SDS-WAS: ENSEMBLE PREDICTION OF AIRBORNE DUST

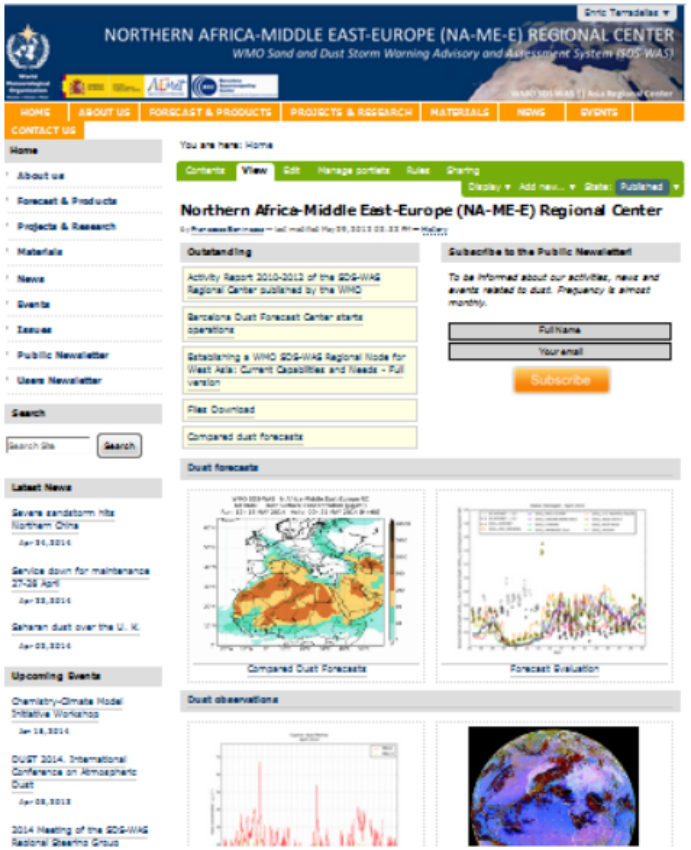
Gerardo GARCÍA-CASTRILLO Alfons Callado
Enric Terradellas

International Workshop on Middle East (Regional) Dust Sources and Their Impacts
Istambul Oct 23th-25th

Outline

Outline

SDS-WAS (NA-ME-E) Regional Center



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GOBIERNO DE ESPAÑA
MINISTERIO DE MEDIO AMBIENTE Y MEDIO RURAL Y MARINO
AEMet Agencia Estatal de Meteorología

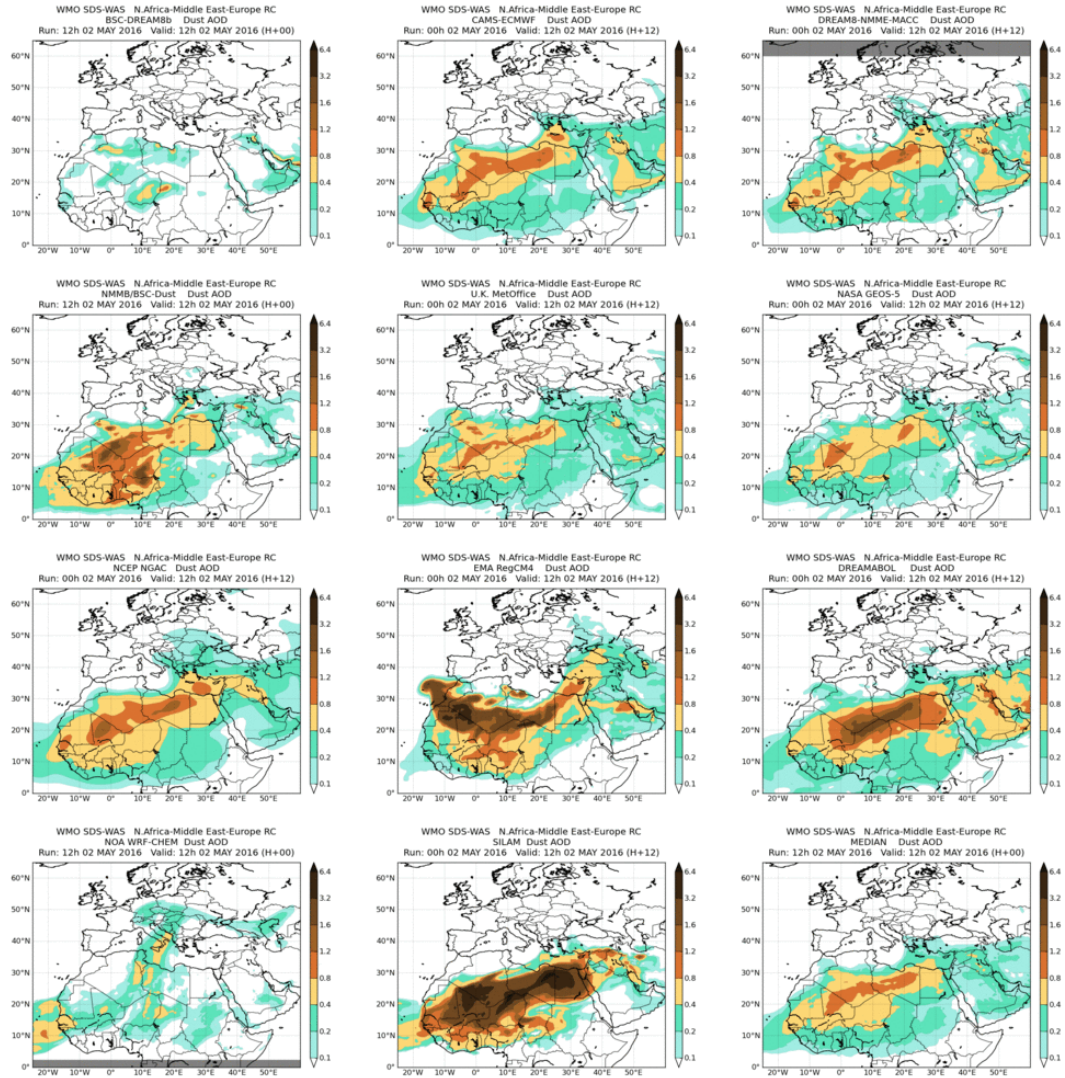
BSC Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Dust model inter-comparison

MODEL	RUN TIME	DOMAIN	DATA ASSIMILATION
CHIMERE	00	Global	No
LMDzT-INCA	00	Regional	No
CAMS-ECMWF	00	Global	MODIS AOD
BSC-DREAM8B V2.0	12	Regional	No
DREAM8-NMME	00	Regional	CAMS analysis
NMMB/BSC-DUST	12	Regional	No
MetUM	00	Global	MODIS AOD
GEOS-5	00	Global	MODIS reflectances
NGAC	00	Global	No
EMA REG CM4	00	Regional	No
DREAMABOL	00	Regional	No
NOA WRF-CHEM	12	Regional	No
FMI-SILAM	00	Global	No
LOTOS-EURO	00	Regional	MODIS AOD

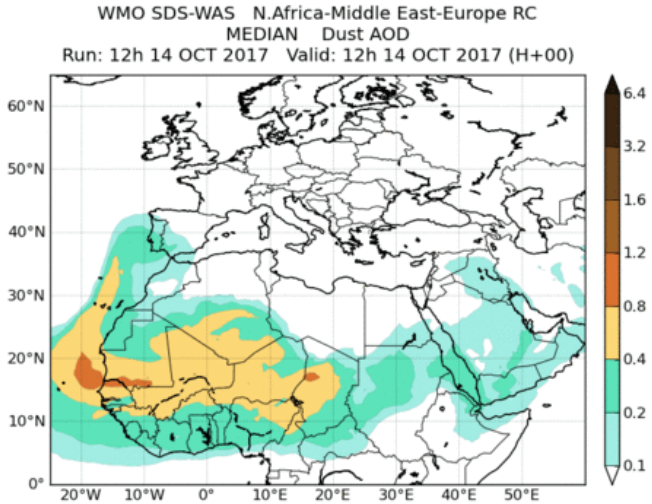
Dust model inter-comparison

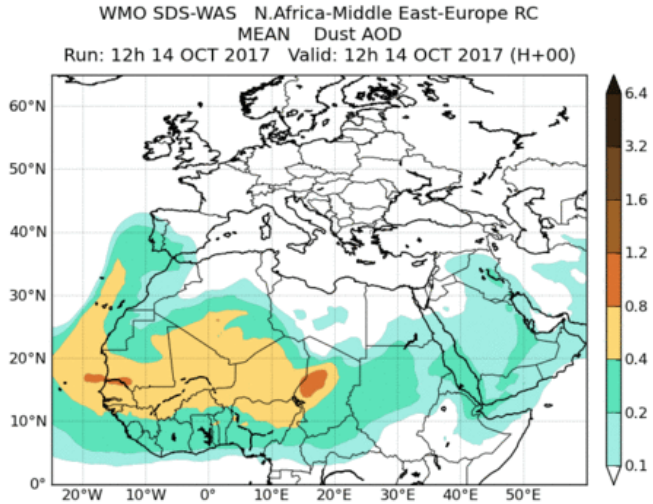
Dust Optical Depth 550 nm. Models runtime: 2 May 2016

