

Aerosol Optical Depth measurements in the Azores

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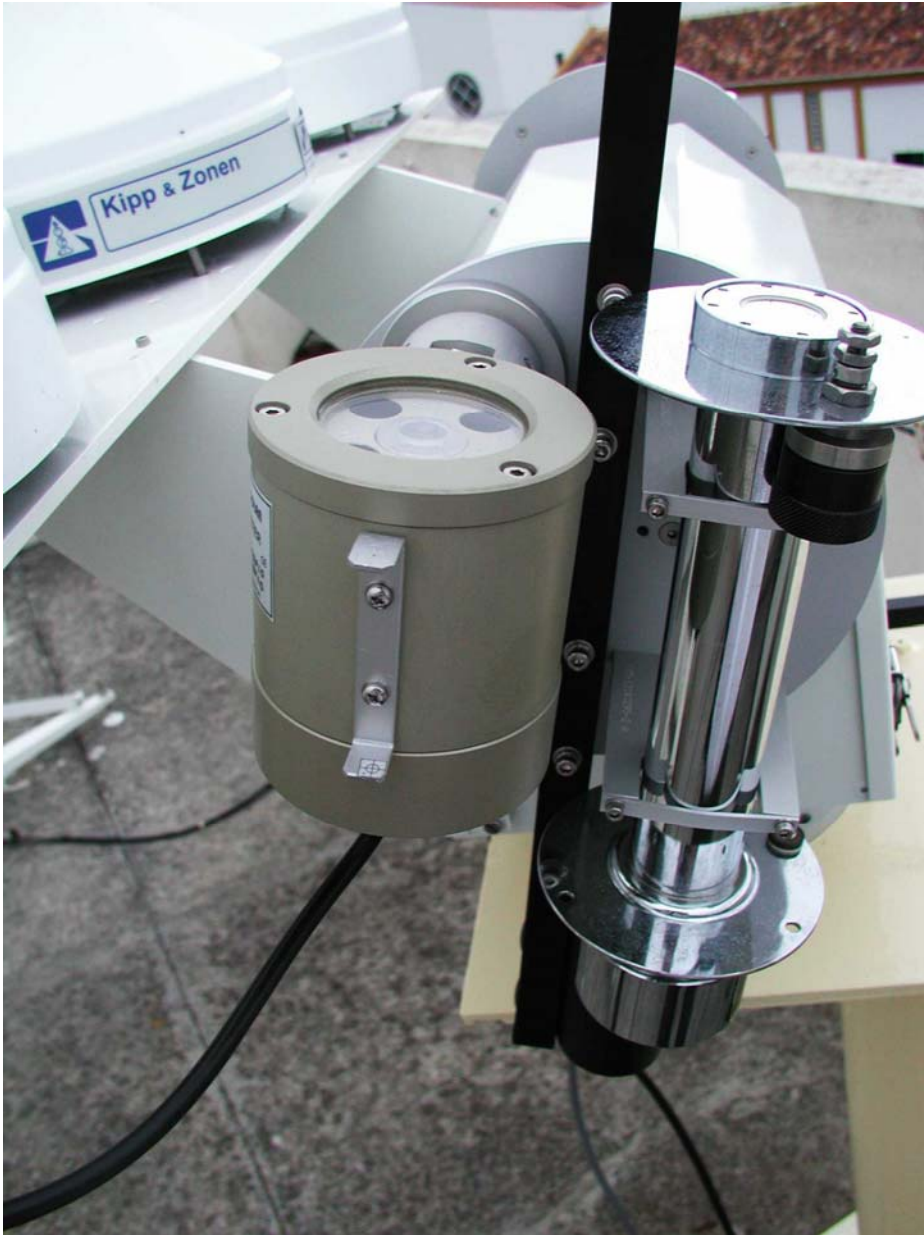


GAW Global Atmosphere Watch
BSRN Baseline Station Radiation Network
WMO World Meteorological Organisation

The José Agostinho Observatory, located in Angra do Heroísmo town, is part of the regional station GAW network since 1992 and proposed to BSRN station in 2008.

The very first global irradiance measurements in Portugal using conventional instruments and methods were done in this Observatory in 1937.







Aerosol Optical Depth ($\tau_{a,\lambda}$) computations

$$\tau_{a,\lambda} = -(1/m) \ln(E_{\lambda} / E_{0,\lambda}) - \tau_{R,\lambda} - \tau_{O,\lambda} - \tau_{H2O}$$

$$m = 1./(\cos(za*\pi/180.)+0.15*(93.885-za)**(-1.253))$$

$$mr = m*p/p0$$

$$vdo = 10000./cdo(\lambda)$$

$$\tau_{R,\lambda} = mr*7.994*(vdo**4.)/(9.26799e18-1.07123e9*vdo**2.)$$

$$\tau_{O,\lambda} = a_{o3}(\lambda)*o_3*m_{o3}$$

$$m_{o3} = 35.0/(1224.0*(\cos(za*\pi/180.)**2)+1.)**0.5$$

$$\tau_{H2O} = 0.3285*a_{H2O}(\lambda)*(w+(1.42-w)**0.5)*m/(1.0+20.07*a_{H2O}(\lambda)*m)**0.45$$

Aerosol Optical Depth ($\tau_{a,\lambda}$) computations (Cont.)

Wavelength (nm)	412	500	675	862
Extraterrestrial const (E0)	3034	2477	2462	2565
O3 absorption coef. (aO3)	0.0000	0.0294	0.0391	0.0000
H2O absorption coef. (aH2O)	0.0000	0.0000	0.00037235	0.010629

- Precipitable water (w): 2.0 cm
- Total ozone (o3): Brewer observed nearest value

Data acquisition and processing

Acquisition system: DTK500

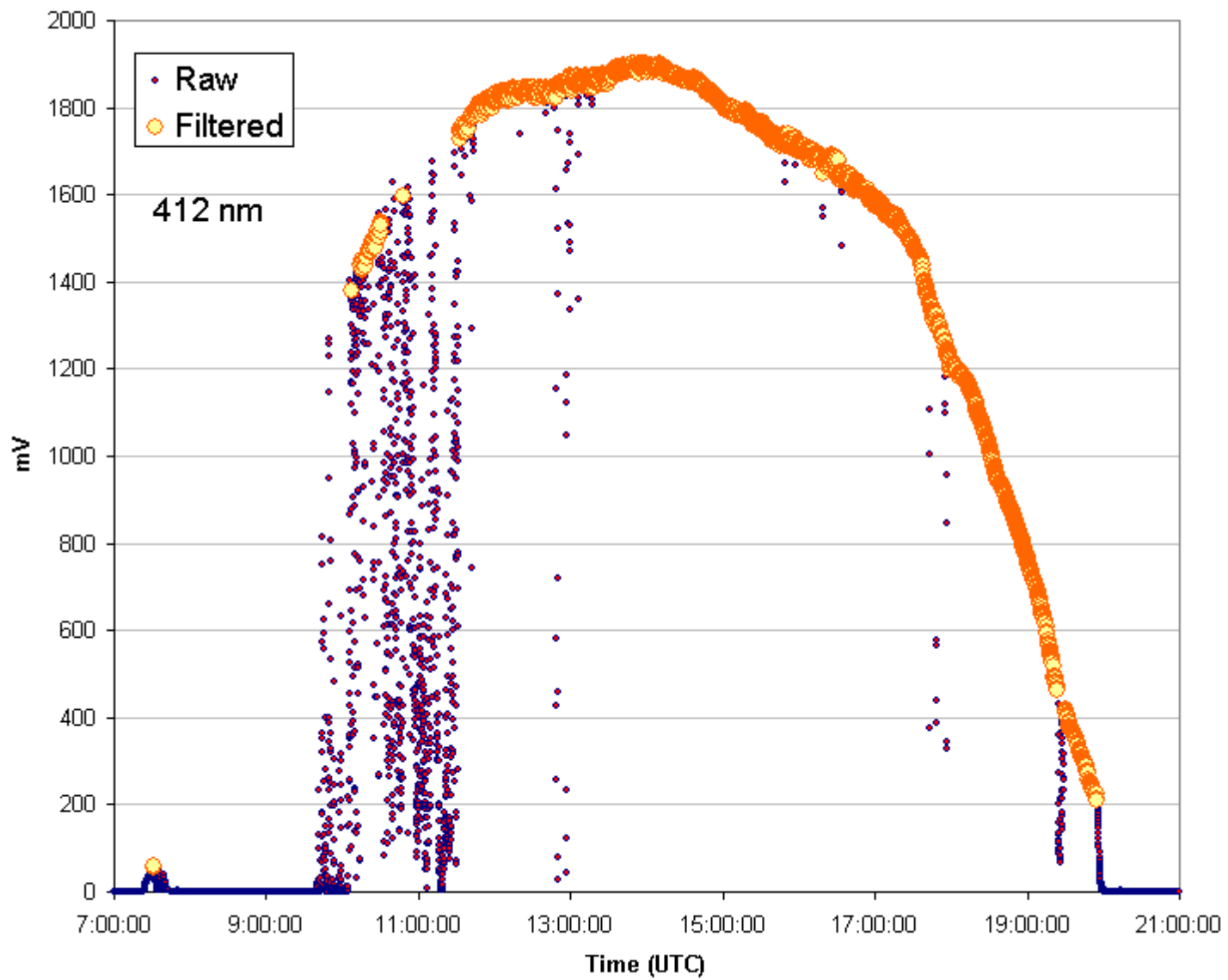
Integration: 5 s (avg;std)

