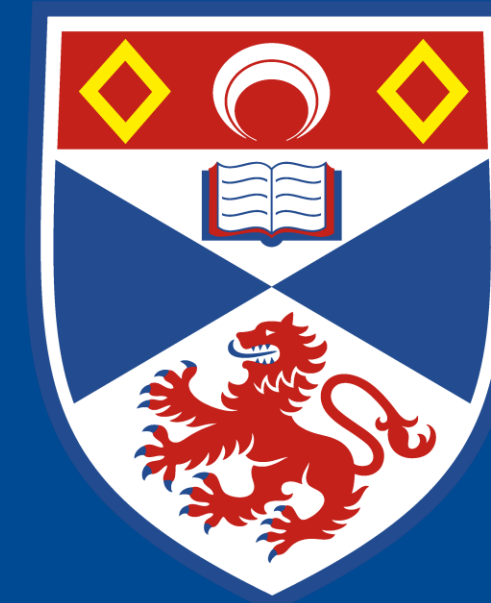


Talking about the weather: How meteorology and amateurs popularised curve plotting culture

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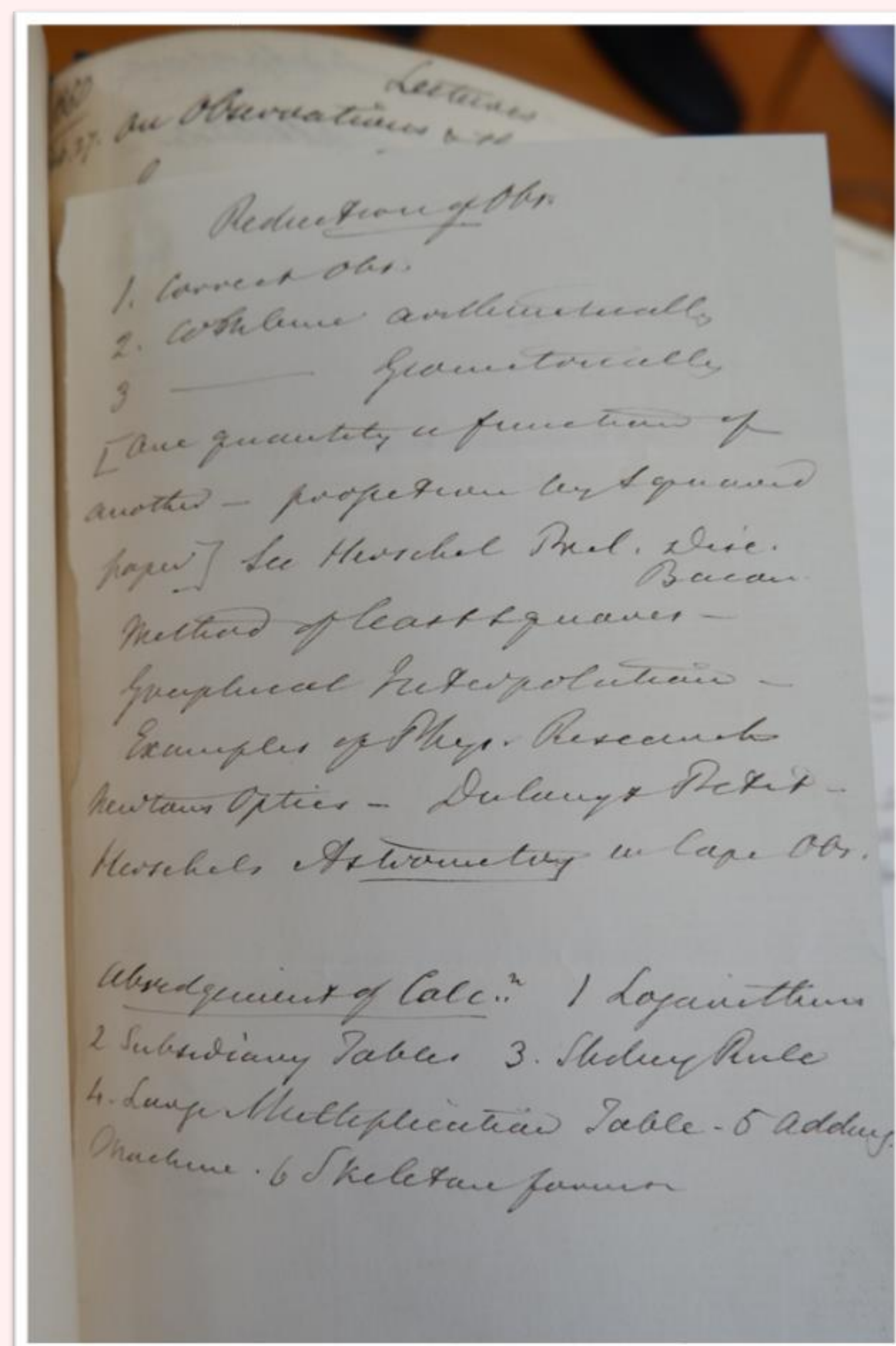
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Introduction

- Today graphs are a major tool of scientific analysis and are used almost ubiquitously to display experimental findings. This has not always been the case!
- Experimental or observational curves are when a number of scientific data points have been plotted on a set of axes and a smooth curve has been drawn through them.
- Before the 1830s these were rarely used by the majority of scientists who instead would display all their data in a table of numbers believing this would be more accurate and lead to fewer misunderstandings of their findings¹.
- We were interested in why this situation changed to the extent that by the 1870s there is evidence of widespread teaching of the curve plotting method as an essential tool for experimenters.

