

3rd Training Course on WMO SDS-WAS products (satellite and ground observation and modelling of atmospheric dust)
Muscat-Oman, December 8-12, 2013



Ground observations of mineral dust

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AEMET, Spain

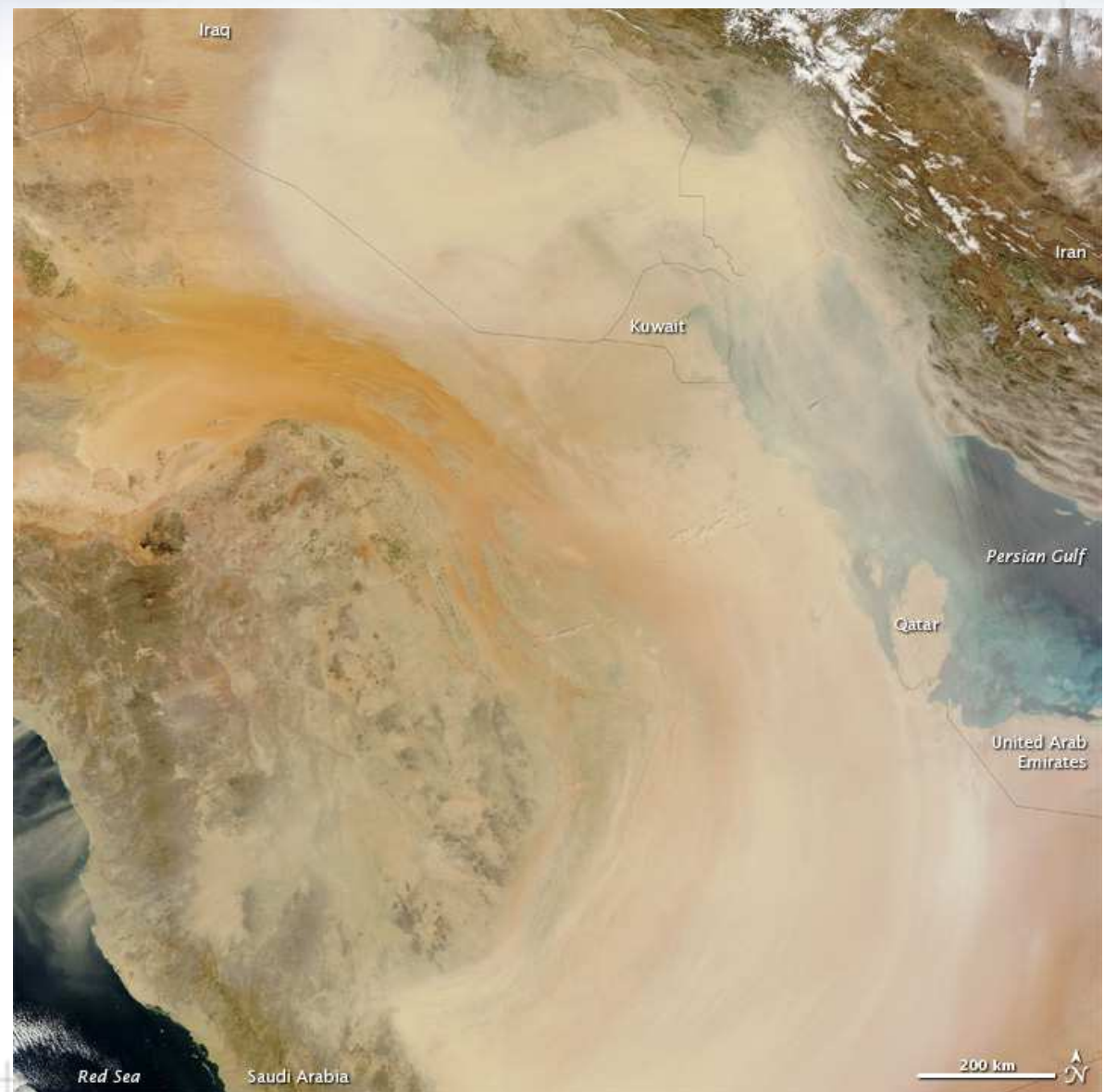
Session of practical work (Ground-based observation) WMO SDS-WAS

Dust intrusion case study

Emilio Cuevas (ecuevasa@aemet.es)
Muscat-Oman, December 9, 2013

Dust storm on March 18th, 2012

The dust storm that formed on March 17 spread across the Arabian Peninsula the following day. The [Moderate Resolution Imaging Spectroradiometer](#) (MODIS) on NASA's [Terra](#) satellite captured this natural-color image on March 18, 2012.





March 19, 2012 ; Muscat -

A severe dust storm hit the sultanate on Monday disrupting flight schedules and affecting vehicular traffic. Three Oman Air flights to Khasab, Marmul and to Marmul via Qarn al Alam were cancelled due to inclement weather conditions.

The Directorate General of Meteorology and Air Navigation urged the public to exercise caution as visibility dropped to less than 400m in some places.

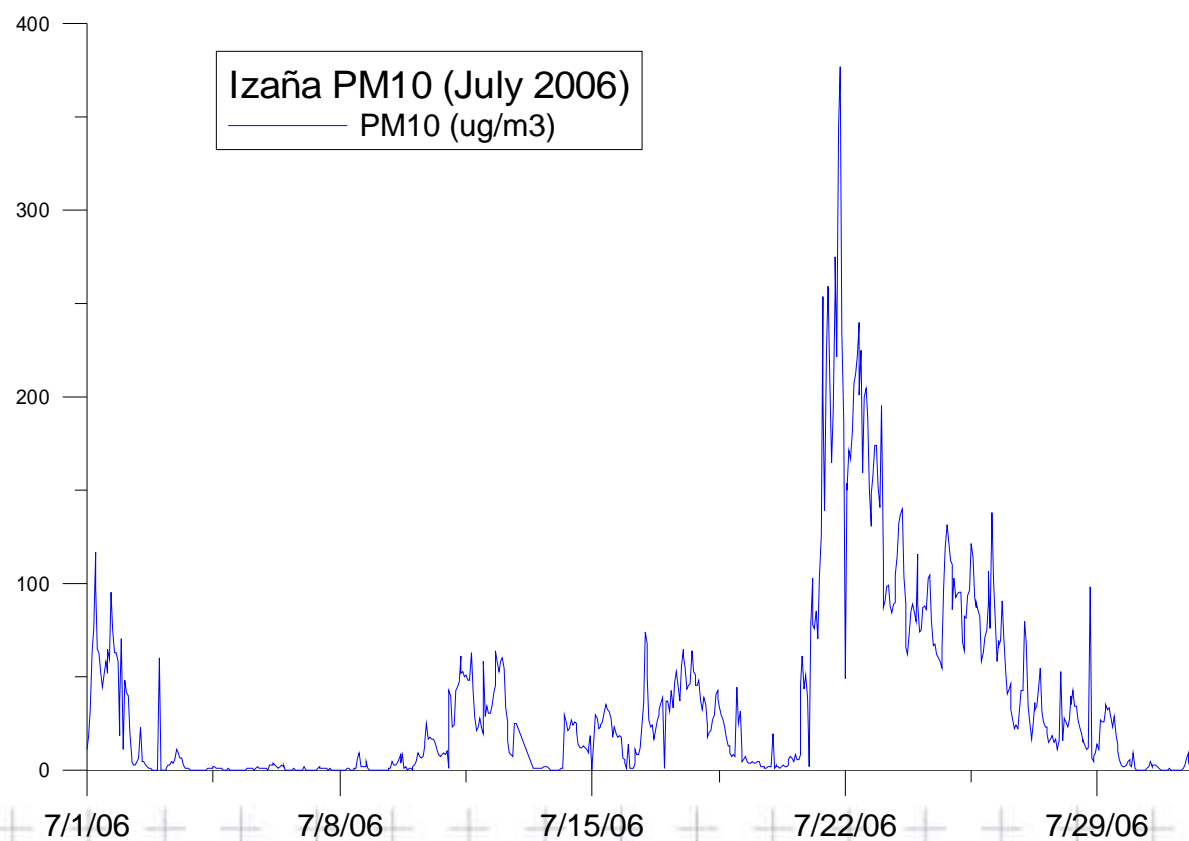
Al Ain/Muscat: A powerful sandstorm blowing over the Gulf has disrupted air traffic in Fujairah and Yemen, and closed schools and sent hundreds of people to hospital with respiratory problems.

The visibility dropped to less than 500 metres in the northern emirates forcing the Fujairah airport to shut down until conditions improved. Officials also warned of fog at night and early on Tuesday.

Unfortunately, no PM10 data available

If we had PM10 data.....