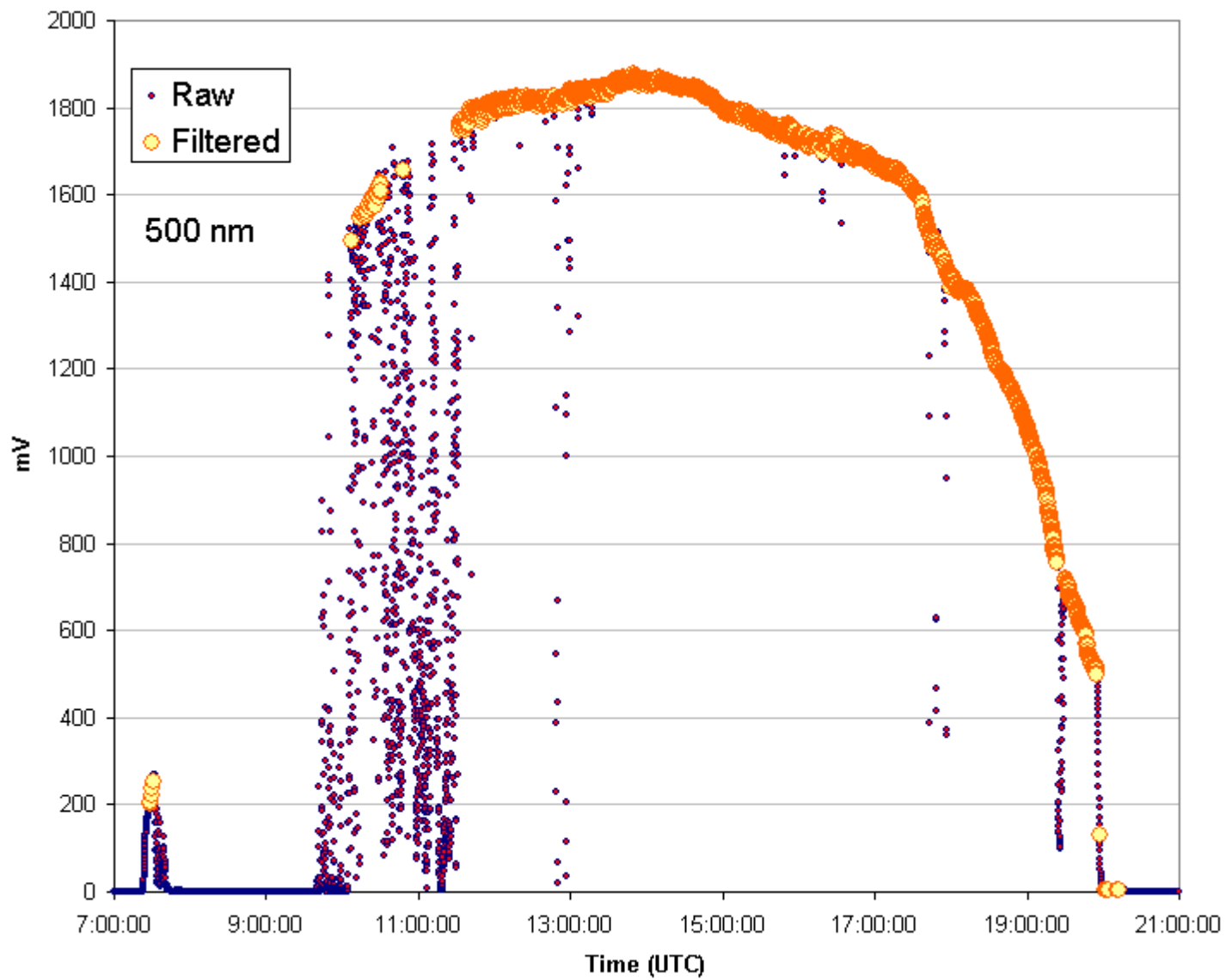
Filter data with:

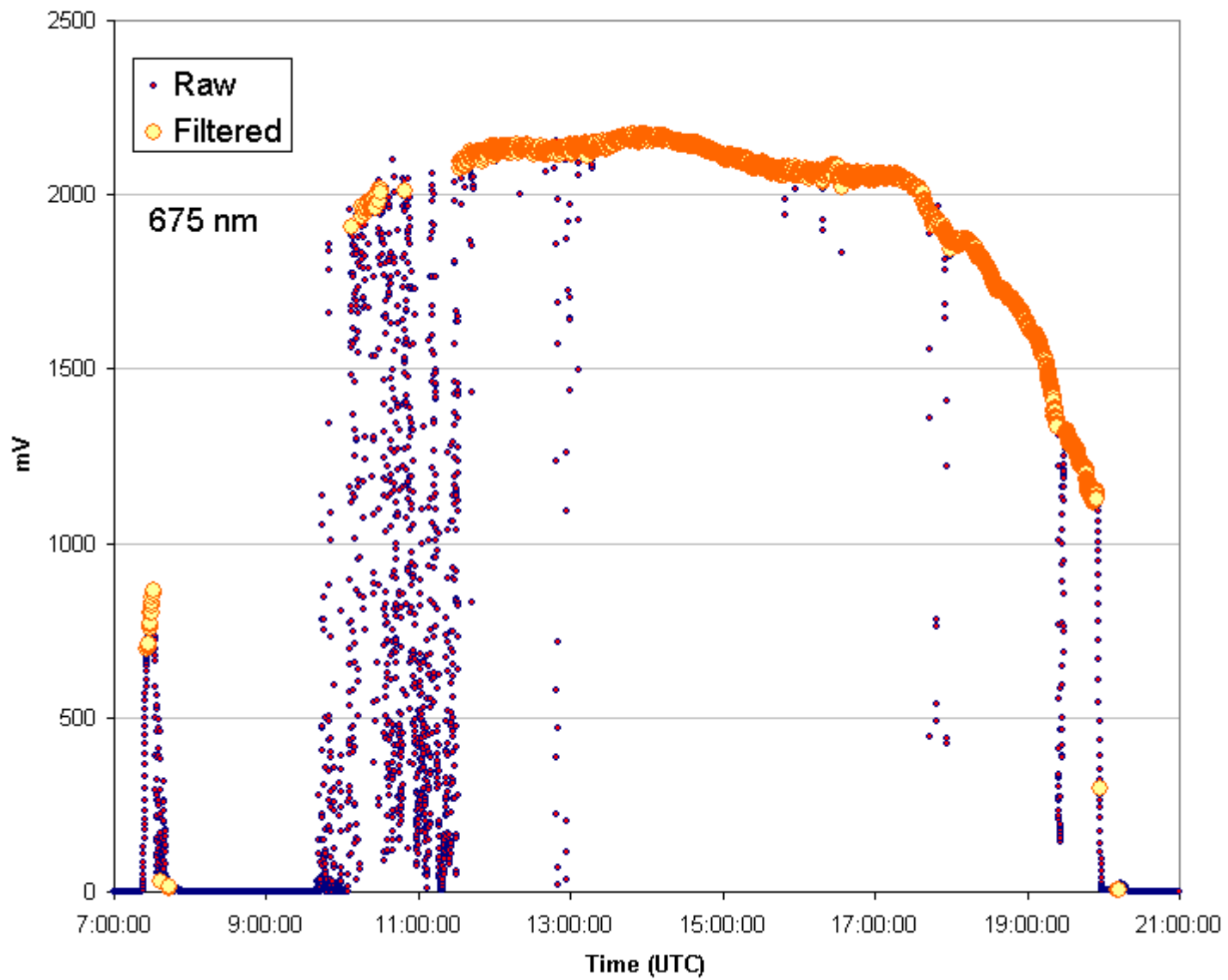
- signal < night background (zero);
- signal noise: $\text{std}/\text{avg} > 0.001$
- night readings ($z_a > 90^\circ$)