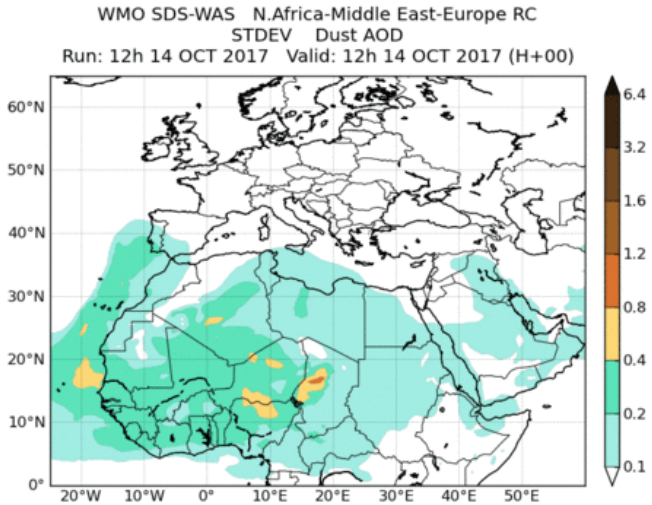


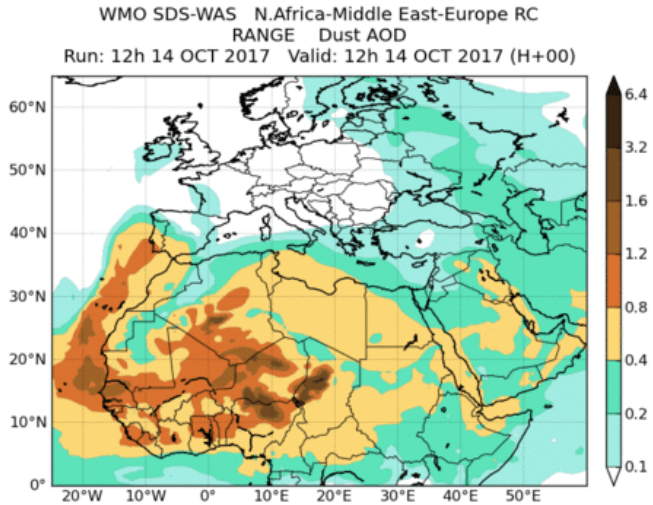
Poor Man Ensemble

Dust Optical Depth 550 nm. Models runtime: 14 Oct 2017

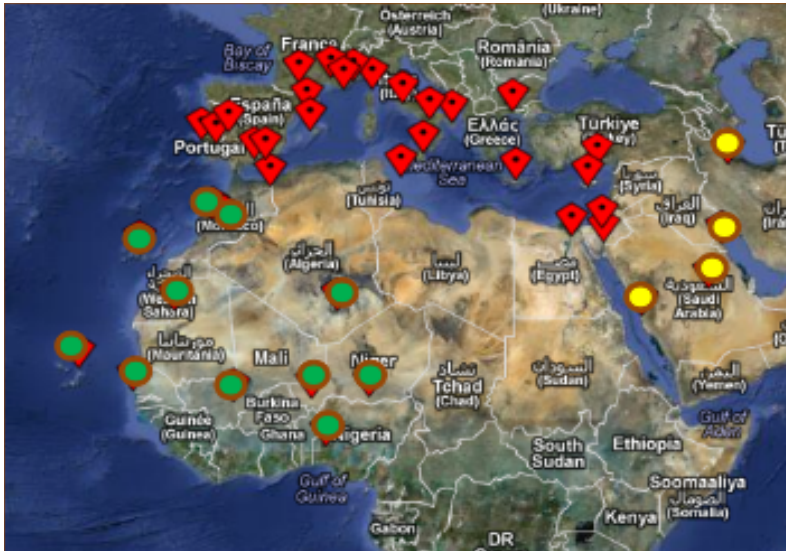


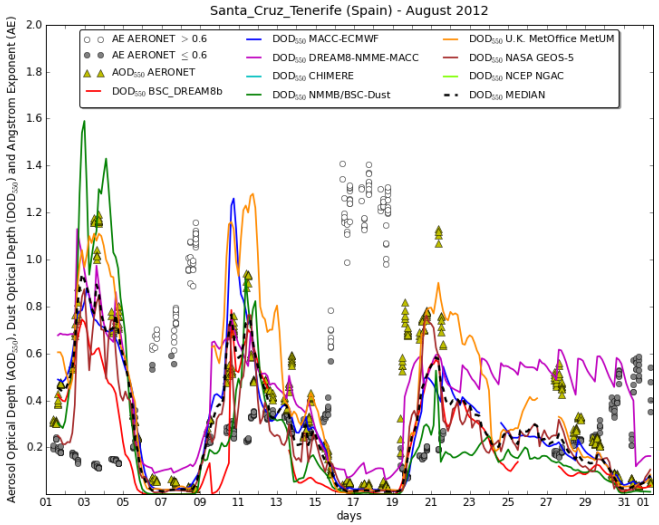


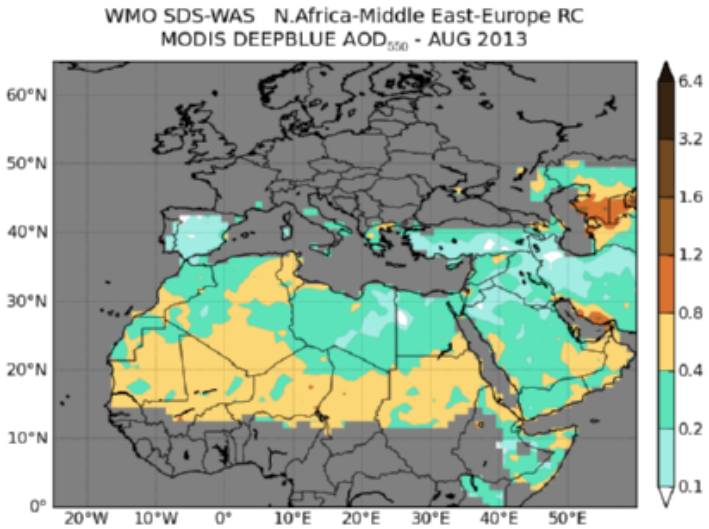




Forecast evaluation



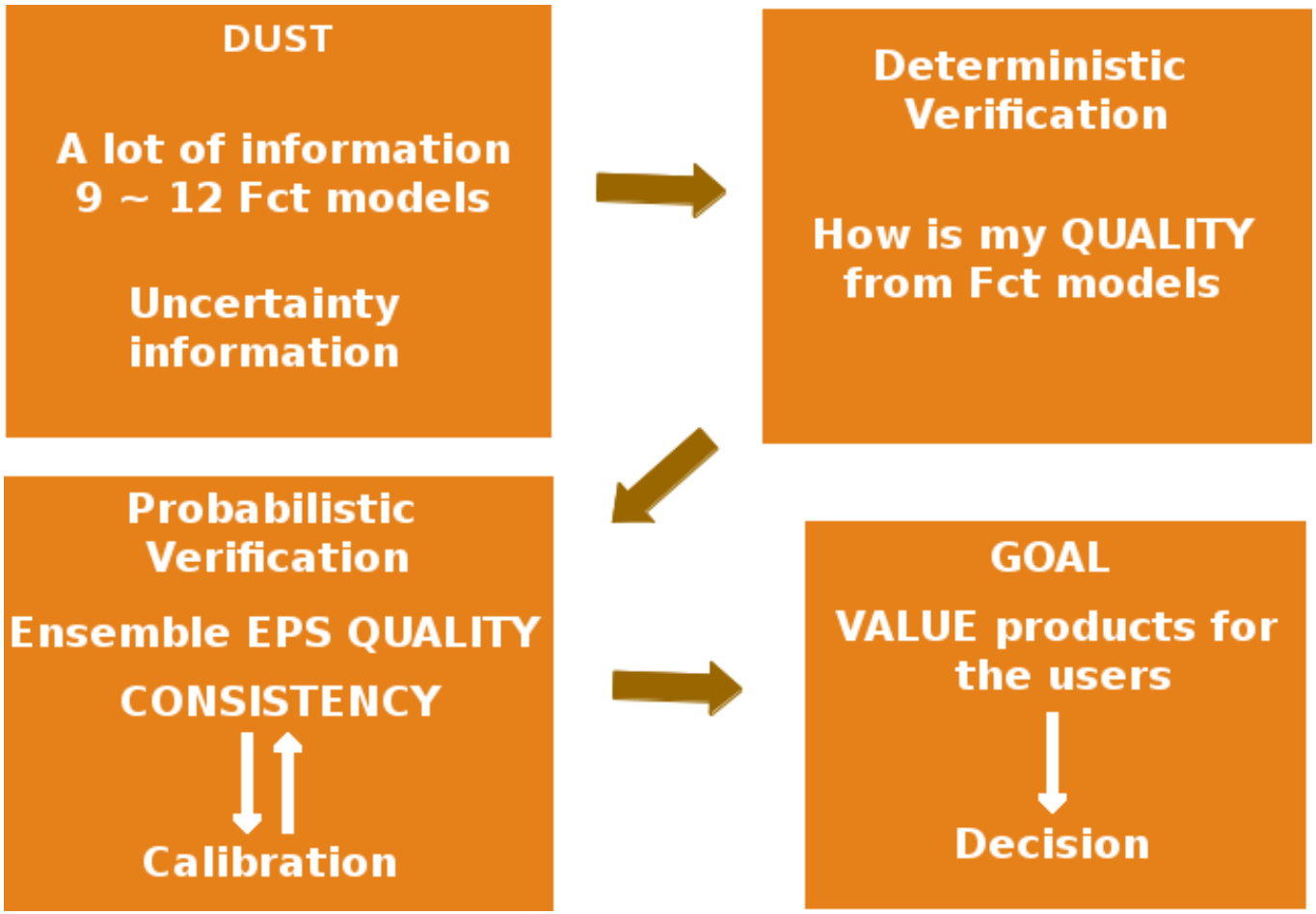




The Objective

Toolboxes

- HARMONIE Verification Monitor - Deterministic
- HARP (Hirlam Aladdin R-based package) - Probabilistic

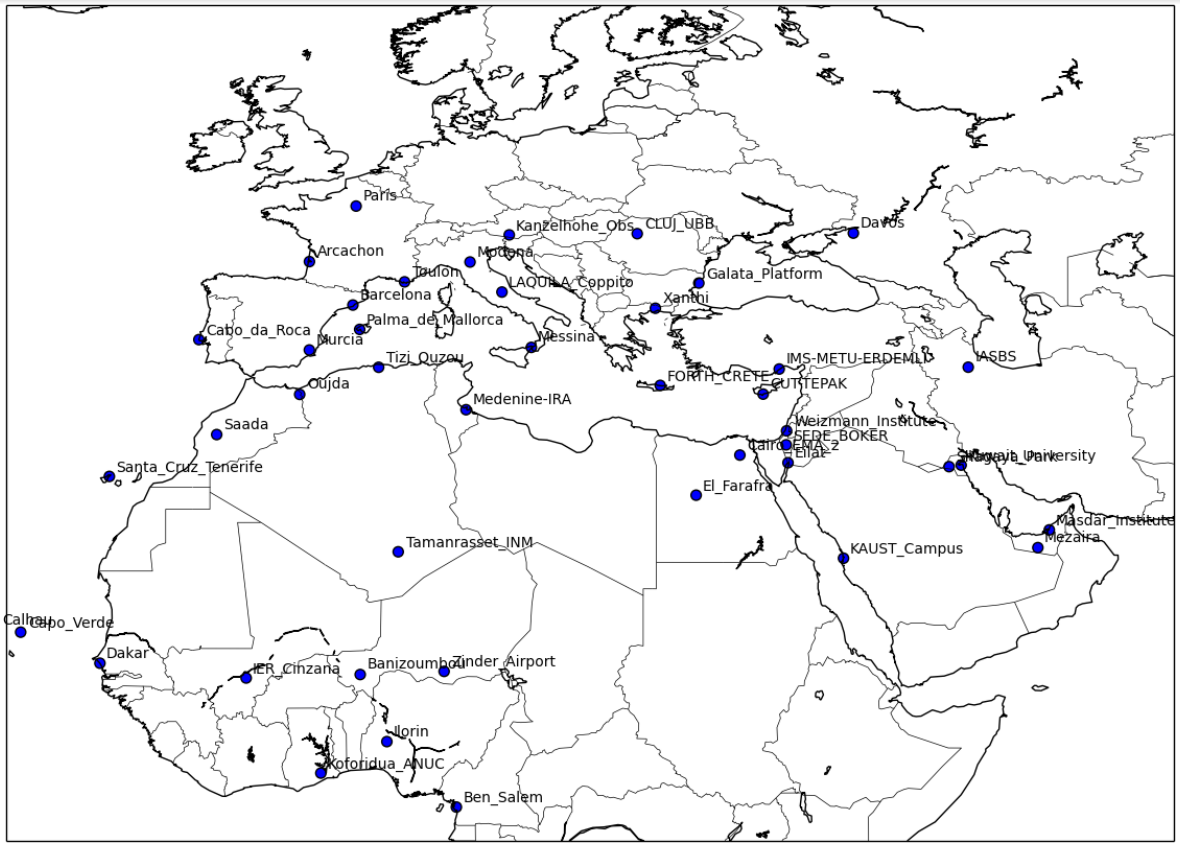


Outline

Observations

Aerosol Optical Depth

- April 2016 from Aerosol Robotic Network (AERONET)
- Thresholds 0.5, 1 and 2
- Daily Maximum, version 3 and level 1.5