i.e. PM10 data (Izana Observatory) (July 21, 2006); data provided by CIAI-AEMET



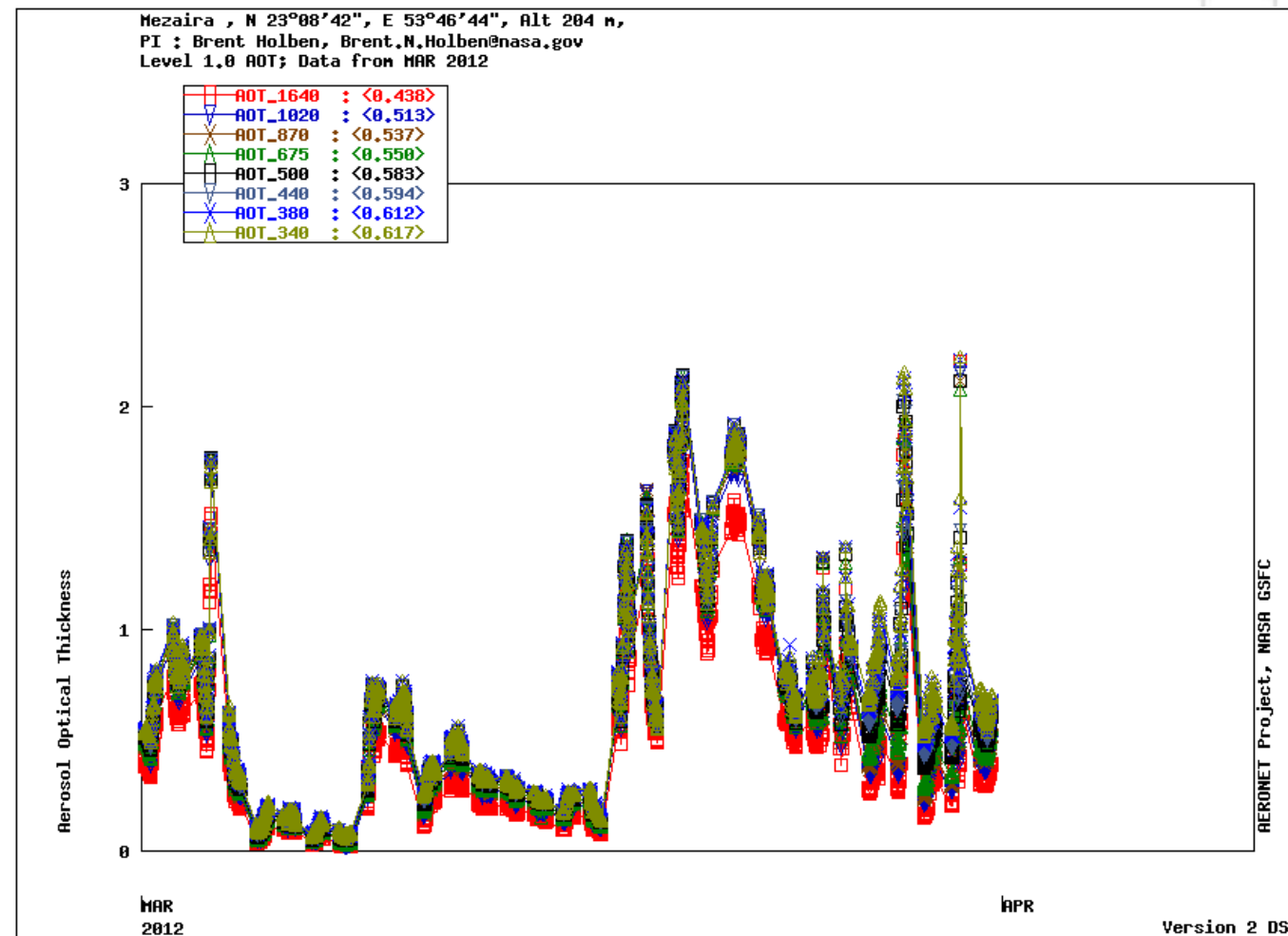
Check BSC-DREAM8b model Asia Experimental Forecasts

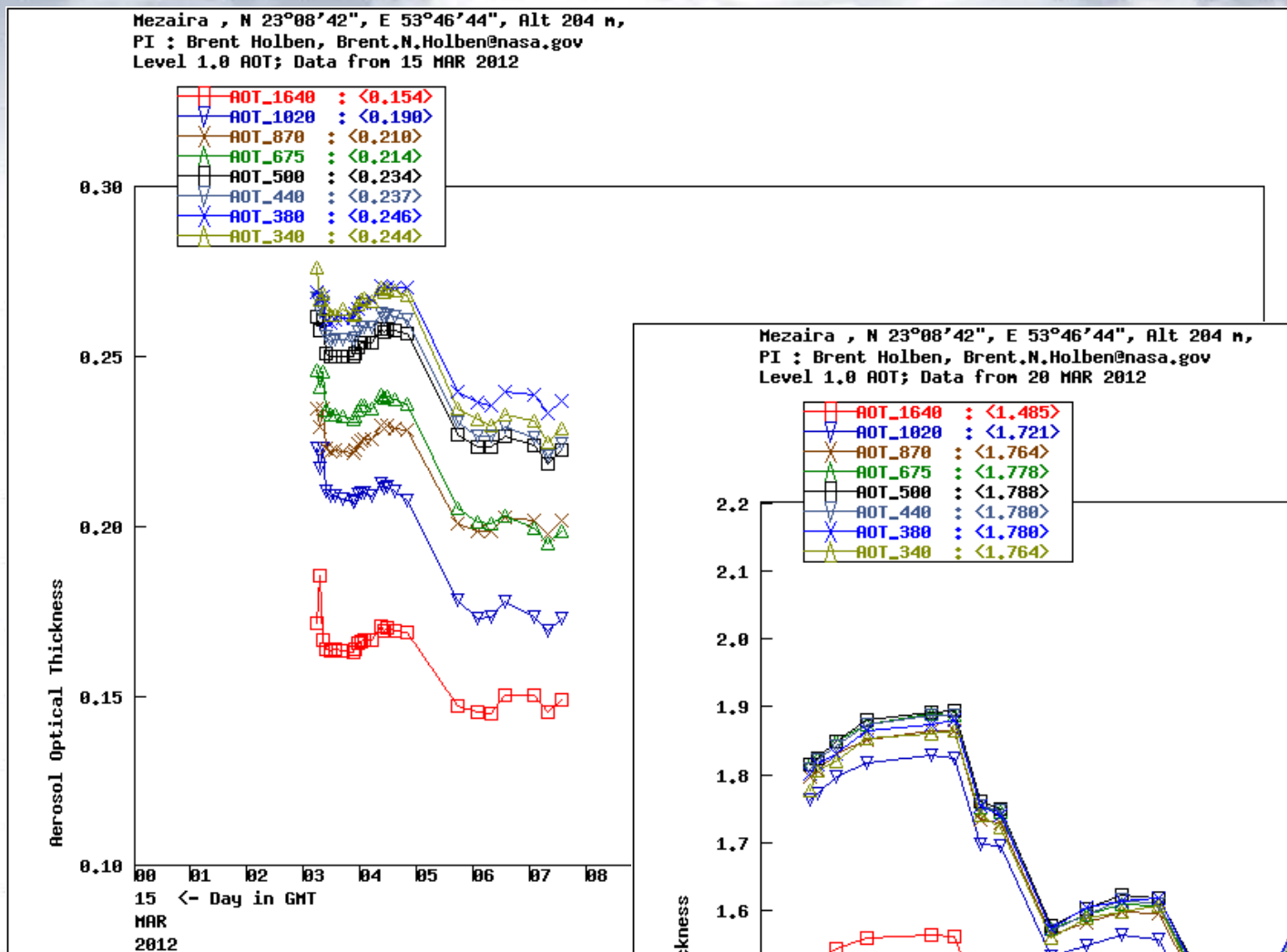
<http://www.bsc.es/earth-sciences/mineral-dust-forecast-system/bsc-dream8b-forecast/>

