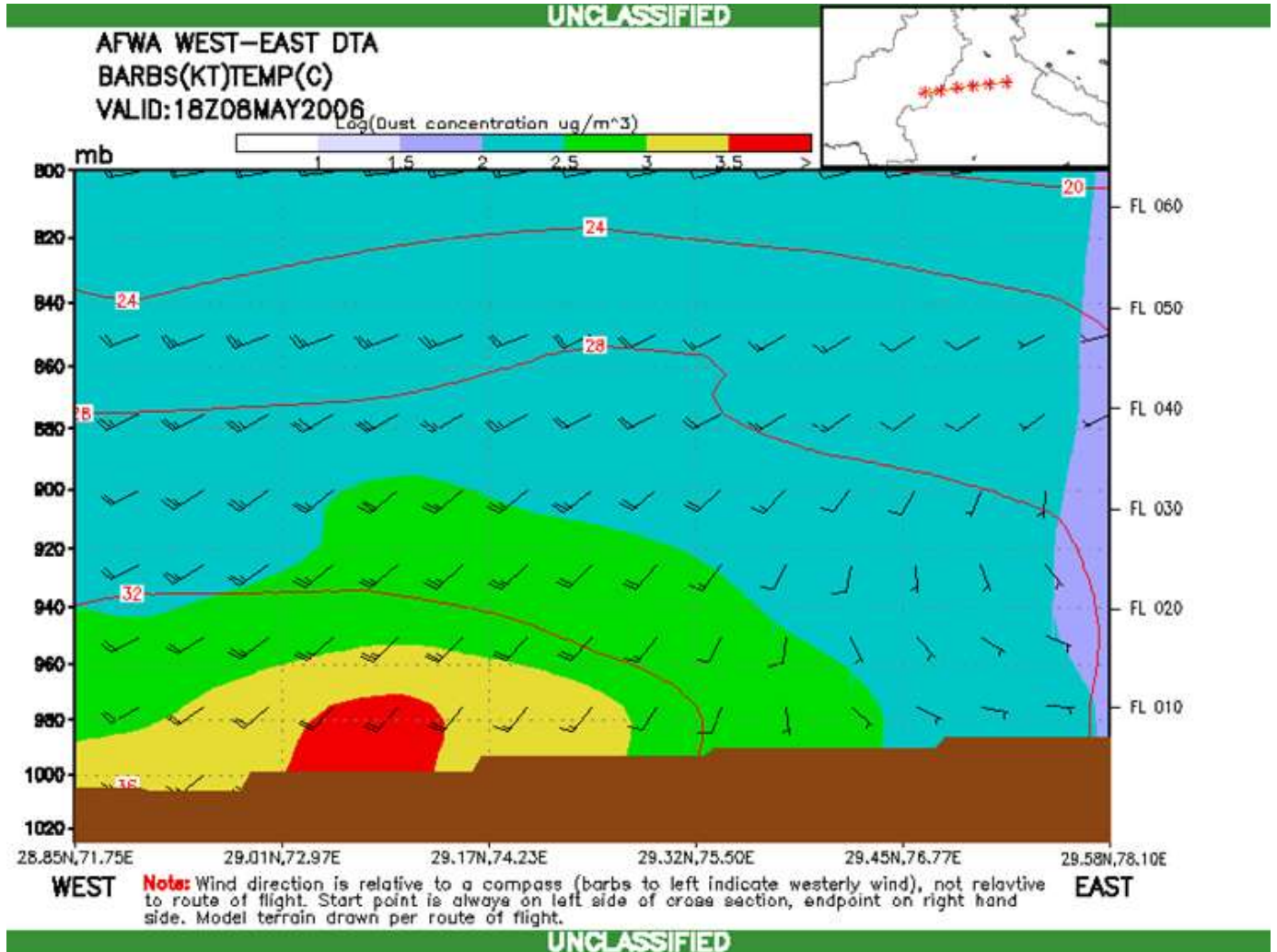


Figure 6. Sample Vertical Cross-Section

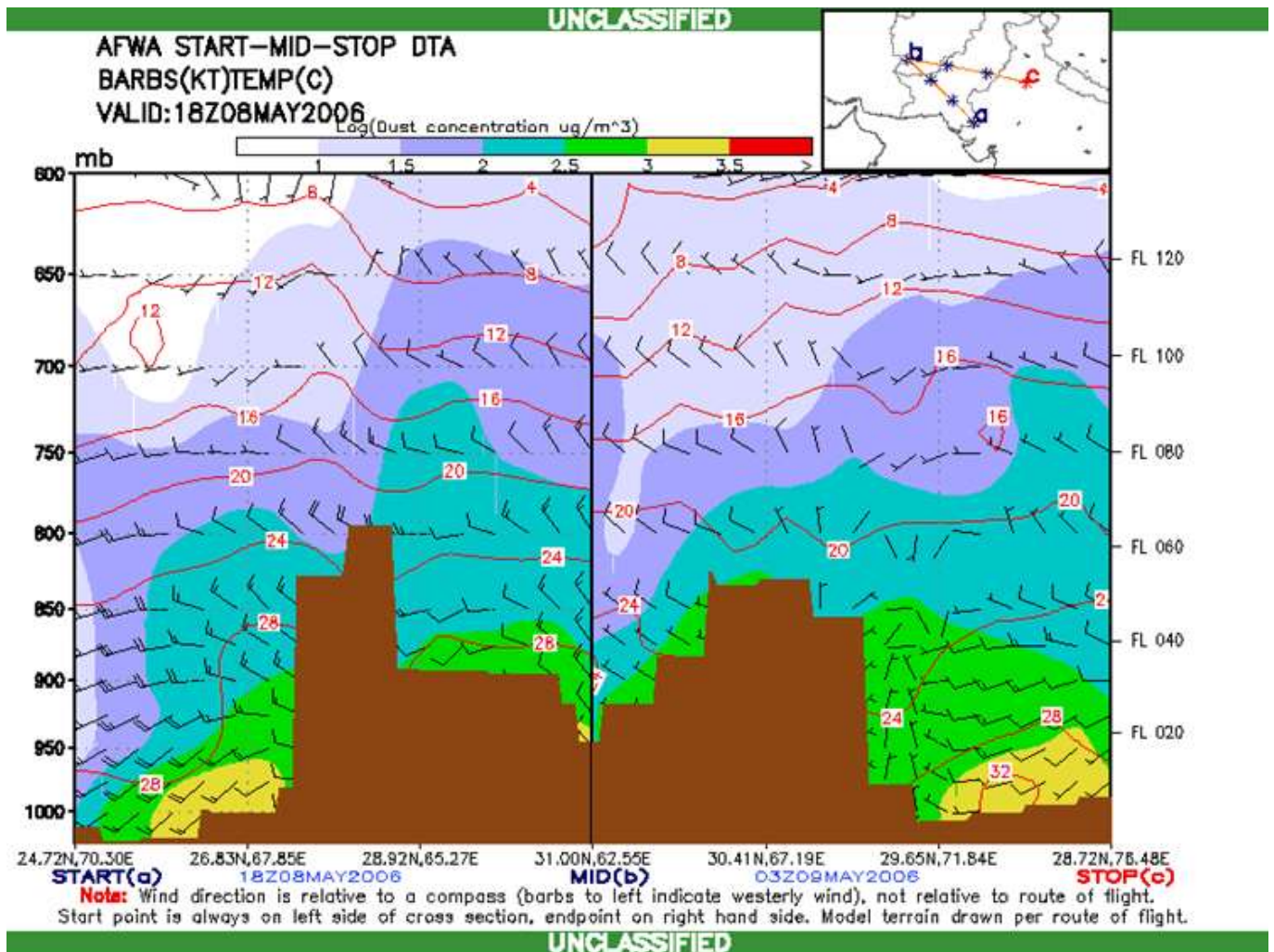


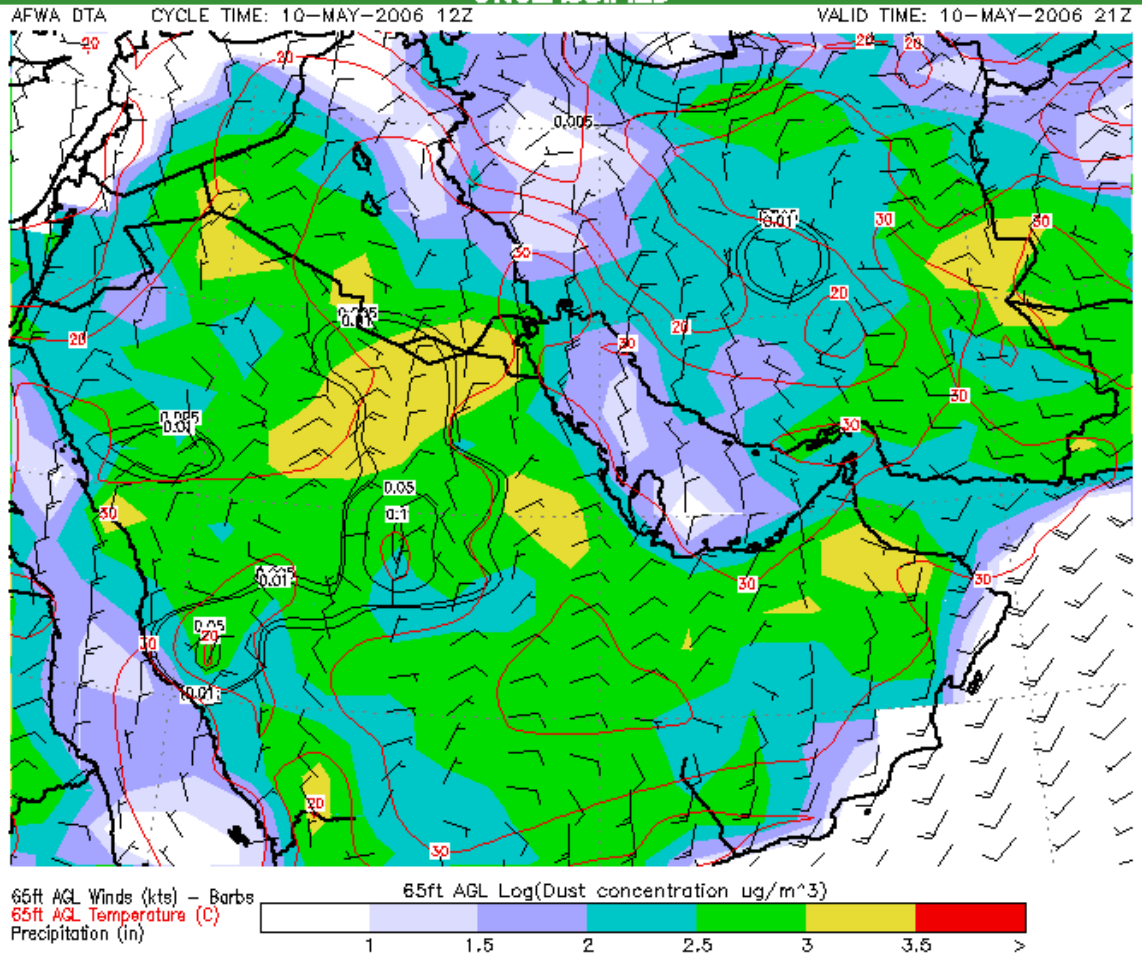
Figure 7. Sample Multiple Leg Cross-Section, from point a, to b, to c.

The IGrADS DTA Forecast Maps

Description: IGrADS allows for a two-dimensional representation of DTA model data over a predefined MM5 theater or user-defined geographical area. The parameters available for display using the DTA selection are Dust Concentration, Precipitation (3-hourly), Temperature, and Winds.

PARAMETER/LEVEL/DISPLAY – The default choice in the first parameter box is Dust Concentration and may be displayed as color filled or contour lines. The first choice is the only one that may be displayed using the color filled option. With DTA, the available levels are from the surface (65ft AGL) to 8,990 ft AGL and then on pressure levels from 700mb through 100mb at 50mb intervals.

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Figure 8. Sample Forecast Map