Observations

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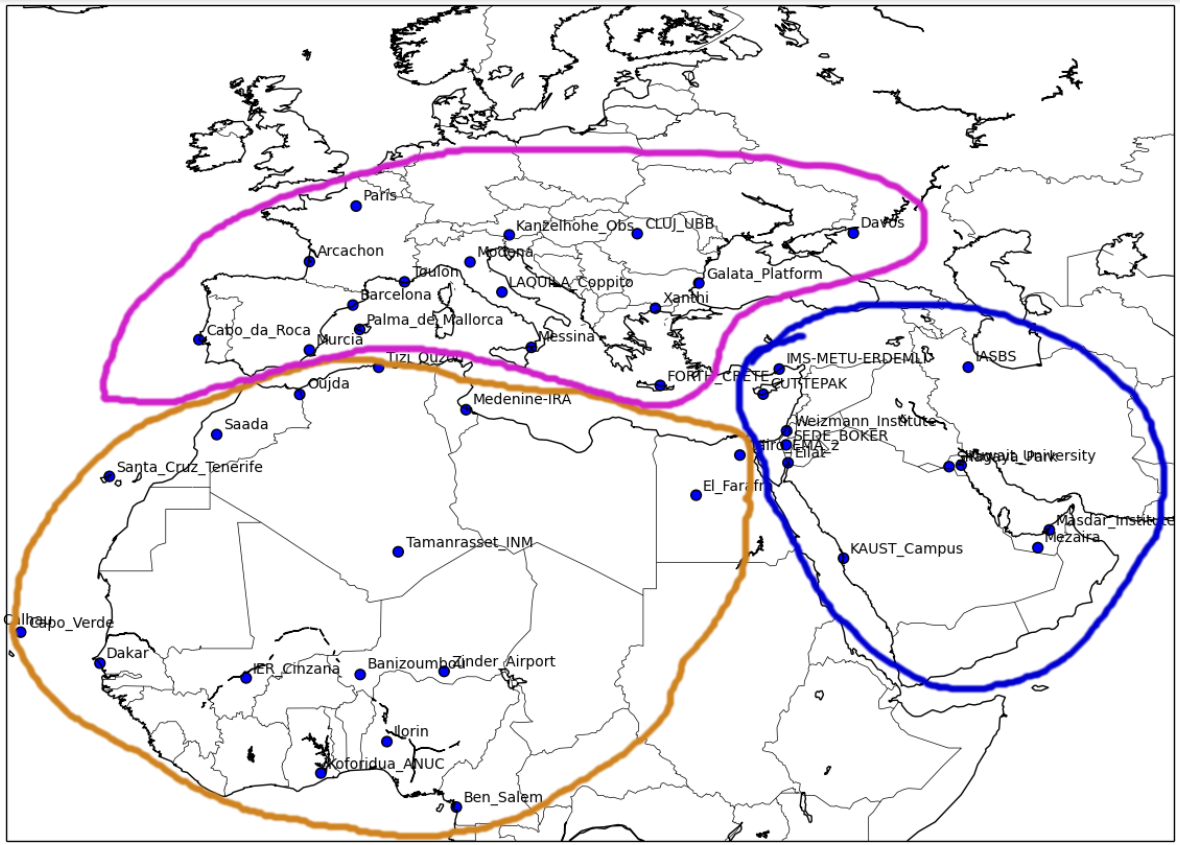
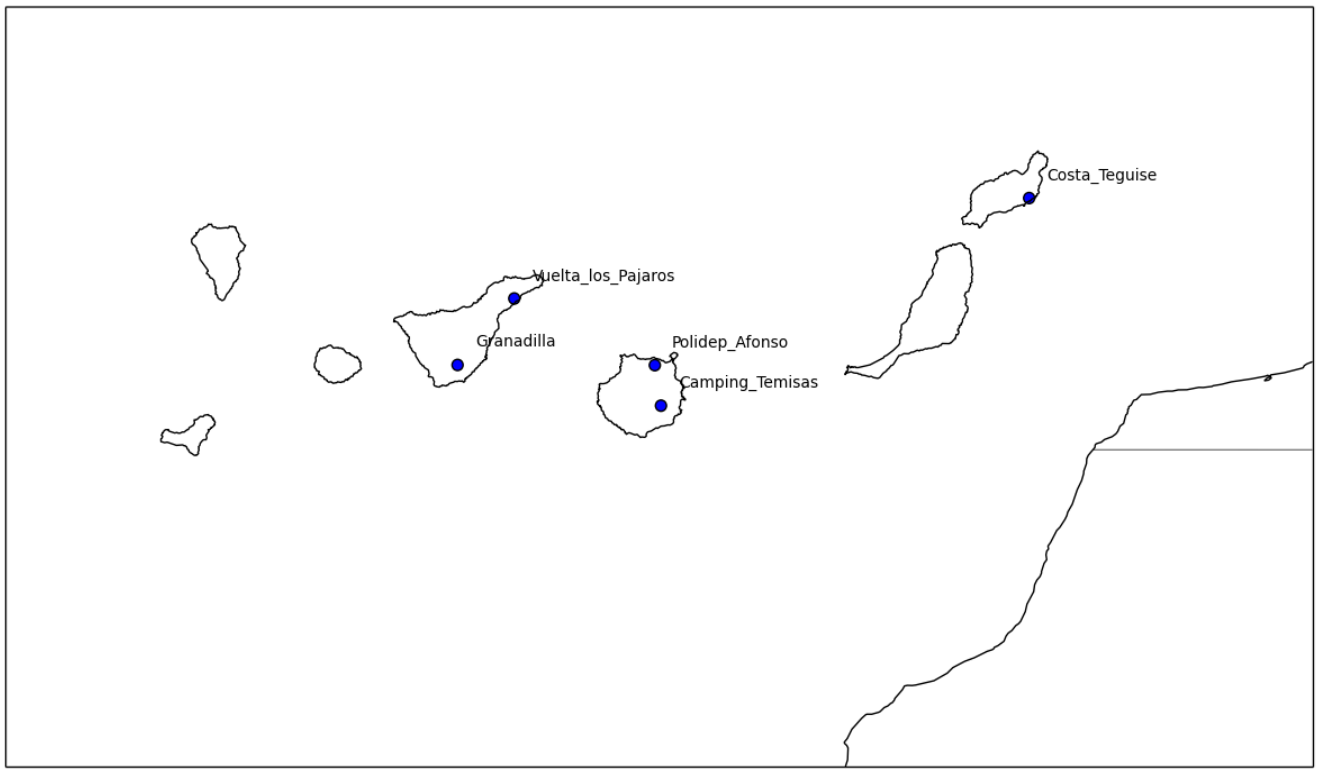


Observations

Surface Concentration

- December 2014 AQMS from Canary Government
- Thresholds 50 and 90 $\mu g/m^3$
- Daily Maximum



Observations

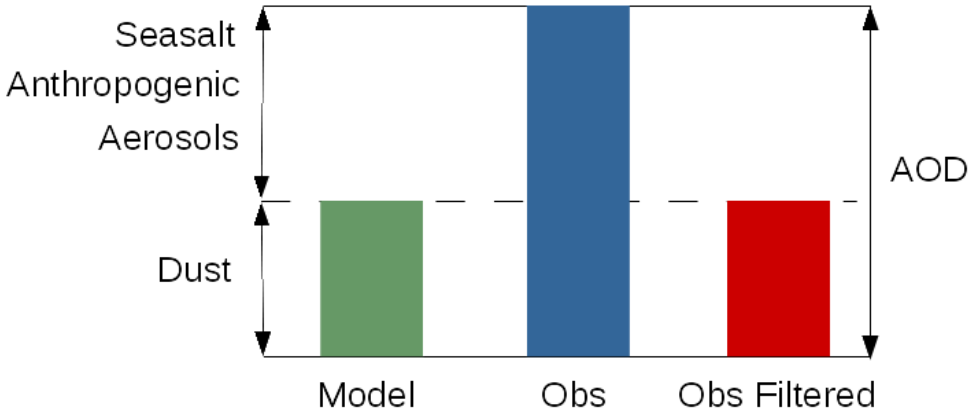
Surface Concentration

- December 2014 AQMS from Canary Government
- Thresholds 50 and 90 $\mu g/m^3$
- Daily Maximum

Dust optical depth

Previous concepts

- AOD_{550} can be dust, sea-salt, anthropogenic particles...



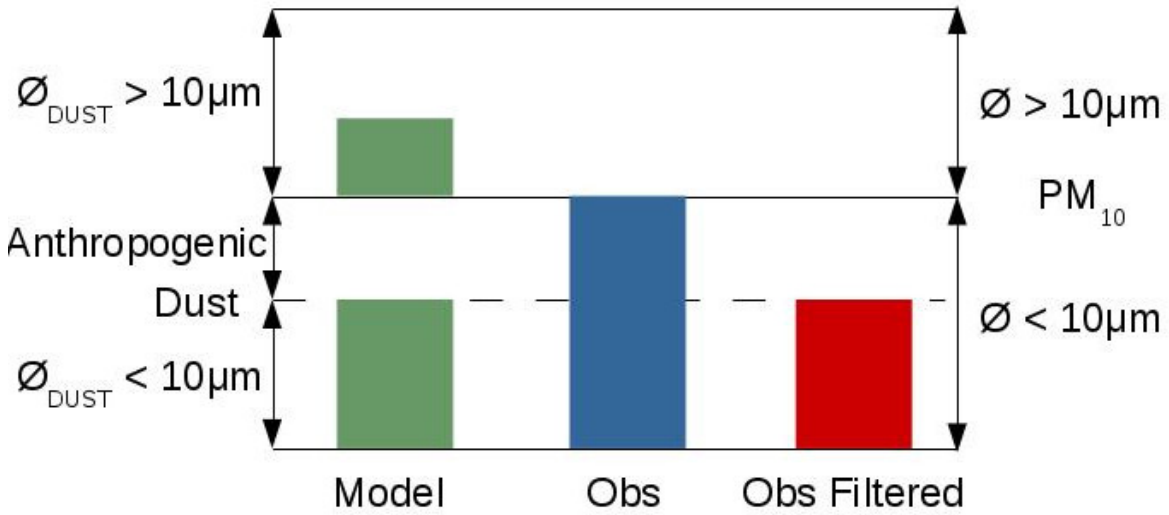
Methods

- NoFilter : Raw Observation
- Filter06 : Ångström exponent less than 0.6
- Coarse : AOD Coarse_fraction from AERONET
- Filter06_12 : Ångström exponent:
  - more than 1.2, AOD = 0
  - less than 0.6 (Filter06)

Dust surface concentration

Previous concepts

- Not all PM10 is dust
- Models could include dust particles with a diameter larger than 10μm



