

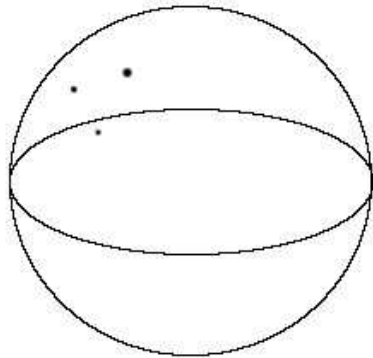
Dependence of Catalogue Orientation Parameters Accuracy from Sources Set Selection

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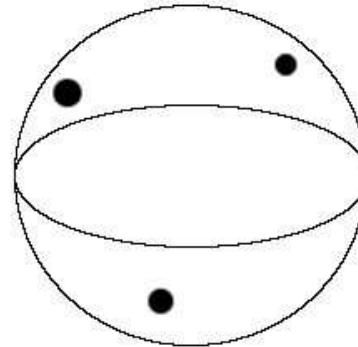
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The problem – orientation of catalogue

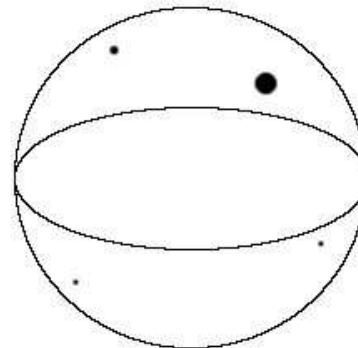
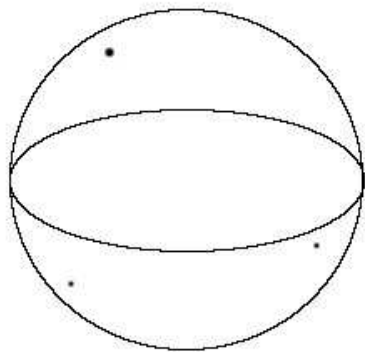
1. High accurate positions but close location



2. Wide spread but low accuracy



4. Real: many sources with different positions and accuracy



2. High accurate positions and wide spread distribution (ideal)

Solution

- Given catalogue RA, DE,
arbitrary catalogue ra, de.
- Rigid rotation transformation model

$$dRA_i = RA_i - ra_i$$

$$dDE_i = DE_i - de_i$$

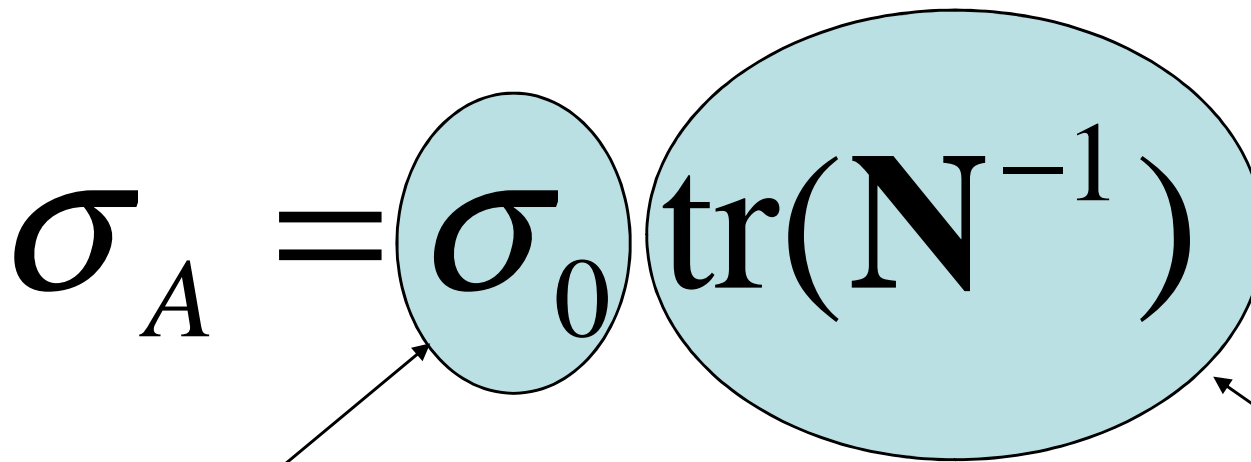
$$dRA_i = A_1 \tan(RA_i) \cos(RA_i) + A_2 \tan(DE_i) \sin(RA_i) - A_3$$

$$dDE_i = A_1 \sin(RA_i) + A_2 \cos(RA_i)$$

Solution (continue)

