Evolution of Δ and the risetime with time

Long-term performance call

Juan Miguel Carceller

University of Granada

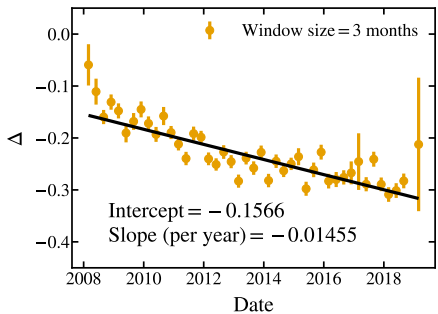
March 10, 2020

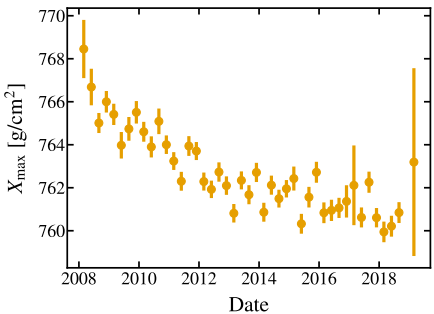
Outline

- Study of the Δ as a function of the year by making windows of time and plotting the mean value for each bin
- Explanation in terms of the risetime

Evolution of Δ

- The average value of Δ is decreasing with time
- The same behaviour is observed for $X_{\max}$ obtained from the Δ, since it is a linear scaling of the values of Δ: $X_{\max} = a + b\Delta + c\log(E_{\mathrm{SD}}/\mathrm{eV})$
- All energies and zenith angles (up to 60°) included (plots made for different energy bins in the backup)

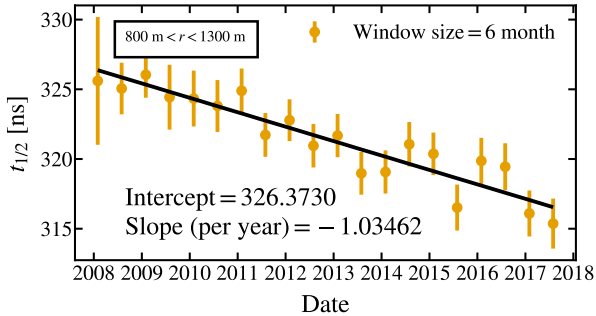




- Thanks for the data to Carlos Todero (data until 08/2018)

Explanation in terms of the risetime

- Δ_i is obtained from the risetime: $\Delta_i = \dfrac{t_{1/2} - t_{1/2}^{bench}}{\sigma_{1/2}}$
- What is known as "Delta" is obtained as an average over all the stations for each event $\langle \Delta \rangle = \dfrac{1}{N} \sum_{i=1}^{N} \Delta_i$
- All energies and zenith angles (up to 45 degrees) included

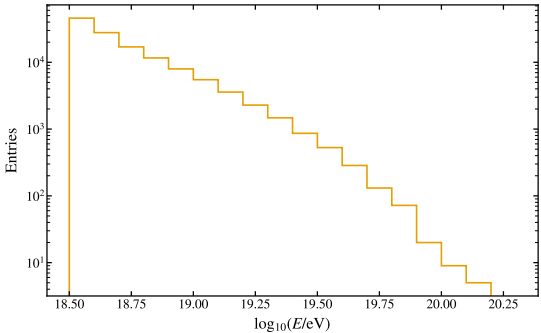


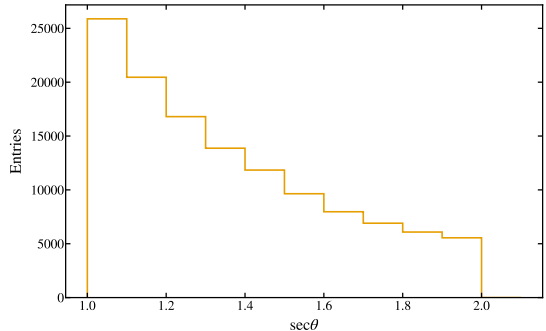
- Risetime decreases $\Longrightarrow$ Δ decreases

Backup

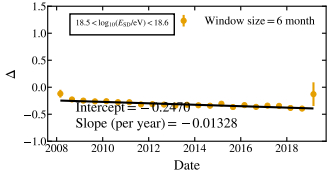
Energy and zenith distribution

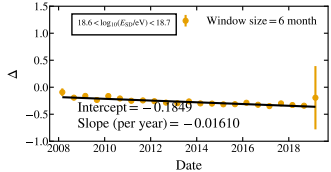
- Energy and zenith distributions of the data used to make the plots for Δ