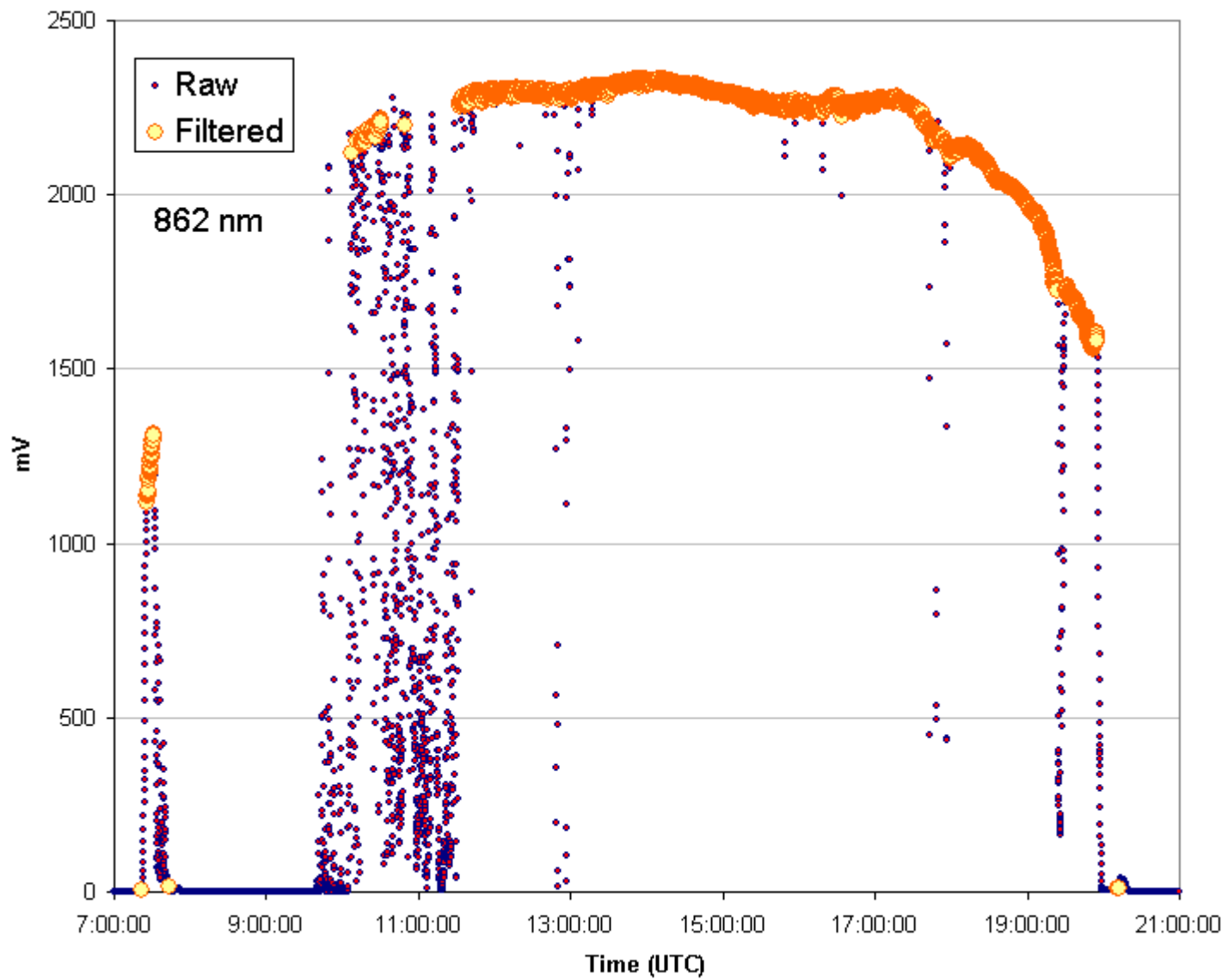
should not be considered.

- **10 minute AOD averages** computed **only** with $n \geq 30$ readings

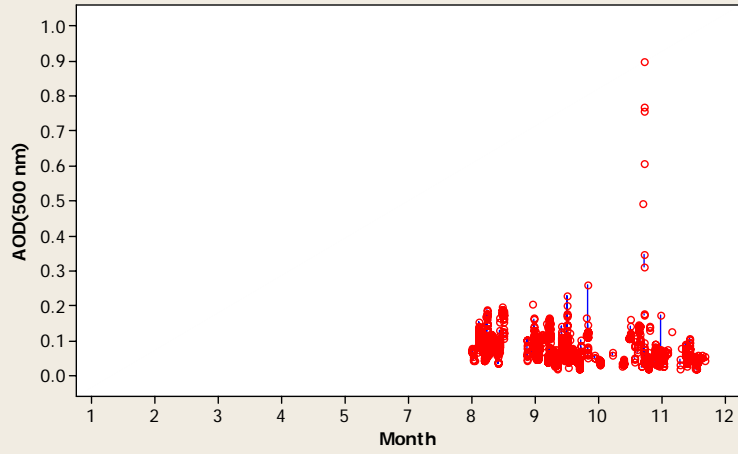




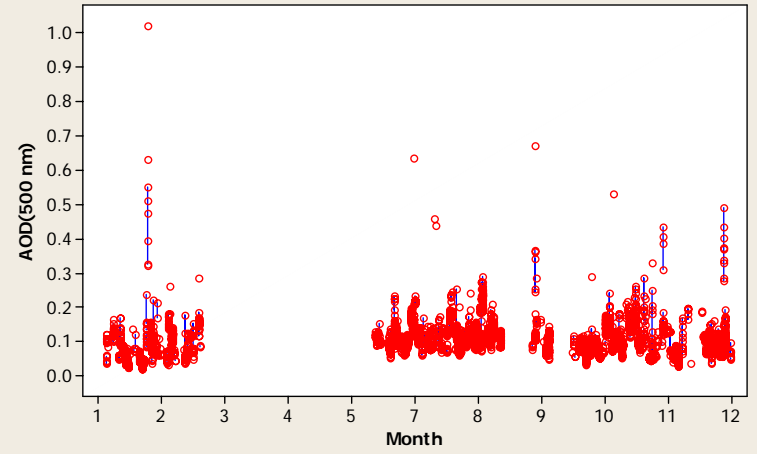




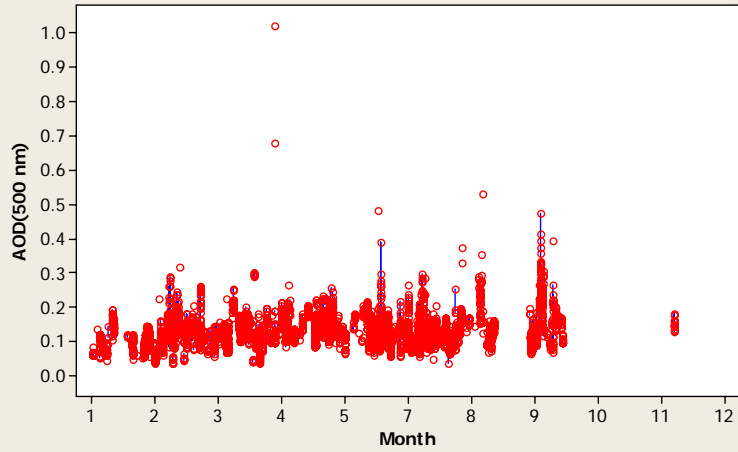
AOD(500 nm) - Angra do Heroísmo - 2004



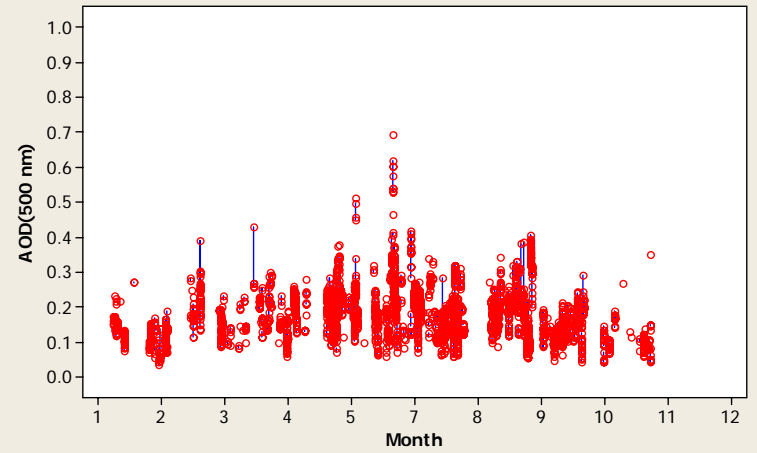
AOD(500 nm) - Angra do Heroísmo - 2005



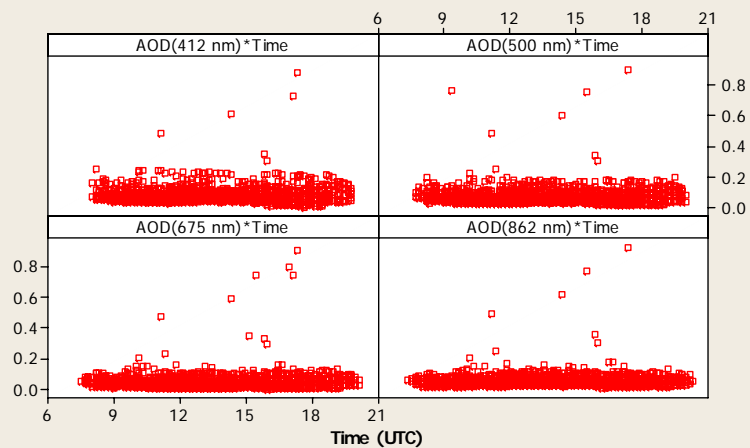
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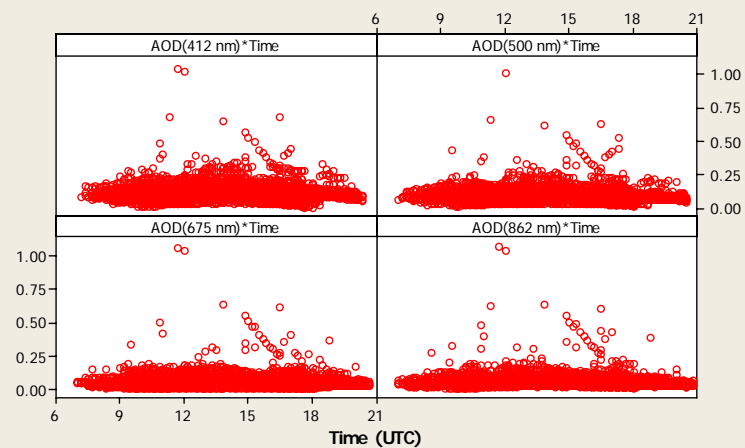
AOD(500 nm) - Angra do Heroísmo - 2007