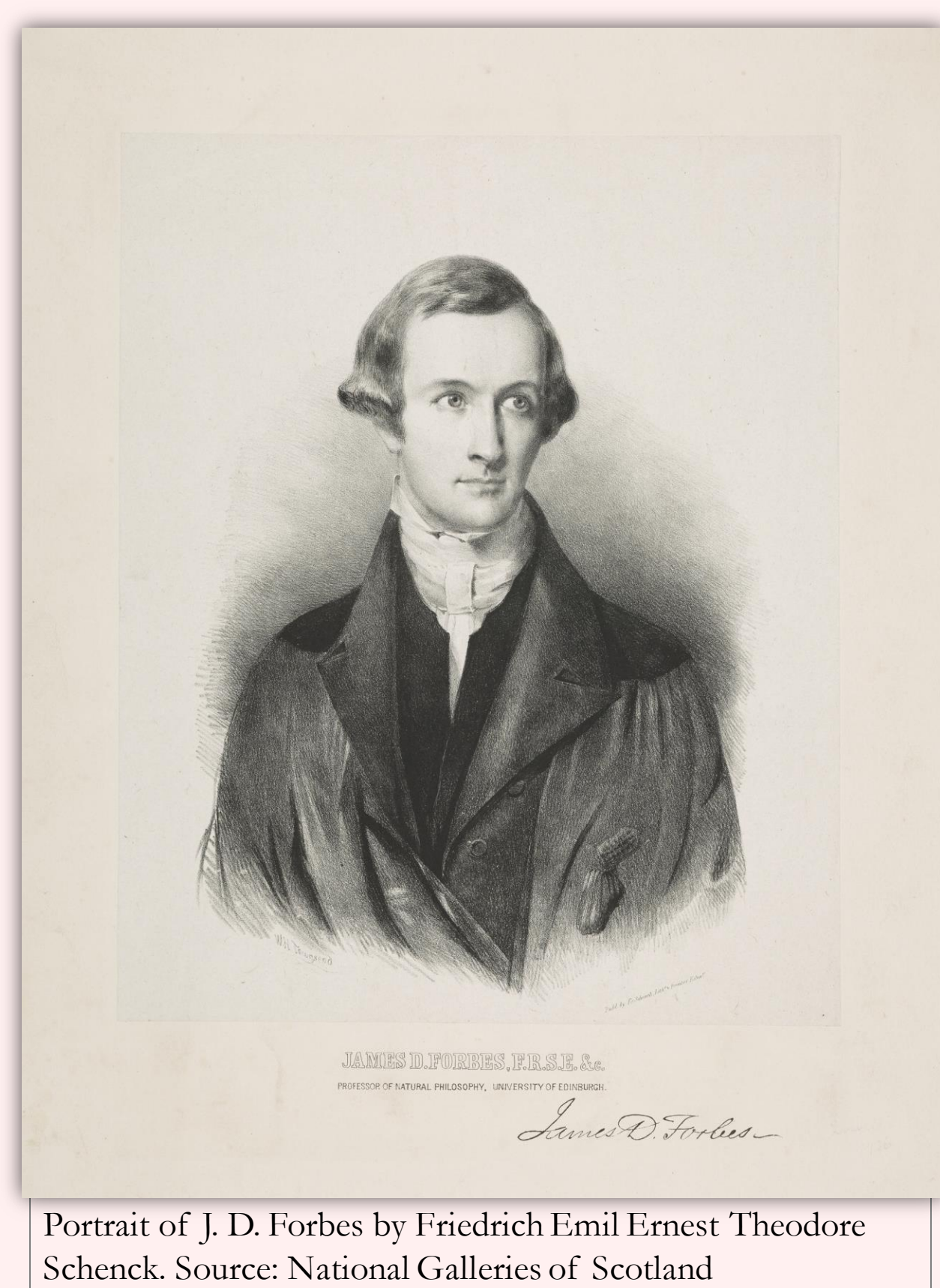
Possible explanations for this massive culture change:

- There was a general explosion in popularity of visual culture in British Science in the 19th century.
- Automatic recording instruments were being used extensively for experiments and they outputted their results as a curve on paper fed into a machine.
- Diurnal phenomena such as the temperature of the atmosphere, outside air pressure and the heights of the tides were drawing large amounts of interest and scrutiny. Data from these subjects were particularly suited to being analysed using curve plotting because of their consistent and sinusoidal nature.
- Graph paper was becoming cheaper and more widely available to scientists and students.
- Curve plotting was being picked up and developed by economists and engineers which then influenced natural scientists⁶.



