The 2019-2020 Geomagnetic Jerk as observed by southern African Magnetic Observatories

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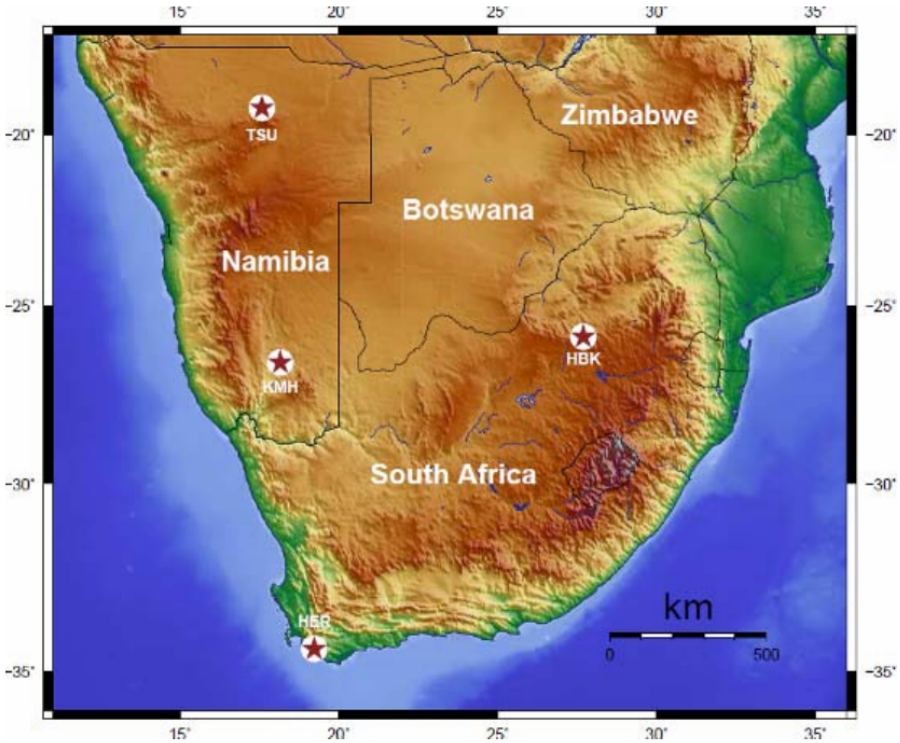
Introduction to rapid secular variation pulses

- SV corresponds to the first time derivative of the magnetic field.
- 'Jerks' manifest as changes of the secular variation trend (*Pinheiro and Travassos, 2009*).
- Occur at intervals ranging from 3 - 5 years (*Kotzé, 2017*).
- Possible oscillatory driving force within the core of the Earth.
- Some areas more rapid than elsewhere, like southern Africa (*Kotzé, 2003*).
- Rapidly drifting core spots moving westwards suggested reason for high SV in southern Africa (*Bloxham and Gubbins, 1985*).
- Here we will show the different secular variation patterns, and variation in strength, for the Y-field component at each of the observatories in southern Africa for the 2019/2020 Jerk.

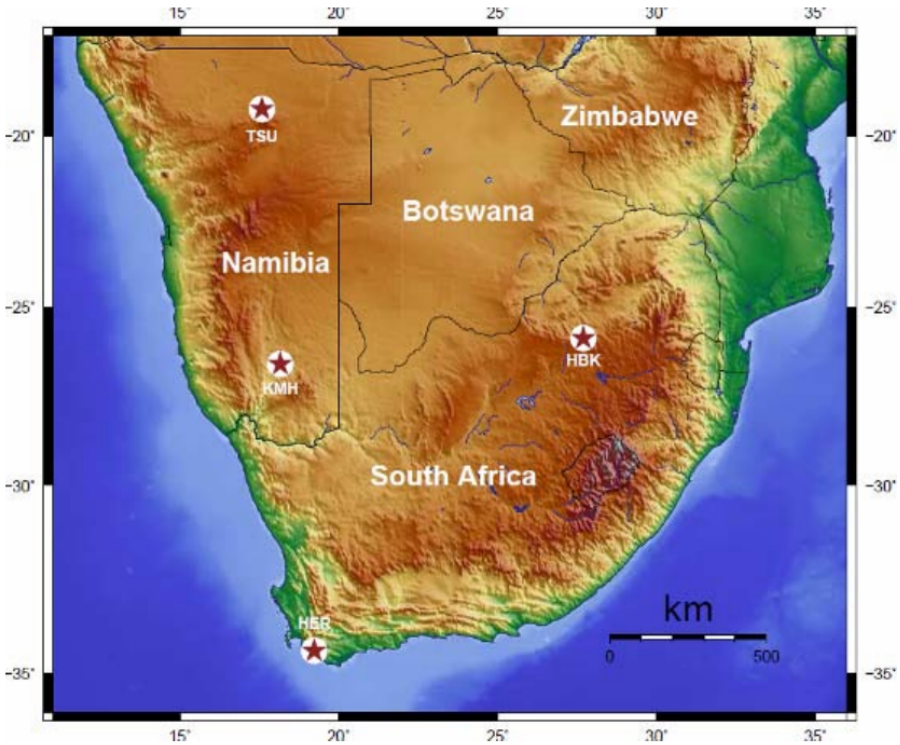
Location of observatories and data processing method