Check AERONET data

<http://aeronet.gsfc.nasa.gov>

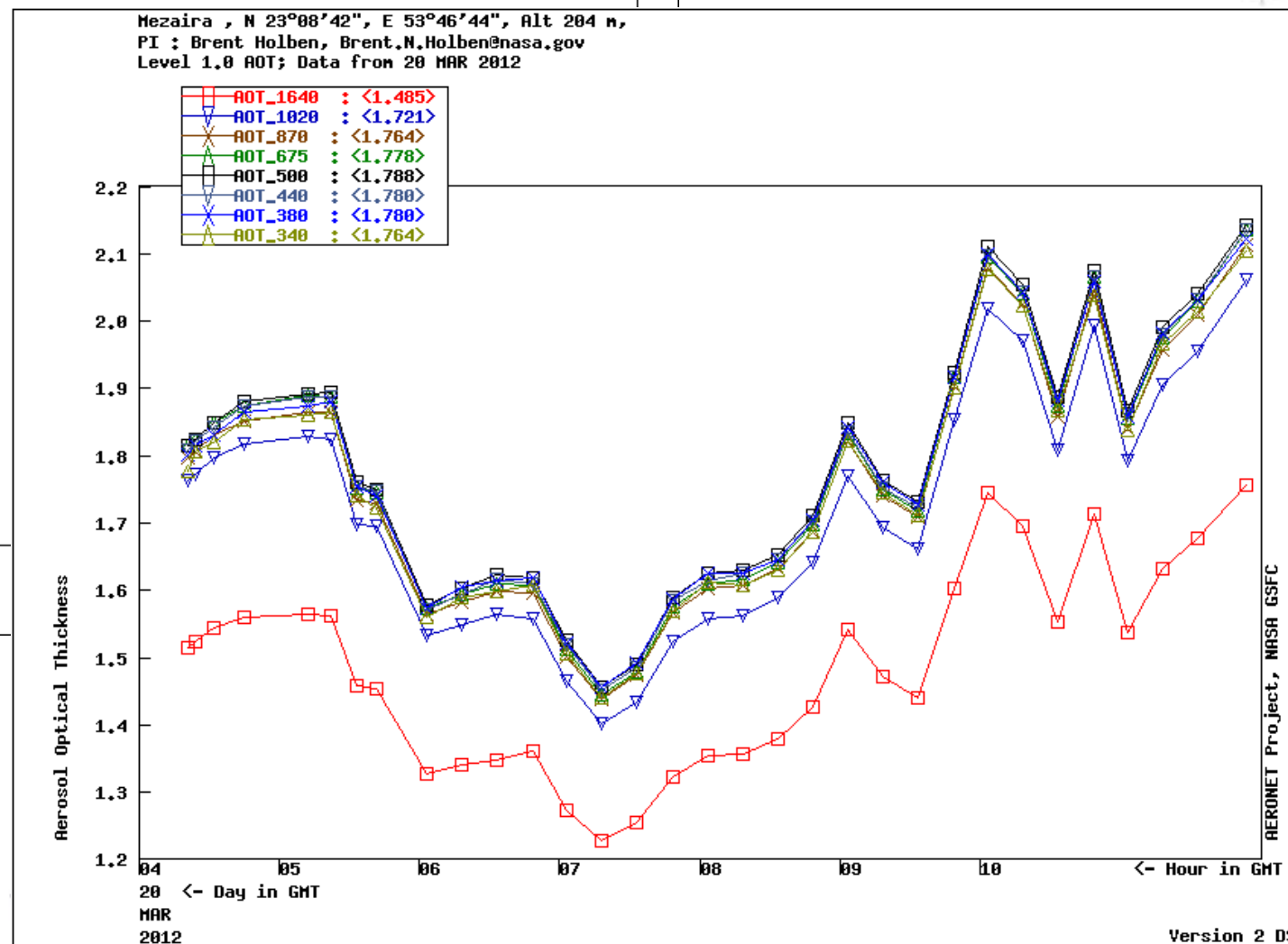
Mezaira station





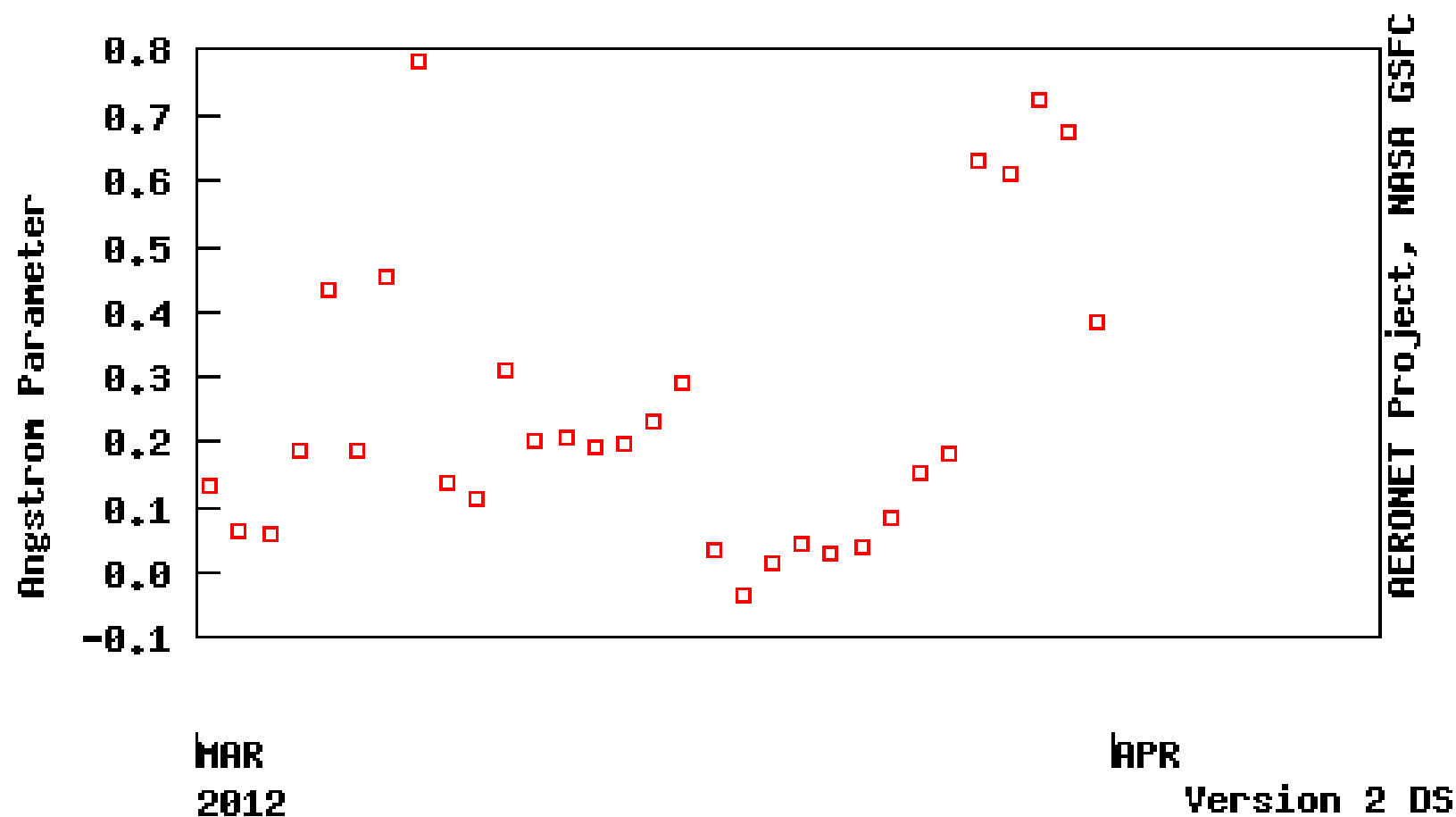
March 15th, 2012

March 20th, 2012



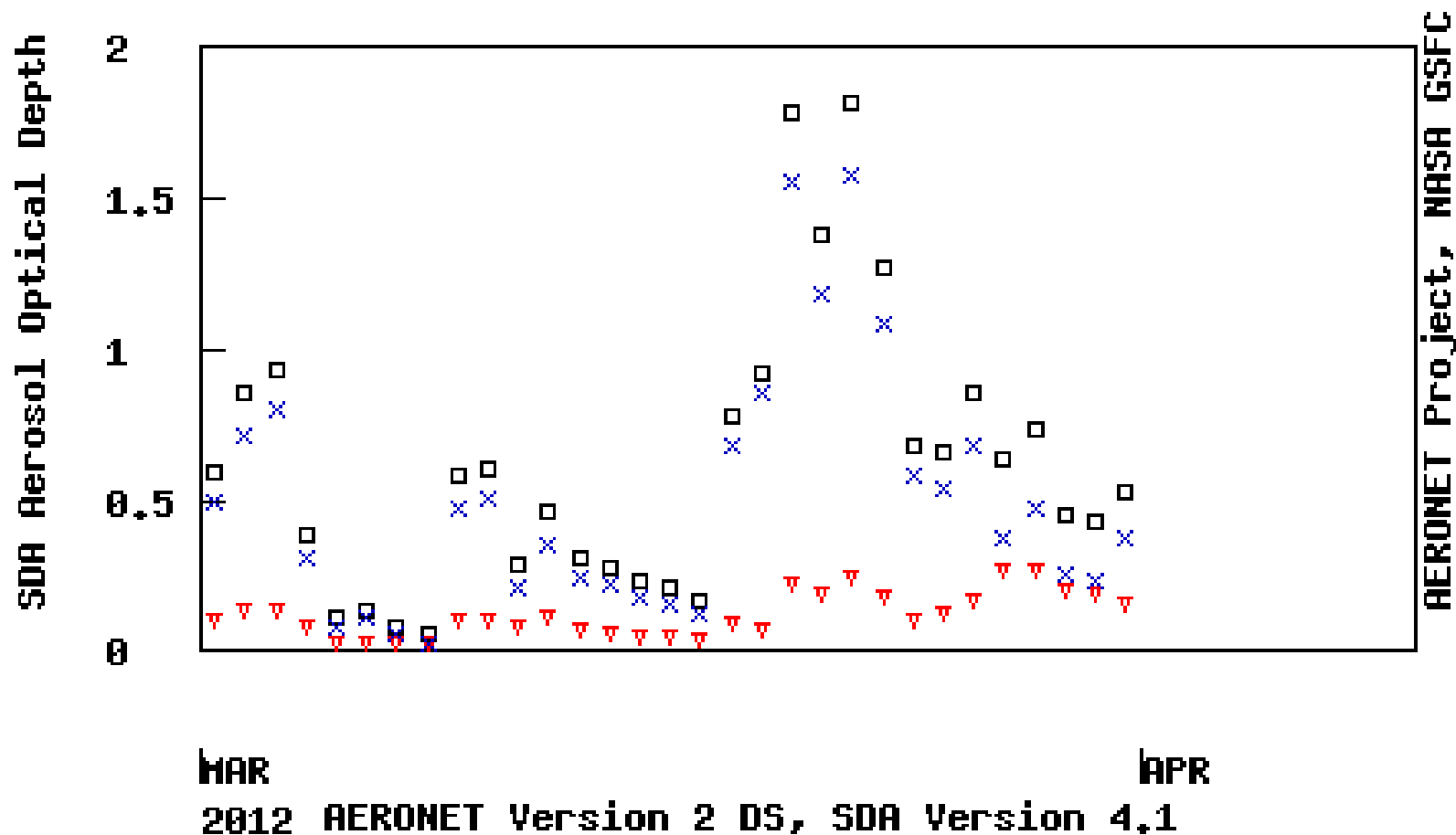
Mezaira , N 23°08'42", E 53°46'44", Alt 204 m,
PI : Brent Holben, Brent.N.Holben@nasa.gov
Angstrom from Level 1.5 AOT; Data from MAR 2012

440-870nm : <0.250>

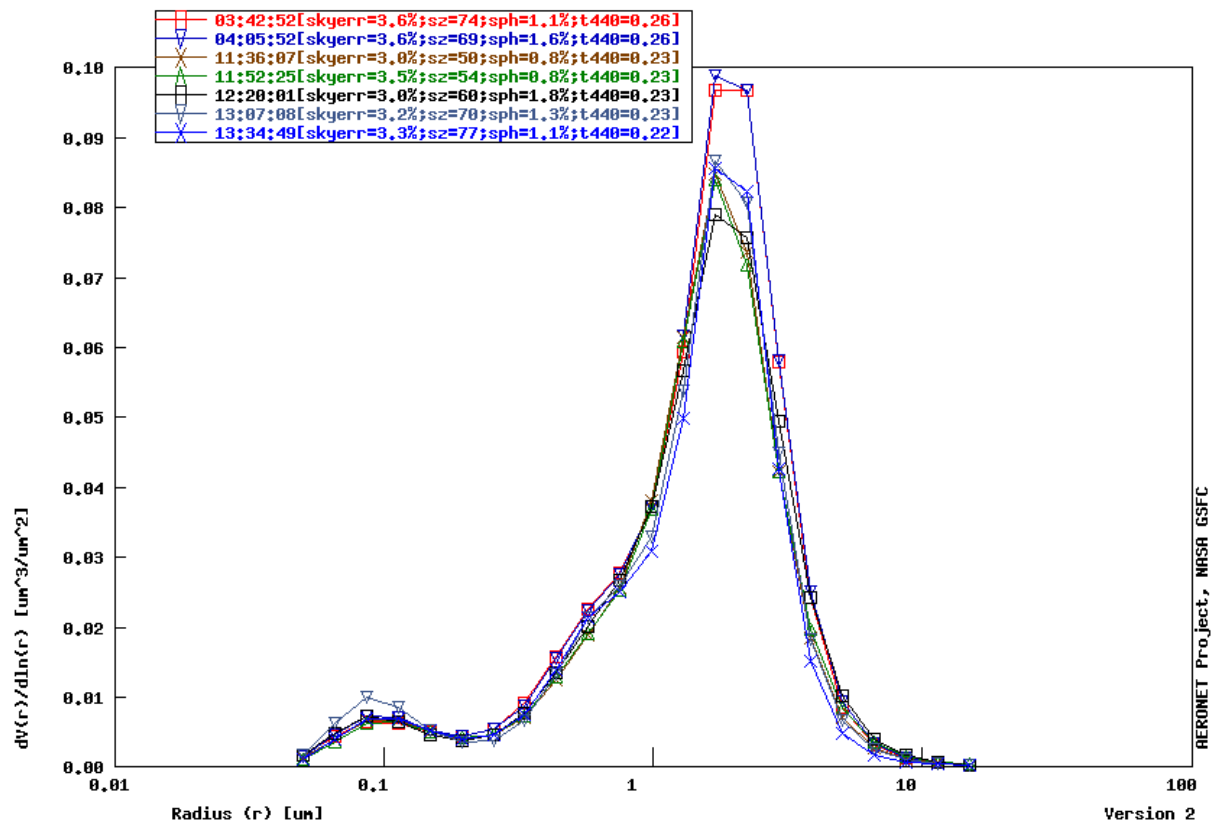


Mezaira , N 23°08'42", E 53°46'42", Alt 204 m,
PI : Brent Holben, Brent.N.Holben@nasa.gov
SDA AOD from Level 1.5 AOD; MAR 2012