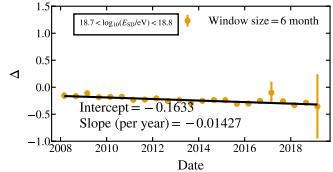


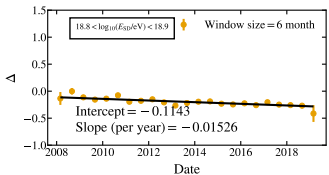


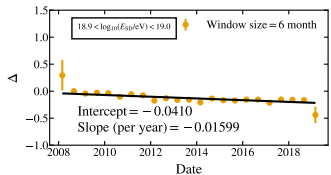
Bins of energy for Δ

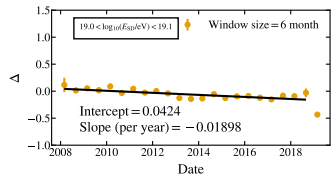


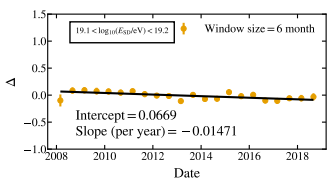


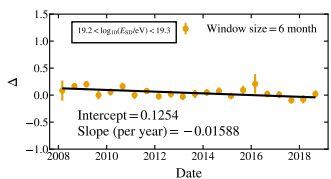


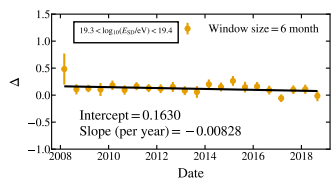




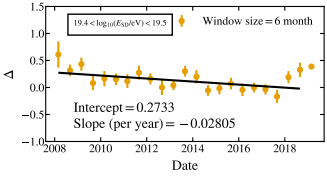


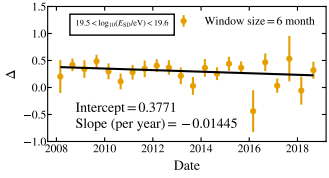


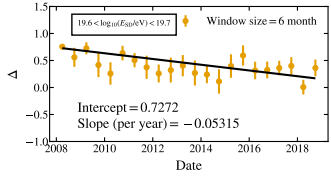


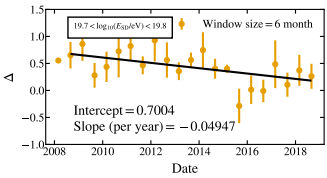


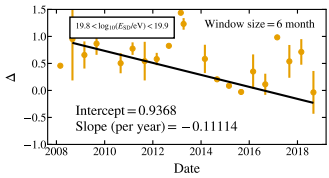
Bins of energy for Δ (continuation)



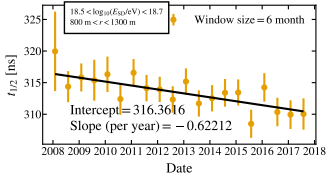


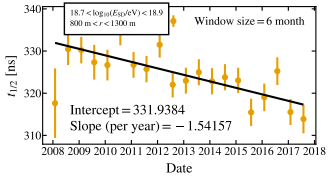


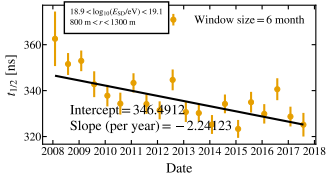


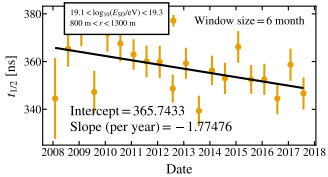


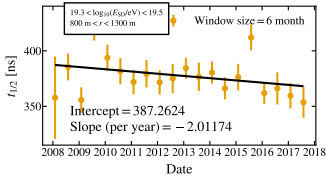
Bins of energy for $t_{1/2}$





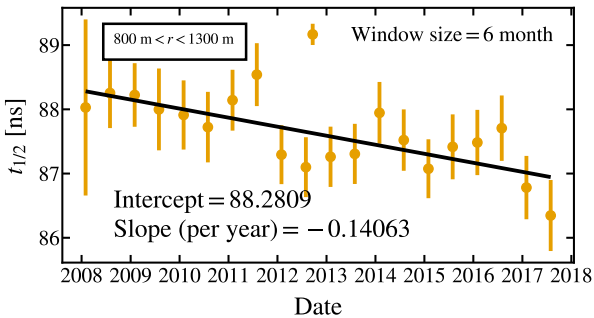






Risetime error

- All energies and zenith angles (up to 45 degrees) included



Ratio of the risetime and its uncertainty