- Least Square for A1, A2, A3 estimation

$$\mathbf{C} = \frac{\partial(dRA, dDE)}{\partial \mathbf{A}}; \mathbf{N} = \mathbf{C}^T \mathbf{C}; \mathbf{A} = \mathbf{N}^{-1} \mathbf{b}$$

$$\sigma_A = \sigma_0 \text{tr}(\mathbf{N}^{-1})$$


Inaccuracy of positions part

Geometry part

If we compare two catalogue (RA,DE) and (ra,de) then

$$\sigma_0 = \frac{\sum (dRA)^2 + \sum (dDE)^2}{2N - 3},$$

But we want statistical characteristic of one catalogue, then we use mean σ_0 :

$$\overline{\sigma_0} = \frac{\sum \sigma_{RA}^2 + \sum \sigma_{DE}^2}{2N - 3},$$

and finally obtain mean formal errors of orientations parameters for give set of sources:

$$\overline{\sigma_A} = \overline{\sigma_0} \text{tr}(\mathbf{N}^{-1})$$

Source set quality characteristic:

$$q = \text{MAX}(\sigma_{A1}, \sigma_{A2}, \sigma_{A3})$$

Two approach for the $\sigma_{RA}^2, \sigma_{DE}^2$

Use global solution
formal errors as σ_{RA}, σ_{DE}

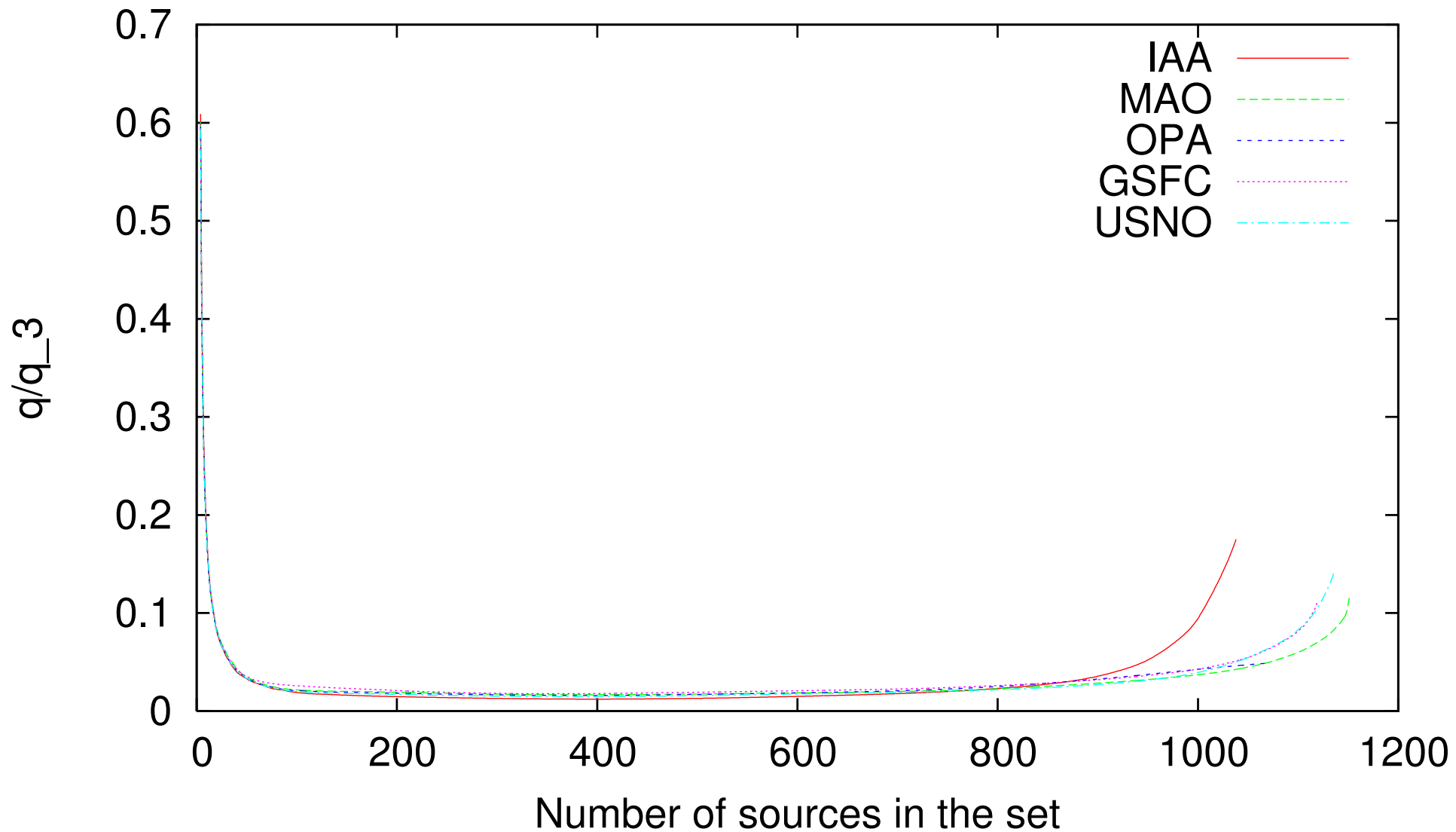
Use time series variances
for σ_{RA}, σ_{DE}