Location of southern African INTERMAGNET observatories (*Courtesy: P.K. Kotzé*)

- Quiet-time data from INTERMAGNET Hermanus (HER), Hartebeeshoek (HBK), and Keetmanshoop (KMH) have been utilised to compile quiet time monthly mean values.
- Complies with the Dst ring current index, no more than 3 nT/h, and K-indices less than or equal to 2.
- Best compromise between truly quiet times and the amount of data left to derive monthly values based on hourly means (*Kotzé 2017*).

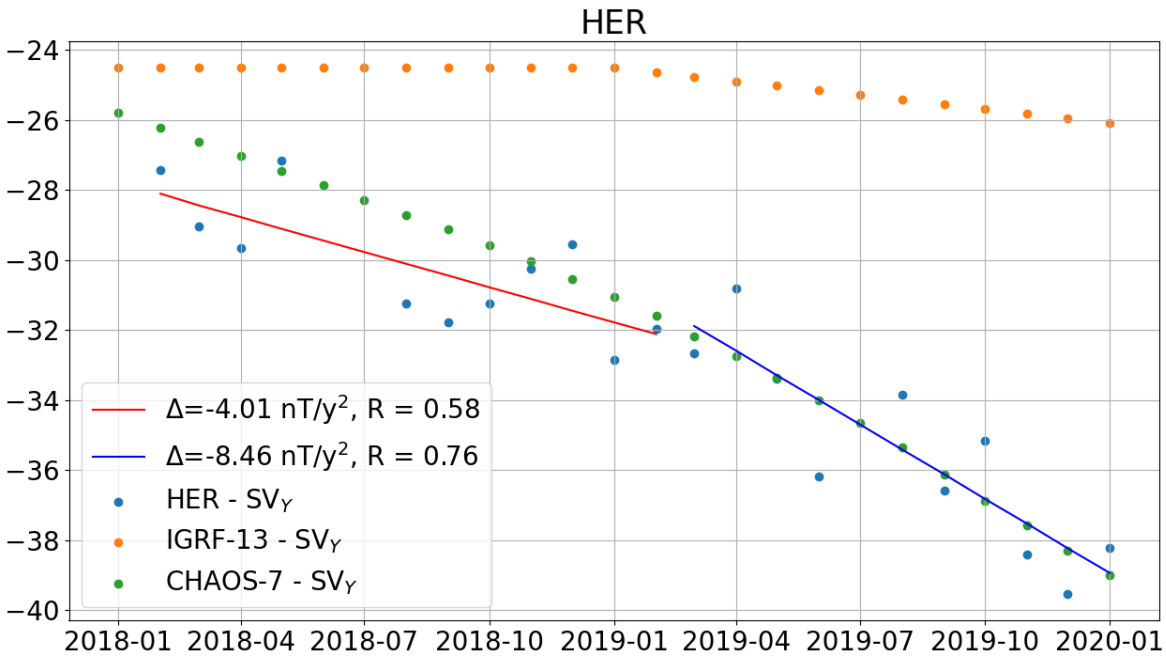
Location of observatories and data processing method



Location of southern African INTERMAGNET observatories (*Courtesy: P.K. Kotzé*)

