On Californian η Aquarid observations and the odd effects of low radiant altitudes

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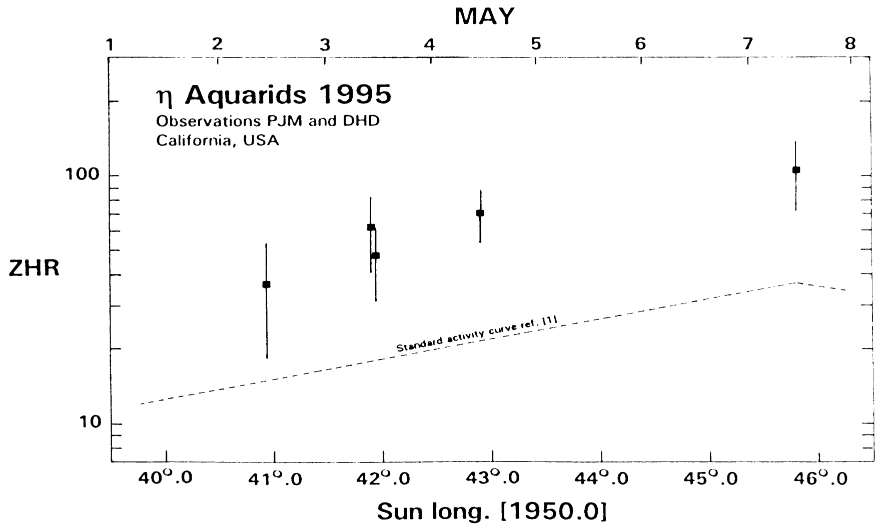
The η Aquarids, one of the major annual meteor streams, are not well observed from northern latitudes. For the Netherlands (52° N), the radiant rises late and stays below 10° altitude even in deep twilight. Therefore, the observation of a stream member is something special indeed for observers at these latitudes [2].
At the latitudes of southern and middle California, USA (32° to 37° N), conditions are slightly better, but the radiant still stays below 30° altitude. However, at these latitudes enough meteors can be observed during the last 1½ hours of the night to try to construct an activity profile.



Peter Jenniskens provided me with some 48 η Aquarids observed from California in 4.59 hours effective observing time by David Holman and himself during the early mornings of May 2, 3, 4 and 7, (1995). They are summarized in the table with this article. The observations were done while the radiant altitude varied between 13° and 25°.
Figure 1 shows the ZHR's calculated from the observations. As a reference, the standard η Aquarid activity curve as given by [1], based on Australian NAPO-MS observations, is shown by a dashed line. What strikes immediately is that the calculated ZHR's come out much too high. Another striking aspect is that while the ZHR profile is evidently too high, the *slope* of the profile is pretty much *the same* as the standard activity profile of [1] in this single logarithmic plot, highly suggestive of a systematic error shifting the calculated ZHR's upwards by about a factor 3.
The same kind of odd effect was noted before by Peter Jenniskens in an analysis of (a.o) the δ Aquarids and the Capricornids [1]. (figure 2). Australian and Dutch observations deviate by a factor of 3 for these streams, while the determined slopes of the activity profiles are pretty much the same. The curves are shown in figure 2 and 3: crosses refer to Australian observations, black dots to Dutch observations. It should be noted that while Australian observers have the radiants of these streams near zenith, Dutch observers never see them rise higher in the sky than 30°. In other words: like the η Aquarid observations presented in this article observations are done with low radiant altitudes, resulting in observed ZHR's which seem too high (by about the same factor!). This might give rise to some suspicion towards the normally used radiant altitude correction:

$$C_{rad} = (\sin h)^{-\gamma} \qquad [1]$$

For γ a value between 1.0 and 1.4 is usually chosen (I have used γ 1.4 for the reduction of the η Aquarid observations). As for the Capricornids and δ Aquarids, Peter Jenniskens remarks:

'*The worst cases with respect to an agreement between southern and northern hemisphere observers, are the streams of Capricornids and Delta Aquarids. The profile [of the d Aquarids] is well represented by a single set of exponential slopes and the profile is symmetric, but the northern latitude observers (descending branch only) find systematically a factor of 3 higher rates. [...]*

The same deviation is found for the Capricornids, for which relative conditions are comparable. The d Aquarids are observed under very different conditions from northern and southern latitudes. While radiant is almost in the zenith from southern latitudes -32°, the radiant stays below 26 degrees altitude at latitude +44° (South of France), where most of the northern hemisphere data from this stream are gathered. g = 0.6, instead of g =1.1, would explain the large difference from an effect due to the radiant altitude correction, but this value seems unreasonably low. I suspect that the difference is due to classification errors, where more sporadic meteors are classified as Aquarids or Capricornids at northern latitudes. It is surprising, though, that the slopes of the resulting profiles are so similar for both groups of observers' [1].

