

# 181017 2<sup>nd</sup> order regressions limitations over 1hour time-frame by Antoine M. Couët

## Quote

### Re: Linear regression and other tools

From: Tony Oz (RE: [Linear-regression-other-tools-TonyOz-oct-2018-g43065](#))

Date: 2018 Oct 13, 15:34 -0700

Hello! Please consider a fictitious adventure. A navigator (apparently capable to see the stars in the daylight) obtains the following H<sub>C</sub>s on 2018-10-13:

- 12:00UT, 60°00'N;30°00'E : H<sub>CDeneb</sub> = 43°19'12"; H<sub>CCapella</sub> = 18°22'10"
- 12:10UT, 60°02'N;30°02'E : H<sub>CDeneb</sub> = 44°32'18"; H<sub>CCapella</sub> = 17°59'26"
- 12:20UT, 60°04'N;30°04'E : H<sub>CDeneb</sub> = 45°45'59"; H<sub>CCapella</sub> = 17°39'02"
- 12:40UT, 60°08'N;30°08'E : H<sub>CDeneb</sub> = 48°14'50"; H<sub>CCapella</sub> = 17°05'17"
- 12:50UT, 60°10'N;30°10'E : H<sub>CDeneb</sub> = 49°29'51"; H<sub>CCapella</sub> = 16°51'59"
- 13:00UT, 60°12'N;30°12'E : H<sub>CDeneb</sub> = 50°45'07"; H<sub>CCapella</sub> = 16°41'05" ...///...

This, I think, proves that interleaving sights of several bodies done even in rather longish time can give quite good fix.

## Unquote

After checking that the environment chosen by Tony is optimum for 2<sup>nd</sup> order regressions over a 1 hour time frame, I am giving here-after counter-examples which show that this claim about the performance of 2<sup>nd</sup> order regressions over this time span may prove totally unsafe. **RE:Pages 5 & 6: Antoine's 2<sup>nd</sup> set of New Data as derived from Tony's Original Data - #1,#2,#3 of 3**

\*\*\*\*\*

**Intercept ratings : intercepts should read zero for "perfect" 2<sup>nd</sup> regression**

**Below 0.5 NM : Excellent - From 0.5 NM to 0.99 NM : Very Good**

**From 1.00 NM to 1.99 NM : Good - from 2.00 to 2.99 NM : Fair**

**From 3.00 NM to 3.99 NM - Still Acceptable From 4.00 NM to 4.99 NM: Not acceptable**

**From 5 NM to 9.99NM: Unsafe, avoid 2<sup>nd</sup> Order Outside 10 NM: Very unsafe, reject 2<sup>nd</sup> Order**

**Note: 2<sup>nd</sup> Order Regressions under the form of  $a+bX+cX^2$  (and not:  $aX^2+bX+c$ )**

\*\*\*\*\*

### CASE #1a - Tony's Original data reprocessed by Antoine

- 12:00UT, 60°00'N;30°00'E : H<sub>CDeneb</sub> = 43°19'12"; H<sub>CCapella</sub> = 18°22'10"
- Offset variables : 0:00 UT                    0°19'12"                    2°22'10"
- 12:10UT, 60°02'N;30°02'E : H<sub>CDeneb</sub> = 44°32'18"; H<sub>CCapella</sub> = 17°59'26"
- Offset variables : 0:10 UT                    1°32'18"                    1°59'26"
- 12:20UT, 60°04'N;30°04'E : H<sub>CDeneb</sub> = 45°45'59"; H<sub>CCapella</sub> = 17°39'02"
- Offset variables : 0:20 UT                    2°45'59"                    1°39'02"
- **12:30UT, 60°06'N;30°06'E : H<sub>CDeneb</sub> = 47°00'11" / 076.8° ; H<sub>CCapella</sub> = 17°20'58" / 345.7°**
- 12:40UT, 60°08'N;30°08'E : H<sub>CDeneb</sub> = 48°14'50"; H<sub>CCapella</sub> = 17°05'17"
- Offset variables : 0:40 UT                    5°14'50"                    1°05'17"
- 12:50UT, 60°10'N;30°10'E : H<sub>CDeneb</sub> = 49°29'51"; H<sub>CCapella</sub> = 16°51'59"
- Offset variables : 0:50 UT                    6°29'51"                    0°51'59"
- 13:00UT, 60°12'N;30°12'E : H<sub>CDeneb</sub> = 50°45'07"; H<sub>CCapella</sub> = 16°41'05"
- Offset variables : 1:00 UT                    7°45'07"                    0°41'05"