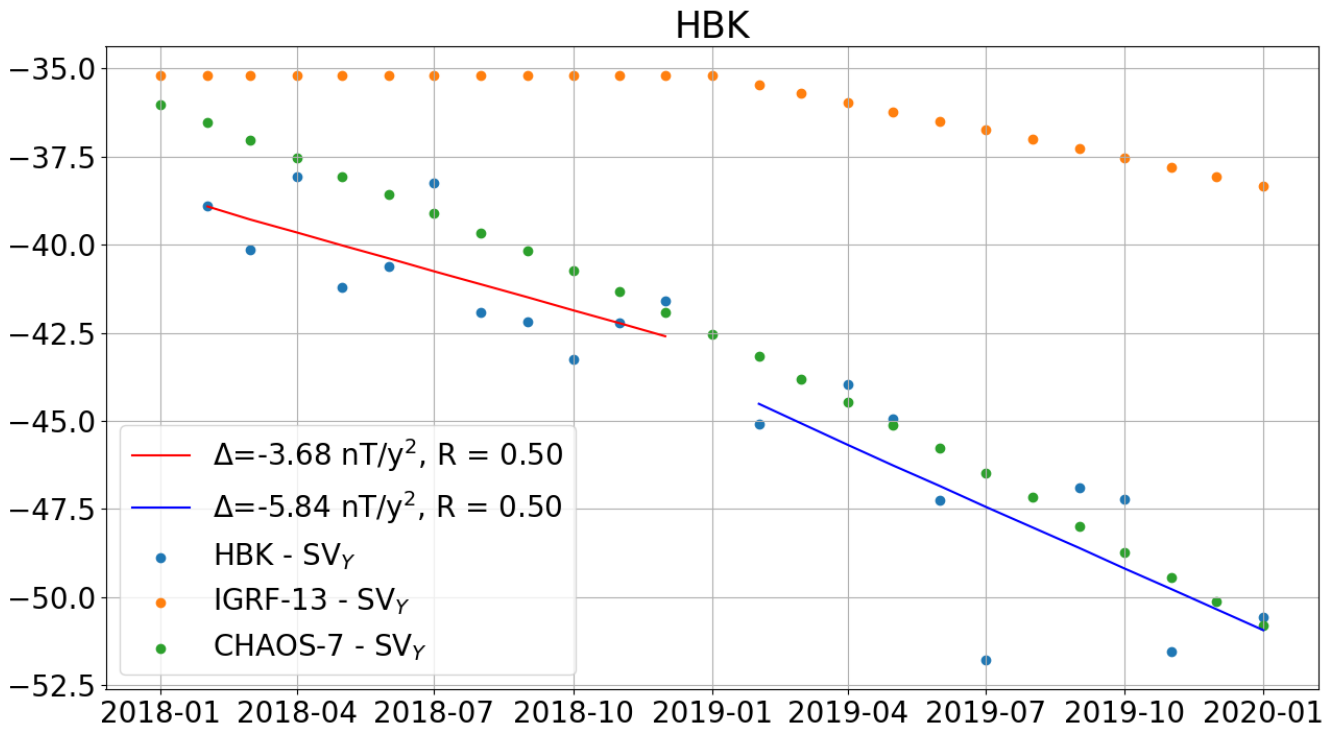
- Rates of SV change estimated via the classical *a priori* (Mandea, 2010) straight line approximation, $t_0 = 2019.0$: directly from time series by piecewise linear fits.
- R indicates an estimate of the quality of the linear fit (0 to 1).
- CHAOS-7 and IGRF-13 were employed to determine SV change patterns at each location.