Algorithm

1. For each catalogue in analysis:
 - Triple loop over all sources in order to find the best trio what gives minimum to the q , thus obtain optimal set for $N=3$
 - Search over all remaining sources in order to minimize q for $N+1$ sources
 - The sequence of source sets obtained and parameter q as function of number of sources in the set
 - For all catalogues that function has a minimum in the N_k point.
2. Take the common part of the “minimum” sets N_k
3. Make 1. and 2. for both global solution σ_{RA} , σ_{DE} and time series and obtain common set

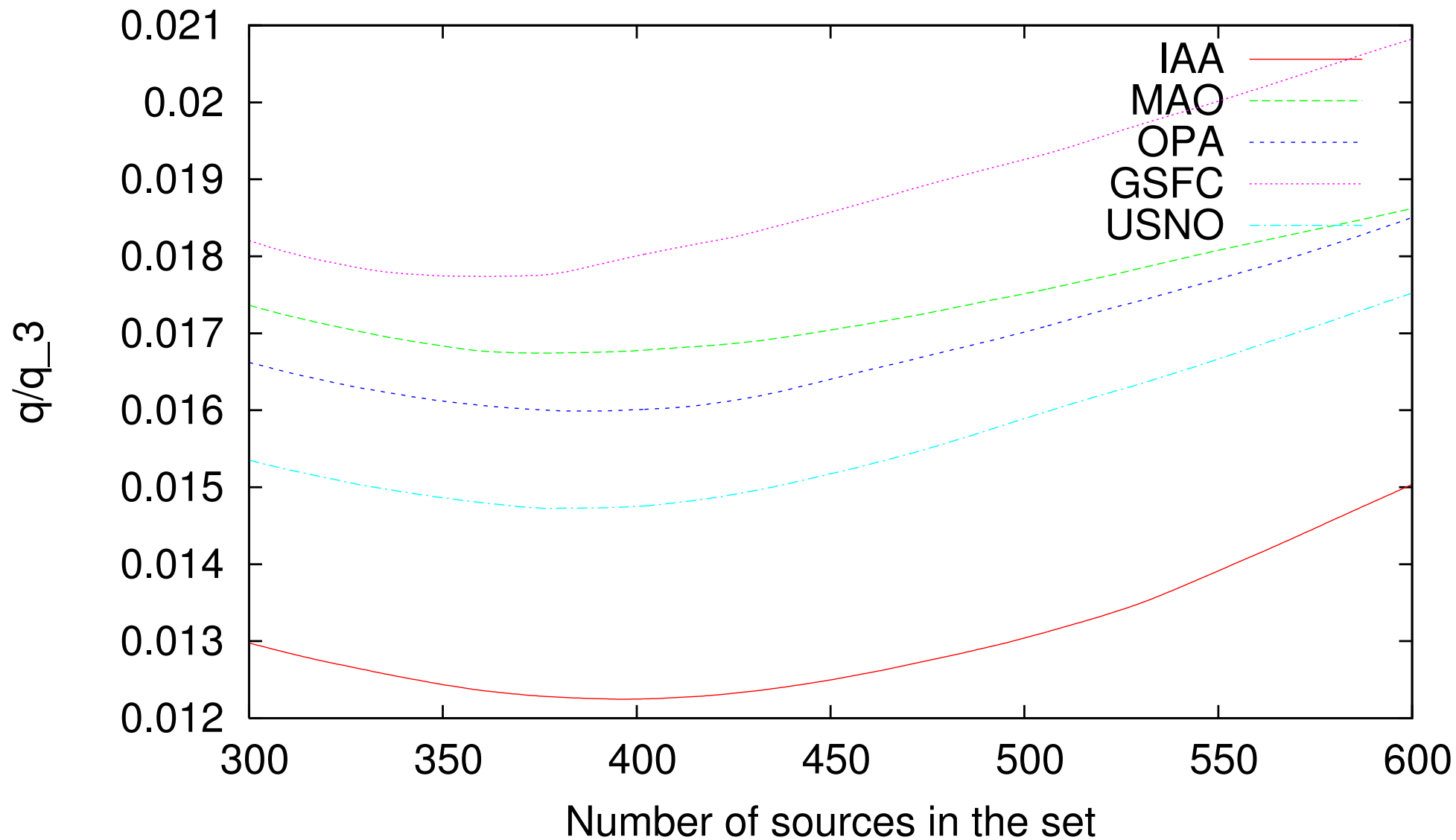
319 common sources for “global solution sigmas” case