□	Total_500nm	: <0.623>
▽	Fine_500nm	: <0.120>
×	Coarse_500nm	: <0.503>



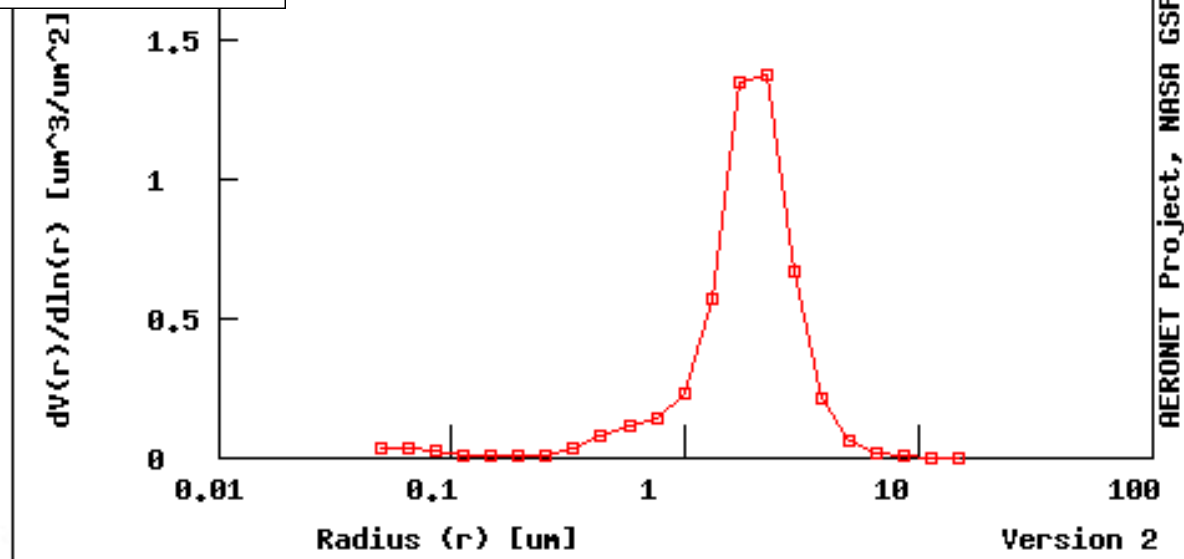
March 15th, 2012



ira , N 23°08'42", E 53°46'44", Alt 204 m,
Brent Holben, Brent.N.Holben@nasa.gov
Distribution Almuqantar Level 1.5; 20 MAR 2012

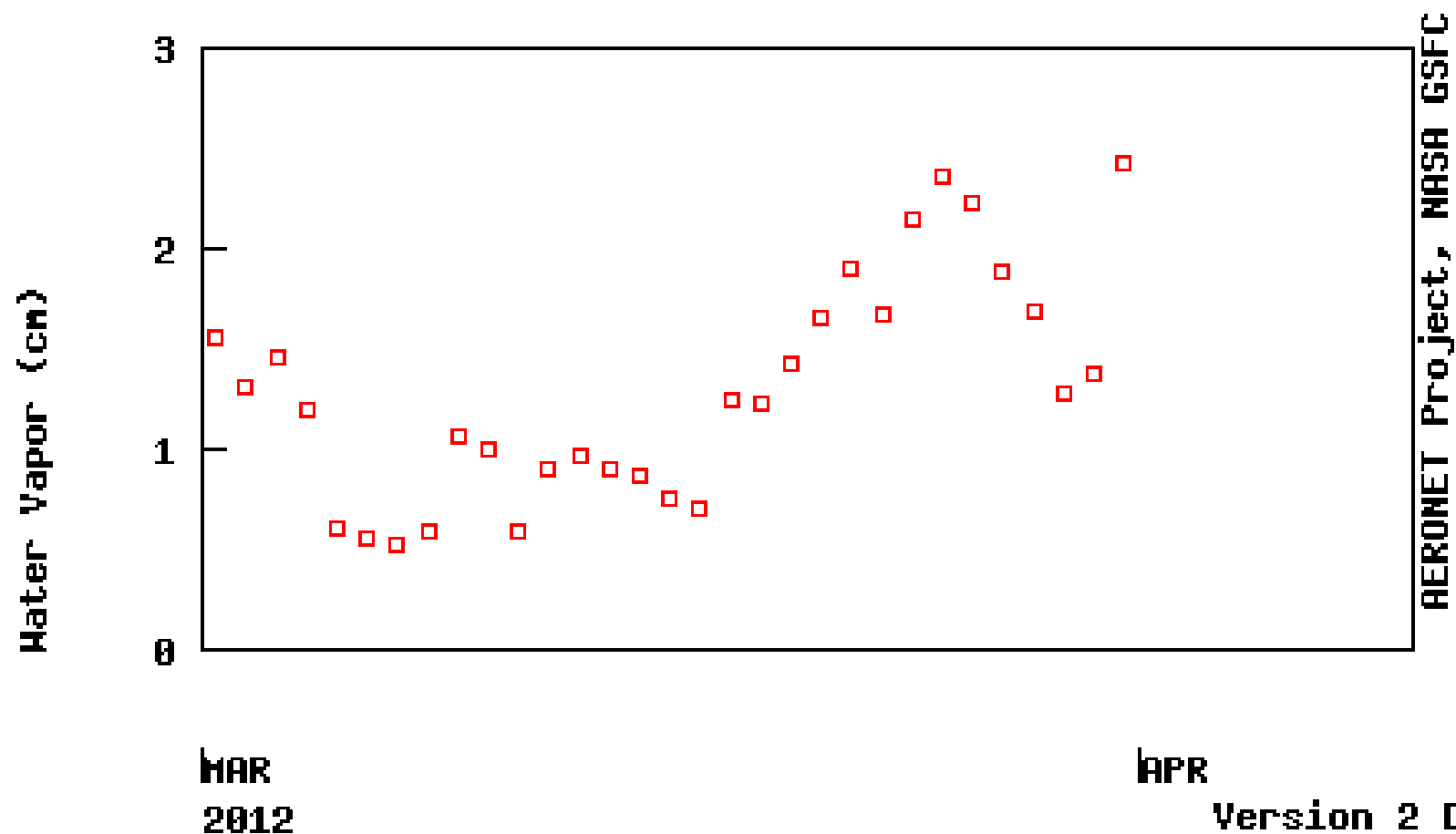
05:13:47[skyerr=5.2%;sz=53;sph=0.4%;t440=1.89]

March 20th, 2012

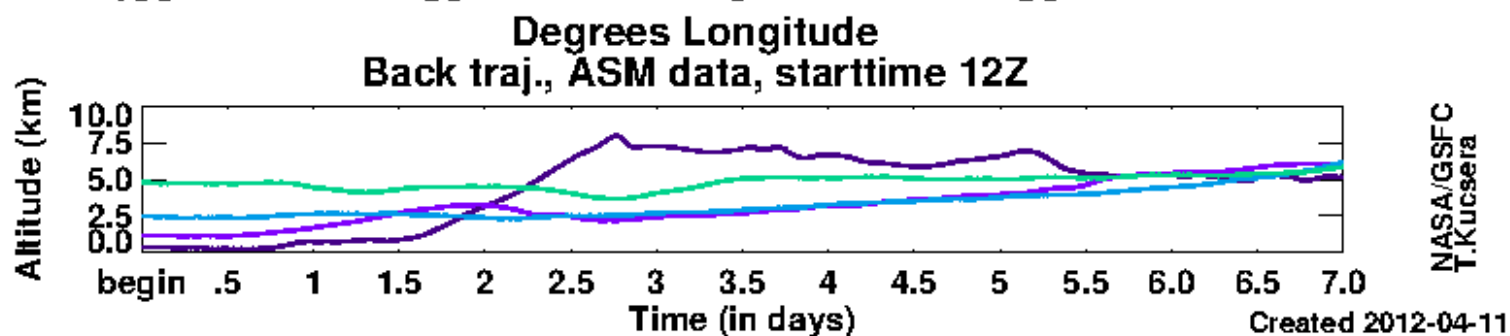
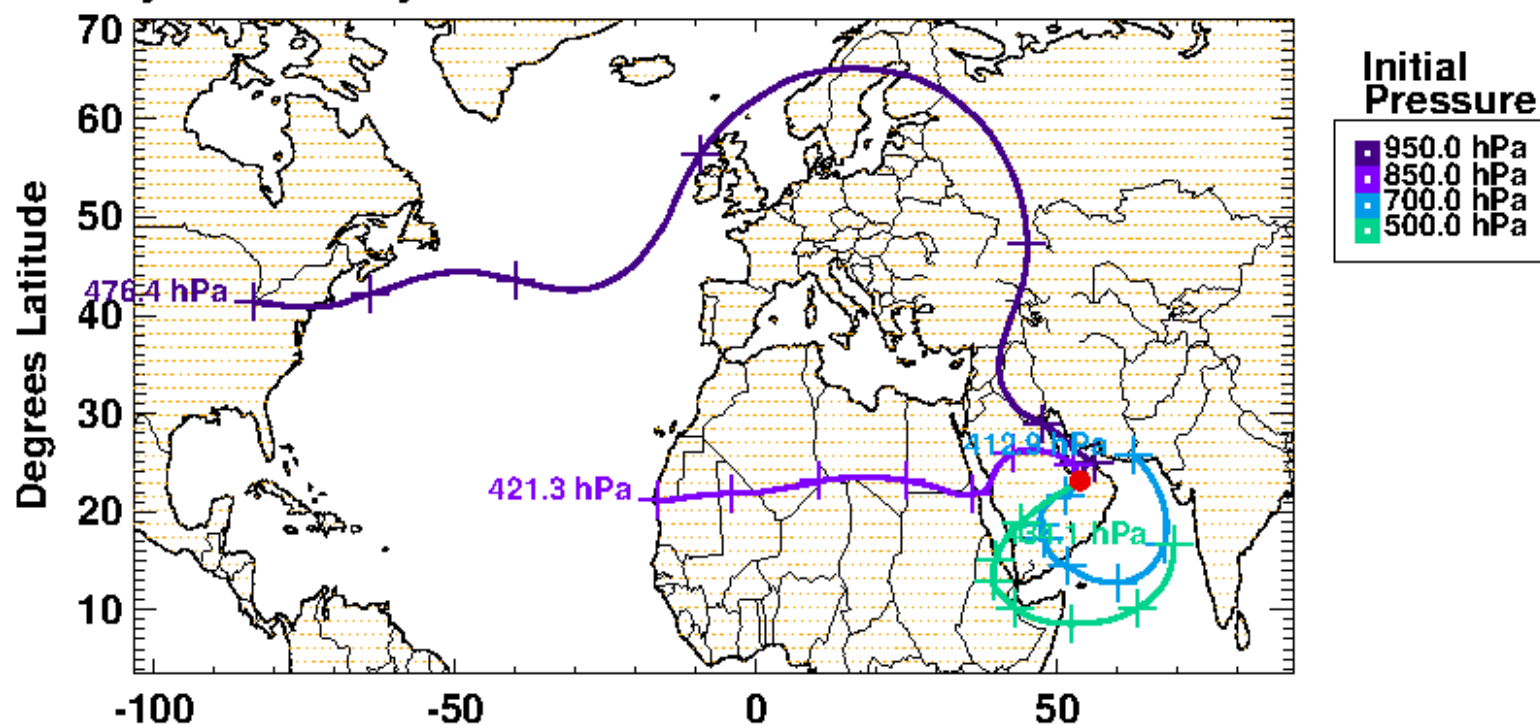


