

Extreme dust event in Canary Islands Feb 2020



Natalia Prats Izaña Atmospheric Research Center – AEMET

(prepared by David Suárez Molina, Director of AEMET Regional Center at Canary Island)

User Workshop on Dust Products for Aviation, 20th May 2021



Santa Cruz Tenerife
 $PM_{10} < 15 \mu g m^{-3}$



Santa Cruz Tenerife
 $PM_{10} > 60 \mu g m^{-3}$



Santa Cruz Tenerife
 $PM_{10} > 3000 \mu g m^{-3}$

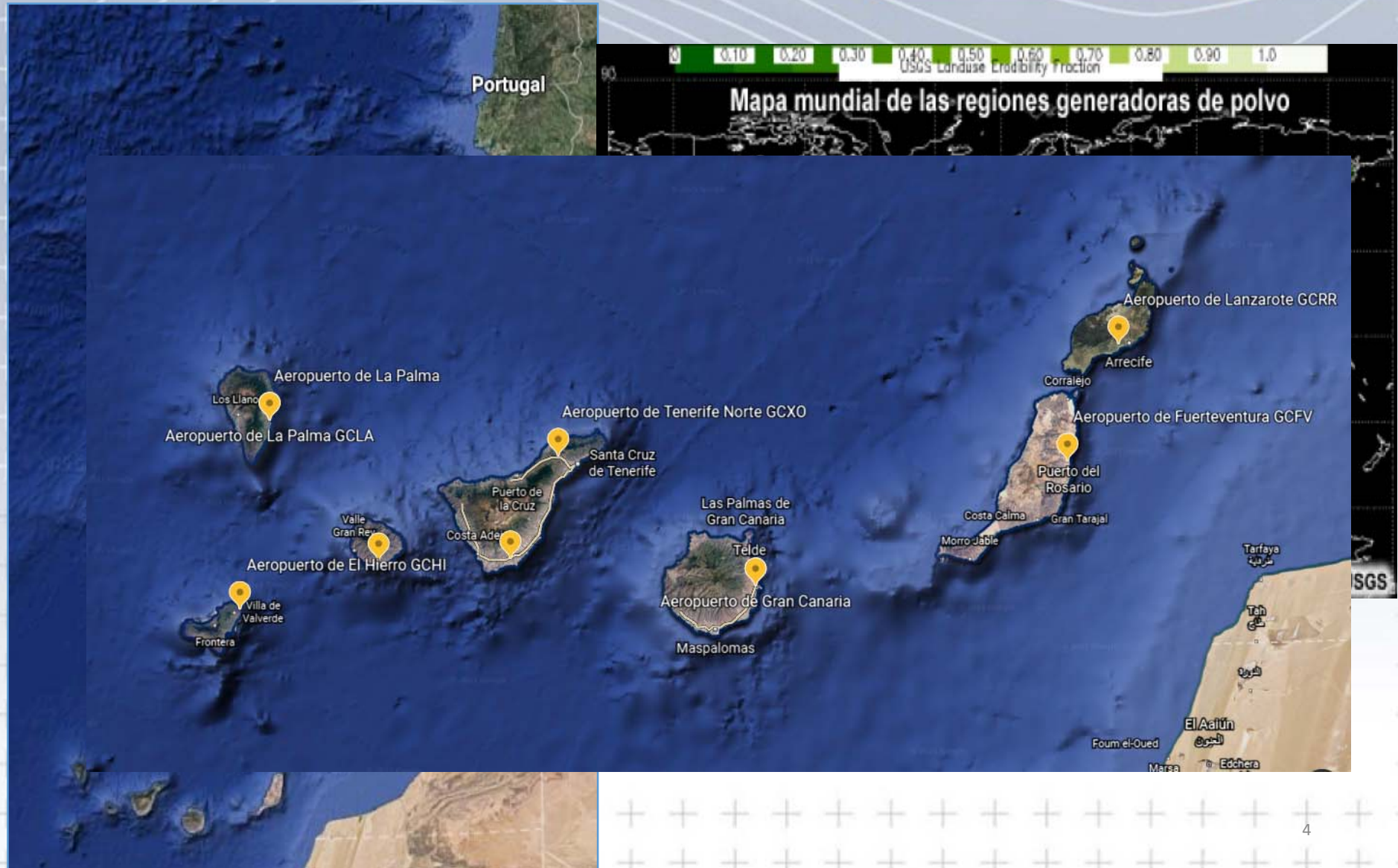
23th February 2020

OUTLINE



1. Introduction
2. Synoptic patterns
3. Forecast and monitoring tools
4. An extreme event: Airports impact
5. Present & Future work
6. Conclusions

INTRODUCTION



SYNOPTIC MECHANISMS

Summer situation

ECMWF Analysis VT: Tuesday 22 July 2003 12UTC 850hPa Temperature/ Mean sea level pressure

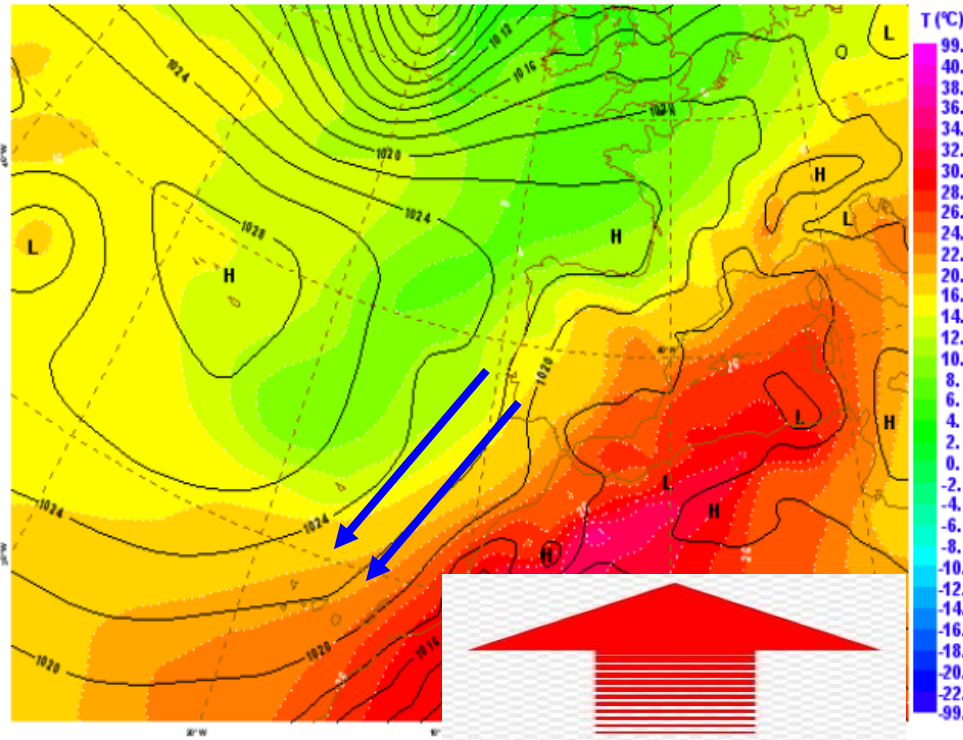


Figura 57: Análisis de superfi
horas del 22 de julio de 2003. (Fuente: AEMET)