With this new results on the η Aquarids, I believe the error *is* in radiant altitude correction, and *not* in classification errors, most notably because again a factor of 3 higher rates are found with radiant altitudes below 25° and I don't see why 'classification errors' would result in such a consequent error. Since the radiant altitude correction equation seems to work well with γ = 1.4 for observations under usual conditions (i.e. observations with relatively high radiant altitudes: normally, observations with low radiant altitudes are removed from the data sample. Only in cases when one has no choice, one incorporates them in an activity profile), it might be that for radiant altitudes >30°, γ = 1.0 - 1.4 is appropriate, but γ dramatically drops for radiant altitudes < 30° (to values in the order of 0.5!) There's one problem however, as Peter pointed out to me in a personal communication: while this could explain the deviating results between northern and southern hemisphere data in case of the δ Aquarids and Capricornids, for the η Aquarids one encounters the fact that actually the Australian observations on which the standard curve [1] is based were done under conditions which where not much better than those at Californian latitudes! This leaves us puzzled. I would be glad to hear from anyone who knows the answer to this odd problem...

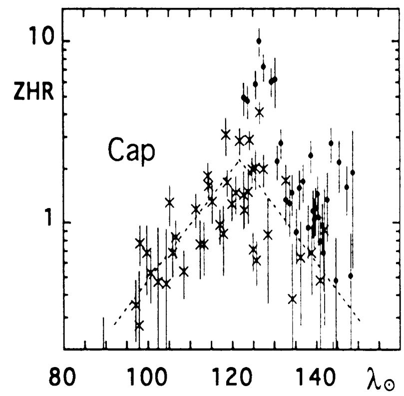
η Aquarids 1995, California (USA)

Observer	code	location	N_{nights}	T_{eff}	N_{aqr}	N_{spo}	N_{oth}	Total	≈ lm	Cp
David Holman	DHD	Descanso	3	3.86	38	46	3	87	+6.3	1.0
Peter Jenniskens	PJM	Stevens Creek	1	0.73	10	6	-	16	+5.9	1.0

References:

[1] Jenniskens P., 1994: *Astron. Astroph.* **287**, 990-1013.

[2] Langbroek M. and Miskotte K., 1995: *Radiant* **17**, 53-55.



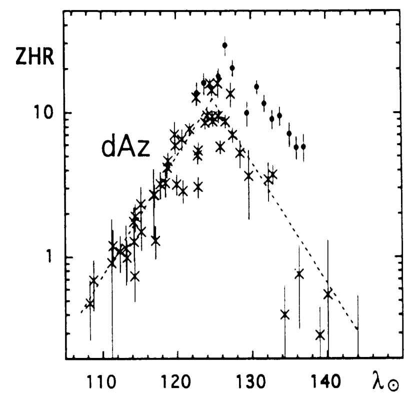


Figure 2 (right) *: Activity curves for the delta Aquarids and Capricornids (ref. 1)*

α Aurigid Observations from California.

Peter Jennniskens

Prospects for a succesfull photographic campaign looked pretty bleak at first. It was in the middle of the week and many of our usual meteor enthousiasts had other obligations. However, Mike Koop and Duncan McNeill were able to man a station at Fremont Peak and my Charlene Hasselbach and myself manned a post on Morgan Hill. Fog from the ocean came in early in the evening and for a minute it looked as if weather would not permit any activity. However, the fog turned out to be a low fog, staying below the mountain top all night. As a result, the city lights were dimmed and the sky was truely spectacular. It was very nice to see the zodiacal light again early in the morning. Meteor activity was good and many meteors were noted that are potentially bright enough to be captured on film. Very few if none of them seemed to be Aurigids however. As I was forced to watch the whole sky for bright meteors, I did not see enough Aurigid like meteors near the radiant to be able to say for certain where the radiant was.

However, at the end of the night, a few seemed to come from the P/Kiess radiant. No meteor outburst occurred. I was able to watch until 13:00 UT, although after 12:30 twilight interfered. Aurigid activity was expected between 11 and 15 UT.