Sigmas from catalogues



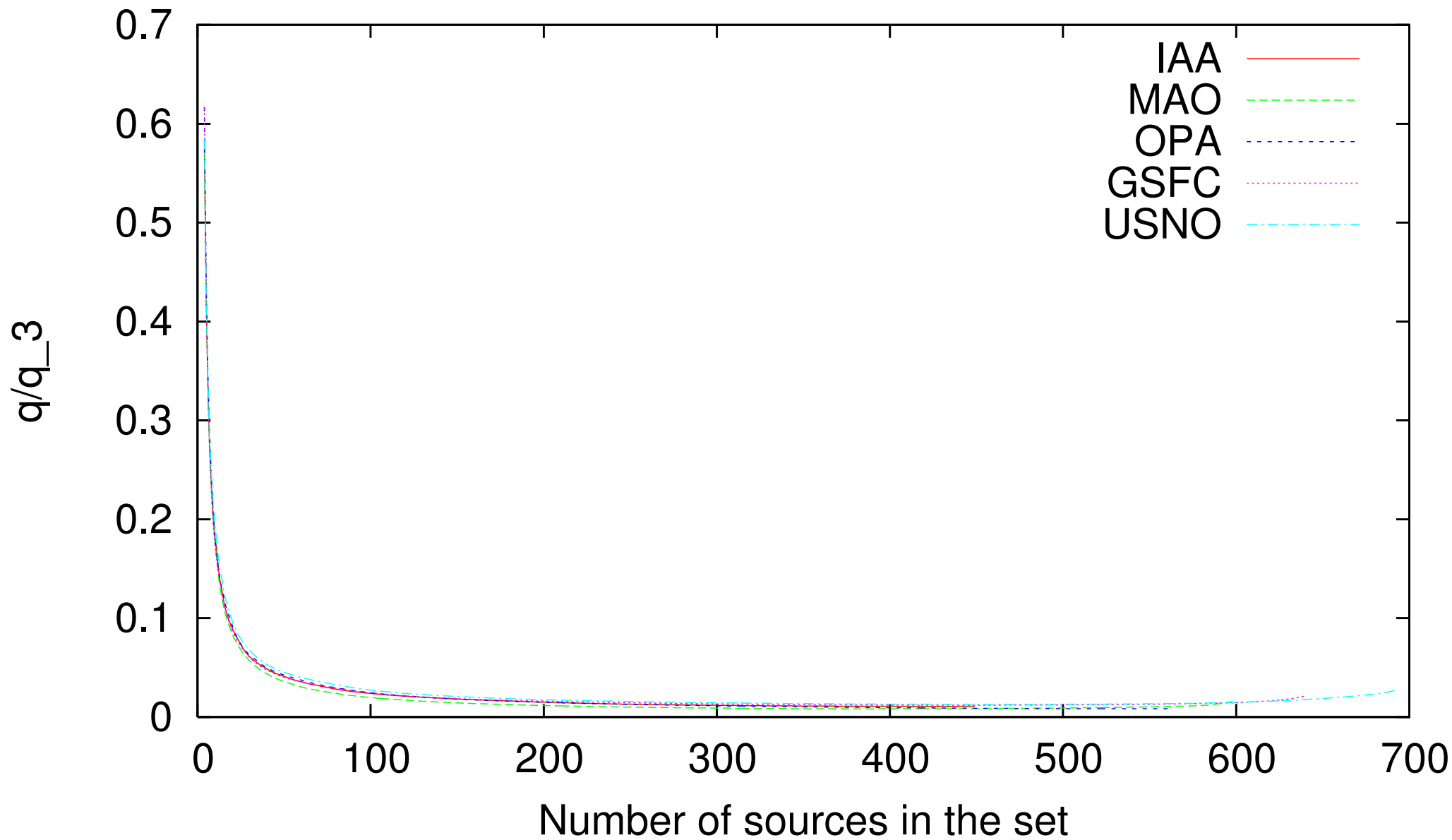
319 common sources before minimum for “global solution sigmas” case