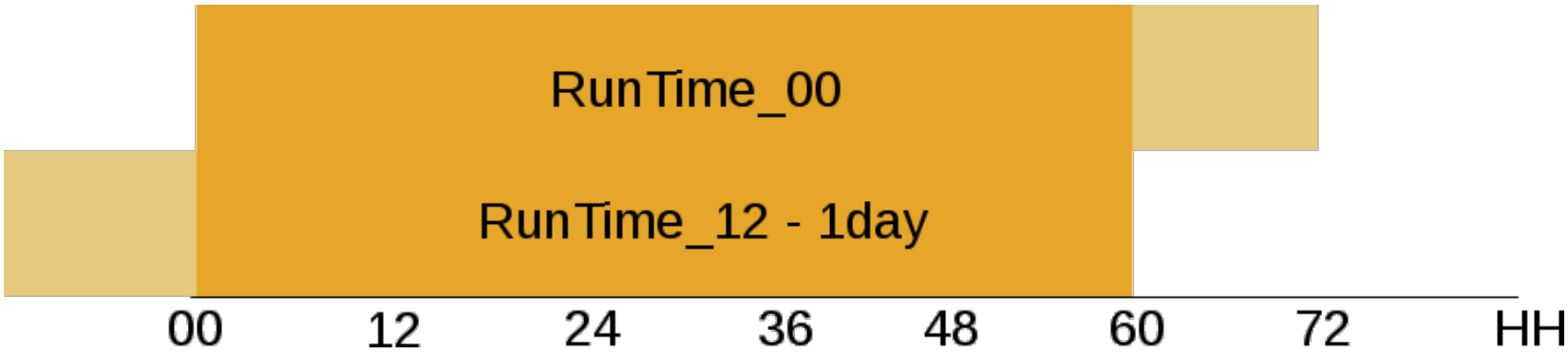
Methods

- NoFilter : Raw Observation
- PMcoarse : PM10 - PM2.5

Model Availability

Run Time

- 00 UTC - CAMS, GEOS-5, NGAC and so on.
- 12 UTC - BSC-DREAM8Bv2.0, MNNB/BSC-DUST and NOA WRF-CHEM

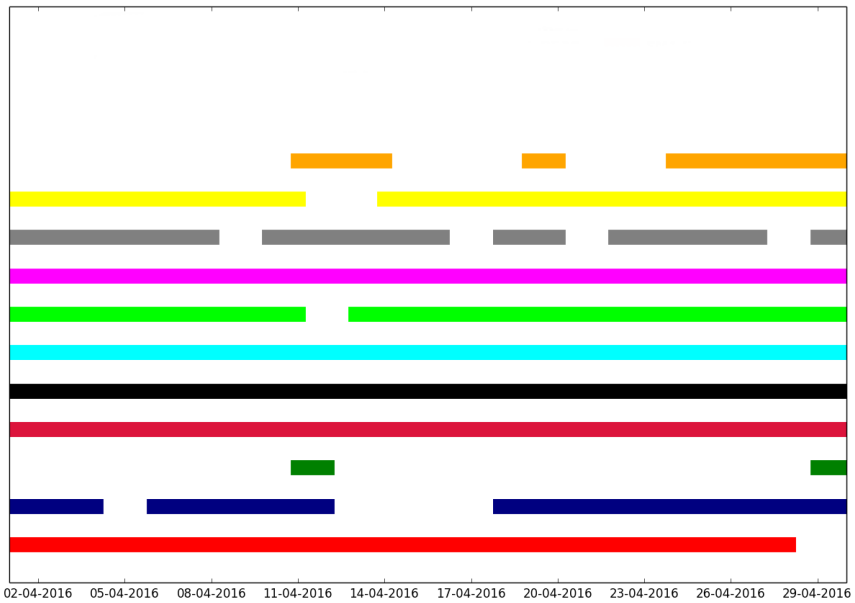


Verification Day: 04-04-2016
00 UTC 04-04-2016
12 UTC 03-04-2016

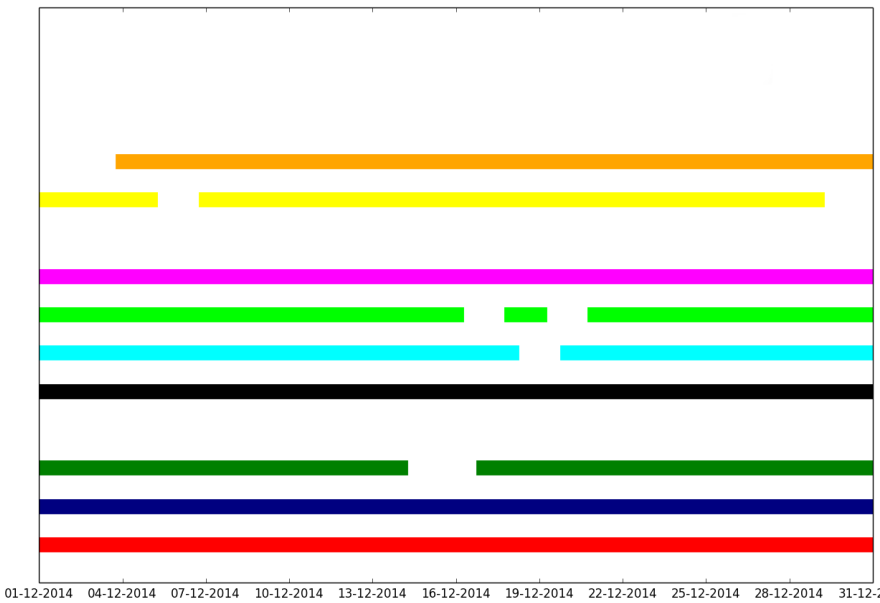
Model Availability

Run Time

- 00 UTC - CAMS, GEOS-5, NGAC and so on.
- 12 UTC - BSC-DREAM8Bv2.0, MNNB/BSC-DUST and NOA WRF-CHEM



April 2016



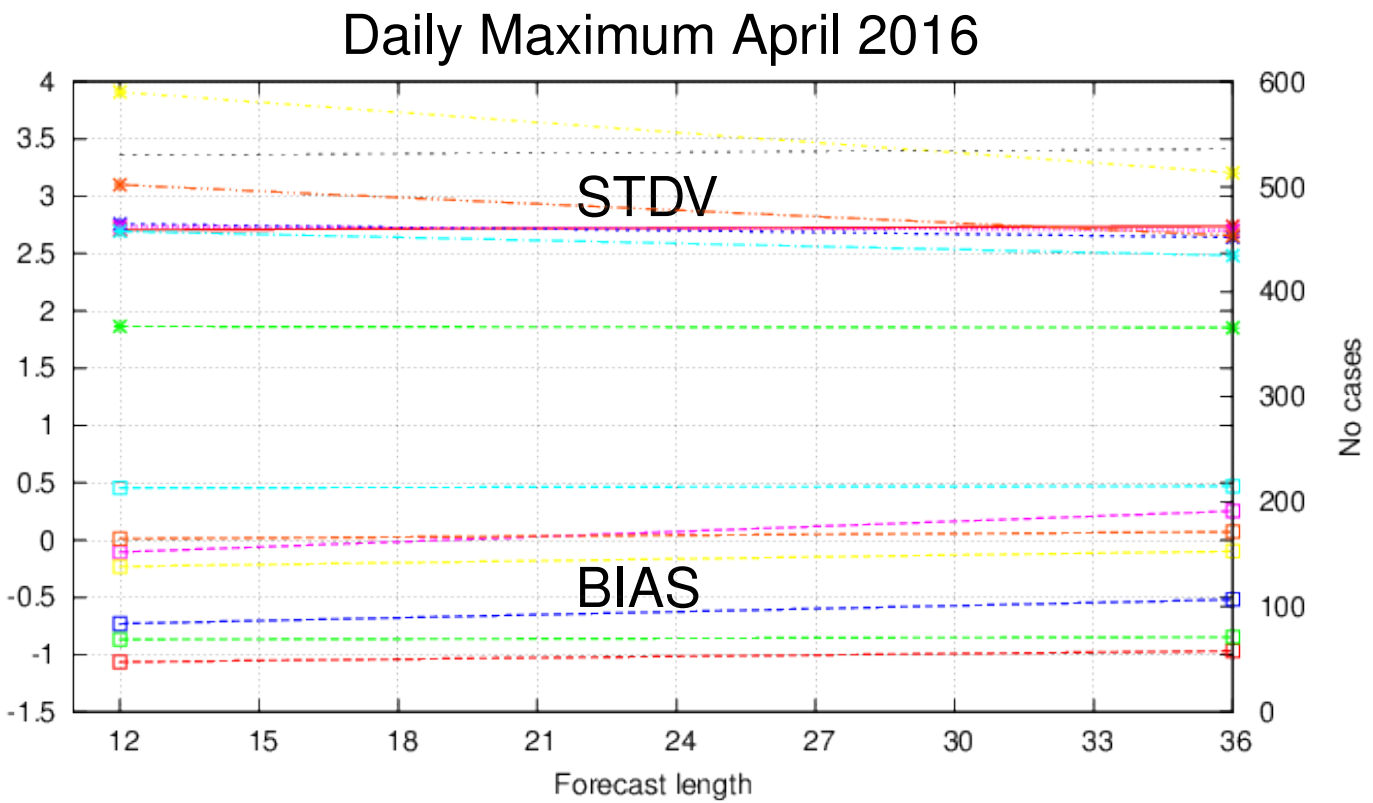
December 2014

Outline

Outline

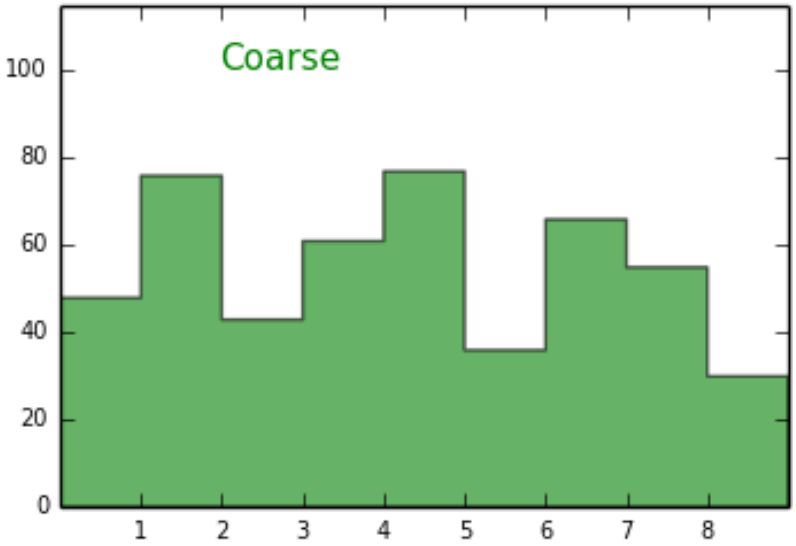
Deterministic Verification

AOD

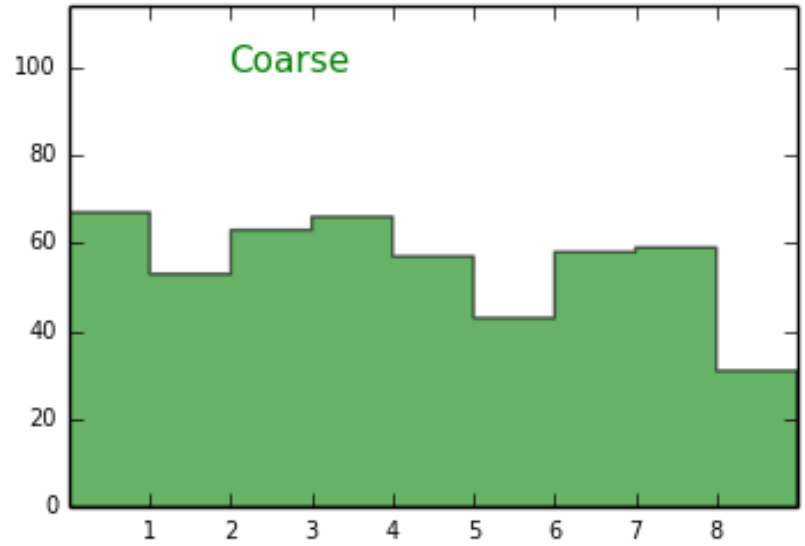


Probabilistic Verification : Rank Histogram (Talagram)

AOD Daily Maximun
ABRIL 2016 NOBS = 987



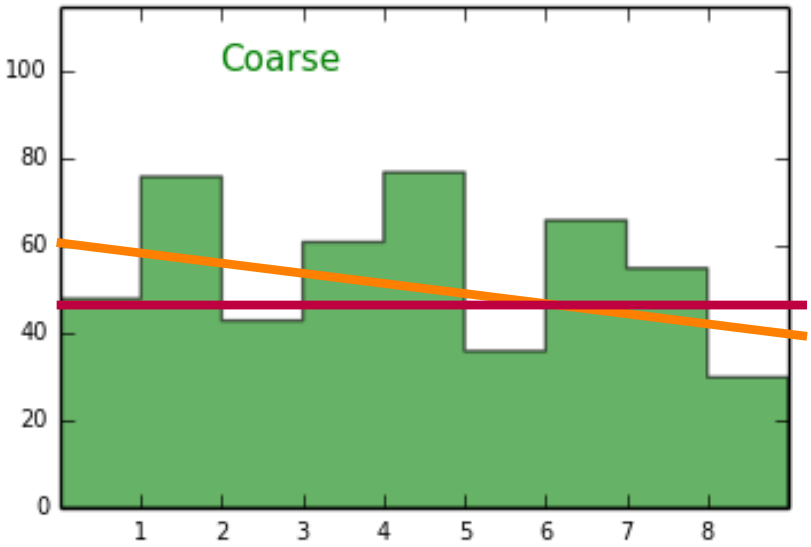
Leadtime = 12h



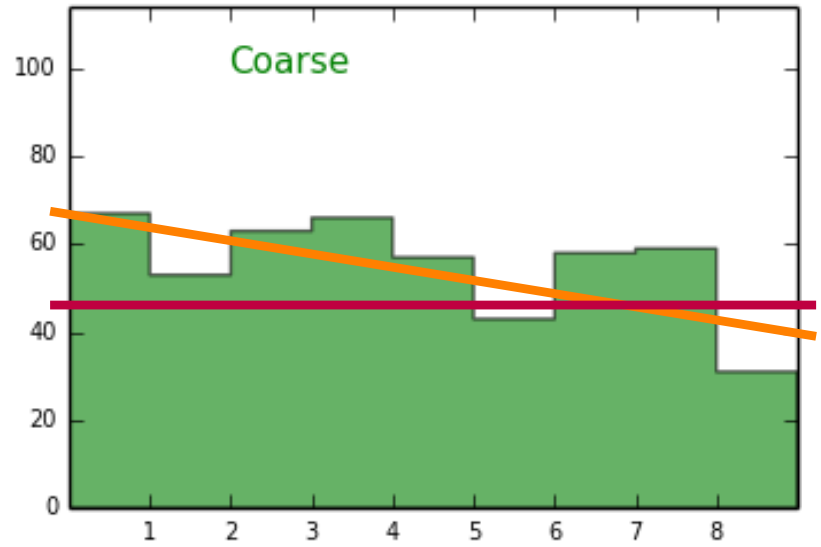
Leadtime = 36h

Probabilistic Verification : Rank Histogram (Talagram)