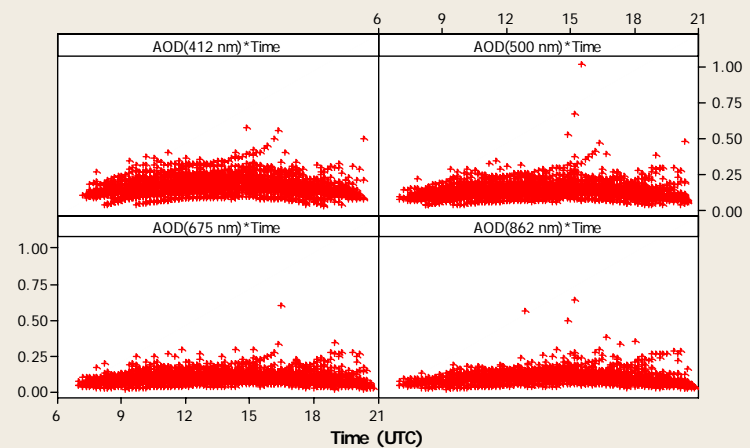
AOD (Aug-Dec 2004) - Angra do Heroísmo



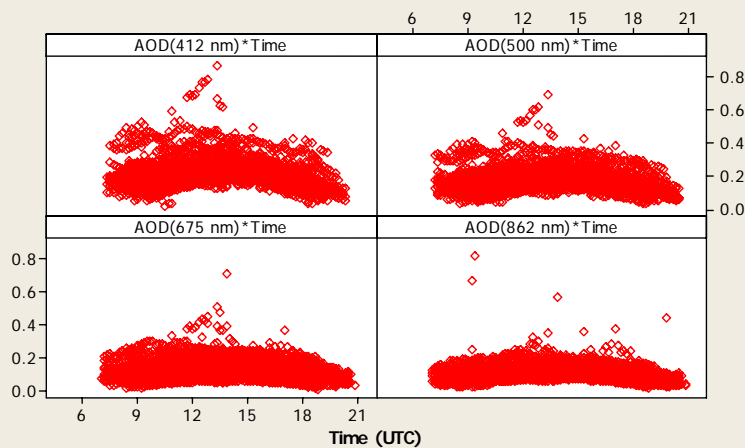
AOD (2005) - Angra do Heroísmo



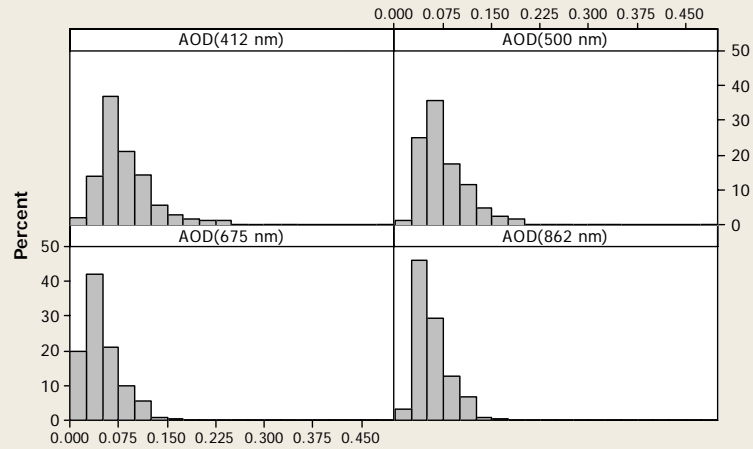
AOD (2006) - Angra do Heroísmo



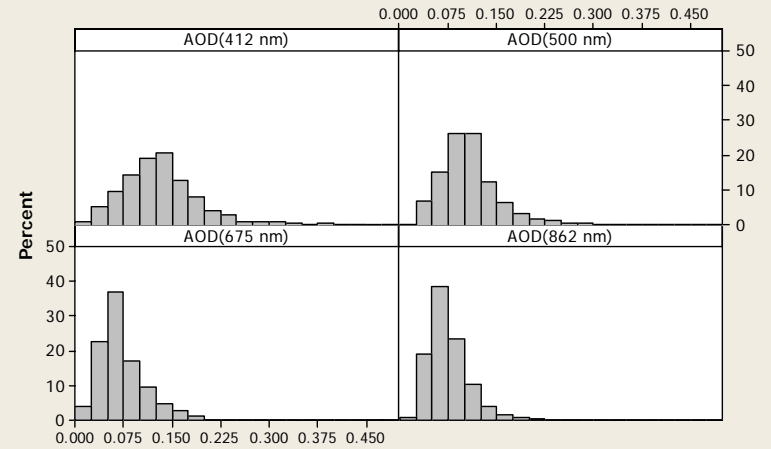
AOD (2007) - Angra do Heroísmo



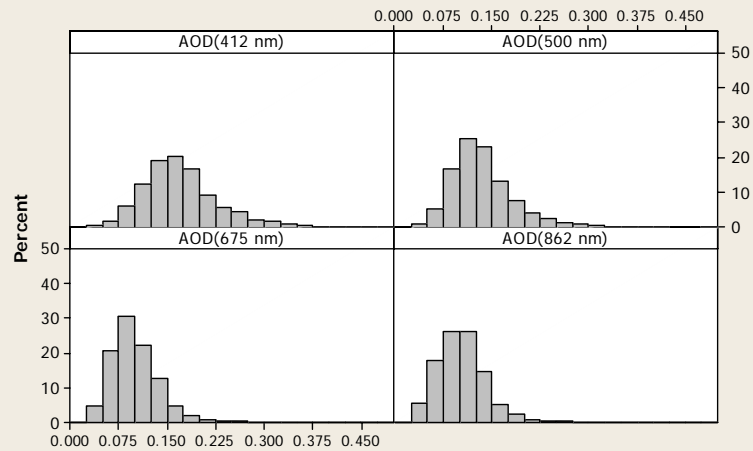
Frequency distribution of AOD - Angra do Heroísmo (Aug-Dec 2004)



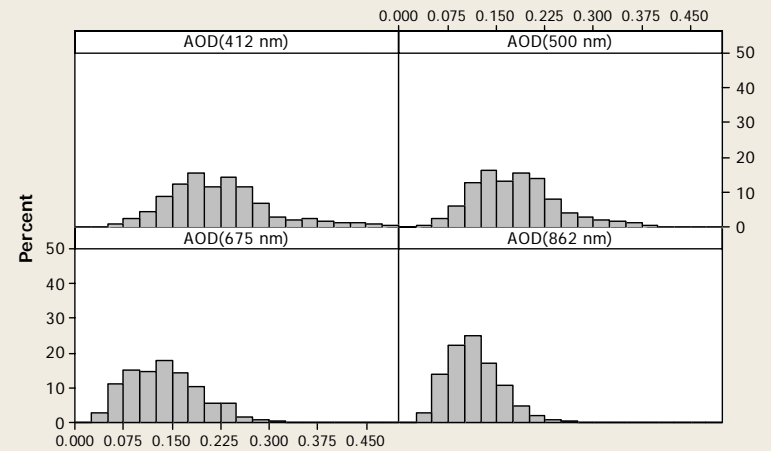
Frequency distribution of AOD - Angra do Heroísmo (2005)



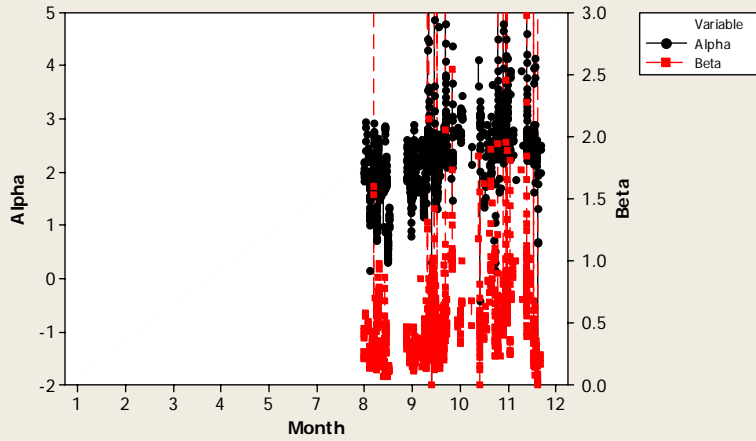
Frequency distribution of AOD - Angra do Heroísmo (2006)