**Deneb R2 = 1.000000** a = 0.318693 b = 7.303520 c = 0.131122

**Deneb HCat at 12:30, i.e. at 00:30 Offset variable, 4°00'11.6" , i.e. 47°00'11.6"**

**Capella R2 = 1.000000** a = 2.369762 b = -2.395357 c = 0.710000

**Capella HCat at 12:30, i.e. at 00:30 Offset variable, 1°20'58.5" , i.e. 17°20'58.5"**

**With the 2<sup>nd</sup> order regression derived heights, and from 60°06'N;30°06'E, get an Intercept of 0.0 NM into bearing 055°**

**Excellent 2<sup>nd</sup> order regression match**

\*\*\*\*\*

## CASE #1b - Tony's Original Data recomputed and then reprocessed by Antoine

- 12:00UT, 60°00'N;30°00'E :  $H_{CDeneb} = 43^{\circ}19'08'' / 071.2^{\circ}$  ;  $H_{CCapella} = 18^{\circ}22'07'' / 340.2^{\circ}$
- Offset variables : 0:00 UT  $0^{\circ}19'08''$   $2^{\circ}22'07''$
- 12:10UT, 60°02'N;30°02'E :  $H_{CDeneb} = 44^{\circ}32'14'' / 073.0^{\circ}$  ;  $H_{CCapella} = 17^{\circ}59'23'' / 342.0^{\circ}$
- Offset variables : 0:10 UT  $1^{\circ}32'14''$   $1^{\circ}59'23''$
- 12:20UT, 60°04'N;30°04'E :  $H_{CDeneb} = 45^{\circ}45'55'' / 074.9^{\circ}$  ;  $H_{CCapella} = 17^{\circ}38'59'' / 343.8^{\circ}$
- Offset variables : 0:20 UT  $2^{\circ}45'55''$   $1^{\circ}38'59''$
- 12:30UT, 60°06'N;30°06'E :  $H_{CDeneb} = 47^{\circ}00'07'' / 076.8^{\circ}$  ;  $H_{CCapella} = 17^{\circ}20'55'' / 345.7^{\circ}$
- 12:40UT, 60°08'N;30°08'E :  $H_{CDeneb} = 48^{\circ}14'46'' / 078.8^{\circ}$  ;  $H_{CCapella} = 17^{\circ}05'14'' / 347.5^{\circ}$
- Offset variables : 0:40 UT  $5^{\circ}14'46''$   $1^{\circ}05'14''$
- 12:50UT, 60°10'N;30°10'E :  $H_{CDeneb} = 49^{\circ}29'46'' / 080.8^{\circ}$  ;  $H_{CCapella} = 16^{\circ}51'56'' / 349.3^{\circ}$
- Offset variables : 0:50 UT  $6^{\circ}29'46''$   $0^{\circ}51'56''$
- 13:00UT, 60°12'N;30°12'E :  $H_{CDeneb} = 50^{\circ}45'03'' / 082.8^{\circ}$  ;  $H_{CCapella} = 16^{\circ}41'01'' / 351.1^{\circ}$
- Offset variables : 1:00 UT  $7^{\circ}45'03''$   $0^{\circ}41'01''$