ECMWF Analysis VT: Tuesday 22 July 2003 12UTC 500hPa Temperature/ Geopotential

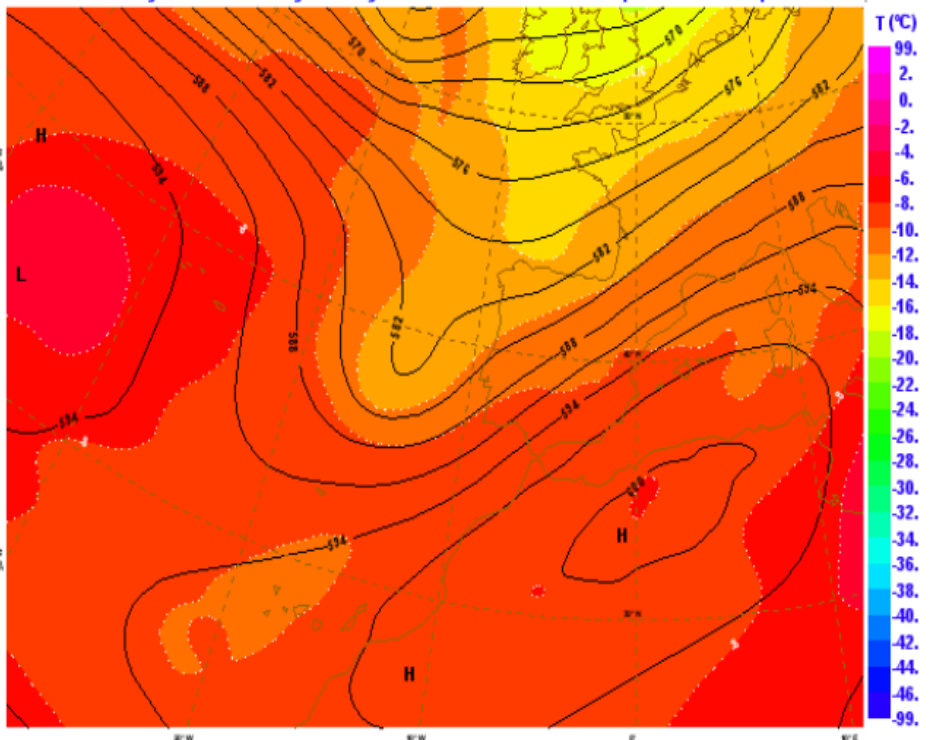
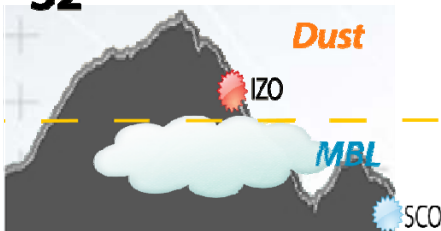


Figura 58: Análisis de 500 hPa, 12 horas del 22 de julio de 2003. (Fuente: AEMET)



Dust intrusion in high levels

SYNOPTIC MECHANISMS

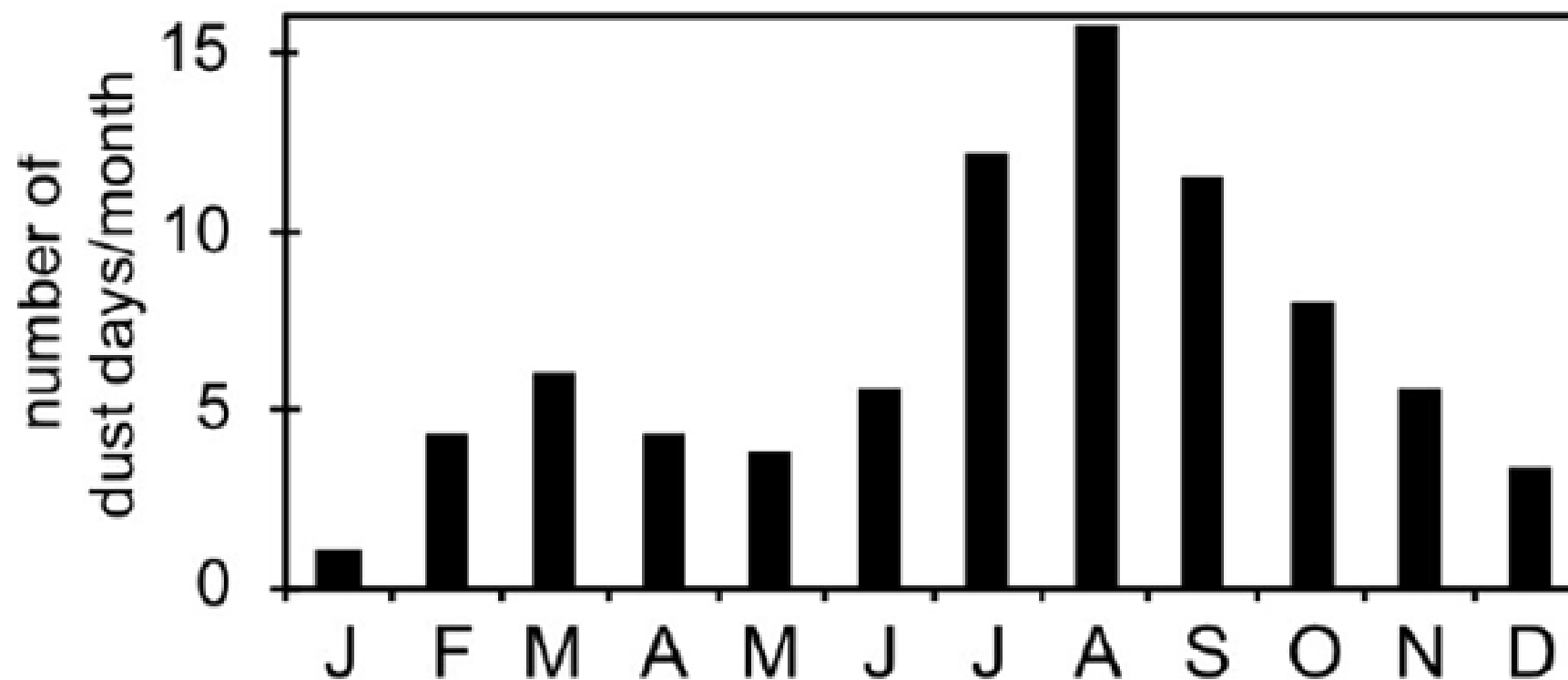
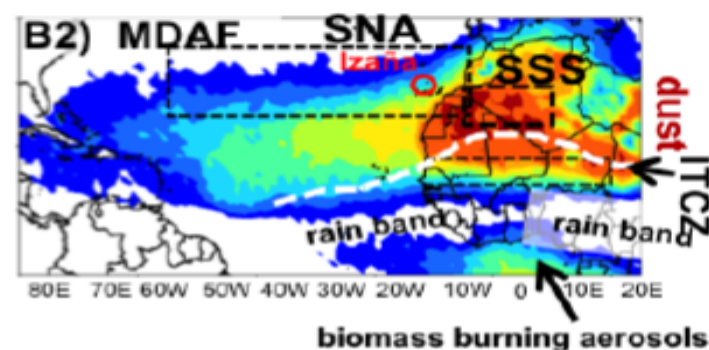
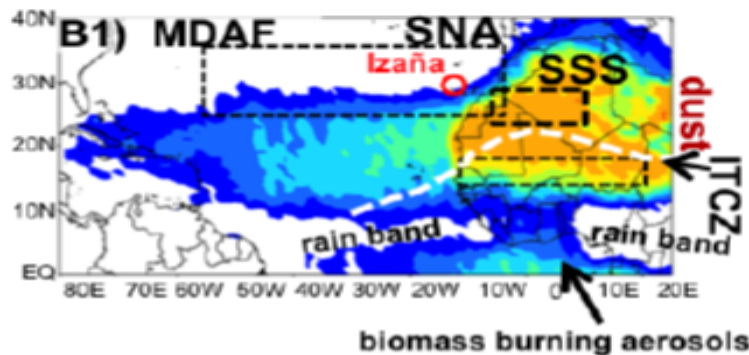
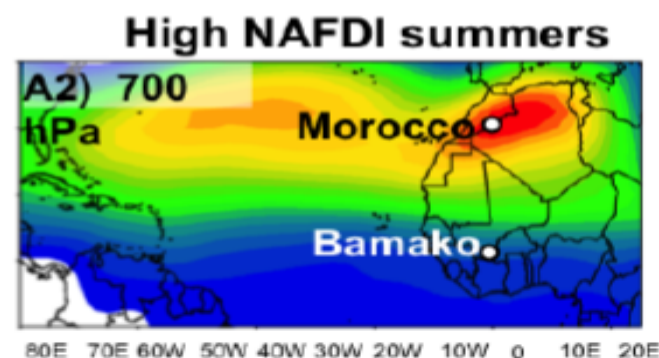
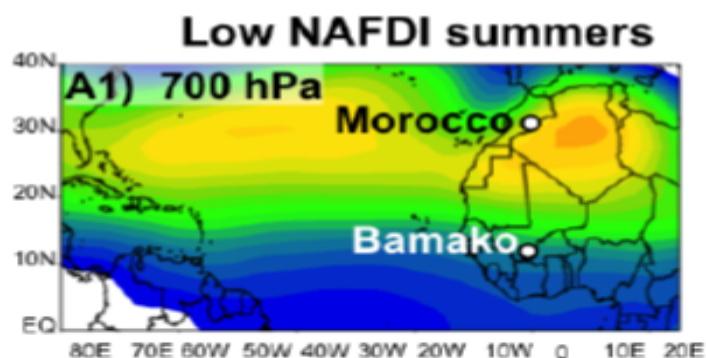
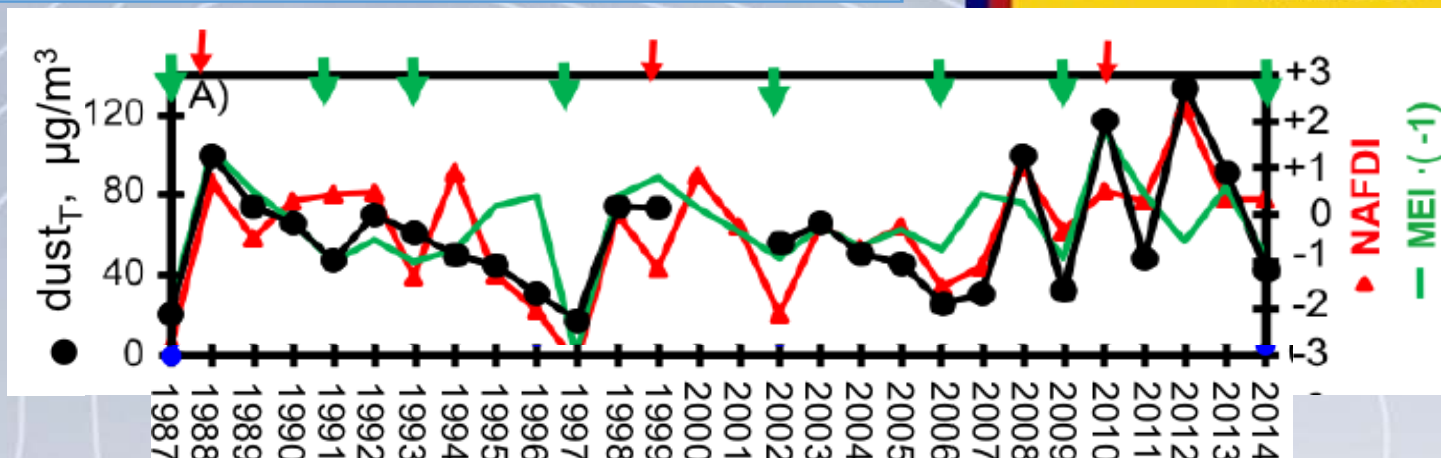