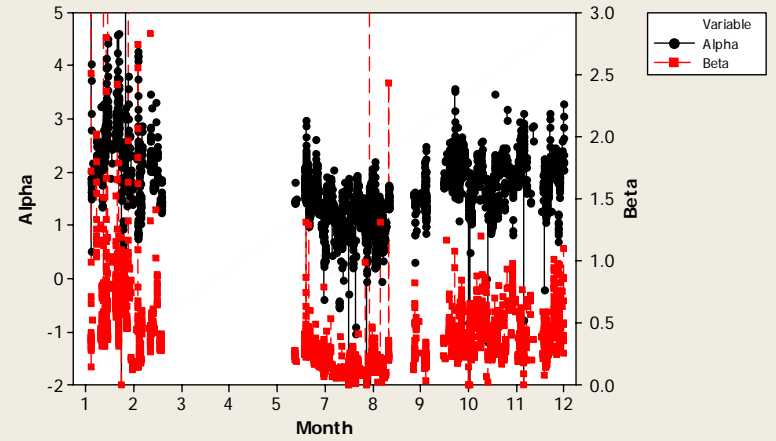
Frequency distribution of AOD - Angra do Heroísmo (2007)



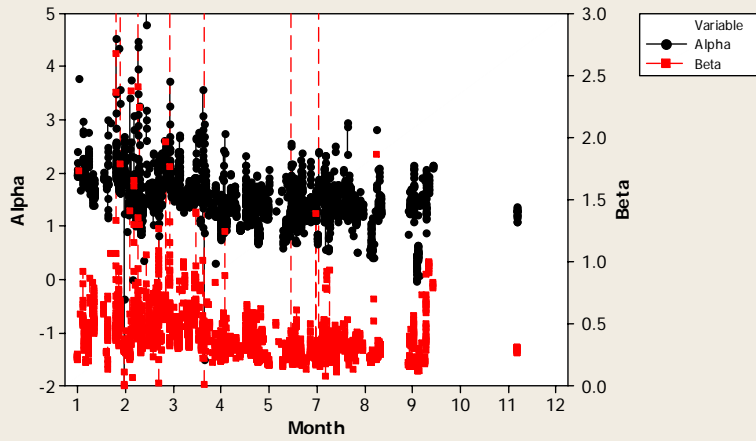
Alpha and Beta - Angra do Heroísmo - 2004



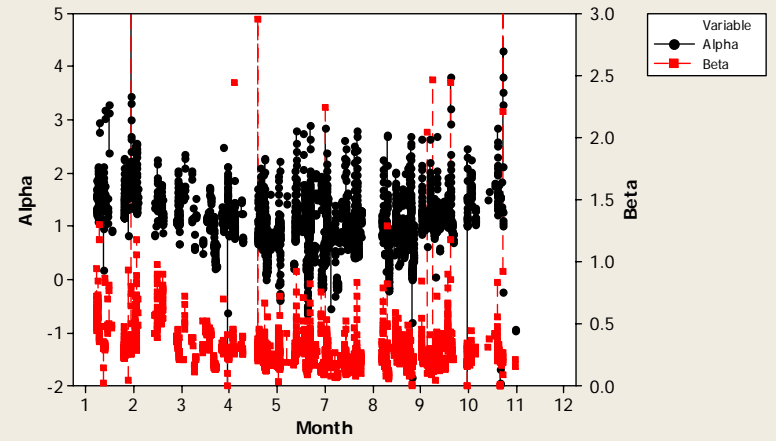
Alpha and Beta - Angra do Heroísmo - 2005



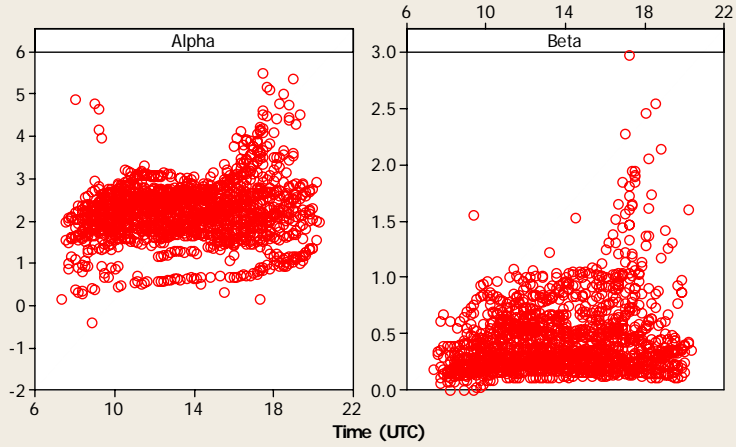
Alpha and Beta - Angra do Heroísmo - 2006



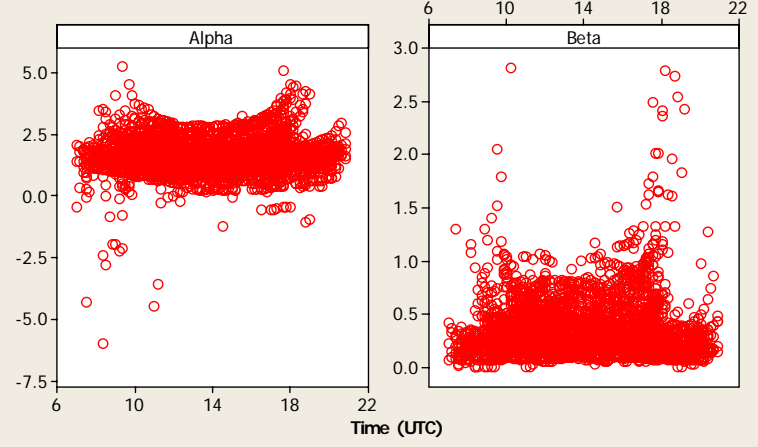
Alpha and Beta - Angra do Heroísmo - 2007



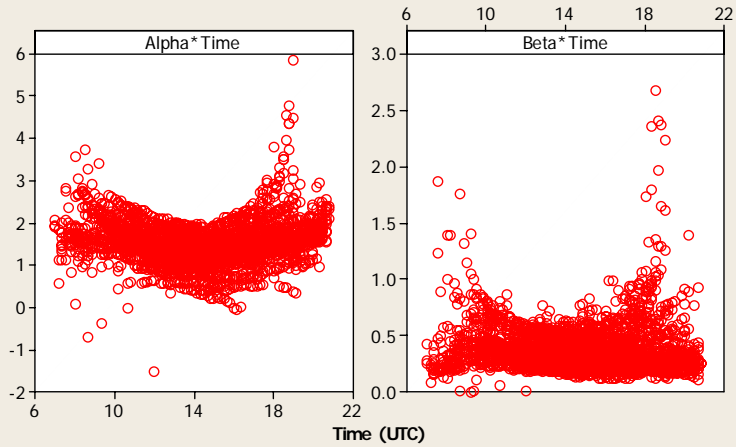
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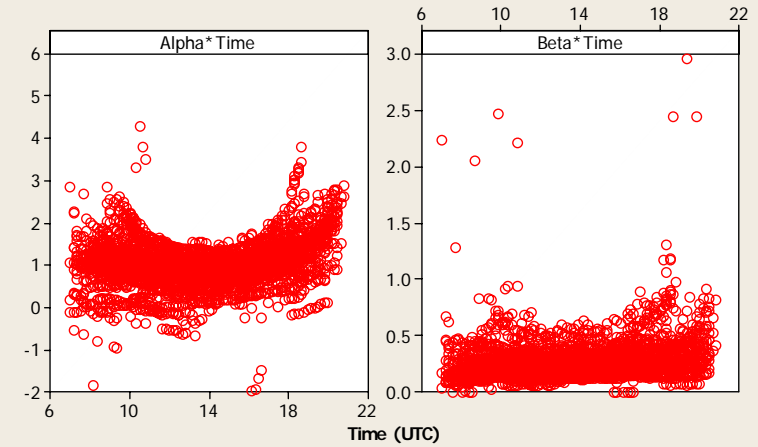
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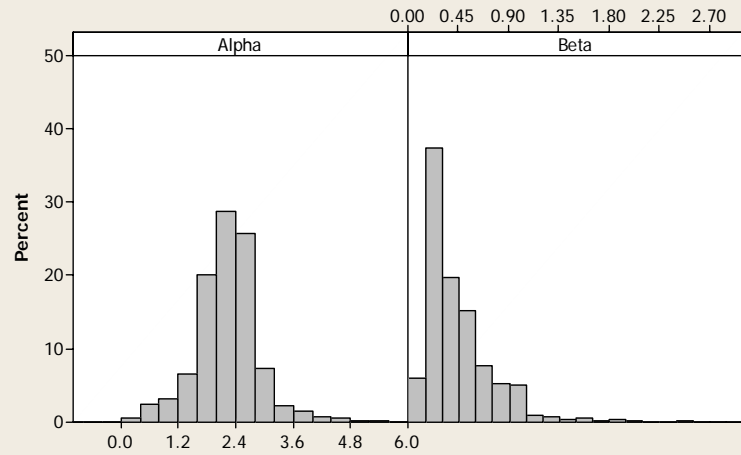
Alpha and Beta - Angra do Heroísmo - 2006