AOD Daily Maximun
ABRIL 2016 NOBS = 987



Leadtime = 12h



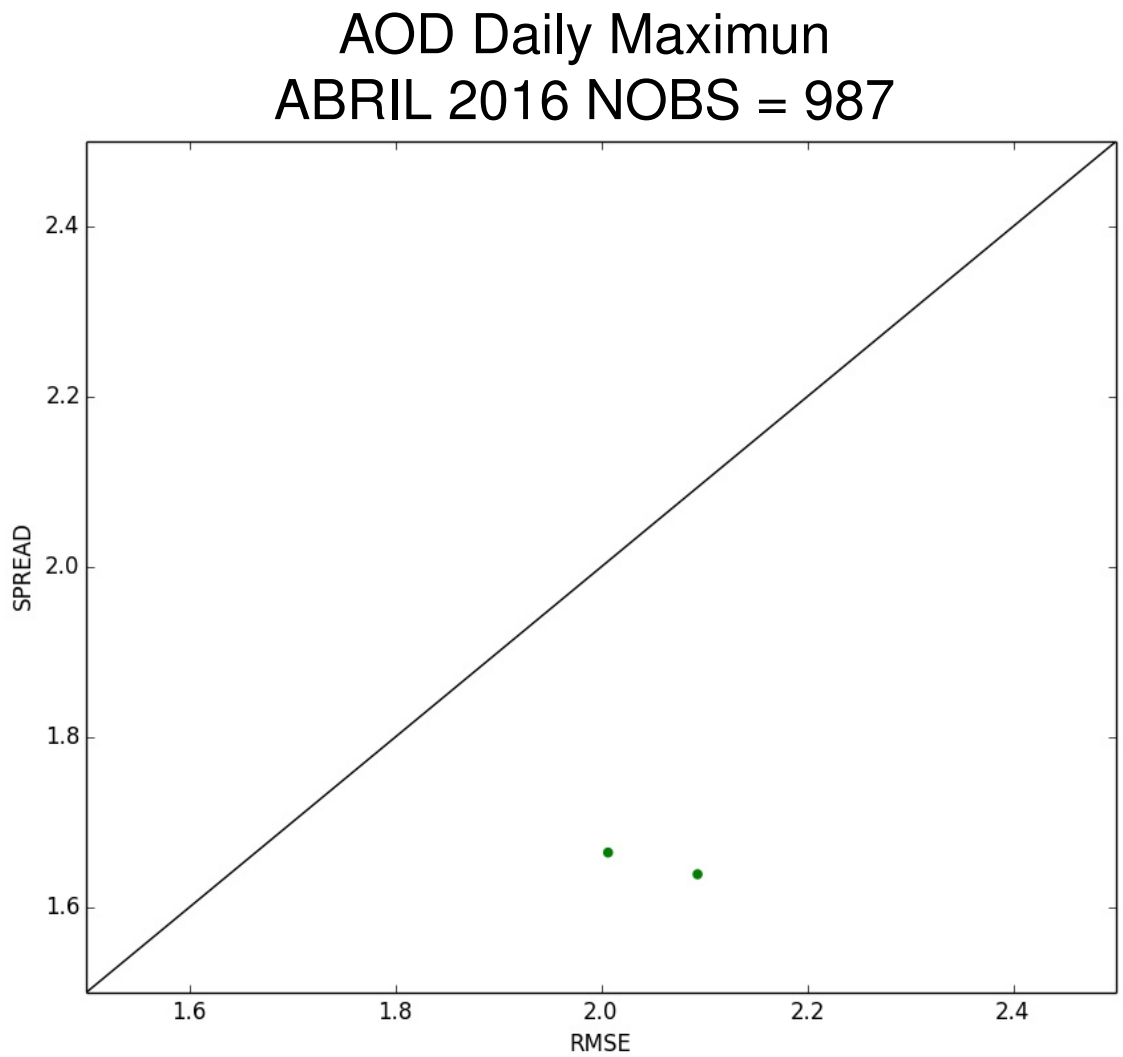
Leadtime = 36h

Ideal or Ensemble SPREAD about right to represent forecast

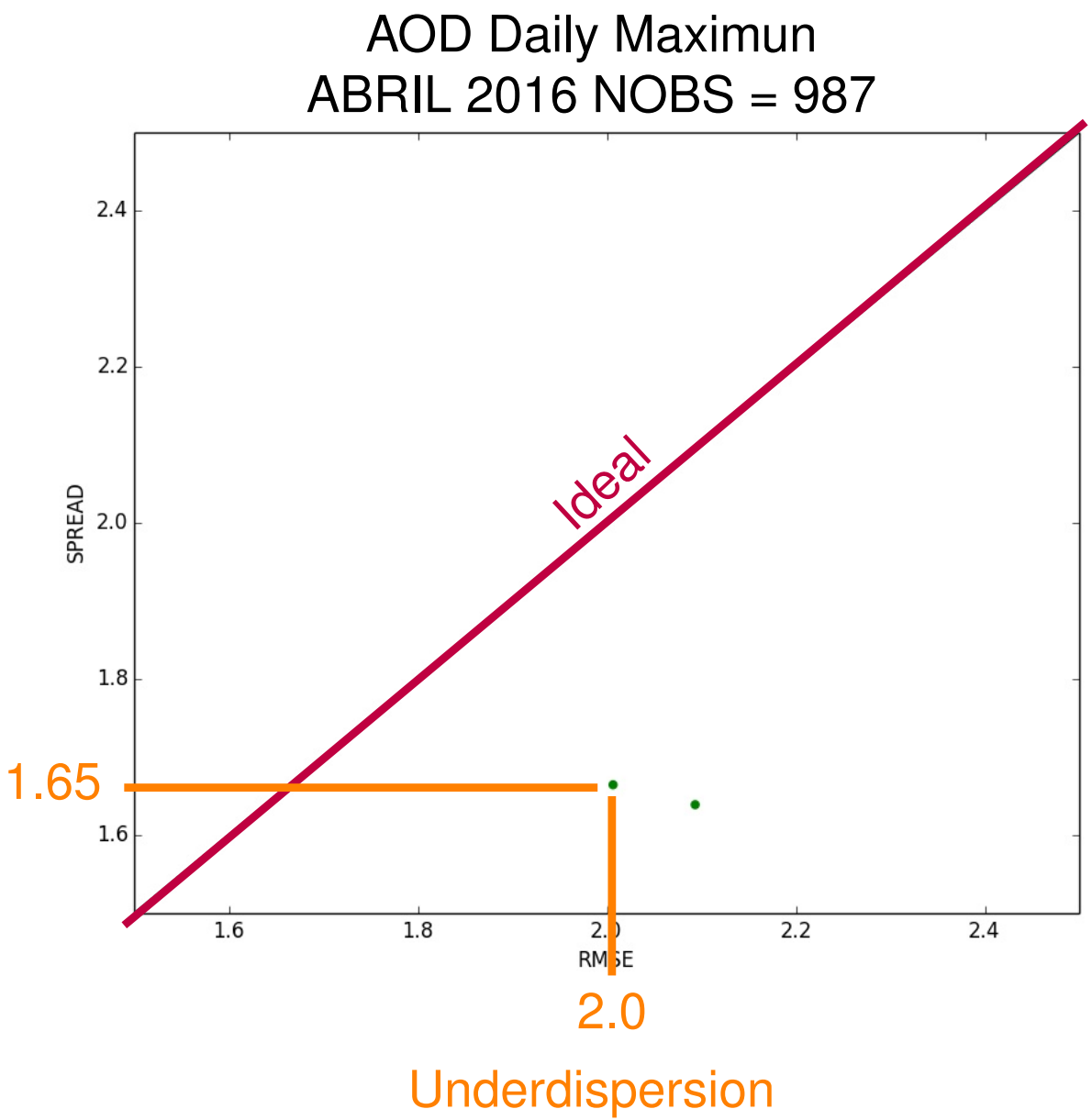
+ BIAS

NECESSARY BUT NOT SUFFICIENT TO KNOW ABOUT EPS CONSISTENCY

Probabilistic Verification : RMSE - SPREAD



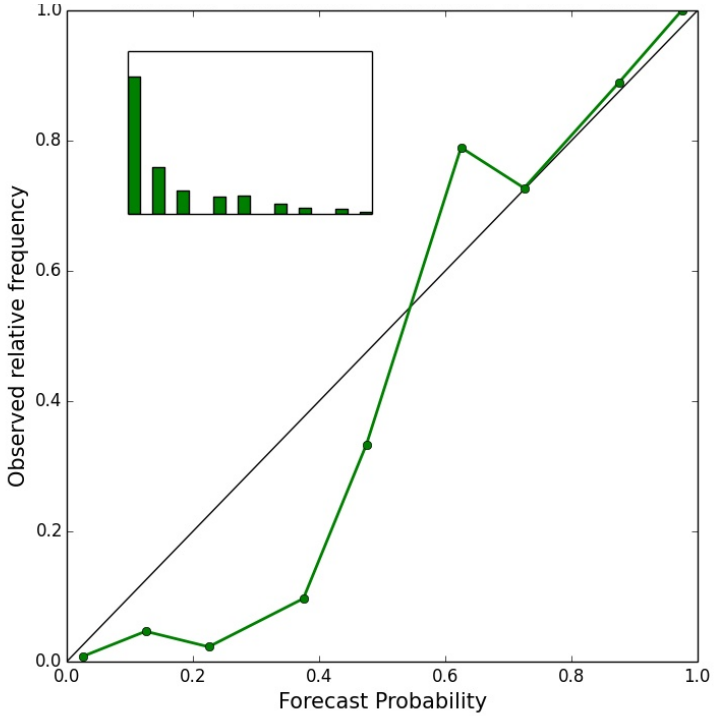
Probabilistic Verification : RMSE - SPREAD



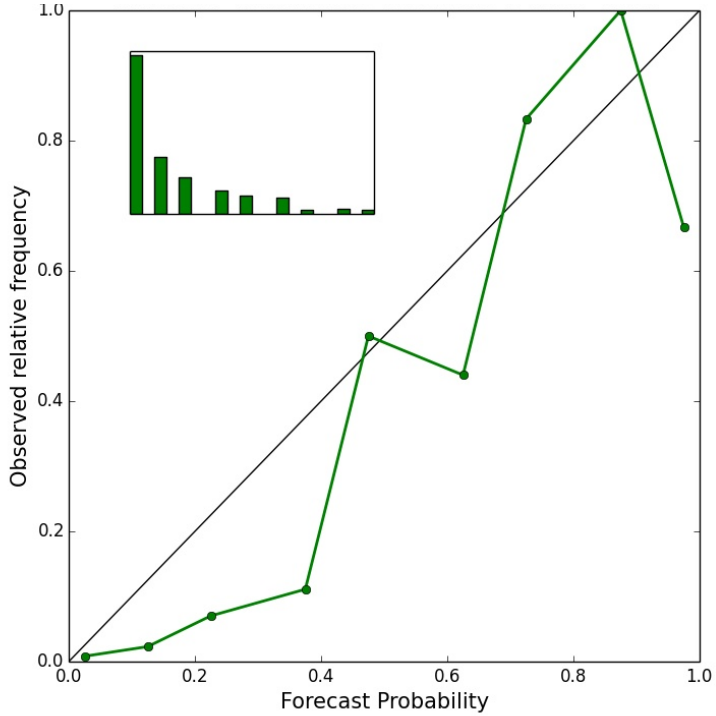
Probabilistic Verification : Reliability Diagram

AOD Daily Maximun
ABRIL 2016 NOBS = 987
Threshold = 0.5

Leadtime = 12h



Leadtime = 36h



Probabilistic Verification : Reliability Diagram

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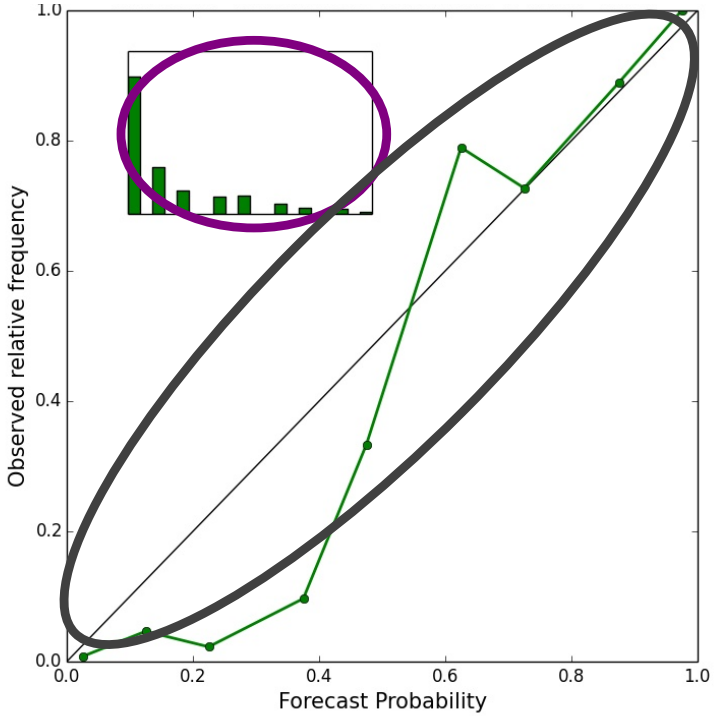
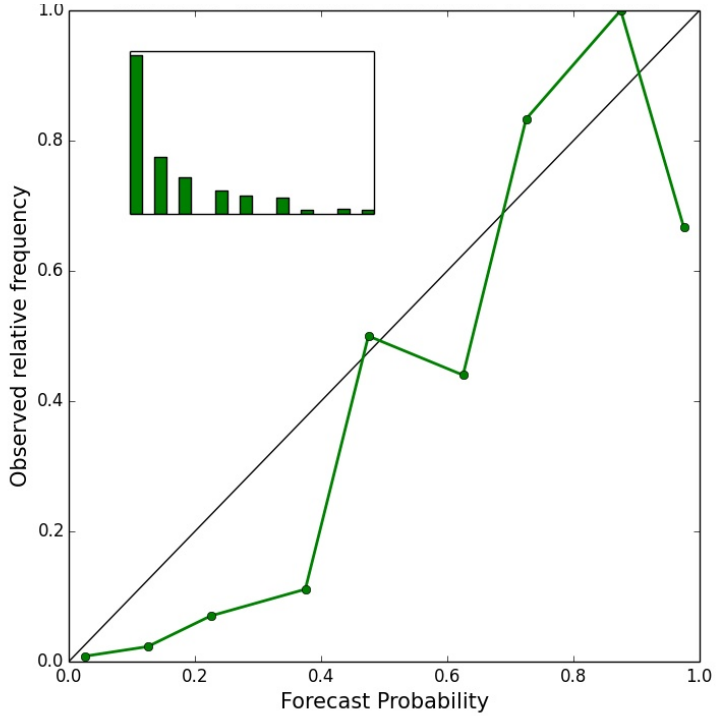