Mezaira , N 23°08'42", E 53°46'44", Alt 204 m,
PI : Brent Holben, Brent.N.Holben@nasa.gov
Level 1.5 AOT; Data from MAR 2012

Water(cm) : <1.301>



Starting Location Station (red dot): Mezaira
7-Day Back-Trajectories: kinematic, 2012-03-20T12:00:00



Check Backtrajectories

<http://ready.arl.noaa.gov/HYSPLIT.php>

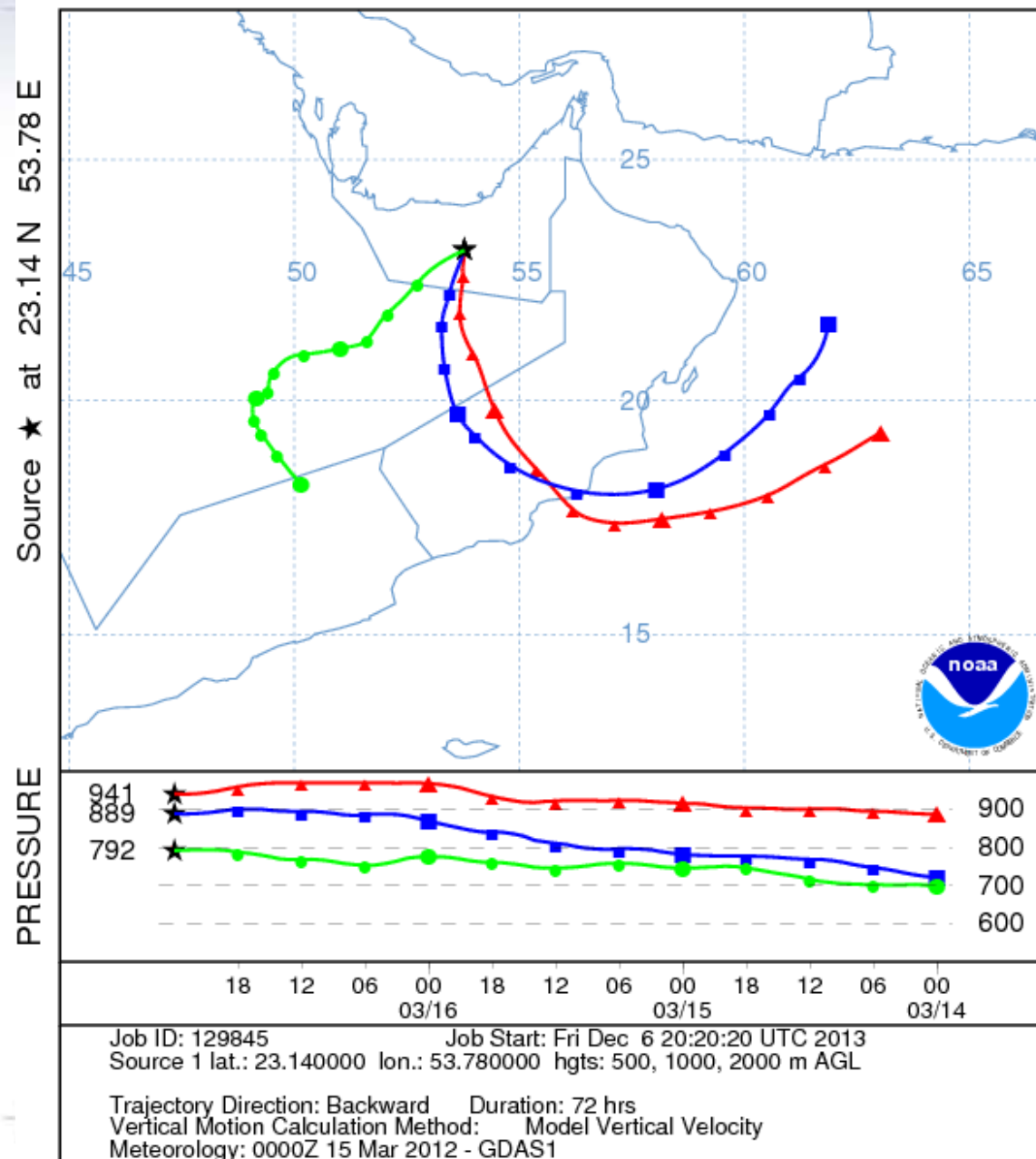
Mezaira station:

Latitude: 23.14500° North

Longitude: 53.77861° East

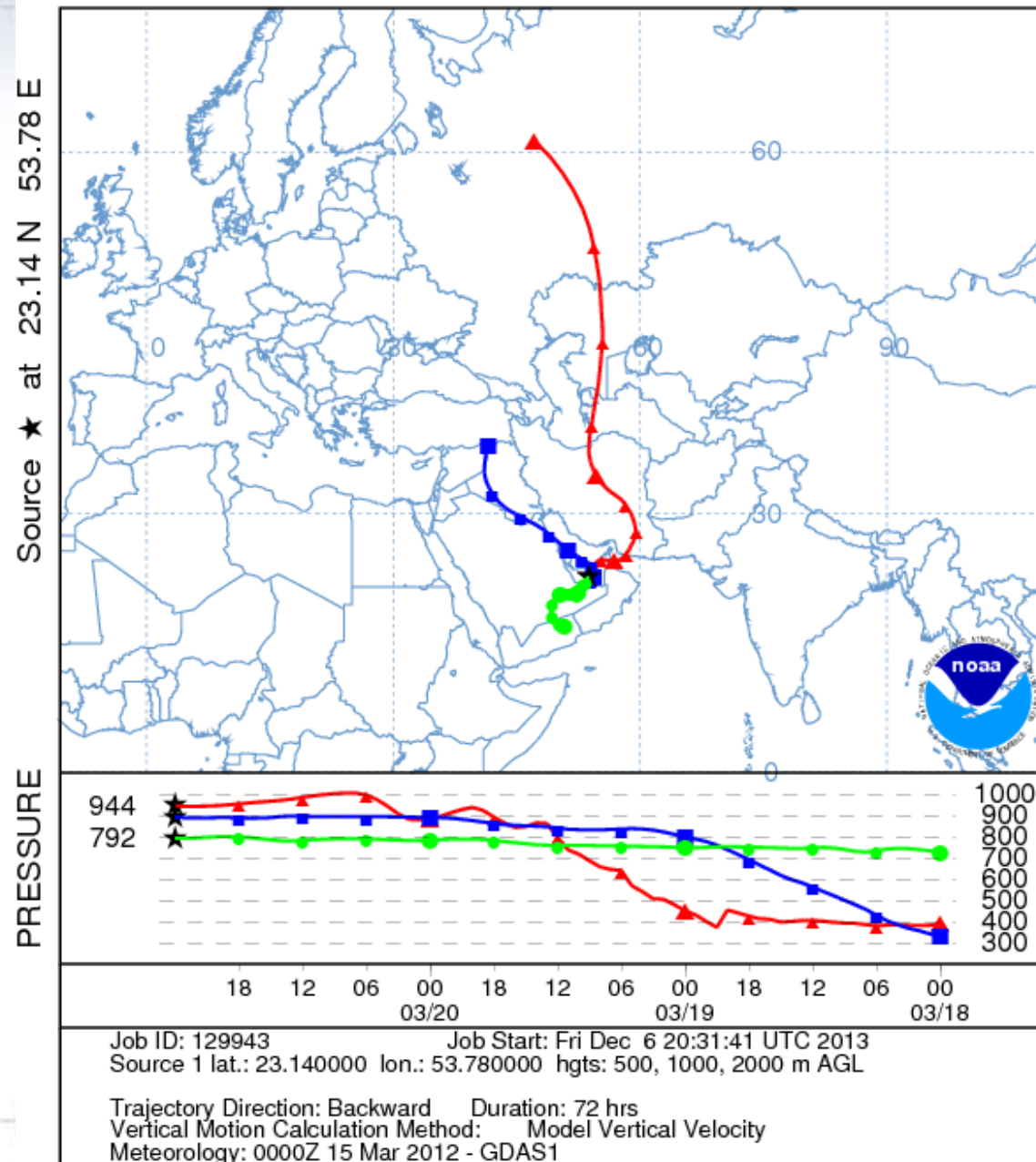
Elevation: 204.0 Meters

NOAA HYSPLIT MODEL Backward trajectories ending at 0000 UTC 17 Mar 12 GDAS Meteorological Data



December, 14th, 2012

NOAA HYSPLIT MODEL
Backward trajectories ending at 0000 UTC 21 Mar 12
GDAS Meteorological Data



December, 20th, 2012

Radiosondes (University of Wyoming)