**Deneb R2 = 1.000000** a = 0.317608 b = 7.303299 c = 0.131225

**Deneb HCat at 12:30 , i.e. at 00:30 Offset variable,  $4^{\circ}00'07.4''$  , i.e.  $47^{\circ}00'07.4''$**

**Capella R2 = 1.0000** a = 2.368892b = -2.394872 c = 0.709337

**Capella HCat at 12:30 , i.e. at 00:30 Offset variable,  $1^{\circ}20'55.6''$  , i.e.  $17^{\circ}20'55.6''$**

**With the 2<sup>nd</sup> order regression derived heights, and from  $60^{\circ}06'N;30^{\circ}06'E$ , get an Intercept of 0.0 NM into bearing  $055^{\circ}$**

**Excellent 2<sup>nd</sup> order regression match**

\*\*\*\*\*

## CASE #2a - Antoine's 1<sup>st</sup> set of New Data as derived from Tony's Original Data - #1 of 4

- 17:00UT, 60°00'N;30°00'E :  $H_{CDeneb} = 75^{\circ}13'13'' / 170.8^{\circ}$  ;  $H_{CCapella} = 22^{\circ}54'42'' / 033.9^{\circ}$
- Offset variables : 0:00 UT  $2^{\circ}13'13''$   $0^{\circ}54'42''$
- 17:10UT, 60°02'N;30°02'E :  $H_{CDeneb} = 75^{\circ}18'45'' / 177.9^{\circ}$  ;  $H_{CCapella} = 23^{\circ}39'47'' / 035.6^{\circ}$
- Offset variables : 0:10 UT  $2^{\circ}18'45''$   $1^{\circ}39'47''$
- 17:20UT, 60°04'N;30°04'E :  $H_{CDeneb} = 75^{\circ}14'56'' / 184.9^{\circ}$  ;  $H_{CCapella} = 24^{\circ}26'40'' / 037.4^{\circ}$
- Offset variables : 0:20 UT  $2^{\circ}14'56''$   $2^{\circ}26'40''$
- 17:30UT, 60°06'N;30°06'E :  $H_{CDeneb} = 75^{\circ}01'56'' / 191.8^{\circ}$  ;  $H_{CCapella} = 25^{\circ}15'20'' / 039.2^{\circ}$
- 17:40UT, 60°08'N;30°08'E :  $H_{CDeneb} = 74^{\circ}40'10'' / 198.5^{\circ}$  ;  $H_{CCapella} = 26^{\circ}05'42'' / 040.9^{\circ}$
- Offset variables : 0:40 UT  $1^{\circ}40'10''$   $4^{\circ}05'42''$
- 17:50UT, 60°10'N;30°10'E :  $H_{CDeneb} = 74^{\circ}10'18'' / 204.8^{\circ}$  ;  $H_{CCapella} = 26^{\circ}57'43'' / 042.6^{\circ}$
- Offset variables : 0:50 UT  $1^{\circ}10'18''$   $4^{\circ}57'43''$
- 18:00UT, 60°12'N;30°12'E :  $H_{CDeneb} = 73^{\circ}33'07'' / 210.9^{\circ}$  ;  $H_{CCapella} = 27^{\circ}51'20'' / 044.4^{\circ}$
- Offset variables : 1:00 UT  $0^{\circ}33'07''$   $5^{\circ}51'20''$

**Deneb R2 = 0.999821** a = 2.228373 b = 0.891548 c = -2.577143

**Deneb HCat at 17:30, i.e. at 00:30 Offset variable,  $2^{\circ}01'47.5''$  , i.e.  $75^{\circ}01'47.5''$**

**Capella R2 = 1.00000** a = 0.910771 b = 4.433265 c = 0.512449

**Capella HCat at 17:30, i.e. at 00:30 Offset variable,  $3^{\circ}15'19.9''$  , i.e.  $25^{\circ}15'19.9''$**

**With the 2<sup>nd</sup> order regression derived heights, and from  $60^{\circ}06'N;30^{\circ}06'E$ , get an Intercept of 0.3 NM into bearing  $310^{\circ}$**