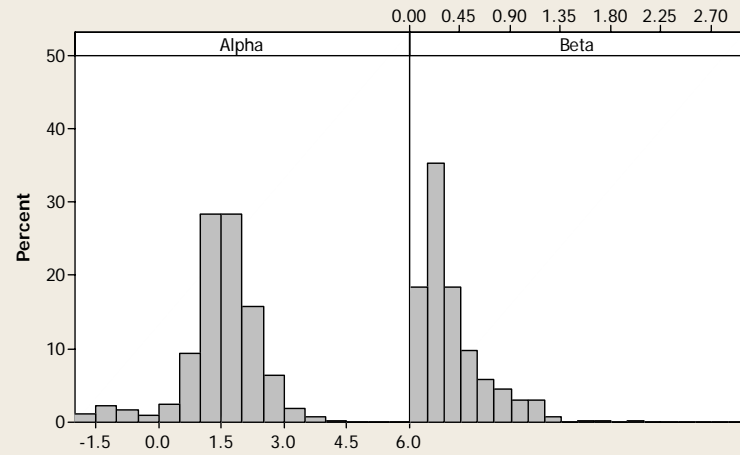
Alpha and Beta - Angra do Heroísmo - 2007



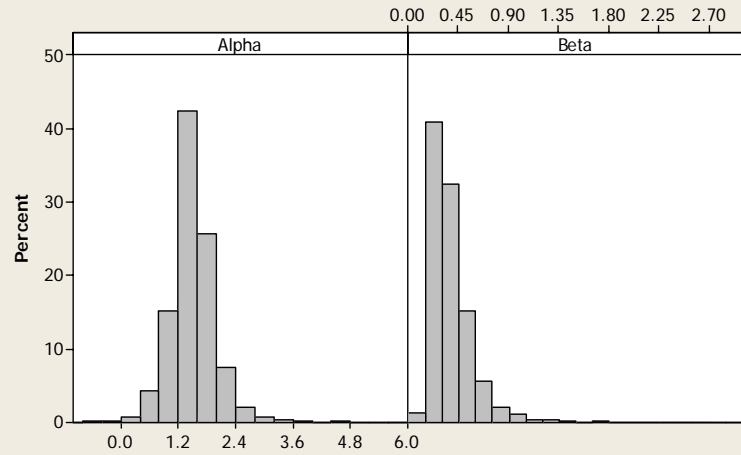
Frequency distribution - alpha & beta - Angra do Heroísmo (2004)



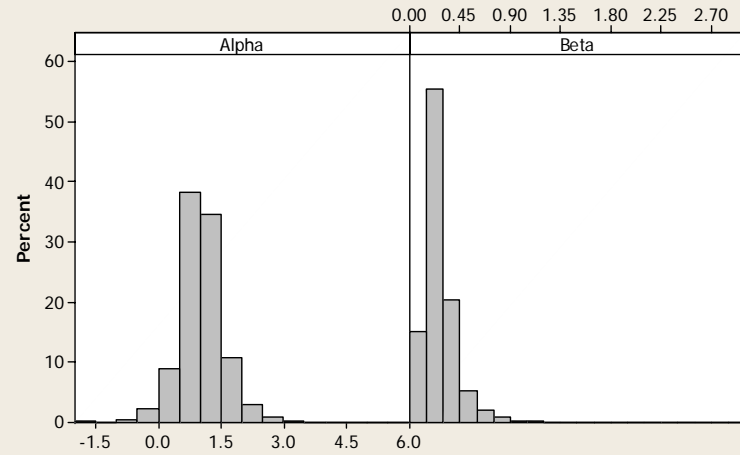
Frequency distribution - alpha & beta - Angra do Heroísmo (2005)



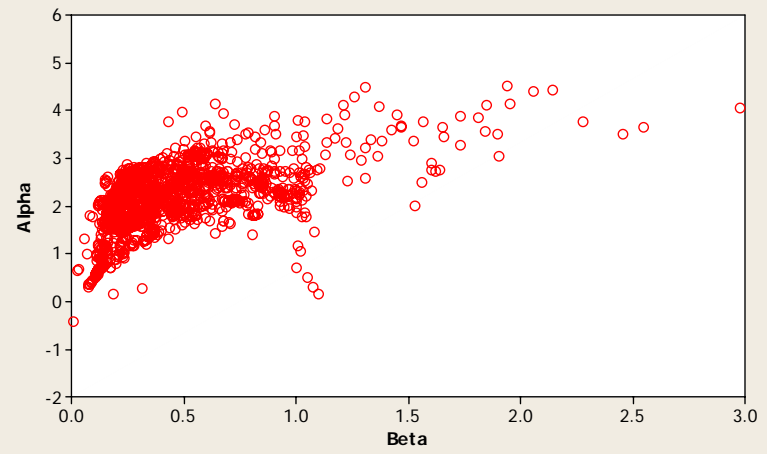
Frequency distribution - alpha & beta - Angra do Heroísmo (2006)



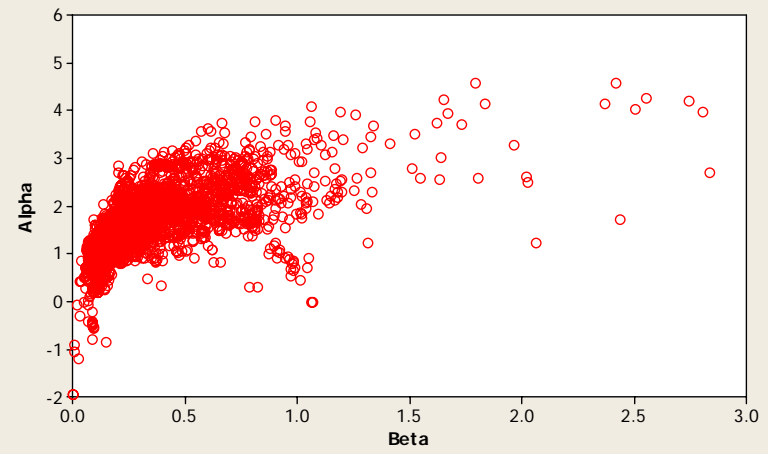
Frequency distribution - alpha & beta - Angra do Heroísmo (2007)



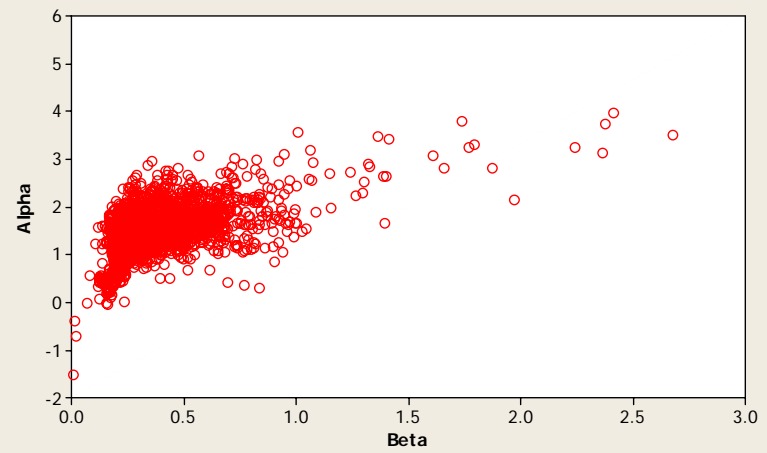
Alpha vs Beta - Angra do Heroísmo - 2004



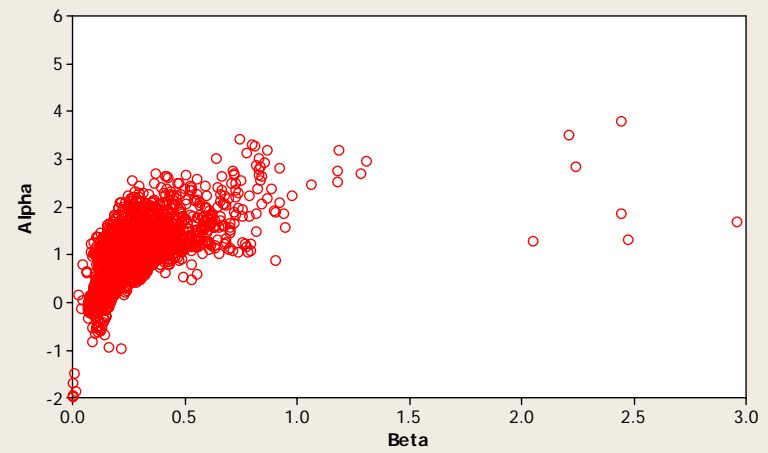
Alpha vs Beta - Angra do Heroísmo - 2005