INTERMAGNET - HERMANUS



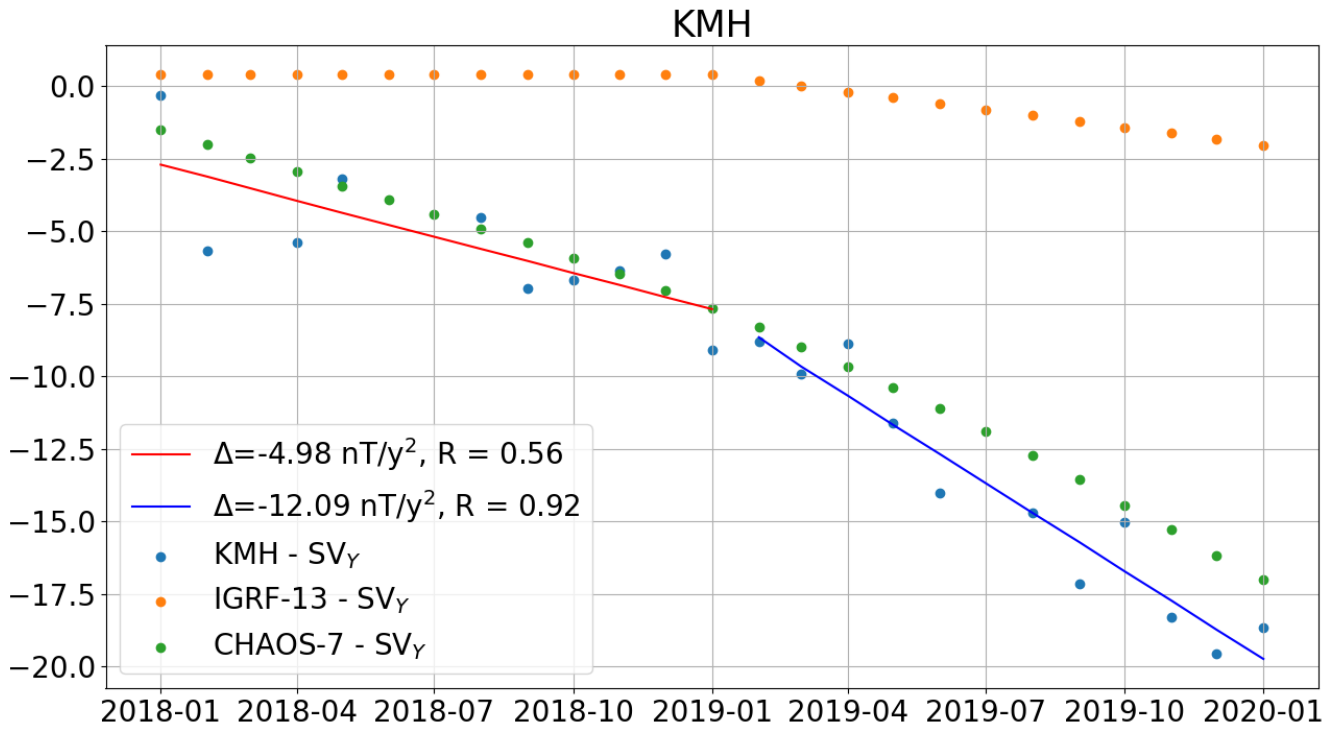
- The jerk in Y occurred in the first half of 2019, with a strength of **4.45** nT/year^2. The strength of the 2014, 2015, and 2016 SA changes were measured as **6.4** nT/year^2,-**14.2** nT/year^2, and **11.2** nT/year^2 respectively (*Kotzé, 2019*).
- The Y-component SV follows the same pattern as the global field models.

INTERMAGNET - HARTEBEESHOEK



- The jerk in Y occurred late 2018, with a strength of **2.16** nT/year^2. The strength of the 2014, 2015, and 2016 SA changes were measured as **6.0** nT/year^2,**-12.3** nT/year^2, and **17.9** nT/year^2 respectively (*Kotzé, 2019*).

INTERMAGNET - KEETMANSHOOP



- The jerk in Y occurred in the first half of 2019, with a strength of **7.11** nT/year^2. The strength of the 2014, 2015, and 2016 SA changes were measured as -**14.2** nT/year^2, **29.7** nT/year^2, and -**11.7** nT/year^2 respectively (*Kotzé, 2019*).

Conclusions

- We were able to identify SV change events in the Y component at all three observatories, following the same pattern.
- The jerk occurred first in the East at HBK, and later at KMH, and HER.
- The observatory showing the highest absolute strength is KMH (**7.11** nT/year^2), followed by HER (**4.45** nT/year^2), and lowest HBK (**2.16** nT/year^2).
- This shows an increase in Jerk-strength from East to West.
- The absolute strength of the 2017 geomagnetic jerk at all three observatories are weaker than the previous jerk.
- Possible explanation for this weak jerk over southern Africa is the shift of the SAA in the westerly direction, with the centre now over South America, and further away form Africa.

Thank You