**Excellent 2<sup>nd</sup> order regression match**

\*\*\*\*\*

**CASE #2b - Antoine's 1<sup>st</sup> set of New Data as derived from Tony's Original Data - #2 of 4**

- 17:00UT, 50°00'N;30°00'E :  $H_{CDeneb} = 84^{\circ}50'45'' / 153.1^{\circ}$  ;  $H_{CCapella} = 14^{\circ}30'51'' / 032.0^{\circ}$
- Offset variables : 0:00 UT  $4^{\circ}50'45''$   $0^{\circ}30'51''$
- 17:10UT, 50°02'N;30°02'E :  $H_{CDeneb} = 85^{\circ}17'27'' / 173.3^{\circ}$  ;  $H_{CCapella} = 15^{\circ}25'37'' / 033.6^{\circ}$
- Offset variables : 0:10 UT  $5^{\circ}17'27''$   $1^{\circ}25'37''$
- 17:20UT, 50°04'N;30°04'E :  $H_{CDeneb} = 85^{\circ}08'22'' / 194.8^{\circ}$  ;  $H_{CCapella} = 16^{\circ}22'34'' / 035.2^{\circ}$
- Offset variables : 0:20 UT  $5^{\circ}08'22''$   $2^{\circ}22'34''$
- **17:30UT, 50°06'N;30°06'E :  $H_{CDeneb} = 84^{\circ}26'30'' / 231.0^{\circ}$  ;  $H_{CCapella} = 17^{\circ}21'38'' / 036.7^{\circ}$**
- 17:40UT, 50°08'N;30°08'E :  $H_{CDeneb} = 83^{\circ}22'09'' / 226.5^{\circ}$  ;  $H_{CCapella} = 18^{\circ}22'44'' / 038.3^{\circ}$
- Offset variables : 0:40 UT  $3^{\circ}22'09''$   $4^{\circ}22'44''$
- 17:50UT, 50°10'N;30°10'E :  $H_{CDeneb} = 82^{\circ}04'27'' / 236.2^{\circ}$  ;  $H_{CCapella} = 19^{\circ}25'49'' / 039.8^{\circ}$
- Offset variables : 0:50 UT  $2^{\circ}04'27''$   $5^{\circ}25'49''$
- 18:00UT, 50°12'N;30°12'E :  $H_{CDeneb} = 80^{\circ}39'02'' / 243.4^{\circ}$  ;  $H_{CCapella} = 20^{\circ}30'48'' / 041.3^{\circ}$
- Offset variables : 1:00 UT  $0^{\circ}39'02''$   $6^{\circ}30'48''$

**Deneb R2 = 0.994124** a = 4.973917 b = 2.317466 c = -6.772347

**Deneb HCat at 17:30, i.e. at 00:30 Offset variable,  $4^{\circ}26'22.4''$  , i.e.  $84^{\circ}26'22.4''$**

**Capella R2 = 1.00000** a = 0.513010 b = 5.388376 c = 0.613112

**Capella HCat at 17:30, i.e. at 00:30 Offset variable,  $3^{\circ}21'37.7''$  , i.e.  $17^{\circ}21'37.7''$**

**With the 2<sup>nd</sup> order regression derived heights, and from  $50^{\circ}06'N;30^{\circ}06'E$ , get an Intercept of 2.0 NM into bearing 307°**