<http://weather.uwyo.edu/upperair/sounding.html>

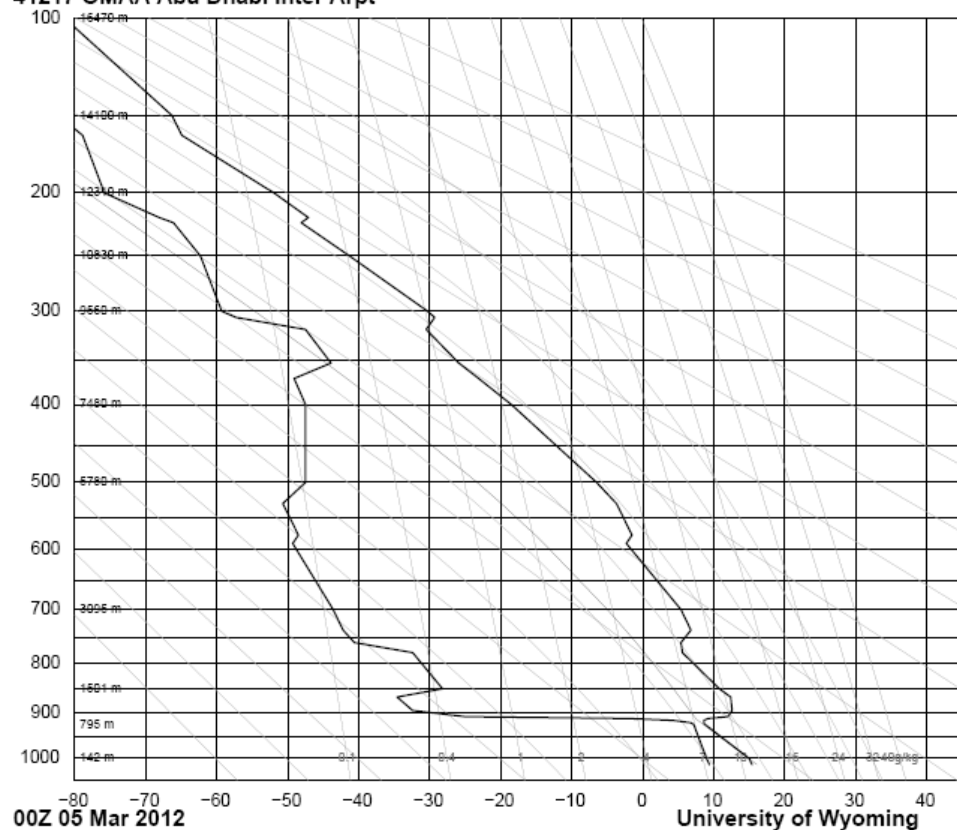


GOBIERNO
DE ESPAÑA

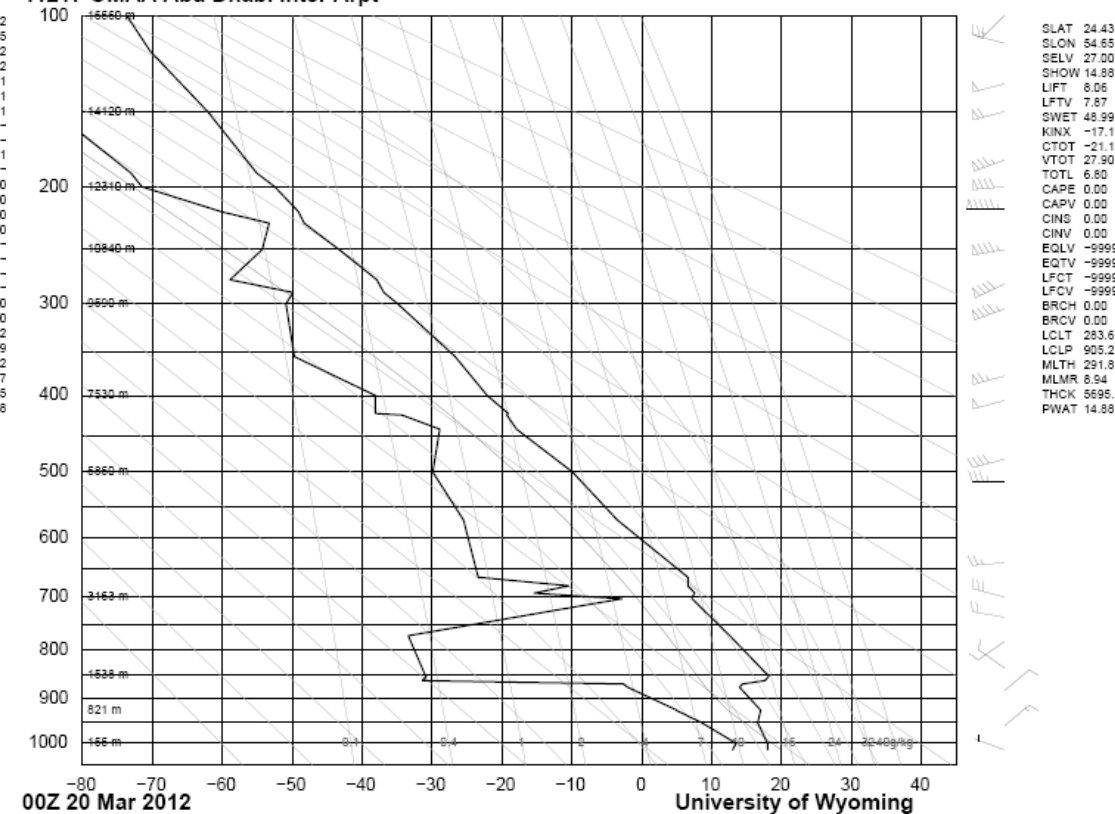
MINISTERIO
DE MEDIO AMBIENTE
Y MEDIO RURAL Y MARINO

Aemet
Agencia Estatal de Meteorología

41217 OMAA Abu Dhabi Inter Arpt



41217 OMAA Abu Dhabi Inter Arpt



41217 Observations at 00Z 15 Mar 2012

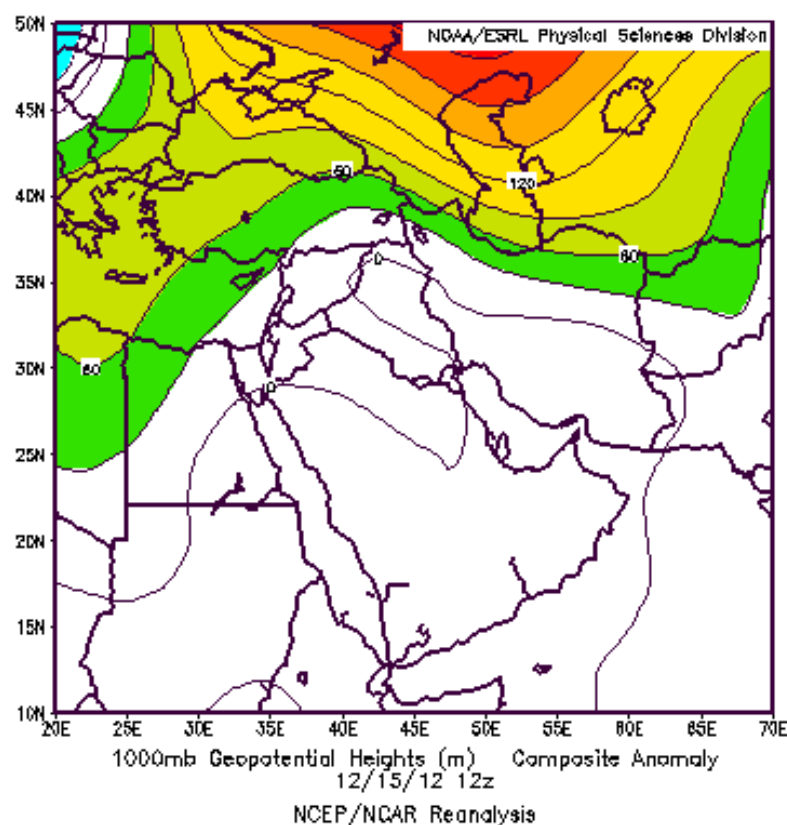
PRES hPa	HGHT m	TEMP C	DWPT C	RELH %	MIXR g/kg	DRCT deg	SKNT knot
1009.0	27	20.0	6.0	40	5.84	130	6
1003.0	81	23.2	5.2	31	5.56	123	7
1001.0	100	26.8	2.8	21	4.70	121	7
1000.0	109	27.0	2.0	20	4.44	120	7
979.0	297	28.6	-2.4	13	3.29	157	8
944.0	618	27.0	-2.0	15	3.52	220	11
928.0	769	26.2	-1.8	16	3.63	228	13
925.0	797	26.0	-2.0	16	3.59	230	13
871.0	1320	21.2	-2.4	20	3.71	230	20
864.0	1390	20.6	-2.4	21	3.73	235	19
850.0	1531	20.4	-9.6	12	2.18	245	17
845.0	1582	20.8	-16.2	7	1.28	248	17
824.0	1797	19.9	-19.1	6	1.03	260	15
782.0	2245	18.0	-25.1	4	0.64	250	12
773.0	2344	17.6	-26.4	4	0.58	260	11
755.0	2542	16.3	-24.8	4	0.68	280	10
700.0	3180	12.2	-19.8	9	1.14	245	18
688.0	3321	11.2	-20.3	9	1.11	235	18
656.0	3709	8.3	-21.7	10	1.03	245	14
634.0	3986	6.3	-22.7	10	0.98	285	17
615.0	4234	4.5	-23.6	11	0.93	295	21
542.0	5263	-3.1	-27.3	13	0.76	270	34
538.0	5323	-3.5	-27.5	14	0.75	271	33
511.0	5729	-5.3	-38.5	5	0.27	275	25
500.0	5900	-6.1	-43.1	4	0.17	275	27