Figura 54: Frecuencia de eventos de polvo ($>10 \mu\text{g}/\text{m}^3$) en Izaña en el periodo 1987–2014.



Measurements at 2400 m above sea level

SYNOPTIC MECHANISMS



SYNOPTIC MECHANISMS

Winter situation

ECMWF Analysis VT: Tuesday 4 March 2003 12UTC 850hPa Temperature/ Mean sea level pressure

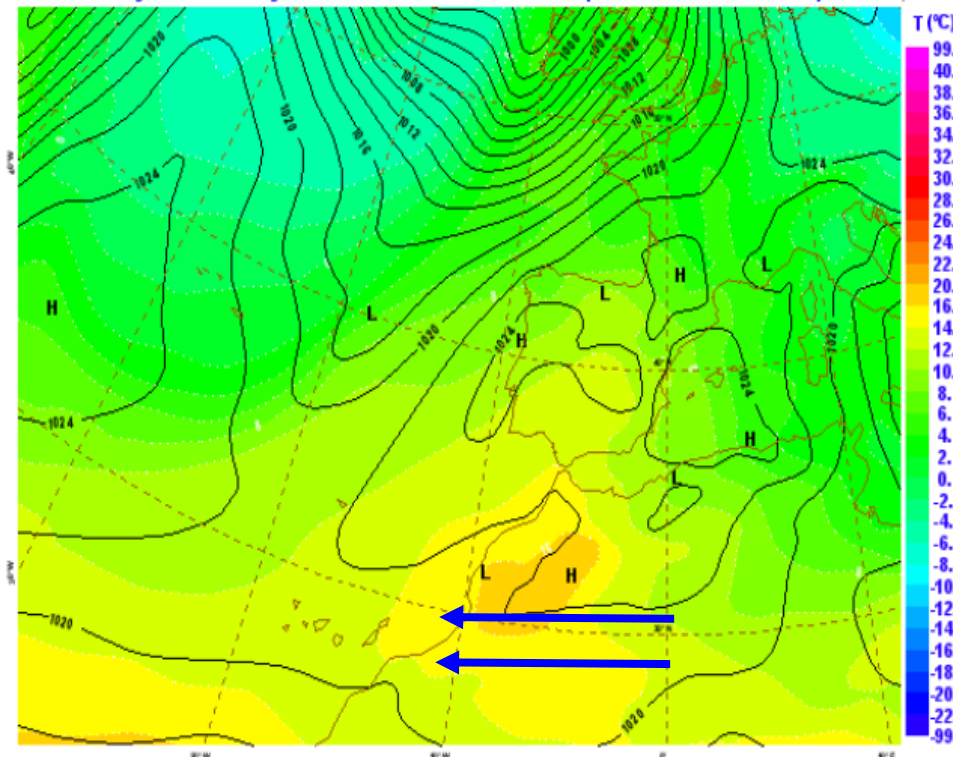


Figura 61: Análisis de superficie, 12 horas del 4 de marzo de 2003. (Fuente: AEMET)