**Fair 2<sup>nd</sup> order regression match**

\*\*\*\*\*

**CASE #2c - Antoine's 1<sup>st</sup> set of New Data as derived from Tony's Original Data - #3 of 4**

- 02:00UT, 60°00'N;30°00'E :  $H_{CDeneb} = 22^{\circ}39'45'' / 325.0^{\circ}$  ;  $H_{CCapella} = 75^{\circ}57'30'' / 185.9^{\circ}$
- Offset variables : 0:00 UT  $3^{\circ}39'45''$   $3^{\circ}57'30''$
- 02:10UT, 60°02'N;30°02'E :  $H_{CDeneb} = 21^{\circ}58'38'' / 326.7^{\circ}$  ;  $H_{CCapella} = 75^{\circ}42'56'' / 193.1^{\circ}$
- Offset variables : 0:10 UT  $2^{\circ}58'38''$   $3^{\circ}42'56''$
- 02:20UT, 60°04'N;30°04'E :  $H_{CDeneb} = 21^{\circ}19'93'' / 328.5^{\circ}$  ;  $H_{CCapella} = 75^{\circ}19'23'' / 199.9^{\circ}$
- Offset variables : 0:20 UT  $2^{\circ}19'93''$   $3^{\circ}19'23''$
- **02:30UT, 60°06'N;30°06'E :  $H_{CDeneb} = 20^{\circ}42'34'' / 330.3^{\circ}$  ;  $H_{CCapella} = 74^{\circ}47'35'' / 206.5^{\circ}$**
- 02:40UT, 60°08'N;30°08'E :  $H_{CDeneb} = 20^{\circ}07'41'' / 332.1^{\circ}$  ;  $H_{CCapella} = 74^{\circ}08'24'' / 212.6^{\circ}$
- Offset variables : 0:40 UT  $1^{\circ}07'41''$   $2^{\circ}08'24''$
- 02:50UT, 60°10'N;30°10'E :  $H_{CDeneb} = 19^{\circ}34'58'' / 333.8^{\circ}$  ;  $H_{CCapella} = 73^{\circ}22'48'' / 218.2^{\circ}$
- Offset variables : 0:50 UT  $0^{\circ}34'58''$   $1^{\circ}22'48''$
- 03:00UT, 60°12'N;30°12'E :  $H_{CDeneb} = 19^{\circ}04'26'' / 335.6^{\circ}$  ;  $H_{CCapella} = 72^{\circ}31'41'' / 223.5^{\circ}$
- Offset variables : 1:00 UT  $0^{\circ}04'26''$   $0^{\circ}31'41''$

**Deneb R2 = 0.999982** a = 3.663637 b = -4.195281 c = 0.601888

**Deneb HCat at 02:30, i.e. at 00:30 Offset variable,  $1^{\circ}42'59.3''$  , i.e.  $20^{\circ}42'59.3''$**

**Capella R2 = 0.999864** a = 13.972863 b = -1.262602 c = -2.197041

**Capella HCat at 02:30, i.e. at 00:30 Offset variable,  $2^{\circ}47'33.0''$  , i.e.  $74^{\circ}47'33.0''$**

**With 2<sup>nd</sup> order regression derived heights, and from  $60^{\circ}06'N;30^{\circ}06'E$ , get an Intercept of 0.9 NM into bearing 115°**

**Very good 2<sup>nd</sup> order regression match**

\*\*\*\*\*

**CASE #2d - Antoine's 1<sup>st</sup> set of New Data as derived from Tony's Original Data - #4 of 4**

- 02:00UT, 50°00'N;30°00'E :  $H_{CDeneb} = 14^{\circ}22'26'' / 326.8^{\circ}$  ;  $H_{CCapella} = 85^{\circ}46'44'' / 199.9^{\circ}$
- Offset variables : 0:00 UT  $5^{\circ}22'26''$   $8^{\circ}46'44''$
- 02:10UT, 50°02'N;30°02'E :  $H_{CDeneb} = 13^{\circ}31'42'' / 328.4^{\circ}$  ;  $H_{CCapella} = 84^{\circ}56'07'' / 219.2^{\circ}$
- Offset variables : 0:10 UT  $4^{\circ}31'42''$   $7^{\circ}56'07''$
- 02:20UT, 50°04'N;30°04'E :  $H_{CDeneb} = 12^{\circ}43'23'' / 330.1^{\circ}$  ;  $H_{CCapella} = 83^{\circ}44'13'' / 232.4^{\circ}$
- Offset variables : 0:20 UT  $3^{\circ}43'23''$   $6^{\circ}44'13''$
- **02:30UT, 50°06'N;30°06'E :  $H_{CDeneb} = 11^{\circ}57'32'' / 331.7^{\circ}$  ;  $H_{CCapella} = 82^{\circ}21'02'' / 241.4^{\circ}$**
- 02:40UT, 50°08'N;30°08'E :  $H_{CDeneb} = 11^{\circ}14'13'' / 333.3^{\circ}$  ;  $H_{CCapella} = 80^{\circ}51'48'' / 247.9^{\circ}$
- Offset variables : 0:40 UT  $2^{\circ}14'13''$   $3^{\circ}51'48''$
- 02:50UT, 50°10'N;30°10'E :  $H_{CDeneb} = 10^{\circ}33'28'' / 335.0^{\circ}$  ;  $H_{CCapella} = 79^{\circ}19'08'' / 252.8^{\circ}$
- Offset variables : 0:50 UT  $1^{\circ}33'28''$   $2^{\circ}19'08''$
- 03:00UT, 50°12'N;30°12'E :  $H_{CDeneb} = 09^{\circ}55'22'' / 336.7^{\circ}$  ;  $H_{CCapella} = 77^{\circ}44'26'' / 256.7^{\circ}$
- Offset variables : 1:00 UT  $0^{\circ}55'22''$   $0^{\circ}44'26''$