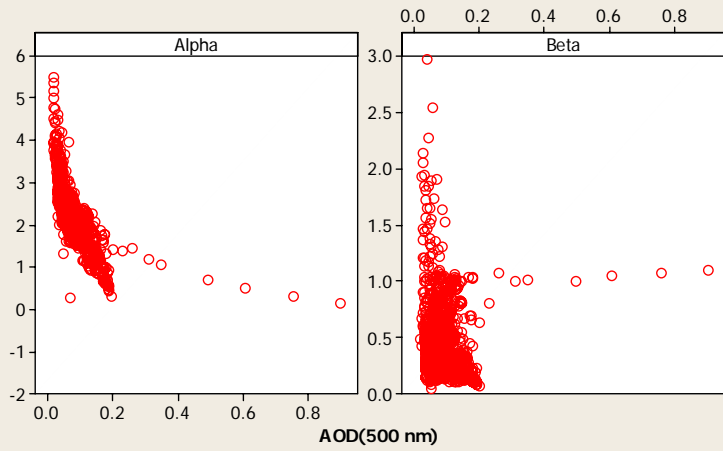
Alpha vs Beta - Angra do Heroísmo - 2006



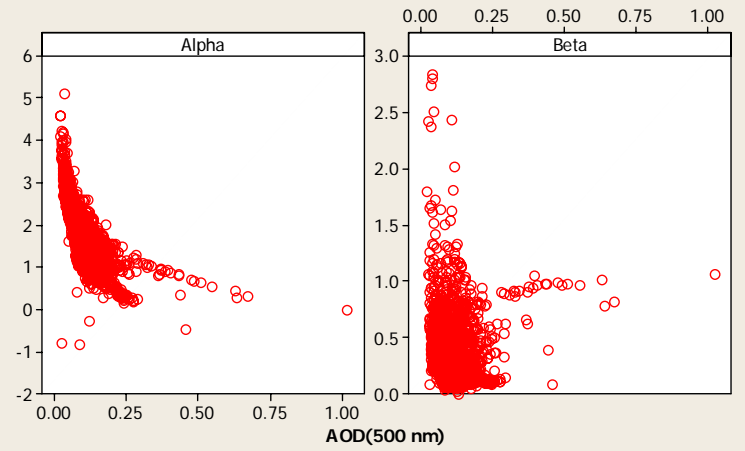
Alpha vs Beta - Angra do Heroísmo - 2007



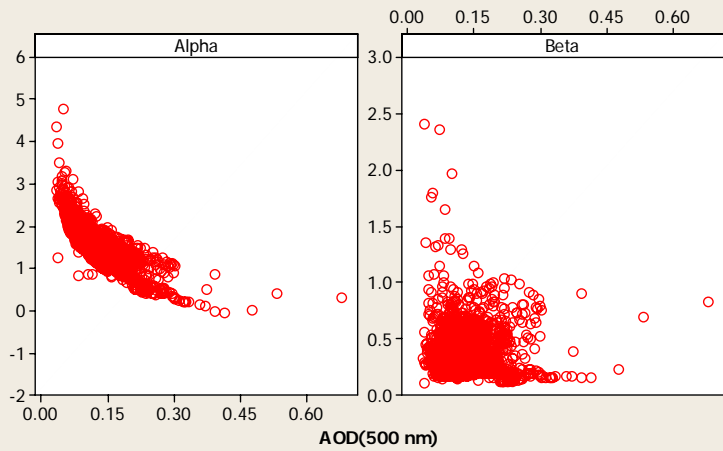
Alpha; Beta vs AOD(500 nm) - Angra do Heroísmo - 2004



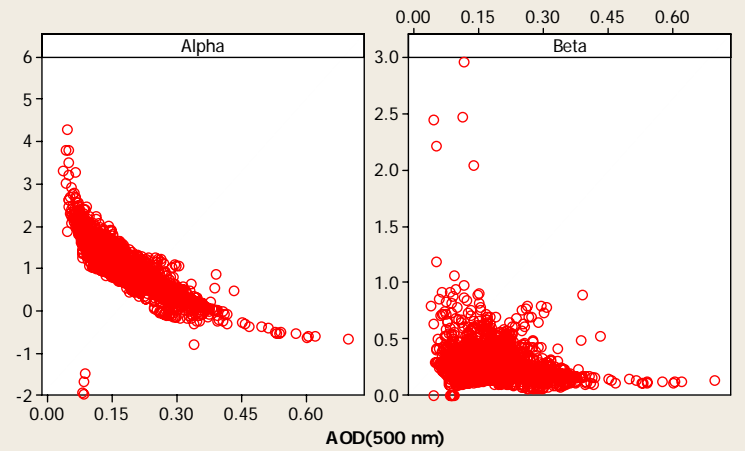
Alpha; Beta vs AOD(500 nm) - Angra do Heroísmo - 2005



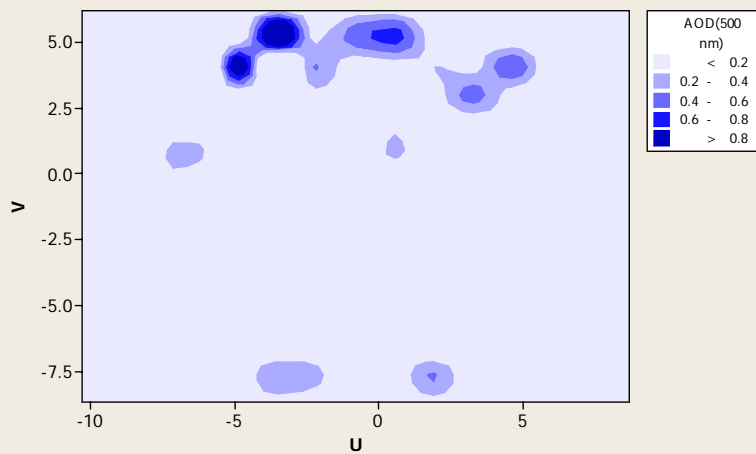
Alpha; Beta vs AOD(500 nm) - Angra do Heroísmo - 2006



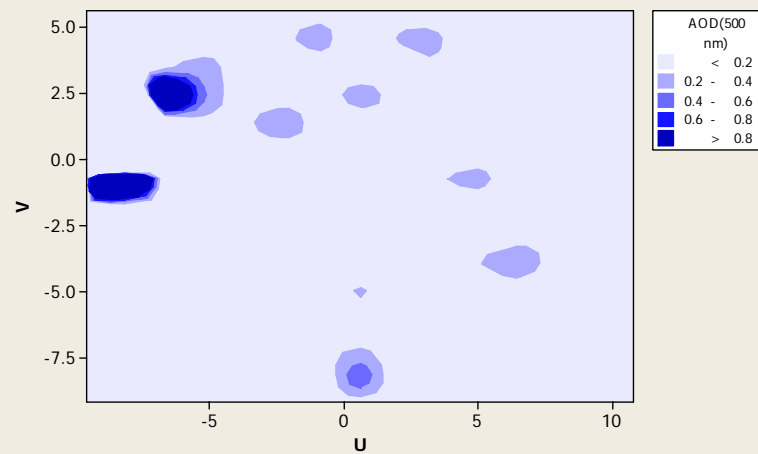
Alpha; Beta vs AOD(500 nm) - Angra do Heroísmo - 2007



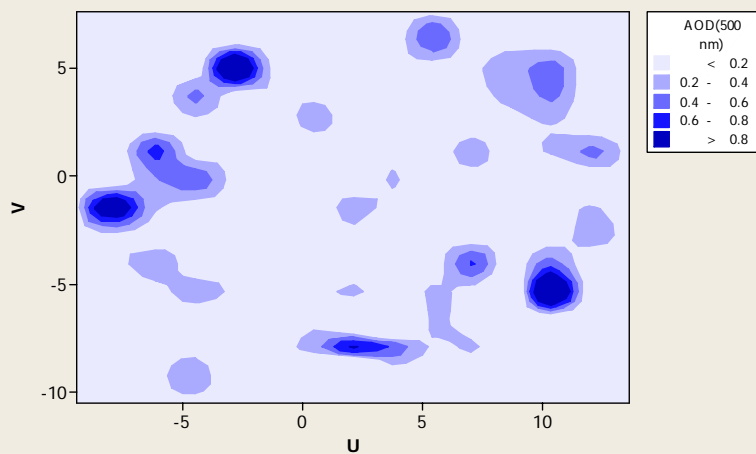
AOD(500 nm) vs V; U - Angra do Heroísmo - 2004



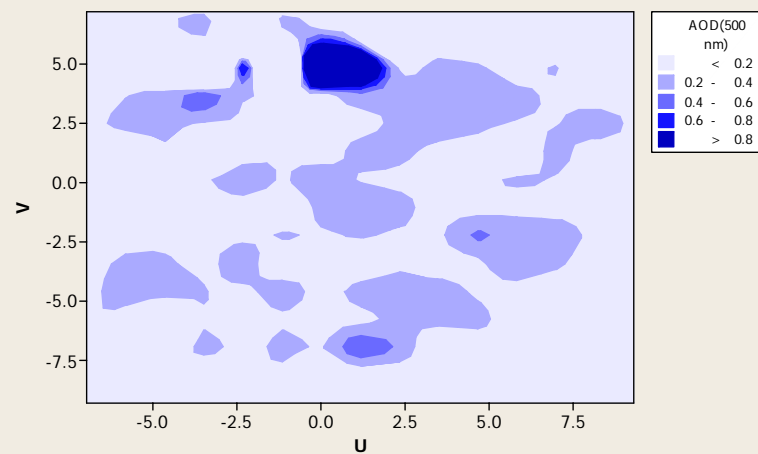
AOD(500 nm) vs V; U - Angra do Heroísmo - 2005