ECMWF Analysis VT: Tuesday 4 March 2003 12UTC 500hPa Temperature/ Geopotential

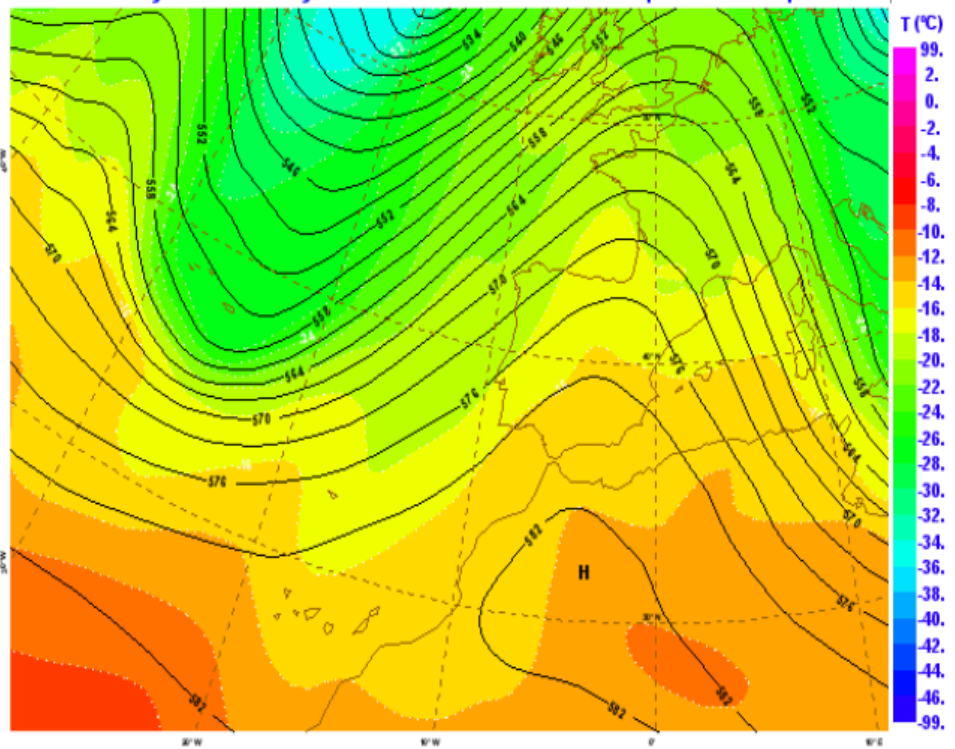
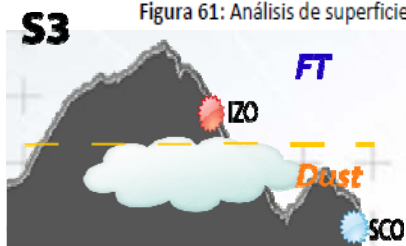
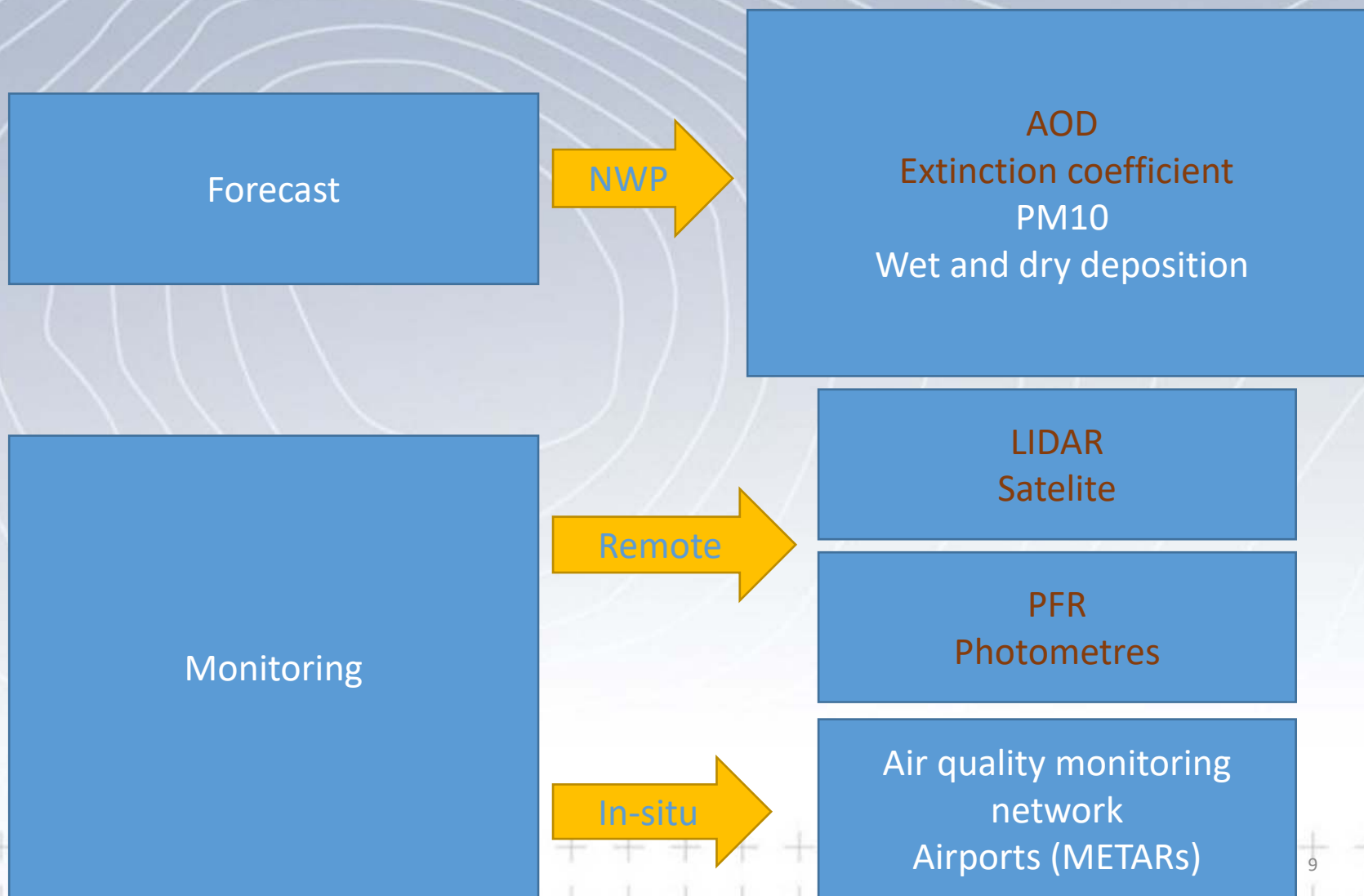


Figura 62: Análisis de 500 hPa, 12 horas del 4 de marzo de 2003. (Fuente: AEMET)



Dust intrusion in low levels

FORECAST AND MONITORING TOOLS

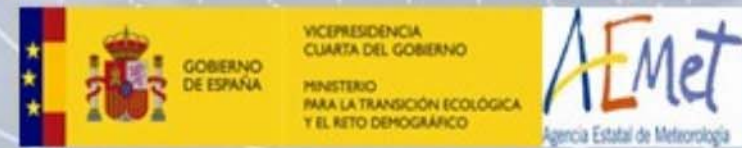


EXTREME EVENT

Historical sand storm over the Canary Islands: February 22 to 24, 2020



AERONAUTICAL IMPACTS



More than 800 flights were canceled or diverted to other airports, stranding hundreds of travelers.

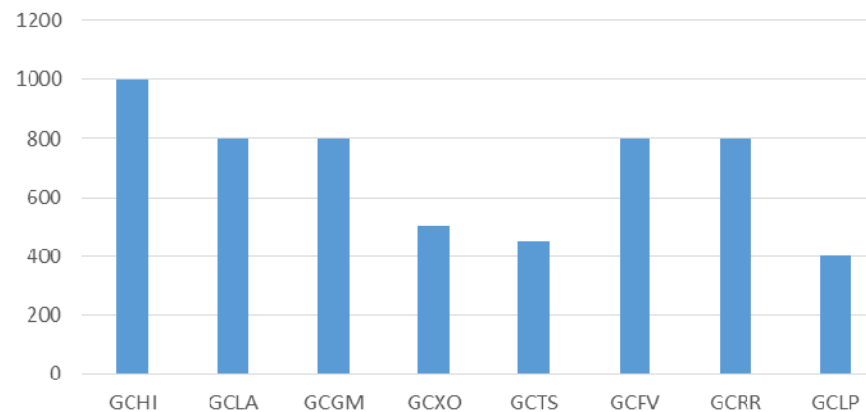


Aeronautical procedures
Visibility < (550 to 800
m). Stop aeronautical
operations



@enaire

Minimum visibility
February 22 -25, 2020



AERONAUTICAL IMPACTS

(ECONOMIC IMPACT)

<https://www.eurocontrol.int/sites/default/files/publication/files/standard-input-for-eurocontrol-cost-benefit-analyses-2018-edition-8-version-2.6.pdf>