**Deneb R2 = 1.000000** a = 5.374804 b = -5.210527 c = 0.757551

**Deneb H<sub>cat</sub> at 02:30, i.e. at 00:30 Offset variable, 2°57'32.1" , i.e. 11°57'32.1"**

**Capella R2 = 0.999330** a = 5.374804 b = -5.736675 c = -2.453622

**Capella H<sub>cat</sub> at 02:30, i.e. at 00:30 Offset variable, 5°22'49.4" , i.e. 82°22'49.4"**

**With the 2<sup>nd</sup> order regression derived heights, and from 50°06'N;30°06'E, get an Intercept of 1.8 NM into bearing 242°**

**Good 2<sup>nd</sup> order regression match**

\*\*\*\*\*

**CASE #3a - Antoine's 2<sup>nd</sup> set of New Data as derived from Tony's Original Data - #1 of 3**

- 02:00UT, 00°00'N;30°00'E :  $H_{CBetelgeuse} = 79^{\circ}30'06'' / 044.9^{\circ}$  ;  $H_{CRigel} = 81^{\circ}22'49'' / 198.3^{\circ}$
- Offset variables : 0:00 UT  $0^{\circ}30'06''$   $11^{\circ}22'49''$
- 02:10UT, 00°02'N;30°02'E :  $H_{CBetelgeuse} = 81^{\circ}08'33'' / 033.5^{\circ}$  ;  $H_{CRigel} = 80^{\circ}15'08'' / 212.5^{\circ}$
- Offset variables : 0:10 UT  $2^{\circ}08'33''$   $10^{\circ}15'08''$
- 02:20UT, 00°04'N;30°04'E :  $H_{CBetelgeuse} = 82^{\circ}17'02'' / 017.8^{\circ}$  ;  $H_{CRigel} = 78^{\circ}39'42'' / 223.2^{\circ}$
- Offset variables : 0:20 UT  $3^{\circ}17'02''$   $8^{\circ}39'42''$
- **02:30UT, 00°06'N;30°06'E :  $H_{CBetelgeuse} = 82^{\circ}41'20'' / 358.7^{\circ}$  ;  $H_{CRigel} = 76^{\circ}46'28'' / 231.0^{\circ}$**
- **Offset variables : 0:30 UT  $3^{\circ}41'20''$   $6^{\circ}46'28''$**
- 02:40UT, 00°08'N;30°08'E :  $H_{CBetelgeuse} = 82^{\circ}14'28'' / 339.7^{\circ}$  ;  $H_{CRigel} = 74^{\circ}41'59'' / 236.8^{\circ}$
- Offset variables : 0:40 UT  $3^{\circ}14'28''$   $4^{\circ}41'59''$
- 02:50UT, 00°10'N;30°10'E :  $H_{CBetelgeuse} = 81^{\circ}04'04'' / 324.3^{\circ}$  ;  $H_{CRigel} = 72^{\circ}30'15'' / 241.2^{\circ}$
- Offset variables : 0:50 UT  $2^{\circ}04'01''$   $2^{\circ}30'15''$
- 03:00UT, 00°12'N;30°12'E :  $H_{CBetelgeuse} = 79^{\circ}24'28'' / 313.1^{\circ}$  ;  $H_{CRigel} = 70^{\circ}13'41'' / 244.5^{\circ}$
- Offset variables : 1:00 UT  $0^{\circ}24'28''$   $0^{\circ}13'41''$