Leadtime = 36h



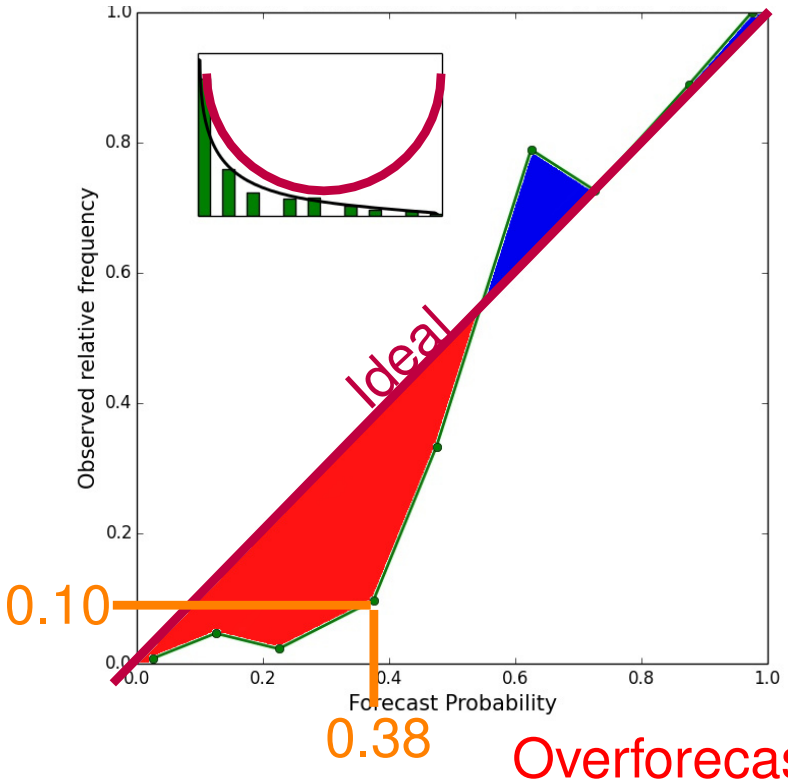
Sharpness - Tendency of the forecast to predict extreme values.

Reliability - The average agreement between the forecast and observation

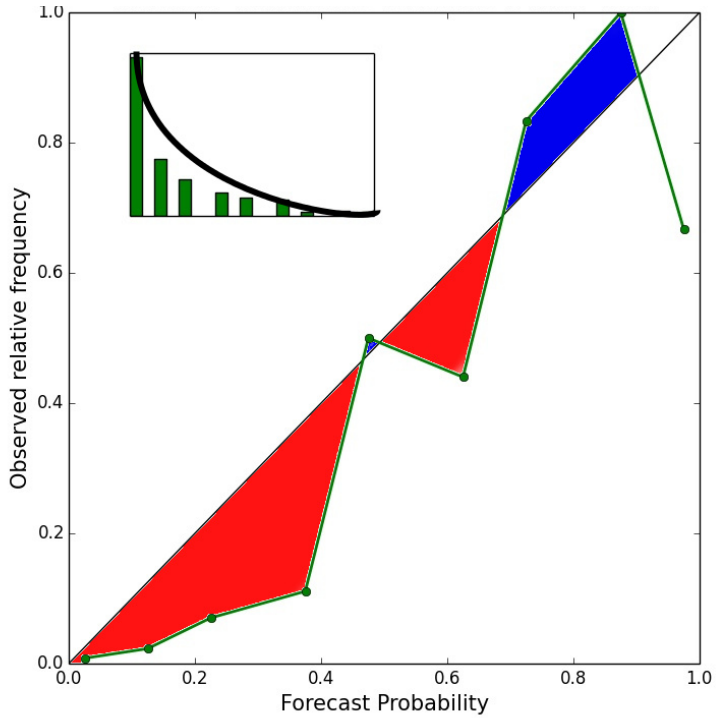
Probabilistic Verification : Reliability Diagram

AOD Daily Maximun
ABRIL 2016 NOBS = 987
Threshold = 0.5

Leadtime = 12h



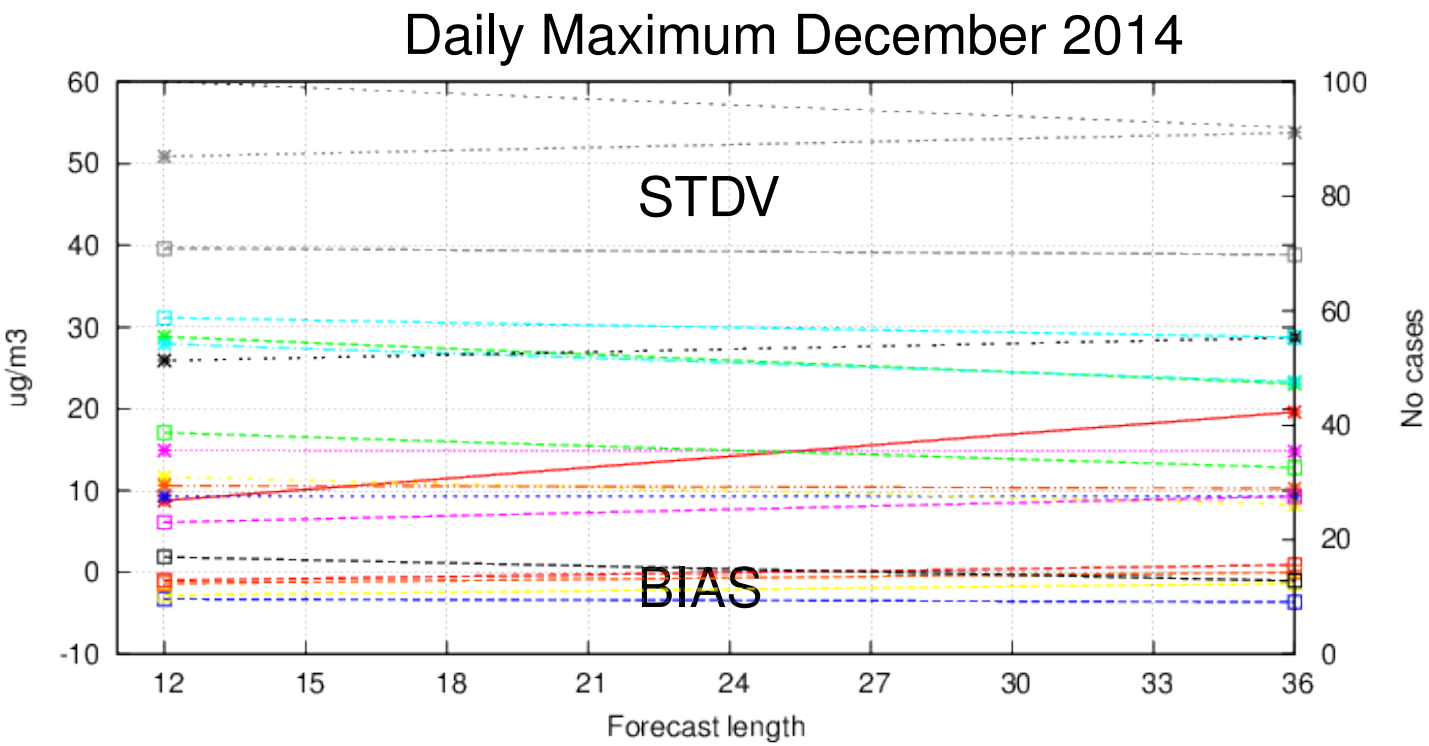
Leadtime = 36h



Overforecasting or + BIAS
Underforecasting or - BIAS
Typical Sharpness

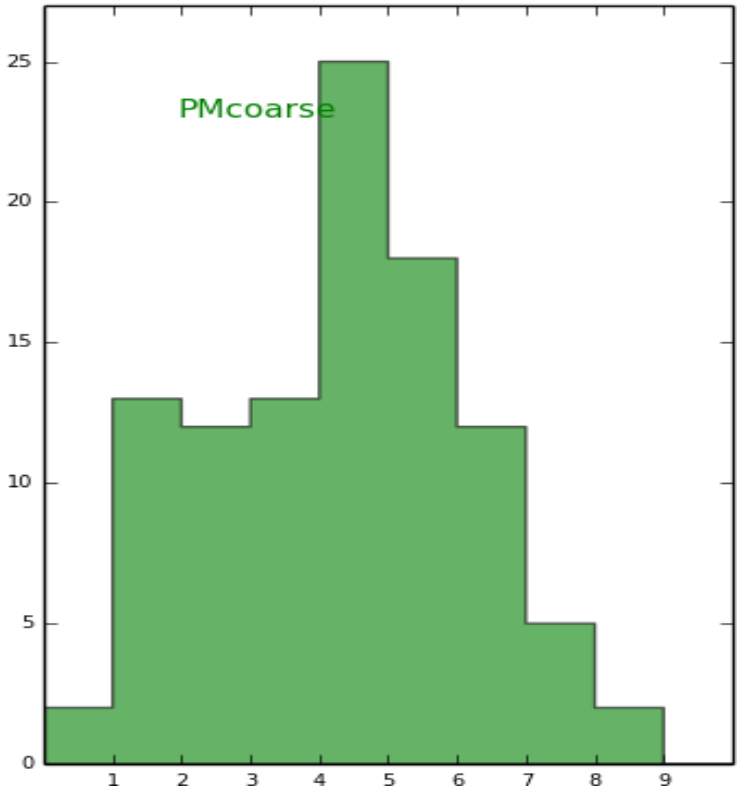
Outline

Deterministic Verification

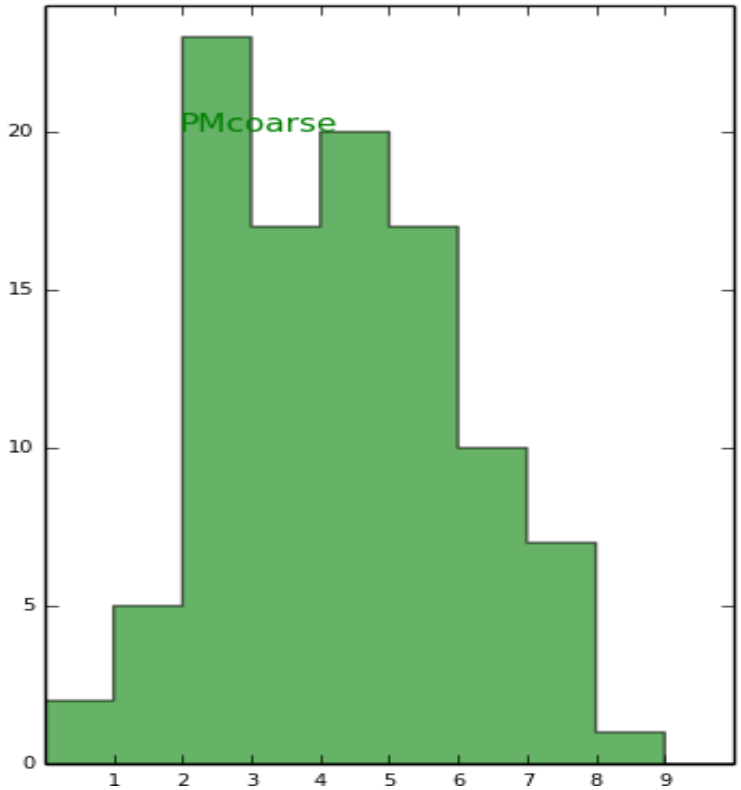


Probabilistic Verification : Rank Histogram (Talagram)

PM10 Daily Maximum
December 2014 NOBS = 202



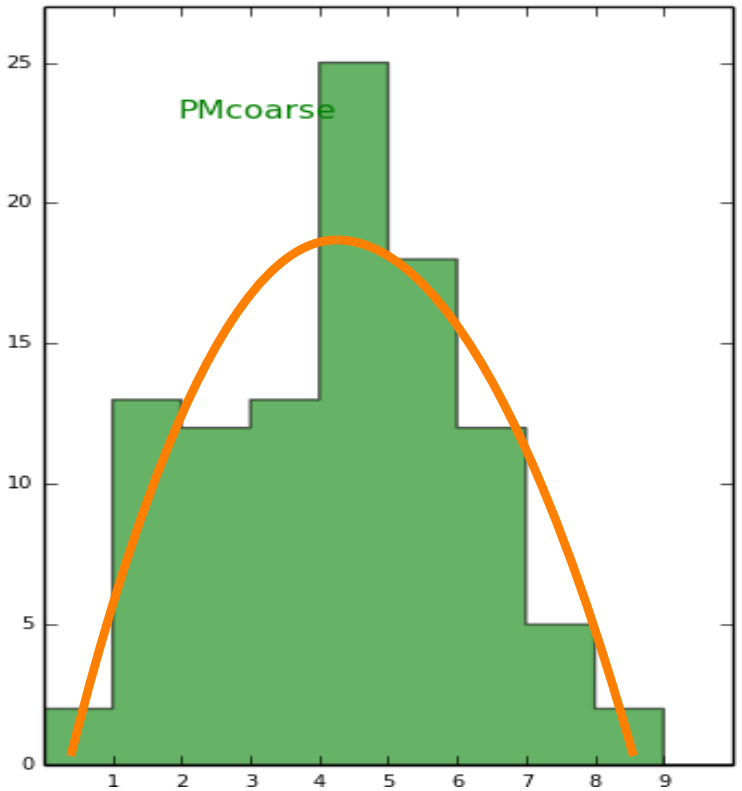
Leadtime = 12h



Leadtime = 36h

Probabilistic Verification : Rank Histogram (Talagram)