Standard Inputs for
EUROCONTROL Cost-Benefit Analyses

Edition Number: 8.0
Edition Date: January 2018



estimated average cost of cancellation per flight = 17,650 €

average delay cost = 100 € per delayed minute

flight deviation cost (regionals) = 830 – 5,900 €

flight deviation cost (continental) = 1,180 – 8,900 €

Event February 2020

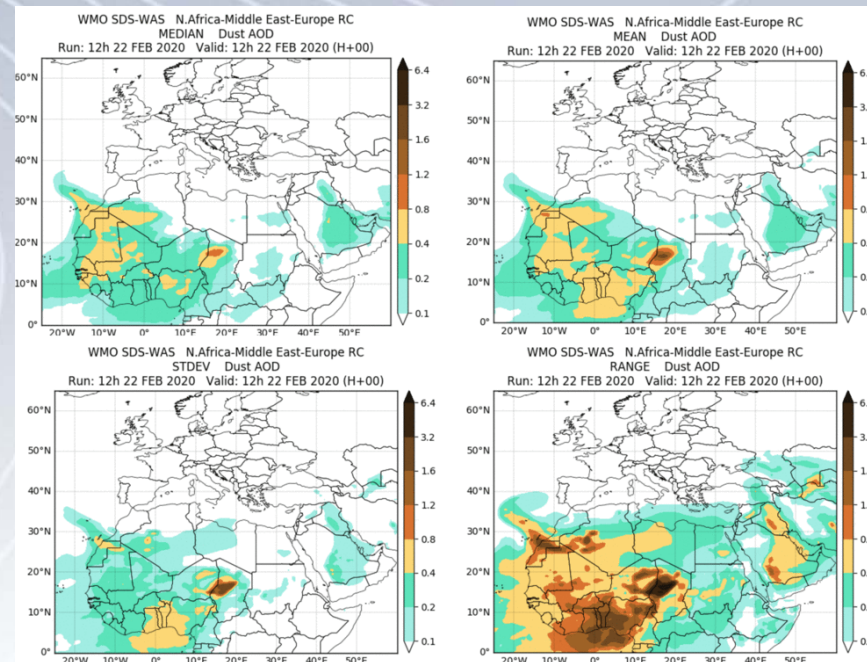
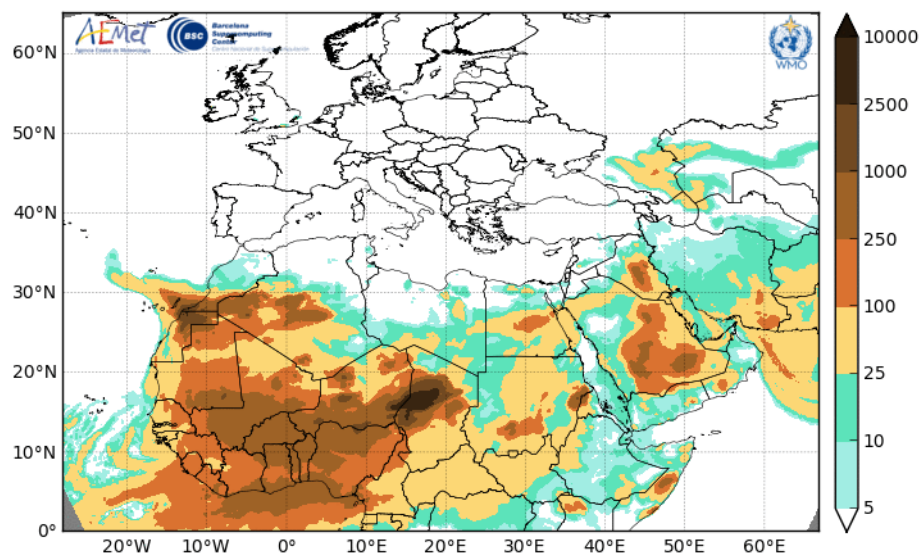
Only considering cancellations,
loss estimation >17 M€

FORECAST TOOLS



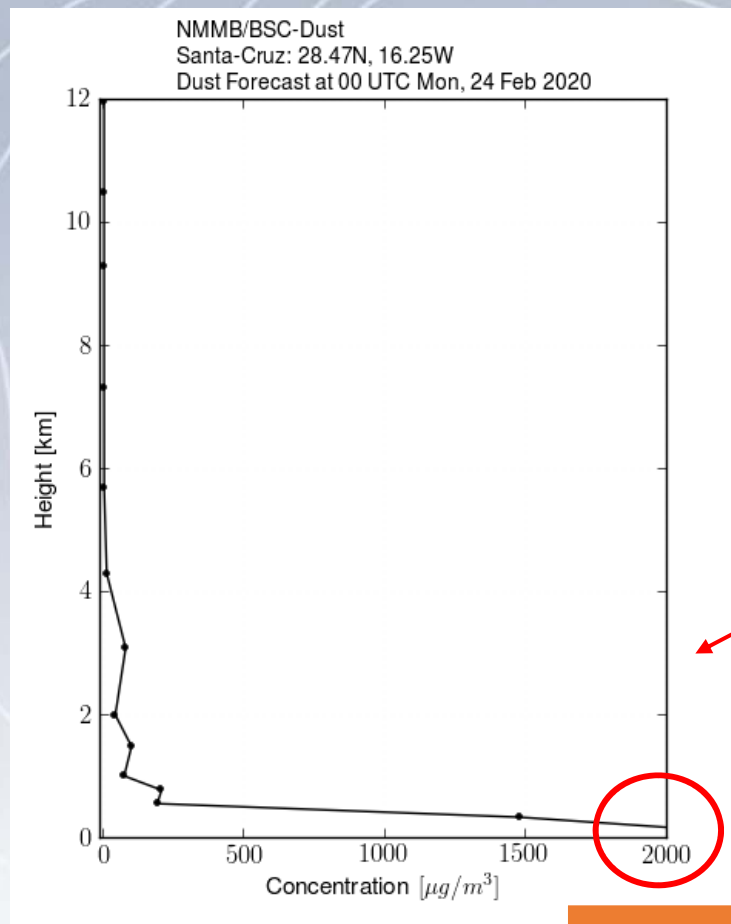
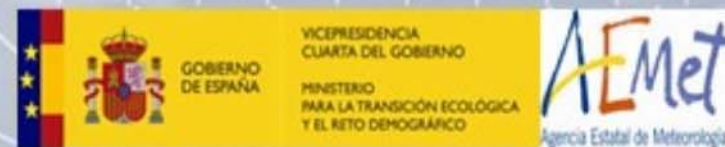
<https://dust.aemet.es/forecast>

Barcelona Dust Forecast Center - <http://dust.aemet.es/>
NMMB-MONARCH Res:0.1°x0.1° Dust Surface Ext. (Mm^{-1})
Run: 12h 22 FEB 2020 Valid: 12h 22 FEB 2020 (H+00)



<https://sds-was.aemet.es/forecast-products/dust-forecasts/ensemble-forecast>

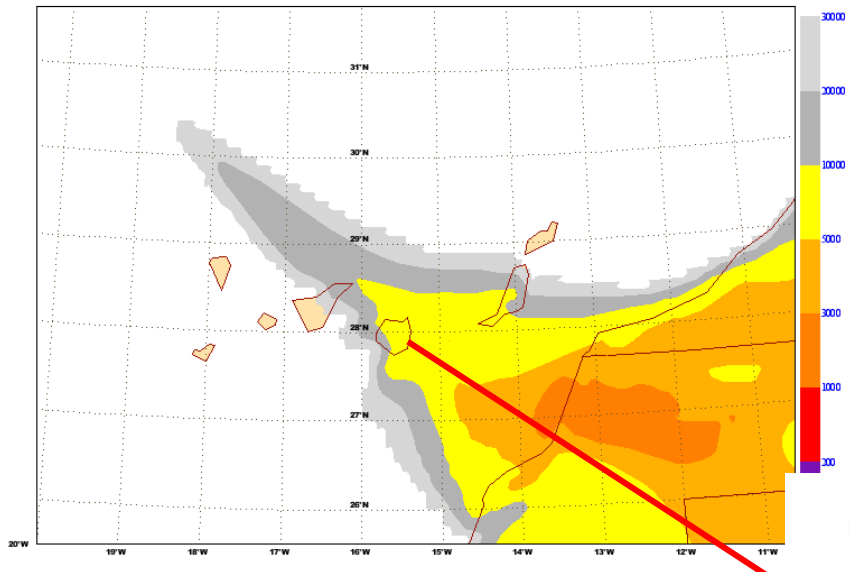
FORECAST TOOLS



>2000 ...
How much?