**Betelgeuse R2 = 0.998186** a = 0.479994 b = 12.456054 c = -12.557959

**Betelgeuse H<sub>cat</sub> at 02:30, i.e. at 00:30 Offset variable, 3°34'06.7" , i.e. 82°34'06.7"**

**Rigel R2 = 0.999477** a = 11.480017 b = -7.375247 c = -3.963622

**Rigel H<sub>cat</sub> at 02:30, i.e. at 00:30 Offset variable, 6°48'05.4" , i.e. 76°48'05.4"**

**With the 2<sup>nd</sup> order regression derived heights, and from 00°06'N;30°06'E, get an Intercept of 8.0 NM into bearing 153°**

**Unsafe 2<sup>nd</sup> order regression match, AVOID use of 2<sup>nd</sup> order regression**

\*\*\*\*\*

**CASE #3b - Antoine's 2<sup>nd</sup> set of New Data as derived from Tony's Original Data - #2 of 3**

- 02:00UT, 00°00'N;30°00'E :  $H_{CBetelgeuse} = 79^{\circ}30'06'' / 044.9^{\circ}$  ;  $H_{CRigel} = 81^{\circ}22'49'' / 198.3^{\circ}$
- Offset variables : 0:00 UT  $0^{\circ}30'06''$   $11^{\circ}22'49''$
- 02:10UT, 00°02'N;30°02'E :  $H_{CBetelgeuse} = 81^{\circ}08'33'' / 033.5^{\circ}$  ;  $H_{CRigel} = 80^{\circ}15'08'' / 212.5^{\circ}$
- Offset variables : 0:10 UT  $2^{\circ}08'33''$   $10^{\circ}15'08''$
- 02:20UT, 00°04'N;30°04'E :  $H_{CBetelgeuse} = 82^{\circ}17'02'' / 017.8^{\circ}$  ;  $H_{CRigel} = 78^{\circ}39'42'' / 223.2^{\circ}$
- Offset variables : 0:20 UT  $3^{\circ}17'02''$   $8^{\circ}39'42''$
- 02:30UT, 00°06'N;30°06'E :  $H_{CBetelgeuse} = 82^{\circ}41'20'' / 358.7^{\circ}$  ;  $H_{CRigel} = 76^{\circ}46'28'' / 231.0^{\circ}$
- Offset variables : 0:30 UT  $3^{\circ}41'20''$   $6^{\circ}46'28''$
- 02:40UT, 00°08'N;30°08'E :  $H_{CBetelgeuse} = 82^{\circ}14'28'' / 339.7^{\circ}$  ;  $H_{CRigel} = 74^{\circ}41'59'' / 236.8^{\circ}$
- Offset variables : 0:40 UT  $3^{\circ}14'28''$   $4^{\circ}41'59''$
- 02:50UT, 00°10'N;30°10'E :  $H_{CBetelgeuse} = 81^{\circ}04'04'' / 324.3^{\circ}$  ;  $H_{CRigel} = 72^{\circ}30'15'' / 241.2^{\circ}$
- Offset variables : 0:50 UT  $2^{\circ}04'01''$   $2^{\circ}30'15''$
- 03:00UT, 00°12'N;30°12'E :  $H_{CBetelgeuse} = 79^{\circ}24'28'' / 313.1^{\circ}$  ;  $H_{CRigel} = 70^{\circ}13'41'' / 244.5^{\circ}$
- Offset variables : 1:00 UT  $0^{\circ}24'28''$   $0^{\circ}13'41''$