41217 Observations at 00Z 20 Mar 2012

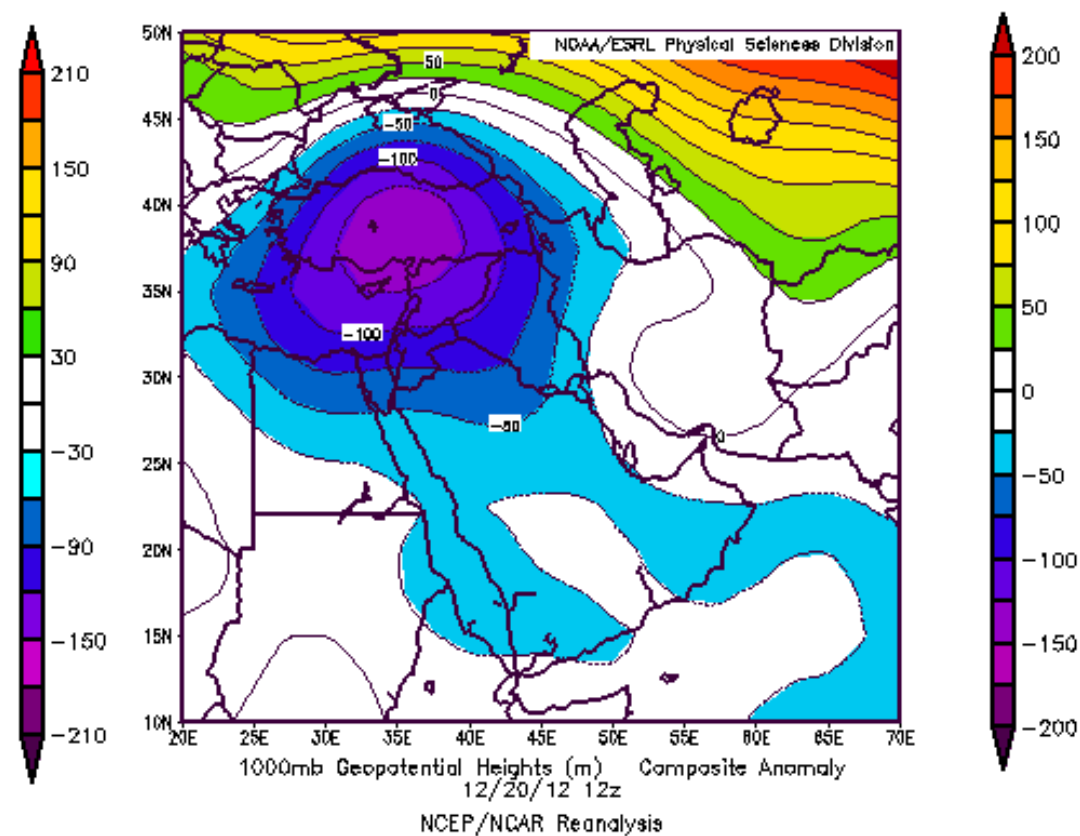
PRES hPa	HGHT m	TEMP C	DWPT C	RELH %	MIXR g/kg	DRCT deg	SKNT knot
1015.0	27	18.0	13.0	73	9.35	290	5
1003.0	129	18.0	13.4	74	9.72	325	12
1000.0	155	18.0	13.5	75	9.81	330	12
960.0	504	16.8	9.3	61	7.74	50	16
953.0	567	16.6	8.6	59	7.41	58	17
951.0	585	16.6	8.3	58	7.29	60	17
926.0	812	17.0	5.0	45	5.94	41	17
925.0	821	17.0	5.0	45	5.94	40	17
921.0	858	16.8	4.4	44	5.74	40	16
883.0	1215	14.4	-1.0	35	4.05	50	10
876.0	1282	14.0	-2.0	33	3.79	30	7
869.0	1350	14.4	-2.6	31	3.65	10	5
864.0	1399	16.7	-23.1	5	0.69	355	3
862.0	1419	17.6	-31.4	2	0.32	347	3
853.0	1508	18.2	-30.8	2	0.35	312	5
850.0	1538	18.0	-31.0	2	0.34	300	5
836.0	1678	17.1	-31.4	2	0.33	305	10
829.0	1749	16.6	-31.6	2	0.33	305	10
783.0	2231	13.4	-33.0	2	0.30	235	10
772.0	2351	12.6	-33.4	3	0.30	246	12
737.0	2736	9.9	-18.2	12	1.24	280	19
708.0	3069	7.6	-5.1	40	3.71	290	30
703.0	3128	7.2	-2.8	49	4.45	287	29
700.0	3163	7.2	-6.8	36	3.30	285	29
693.0	3246	7.6	-15.4	18	1.67	283	28
680.0	3402	6.6	-10.4	29	2.56	279	27
665.0	3585	6.6	-23.4	10	0.88	274	26
640.0	3893	4.1	-23.9	11	0.87	265	23
571.0	4812	-3.5	-25.5	16	0.85	268	30
513.0	5649	-8.7	-29.1	18	0.68	270	36
500.0	5850	-9.9	-29.9	18	0.64	265	39

Check Weather maps (NCEP)

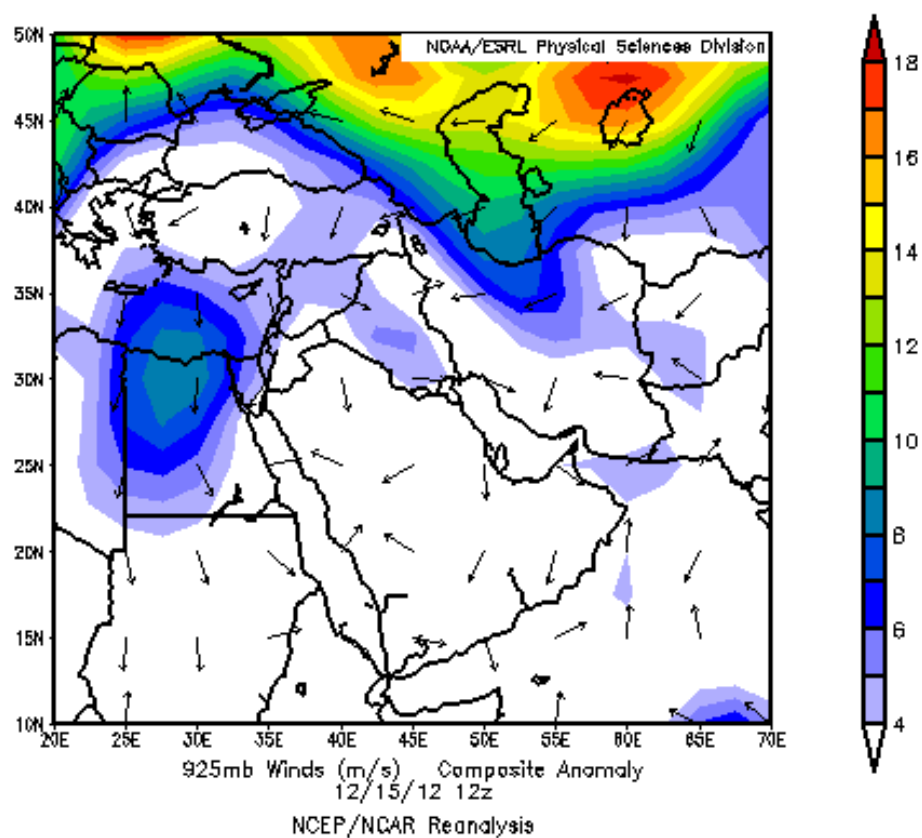
<http://www.esrl.noaa.gov/psd/data/composites/hour/>