PM10 Daily Maximum
December 2014 NOBS = 202



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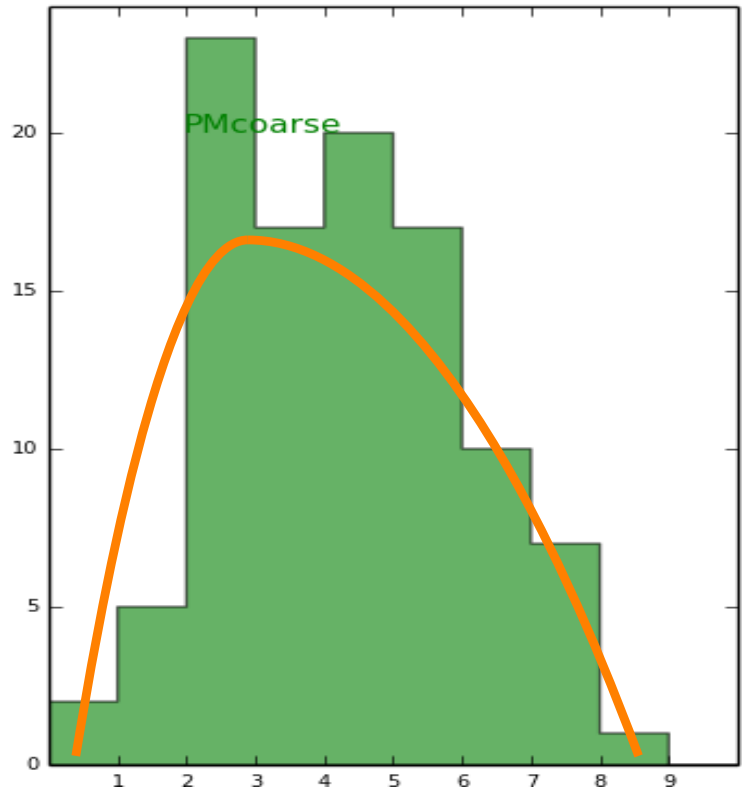
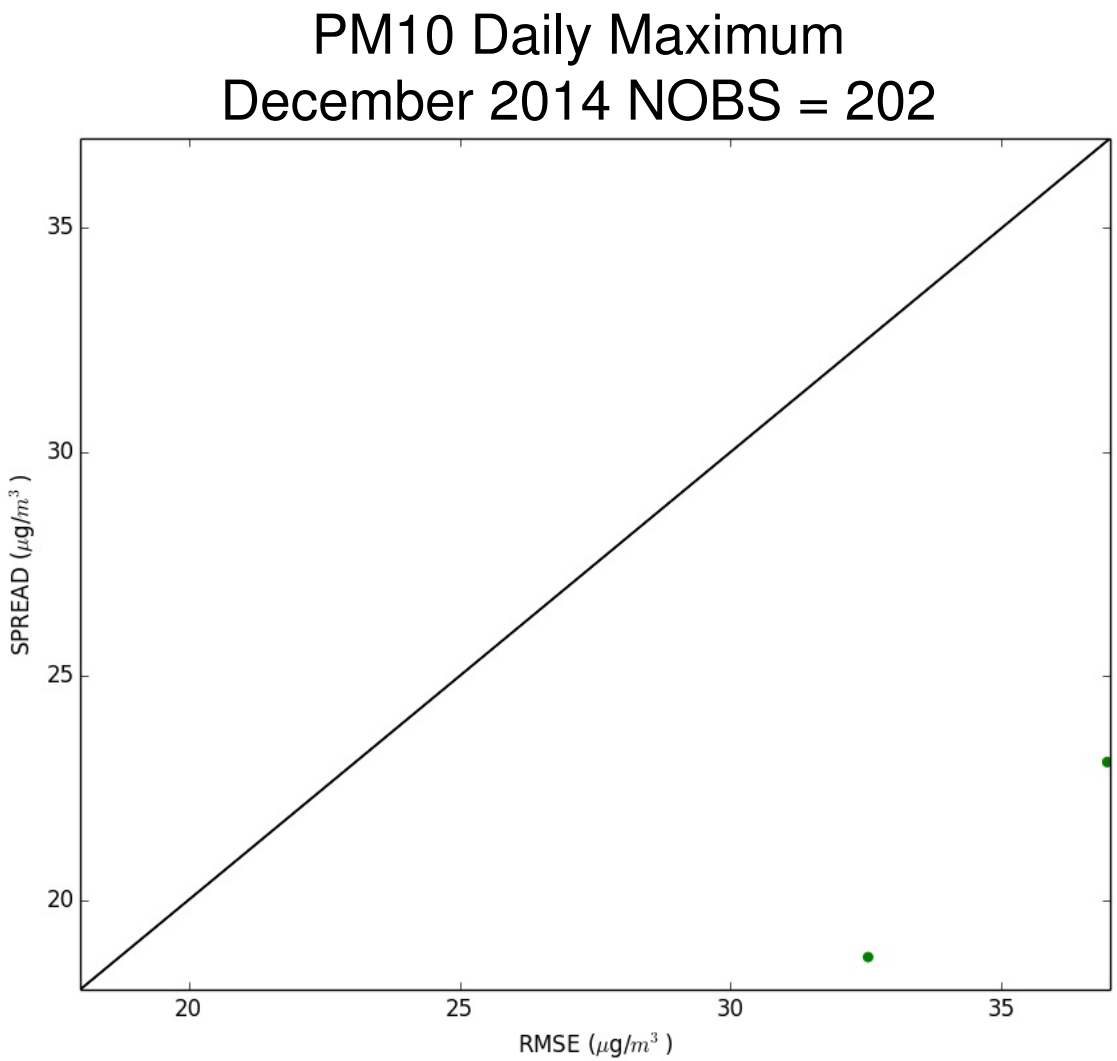


Leadtime = 36h

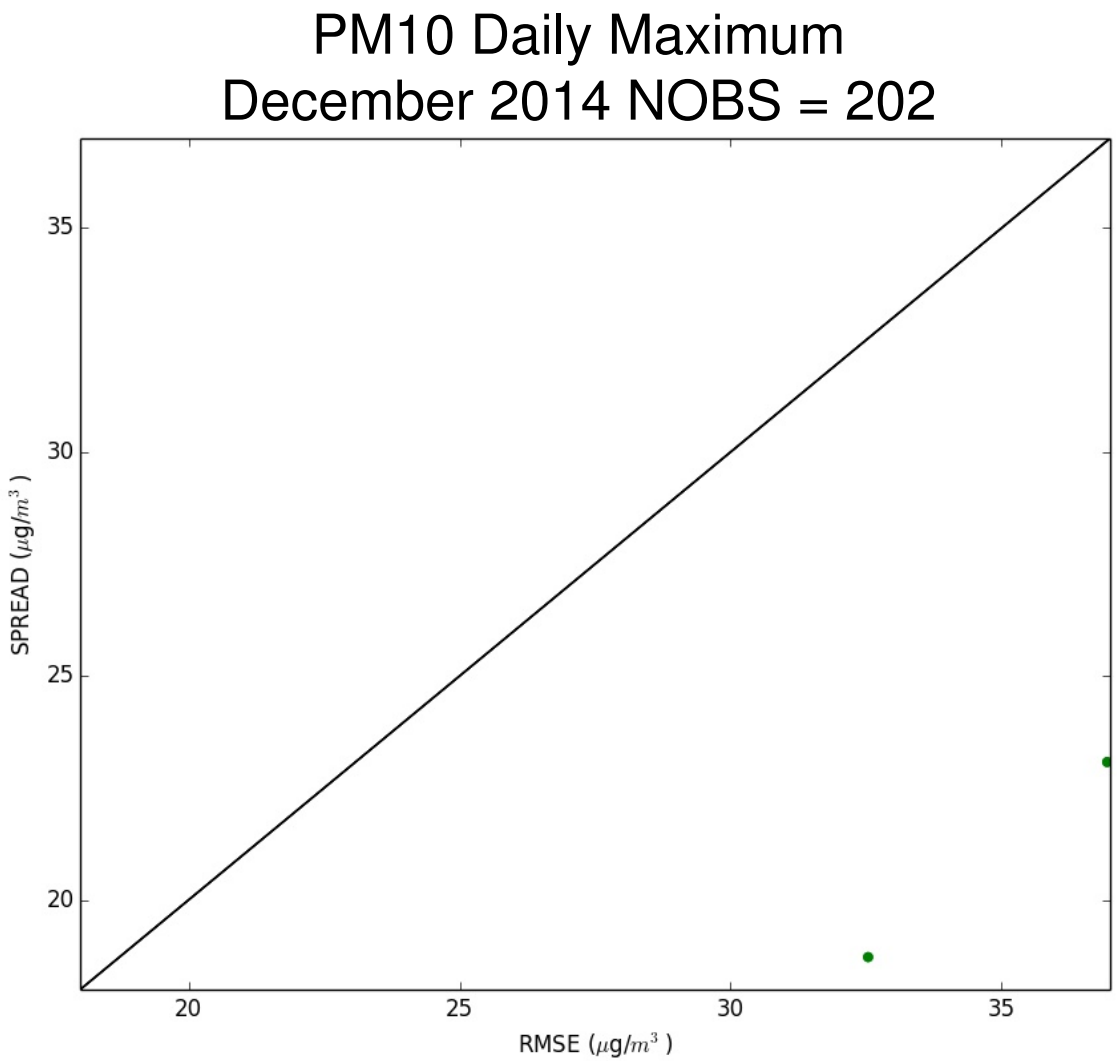
SPREAD TOO LARGE -> Models are very different

NECESSARY BUT NOT SUFFICIENT TO KNOW ABOUT EPS CONSISTENCY

Probabilistic Verification : RMSE - SPREAD



Probabilistic Verification : RMSE - SPREAD

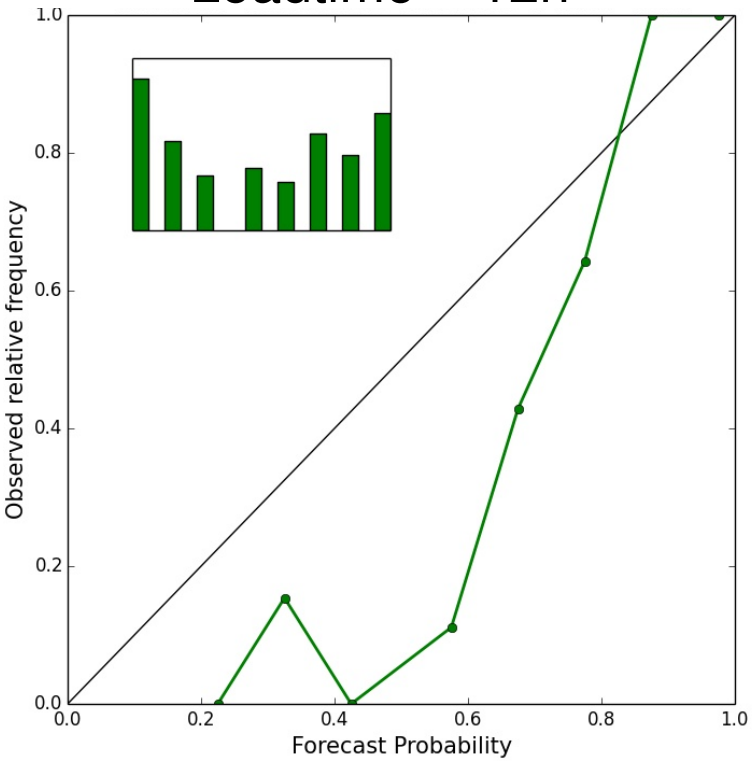


Underdispersion

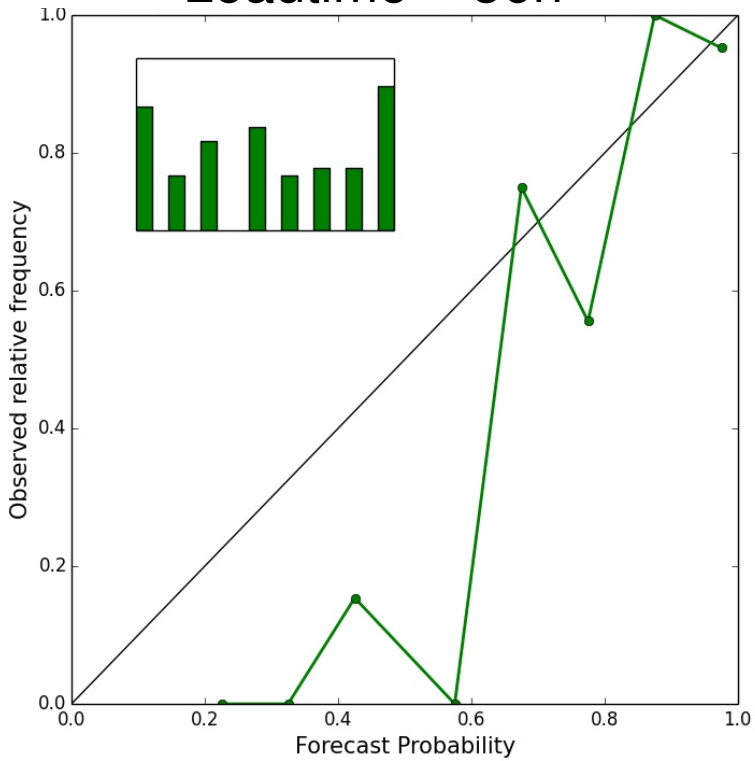
Probabilistic Verification : Reliability Diagram