**Betelgeuse R2 = 0.997315** a = 0.362500 b = 13.050060 c = -13.062500

**Betelgeuse H<sub>cat</sub> at 02:00, i.e. at 00:00 Offset variable, 0°21'45.0" , i.e. 79°21'45.0"**

**Rigel R2 = 0.999870** a = 11.81000 b = -8.618690 c = -2.996429

**Rigel H<sub>cat</sub> at 02:00, i.e. at 00:00 Offset variable, 11°48'36.0" , i.e. 81°48'36.0"**

**With the 2<sup>nd</sup> order regression derived heights, and from 00°00'N;30°00'E, get an Intercept of 41.7 NM into bearing 147°**

**Very Unsafe 2<sup>nd</sup> order regression match, ABSOLUTELY REJECT 2<sup>nd</sup> order regression**

\*\*\*\*\*

**CASE #3c - Antoine's 2<sup>nd</sup> set of New Data as derived from Tony's Original Data - #3 of 3**

- 02:00UT, 00°00'N;30°00'E :  $H_{CBetelgeuse} = 79^{\circ}30'06'' / 044.9^{\circ}$  ;  $H_{CRigel} = 81^{\circ}22'49'' / 198.3^{\circ}$
- Offset variables : 0:00 UT  $0^{\circ}30'06''$   $11^{\circ}22'49''$
- 02:10UT, 00°02'N;30°02'E :  $H_{CBetelgeuse} = 81^{\circ}08'33'' / 033.5^{\circ}$  ;  $H_{CRigel} = 80^{\circ}15'08'' / 212.5^{\circ}$
- Offset variables : 0:10 UT  $2^{\circ}08'33''$   $10^{\circ}15'08''$
- 02:20UT, 00°04'N;30°04'E :  $H_{CBetelgeuse} = 82^{\circ}17'02'' / 017.8^{\circ}$  ;  $H_{CRigel} = 78^{\circ}39'42'' / 223.2^{\circ}$
- Offset variables : 0:20 UT  $3^{\circ}17'02''$   $8^{\circ}39'42''$
- 02:30UT, 00°06'N;30°06'E :  $H_{CBetelgeuse} = 82^{\circ}41'20'' / 358.7^{\circ}$  ;  $H_{CRigel} = 76^{\circ}46'28'' / 231.0^{\circ}$
- Offset variables : 0:30 UT  $3^{\circ}41'20''$   $6^{\circ}46'28''$
- 02:40UT, 00°08'N;30°08'E :  $H_{CBetelgeuse} = 82^{\circ}14'28'' / 339.7^{\circ}$  ;  $H_{CRigel} = 74^{\circ}41'59'' / 236.8^{\circ}$
- Offset variables : 0:40 UT  $3^{\circ}14'28''$   $4^{\circ}41'59''$
- 02:50UT, 00°10'N;30°10'E :  $H_{CBetelgeuse} = 81^{\circ}04'04'' / 324.3^{\circ}$  ;  $H_{CRigel} = 72^{\circ}30'15'' / 241.2^{\circ}$
- Offset variables : 0:50 UT  $2^{\circ}04'01''$   $2^{\circ}30'15''$
- 03:00UT, 00°12'N;30°12'E :  $H_{CBetelgeuse} = 79^{\circ}24'28'' / 313.1^{\circ}$  ;  $H_{CRigel} = 70^{\circ}13'41'' / 244.5^{\circ}$
- Offset variables : 1:00 UT  $0^{\circ}24'28''$   $0^{\circ}13'41''$

**Betelgeuse R2 = 0.997530** a = 0.447956 b = 12.921631 c = -13.134643

**Betelgeuse H<sub>cat</sub> at 03:00, i.e. at 01:00 Offset variable, 0°14'05.8" , i.e. 79°14'05.8"**

**Rigel R2 = 0.999330** a = 11.440427 b = -6.890315 c = -4.676250

**Rigel H<sub>cat</sub> at 03:00, i.e. at 01:00 Offset variable, -0°07'34.1" , i.e. 69°52'25.9"**

**With the 2<sup>nd</sup> order regression derived heights, and from 00°12'N;30°12'E, get an Intercept of 21.4 NM into bearing 072°**

**Very Unsafe 2<sup>nd</sup> order regression match, ABSOLUTELY REJECT 2<sup>nd</sup> order regression**