Sigmas from time series (zoom)



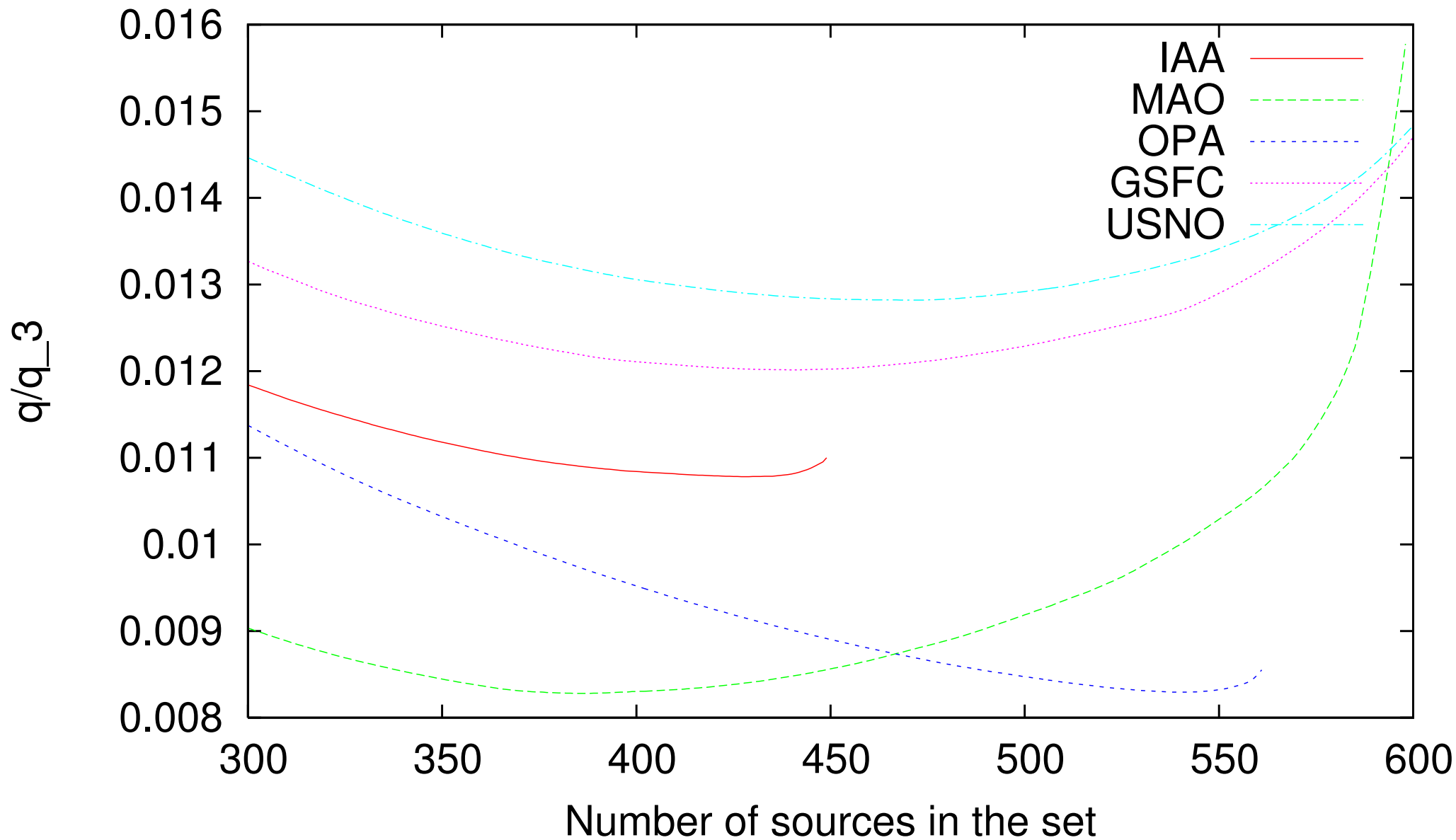
280 common sources for "time series sigmas" case