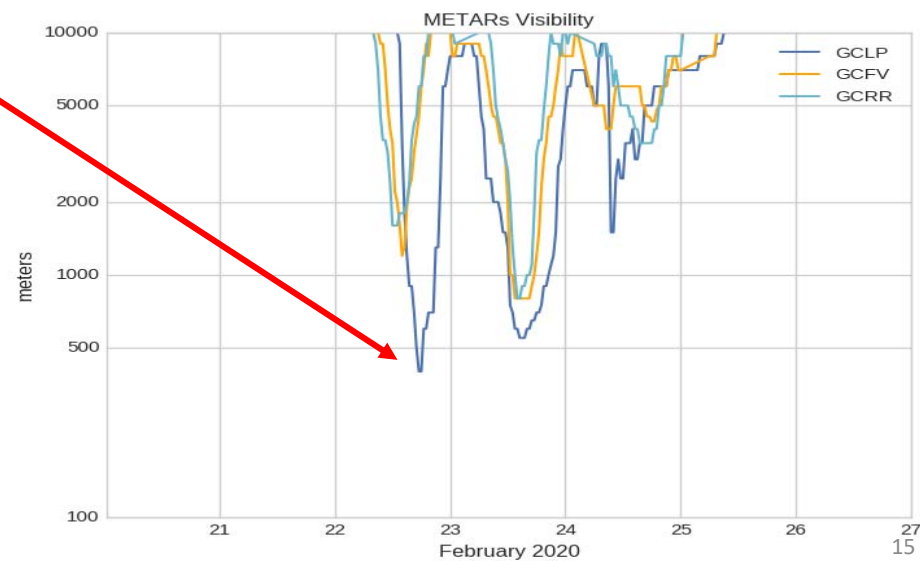
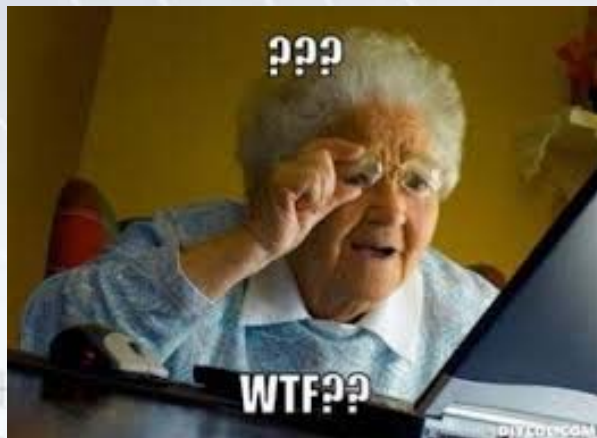
FORECAST TOOLS

BSC (0.1°) 20200222 a 12 UTC. H+006. Validez: sábado, 22 de febrero de 2020, a 18 UTC.
Visibilidad seca en metros



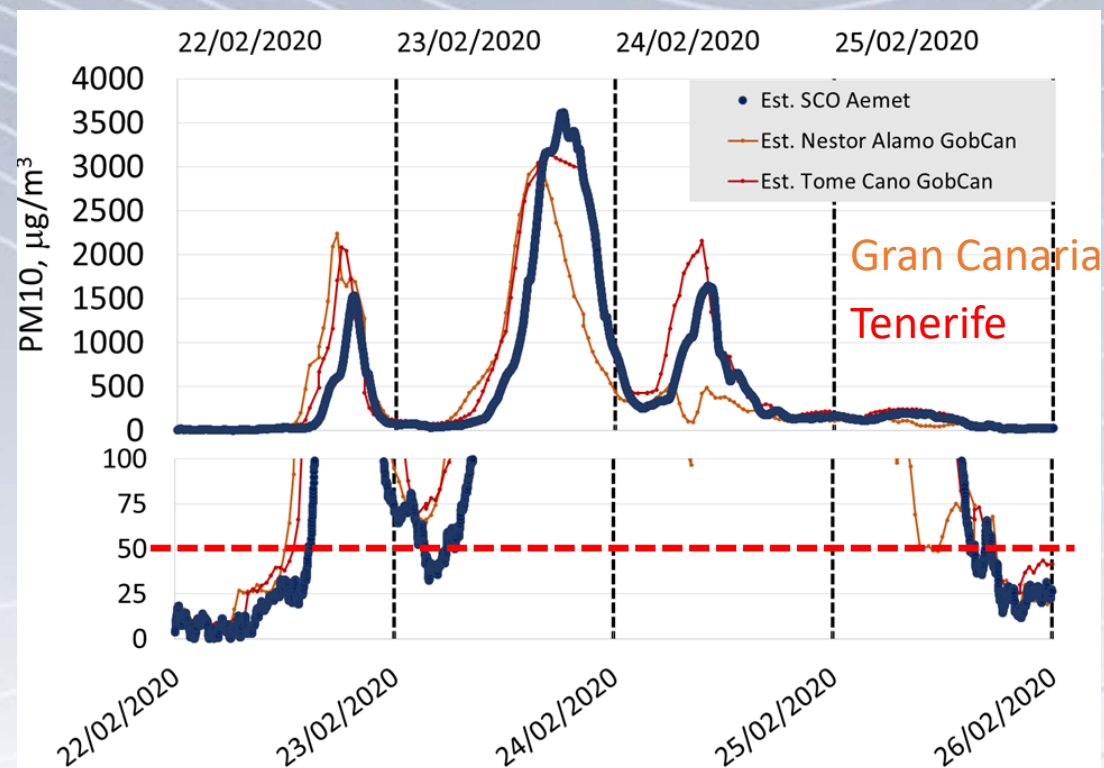
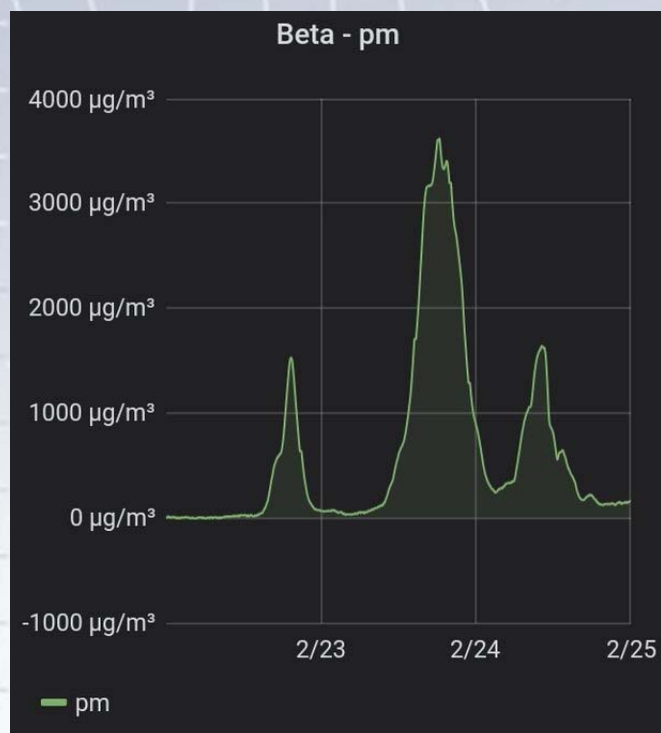
Model forecast at GCLP
Visibility about 5000 m.

Real visibility 400 m.