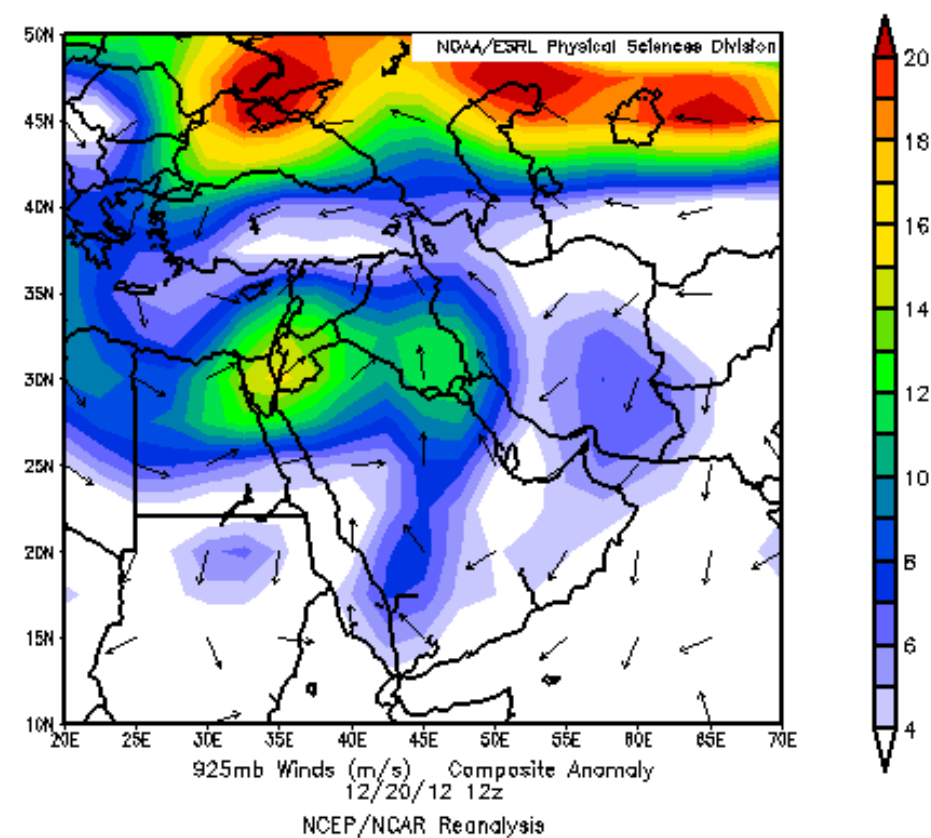
1000 hPa anomaly for Dec. 15, 2012



1000 hPa anomaly for Dec. 20, 2012



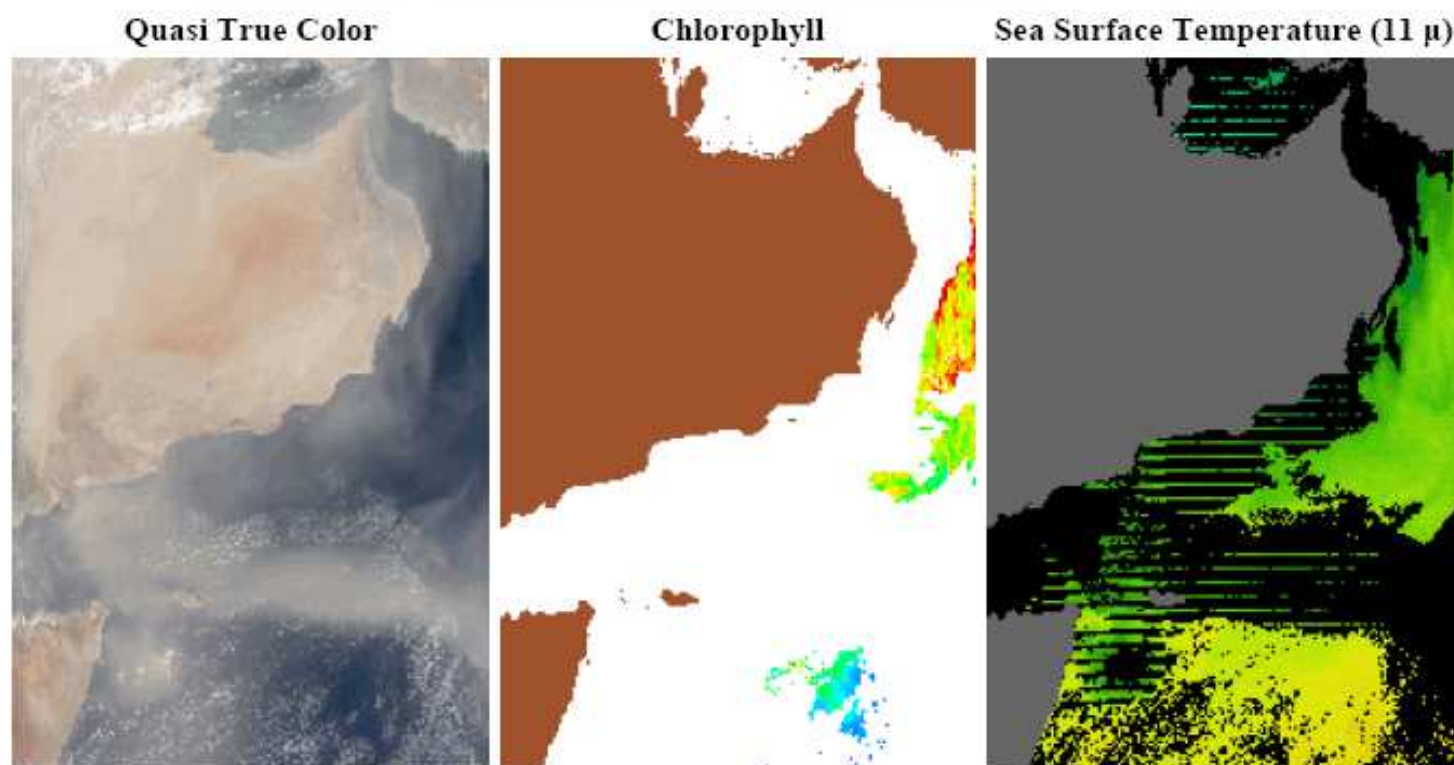
925 hPa wind for Dec. 15, 2012



925 hPa wind for Dec. 15, 2012

Satellite information

<http://oceancolor.gsfc.nasa.gov/cgi/browse.pl>



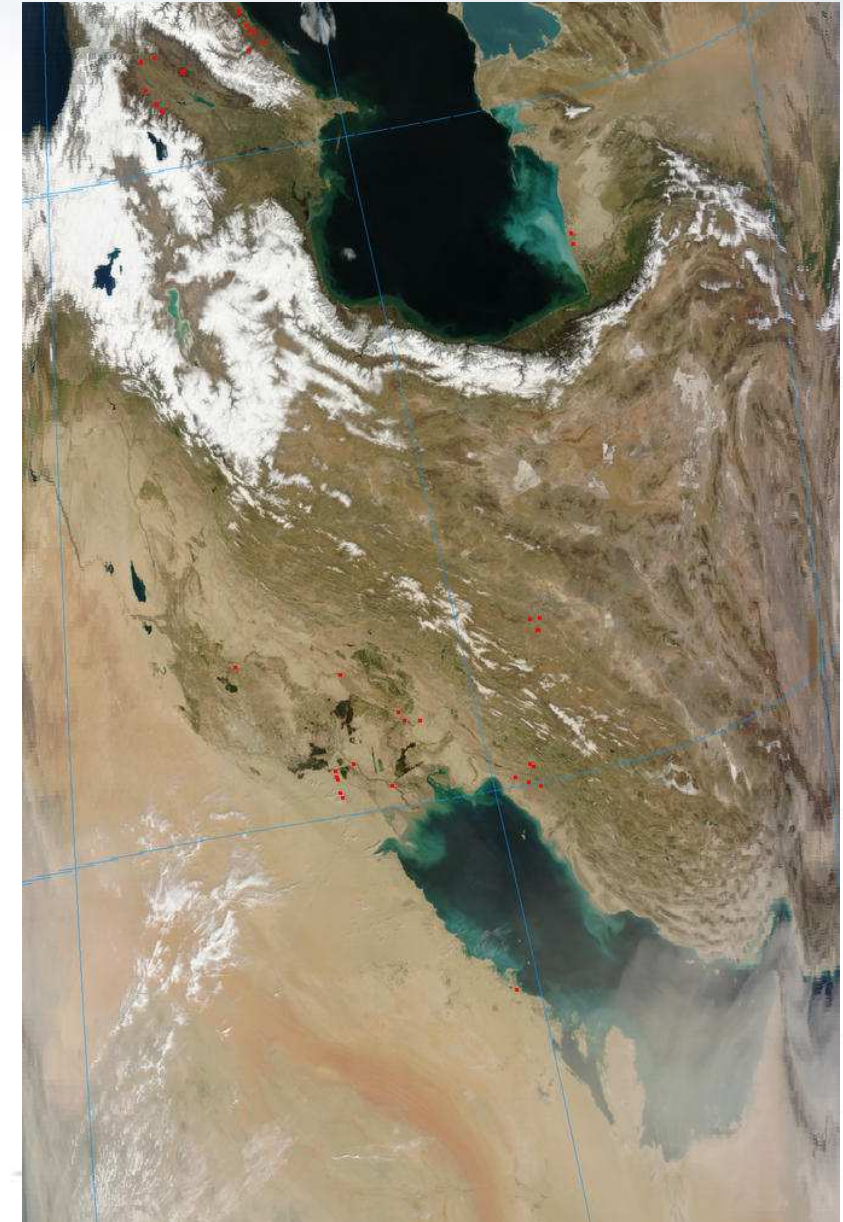
Time Period: 19 Mar 2012 through 21 Mar 2012 (daytime)

Sensors: VIIRS(NPP) and Terra and SeaWiFS and OCTS(ADEOS) and MERIS and HICO(ISS) and CZCS(Nimbus-7) and Aqua

MERIS Data Types: RR and FRS

Area of Interest: Within 0 km of 25.7N,10.2E

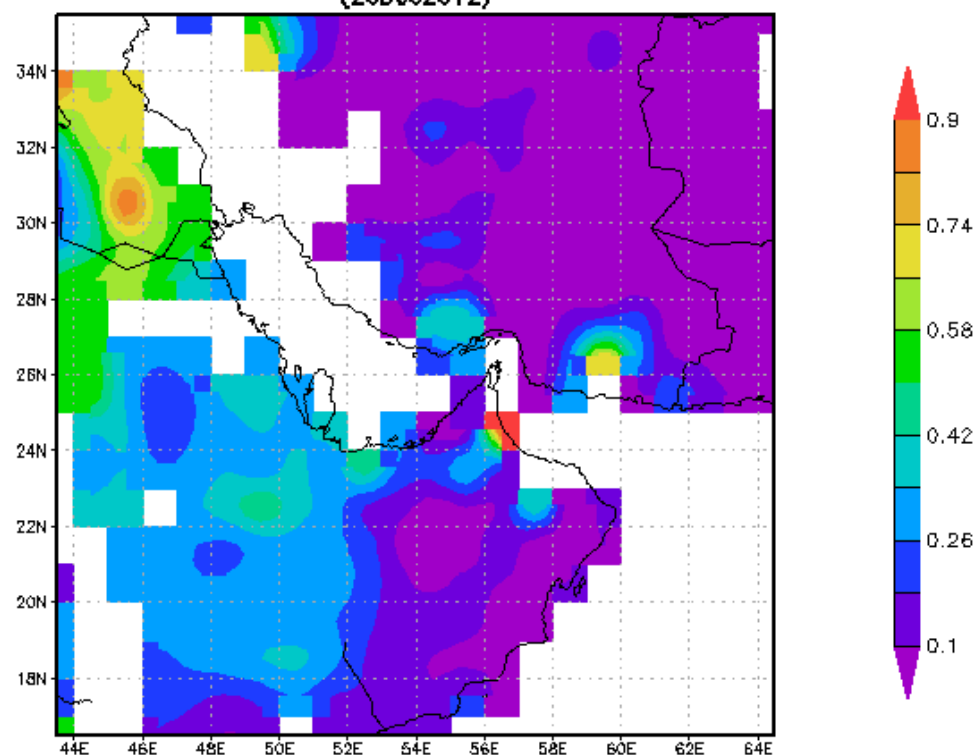
<http://rapidfire.sci.gsfc.nasa.gov/cgi-bin/imagery/realtime.cgi>



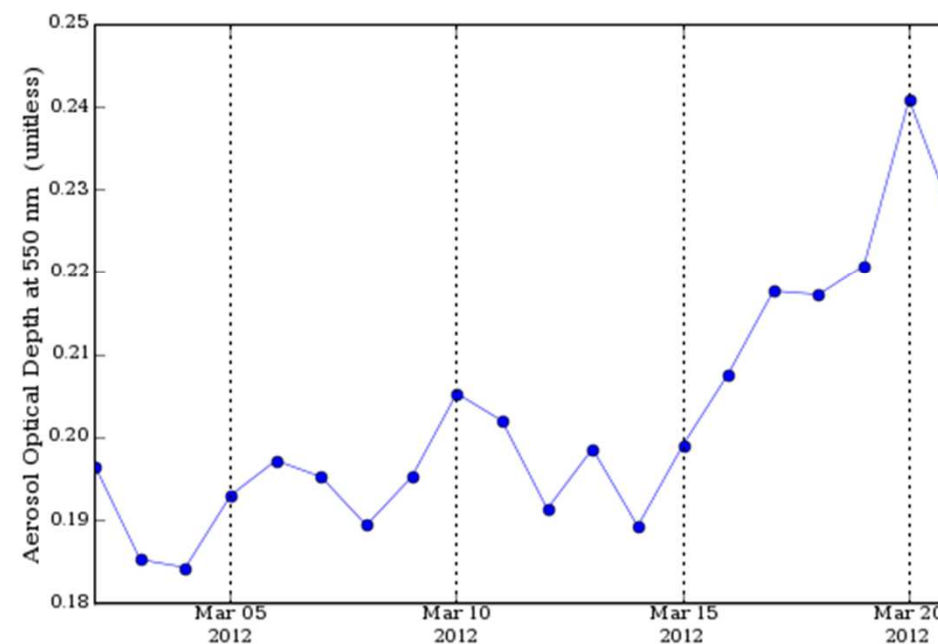
Giovanni - Interactive Visualization and Analysis

<http://disc.sci.gsfc.nasa.gov/giovanni>

MYD08_D3.051 Deep Blue AOD at 550 nm (QA-w, Land only) [unitless]
(20Dec2012)



Area-Averaged Time Series (MOD08_D3.051)
(Region: 180W-180E, 90S-90N)



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Muscat-Oman, December 8-12, 2013



Ground observations of mineral dust

Emilio Cuevas [ecuevasa@aemet.es] (remote sensing)

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