AOD(500 nm) vs V; U - Angra do Heroísmo - 2006

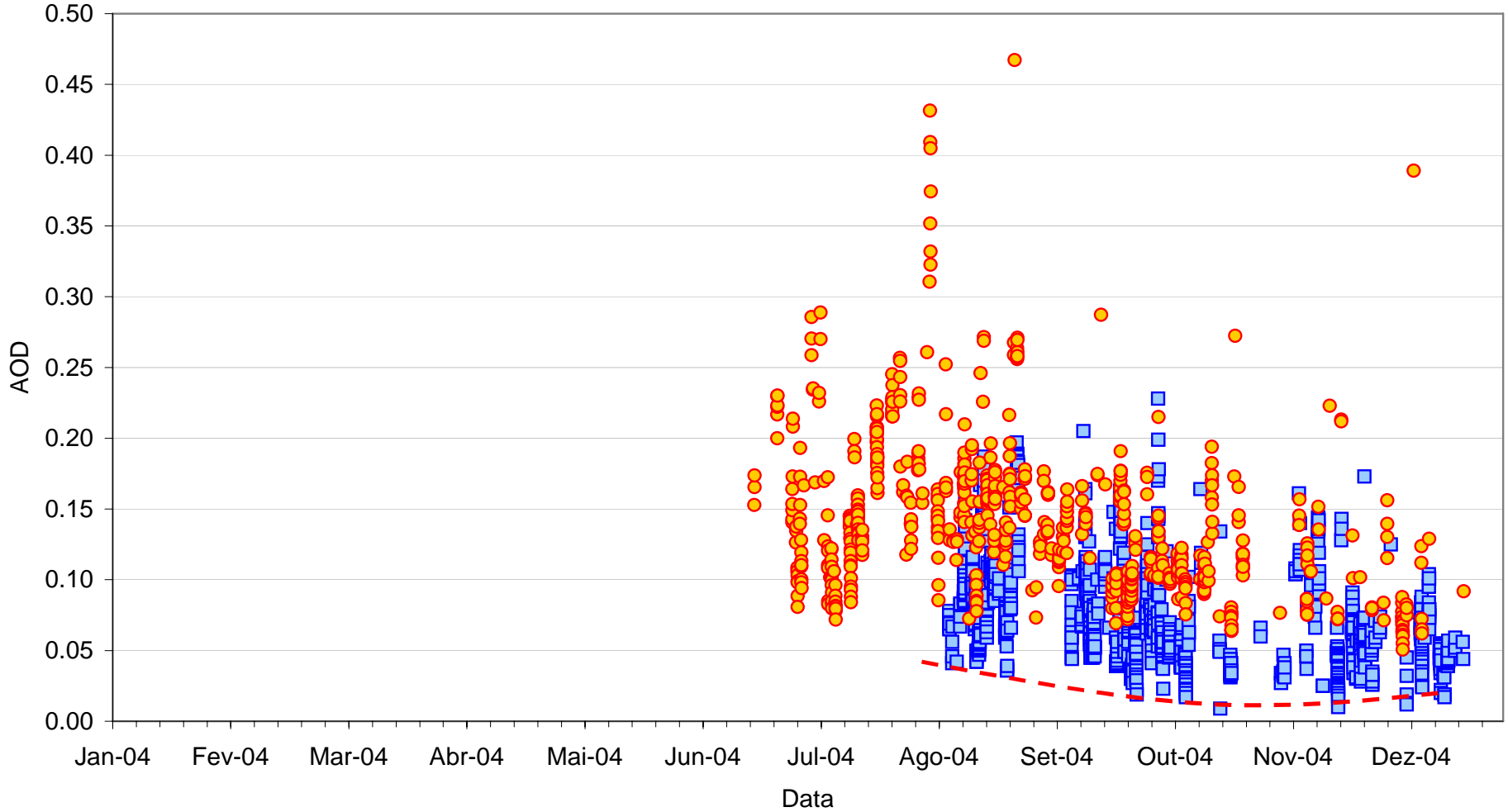


AOD(500 nm) vs V; U - Angra do Heroísmo - 2007

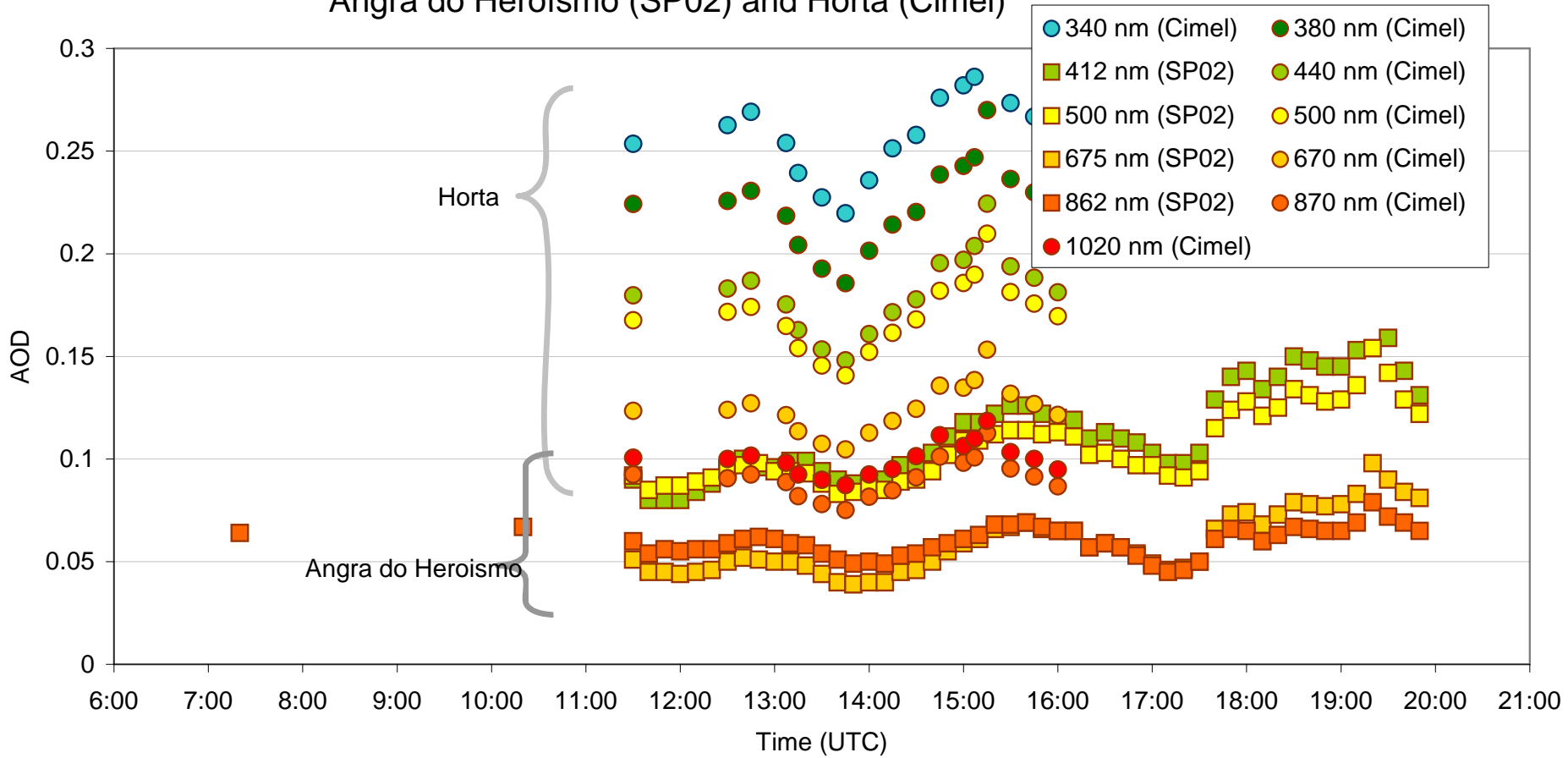


AOD @ 500 nm – Azores 2004

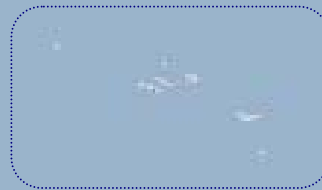
- Cimel (AERONET /Horta)
- SP02 (AZONET/ Angra do Heroismo)



AOD: 11-08-2004
Angra do Heroísmo (SP02) and Horta (Cimel)



Azores



Portugal

Espan
Span

Morocco



Faial Is.



Terceira Is.





Horta

Angra do Heroísmo

An aerial photograph of Horta, Azores, showing the city built on a hillside overlooking the harbor. A white arrow points from the label 'CIMEL' to a specific location in the urban area. The harbor is dark blue, and the surrounding landscape is green with some buildings.

Horta

CIMEL



SP02

Angra do Heroísmo

Acknowledgements

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