MONITORING TOOLS

In-situ

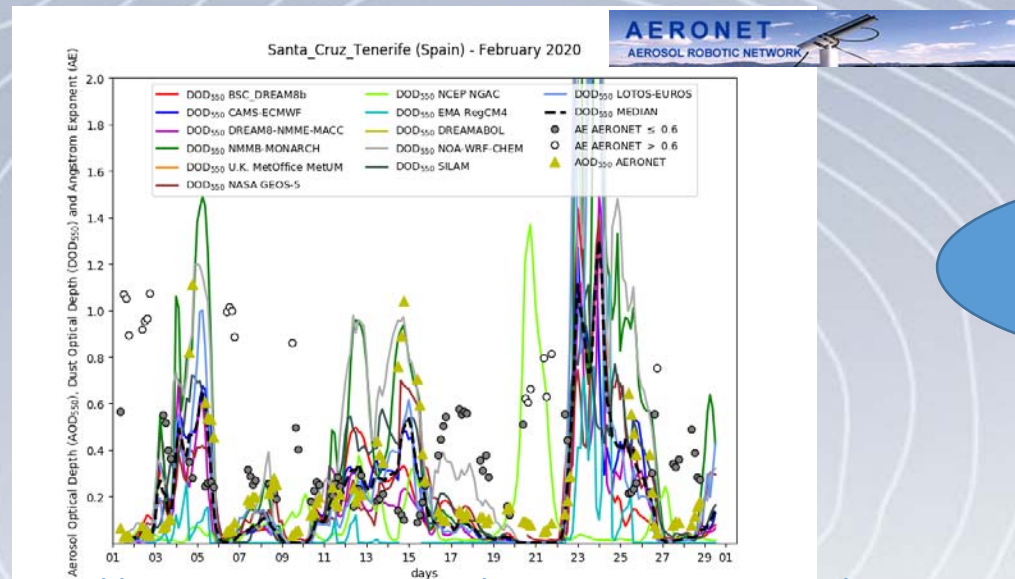


PM10 (daily) > 50 $\mu\text{g}/\text{m}^3$

EU limit values → no more than 35 days/year

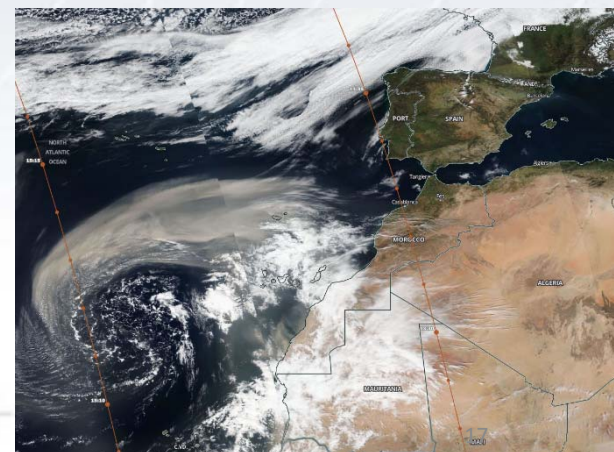
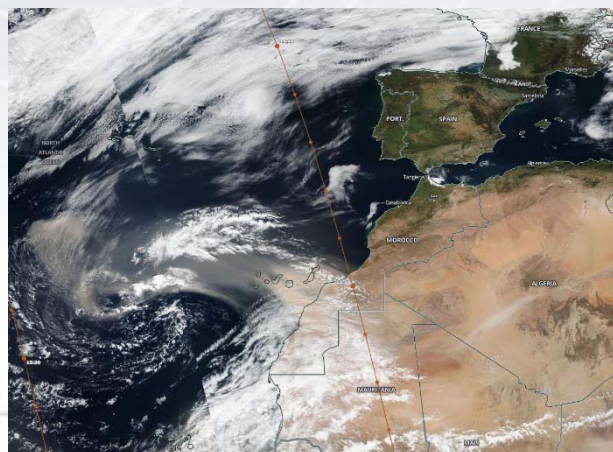
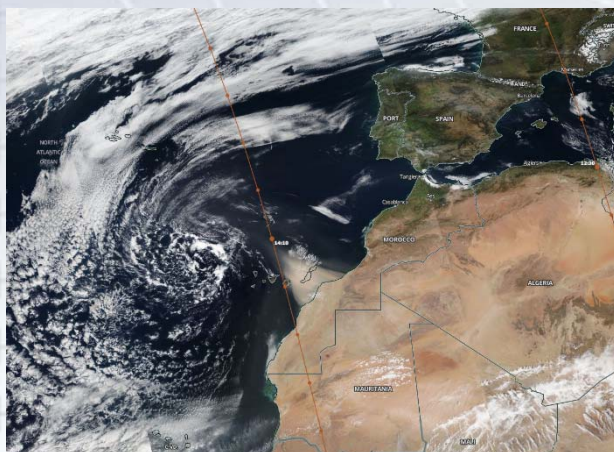
WHO limit values → no more than 3 days/year

MONITORING TOOLS

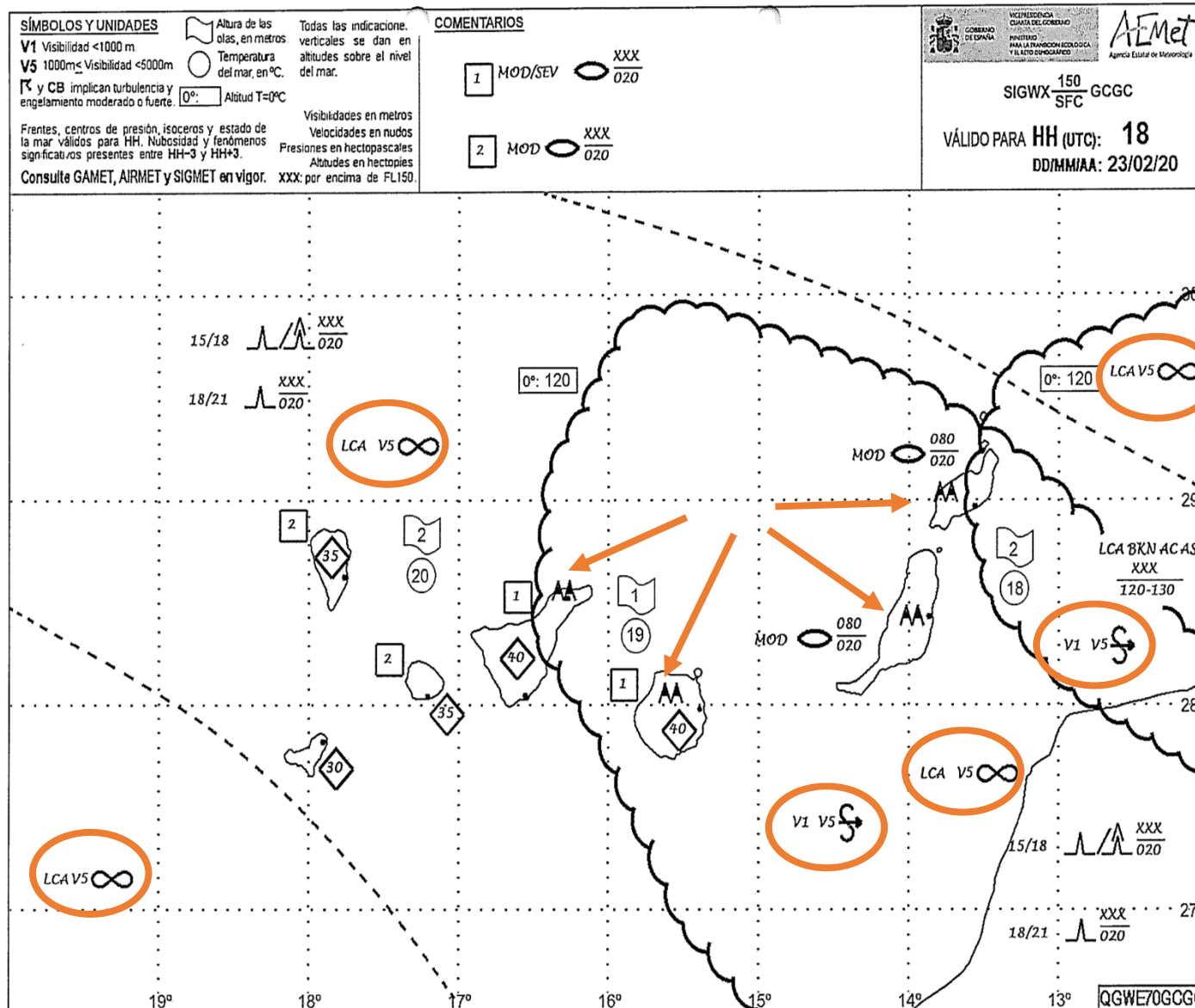


Forecast evaluation and
satellite

<https://sds-was.aemet.es/forecast-products/forecast-evaluation/>



AERONAUTICAL PRODUCTS



AERONAUTICAL PRODUCTS



TAF (Terminal Aerodrome Forecast)