Sigmas from time series



280 common sources before minimum for "time series sigmas" case

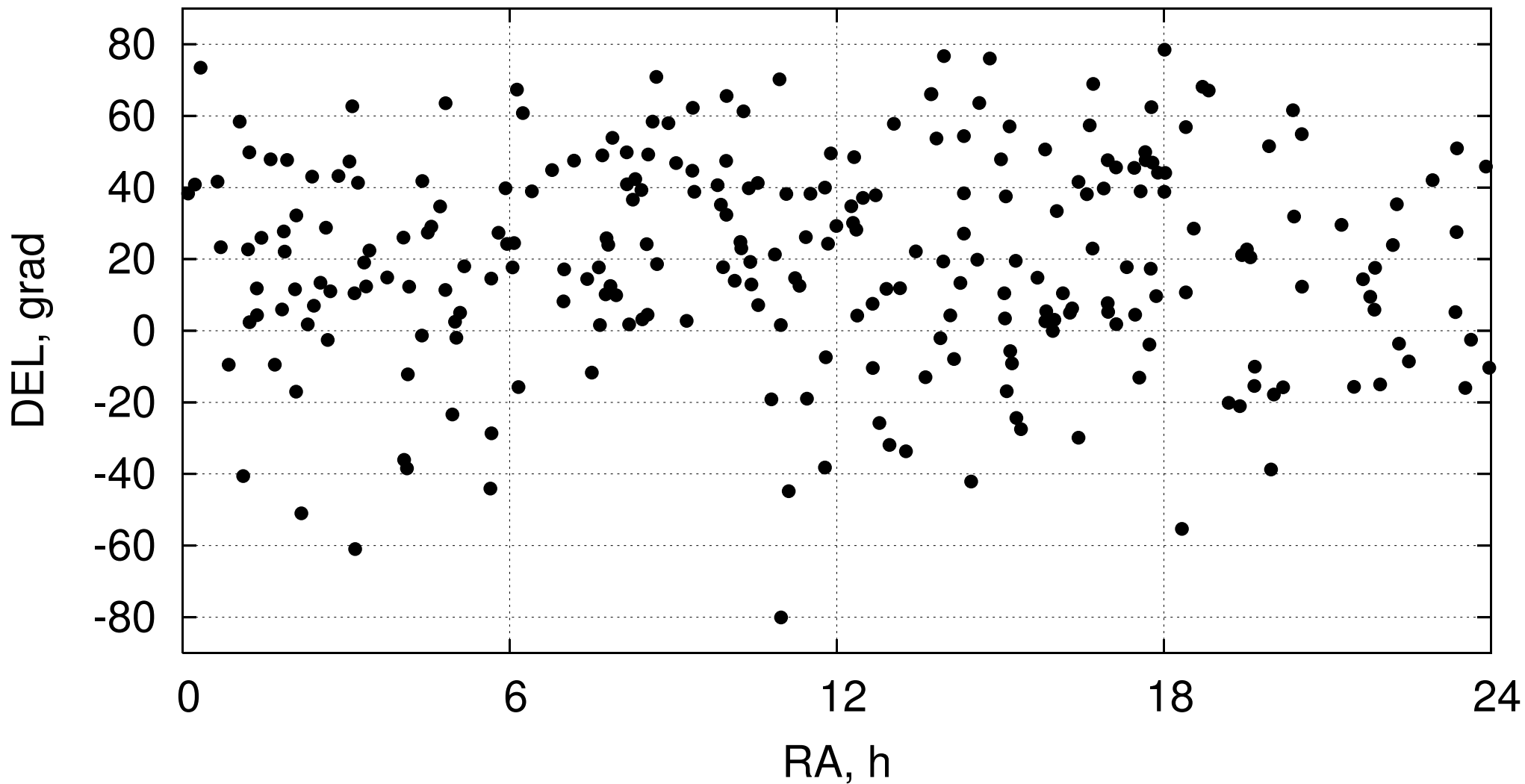
Sigmas from time series (zoom)



319

280

Finally set of 260 sources



The End
Thank you!