PM10 Daily Maximum
December 2014 NOBS = 202
Threshold = 50 $\mu g/m^3$

Leadtime = 12h



Leadtime = 36h



Probabilistic Verification : Reliability Diagram

PM10 Daily Maximum
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Threshold = 50 $\mu g/m^3$

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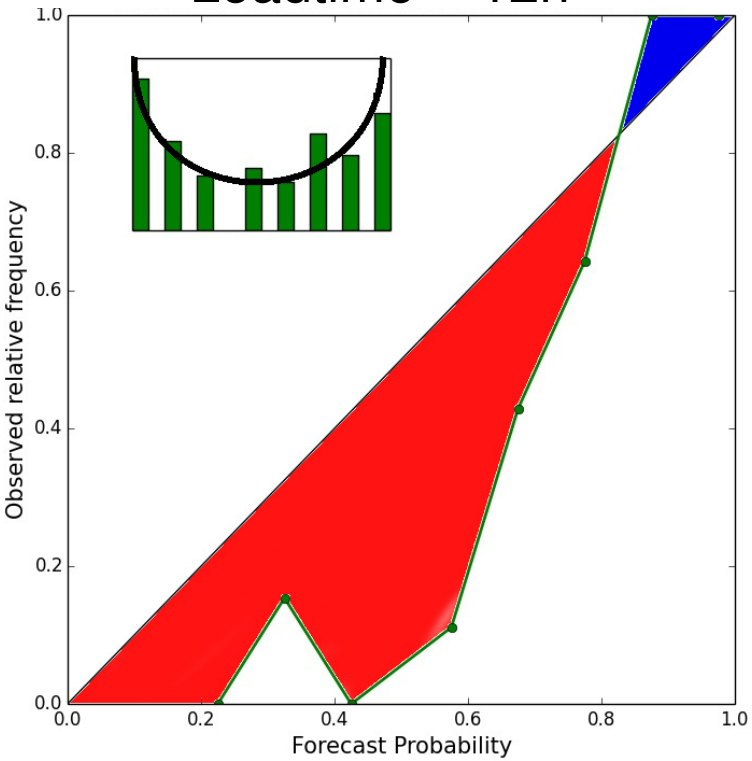
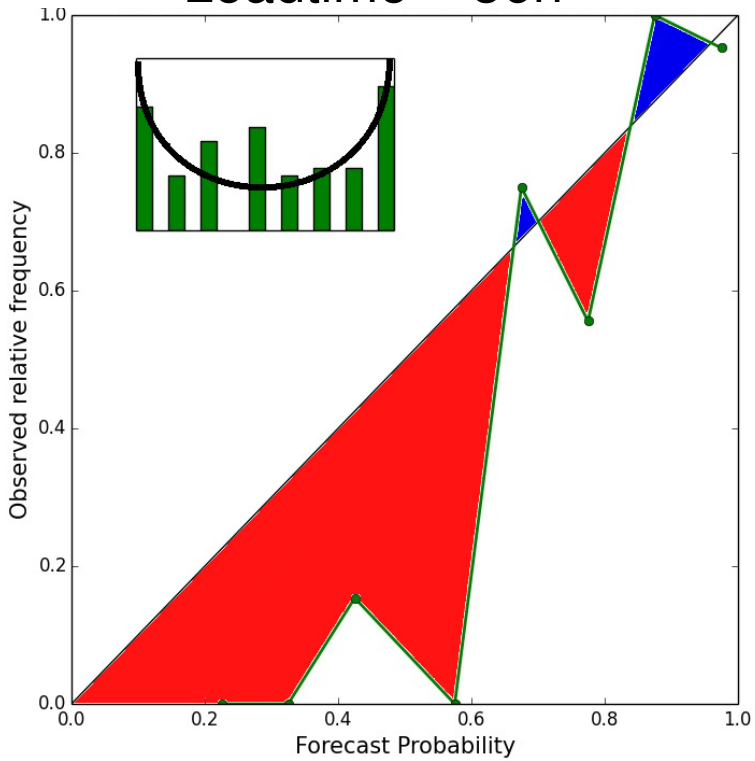


Leadtime = 36h



Overforecasting or + BIAS
Underforecasting or - BIAS
Poor Sharpness

Outline

Outline

Conclusions

AOD

- Coarse, APRIL 2016 for NA-ME-E, $\sim$ 45 stations
- + BIAS and SPREAD close to ideal
- Underdispersion (RMSE higher than SPREAD)
- Typical Sharpness
- Overforecasting in median-low probabilities and Underforecasting in high probabilities
- REGULAR CONSISTENCY -> BETTER WITH CALIBRATION?

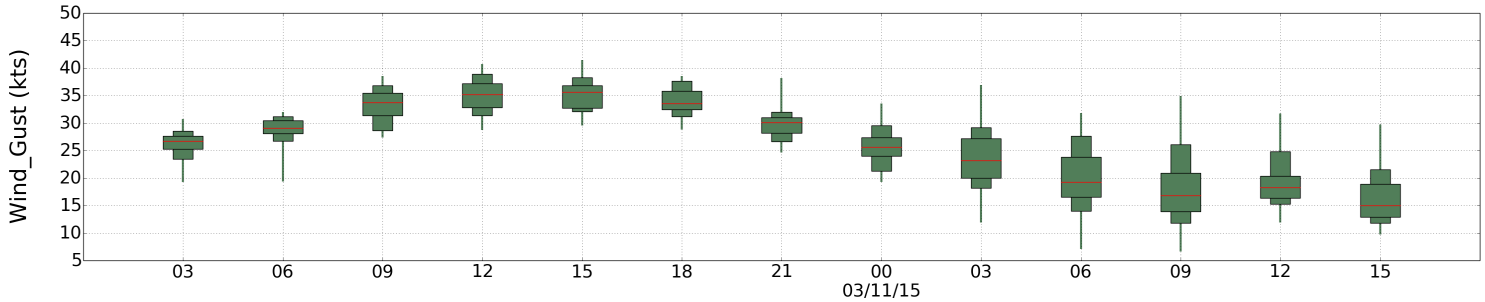
Conclusions

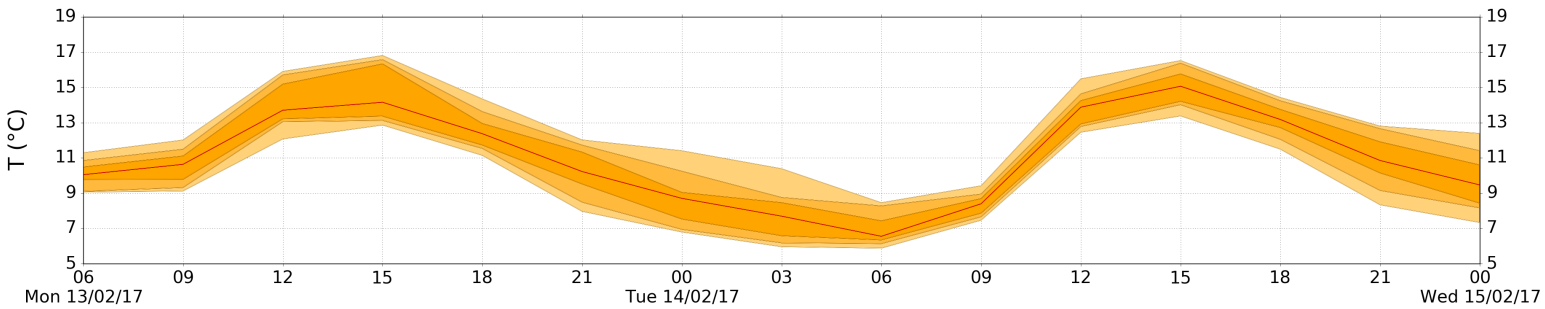
SFC

- PMcoarse, December 2014 for Canary Island, 5 stations
- SPREAD too large
- Underdispersion (RMSE higher than SPREAD)
- Poor Sharpness
- Overforecasting in high-median-low probabilities and Underforecasting in very high probabilities
- BAD CONSISTENCY -> CALIBRATION

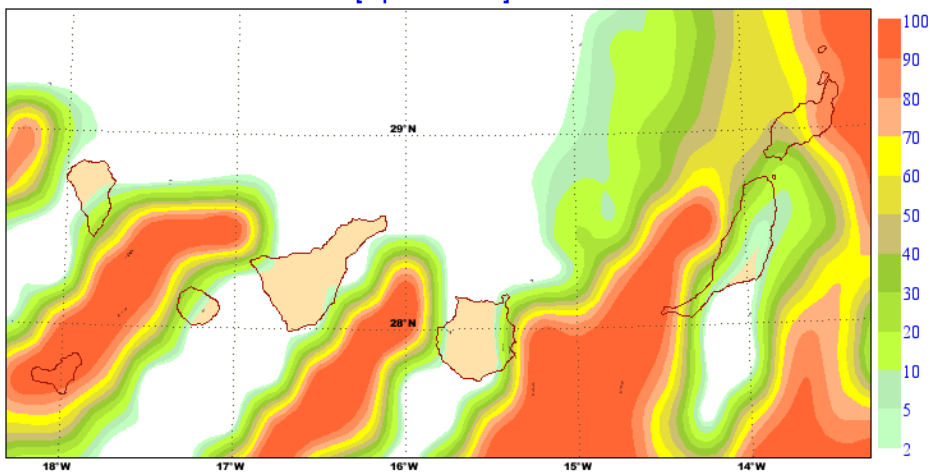
Outline

Value Products





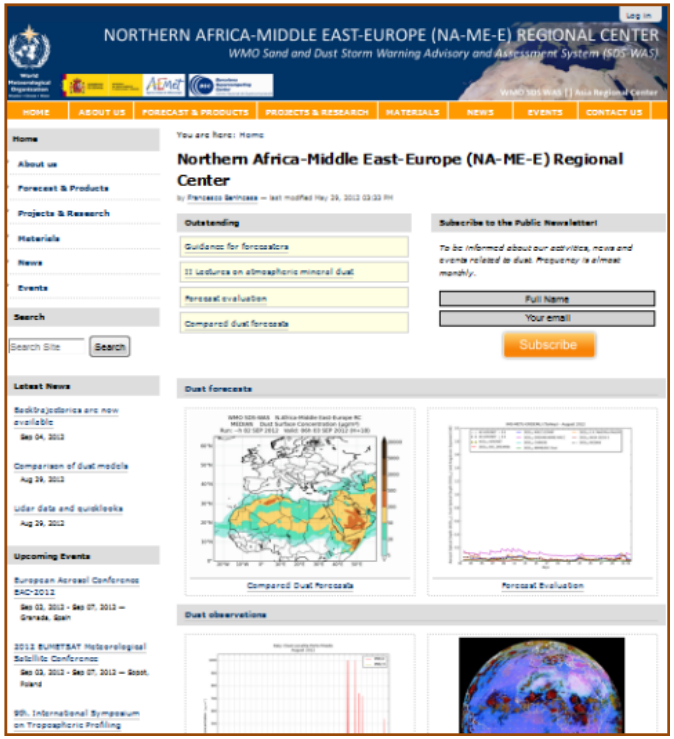
EPS (0.25º) 20170928 a 00 UTC. H+018. Validez: jueves, 28 de septiembre de 2017, a 18 UTC.
Probabilidad viento superior a umbrales
moderado [superior a 11 Kt] Nivel: 10 M



SDS-WAS

Thank you for your attention

http://sds-was.aemet.es



sdswas@aemet.es

SDS-WAS

Çok teşekkür ederim