TAF GCLP 212000Z 2121/2221 32015KT 9999 SCT030
 TX25/2214E TN15/2206E
 PROB30 TEMPO 2121/2123 02016KT
 TEMPO 2210/2217 VRB05KT
 BECMG 2212/2214 3000 HZ=

TAF GCLP 220200Z 2203/2303 32015KT 9999 SCT030
 TX25/2214E TN15/2206E
 TEMPO 2210/2217 VRB05KT
 BECMG 2212/2214 3000 HZ=

TAF GCLP 220800Z 2209/2309 32015KT 9999 SCT030
 TX25/2214E TN19/2306E
 TEMPO 2210/2217 VRB05KT
 PROB40 TEMPO 2306/2309 VRB05KT
 BECMG 2212/2214 3000 HZ=

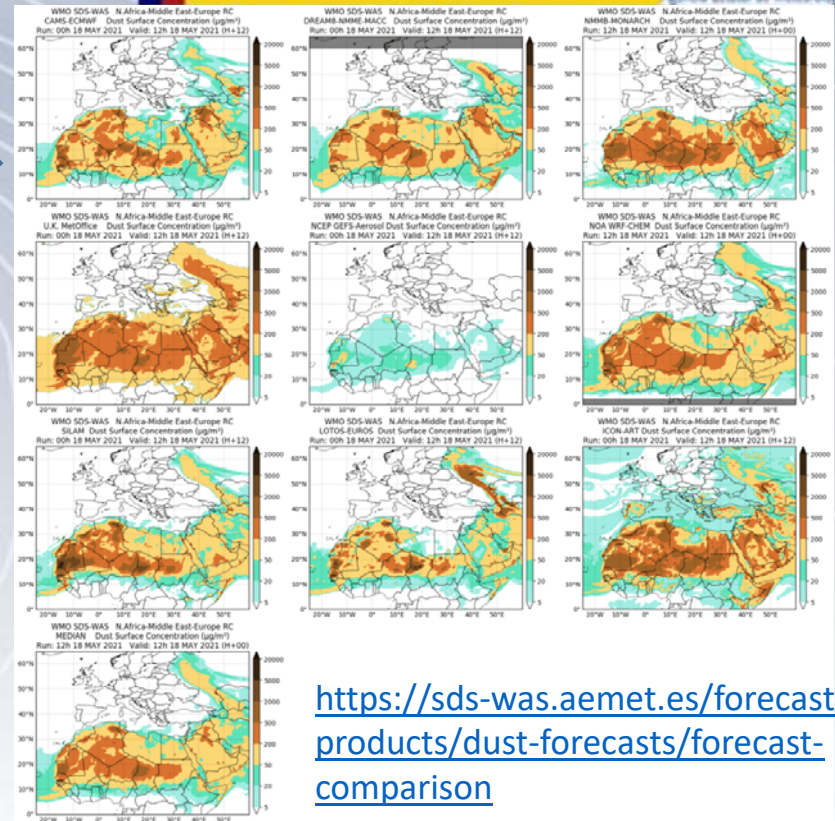
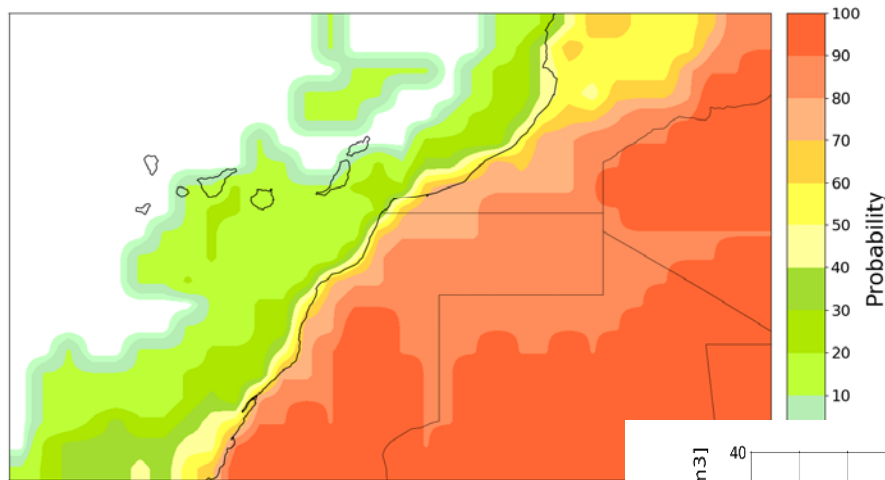
TAF GCLP 221400Z 2215/2315 04012KT 3500 HZ NSC
 TX25/2215E TN15/2306E
 BECMG 2308/2310 17004KT
 PROB30 2220/2306 0900 HZ=

TAF COR GCLP 221508Z 2215/2315 04012KT 2000 HZ NSC
 TX25/2215E TN15/2306E
 BECMG 2308/2310 17004KT
 PROB30 2220/2306 0900 HZ=

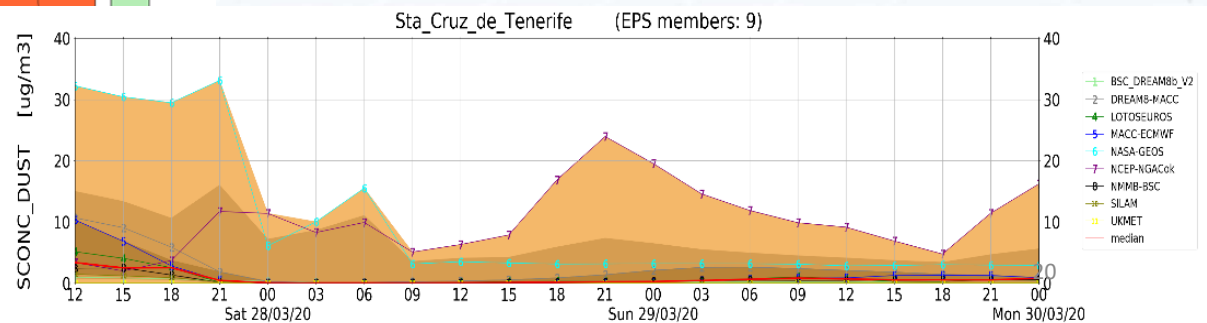
PRESENT & FUTURE WORK



Daily Maximum of **Dust SFC Concentration**
Probability of exceeding **20 $\mu\text{g}/\text{m}^3$**
ENS members: **9** Run: 27/03/2020 Valid for: 28/03/2020



<https://sds-was.aemet.es/forecast-products/dust-forecasts/forecast-comparison>



CONCLUSIONS



- Even if dust intrusions are very common in Canary islands, extreme episodes are quite infrequent.
- The Forecast Group of the Canary Islands is responsible of the alerts concerning severe dust intrusions, as well as the monitoring of such situations
- In the event of a great surface visibility reduction, a series of procedures are started up in the airports of the Canary Islands. Aeronautical operations stop if visibility < (550 to 800m)
- It's very difficult to forecast the visibility from traditional model outputs (AOD, PM10)
- We are working in different approach to the problem.

**THANK YOU VERY MUCH
FOR YOUR ATTENTION!!**



**@AEMET_Esp @AEMET_Canarias
@AEMET_Izana
@david_suarezm**



<https://www.facebook.com/AgenciaEstatalMeteorologia>



CANAL AEMET



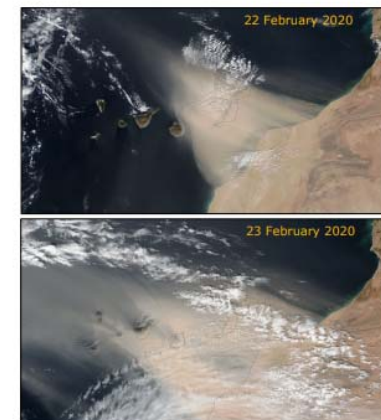
aemetblog.es

E-MAIL :



**dsuarezm@aemet.es
npratasp@aemet.es**

Desert Dust Outbreak in the Canary Islands (February 2020): Assessment and Impacts



**Joint publication of State Meteorological Agency (AEMET)
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WWRP 2021-1**