Note found in Forbes' manuscripts which suggests he taught his students to use curves to analyse their experimental results. Source: St Andrews Special collections Ms Q113.F89

J D Forbes:



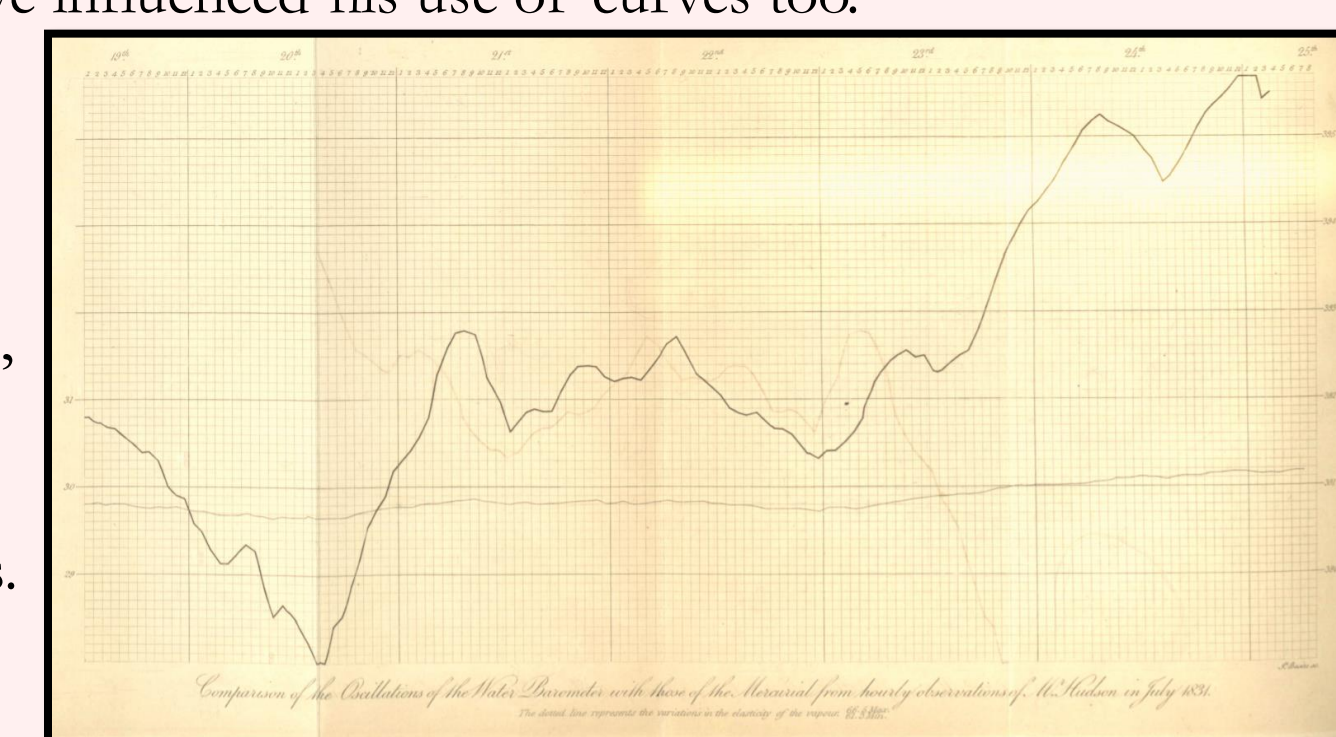
Portrait of J. D. Forbes by Friedrich Emil Ernest Theodore Schenk. Source: National Galleries of Scotland

"The examination of these curves furnishes us with some data of the most important kind for Meteorology which it is best in the first place to state, and afterwards to consider how we can explain." - J. D. Forbes²

- Forbes has previously been identified as an early adopter and proponent of curve plotting and his work can be viewed as an excellent example of how and why scientists' attitudes changed towards the method¹.
- He was influenced by amateurs who had been investigating meteorology for some time and wanted to subject the science to rigorous observation³.
- His work manifests a development of curve plotting and from using it as being an eye-catching way of displaying data to it being a central part of his understanding of the science and a tool for analysis².
- A note he wrote found in a manuscript of his lecture plans gives strong evidence he was teaching the technique to his students and held it in high regard.

Compelling explanations for the culture change:

- The evidence suggests that the main drivers of the adoption of the method of curves were the interest in diurnal phenomena combined with the organic methods of analysis being used by scientists with little formal mathematical training.
- A good selection of people we looked at were Luke Howard, John Frederic Daniell and James Prinsep^{7,8,9,10}. Howard was trained as a pharmacist; Daniell was a chemist and Prinsep was an orientalist scholar based in India.
- It can be seen that Howard decisively influenced Daniell whose work then had a big impact on Forbes. James Prinsep is also mentioned by Forbes and appears to have influenced his use of curves too.
- Since Forbes played a part in teaching and popularising graphical methods we can see that he was a major link between amateurs carrying out their own investigations, mostly to do with meteorology, and the scientific mainstream which would go on to adopt their practices.



A graph from an 1832 paper on pressure by J. F. Daniell. Source: [7]

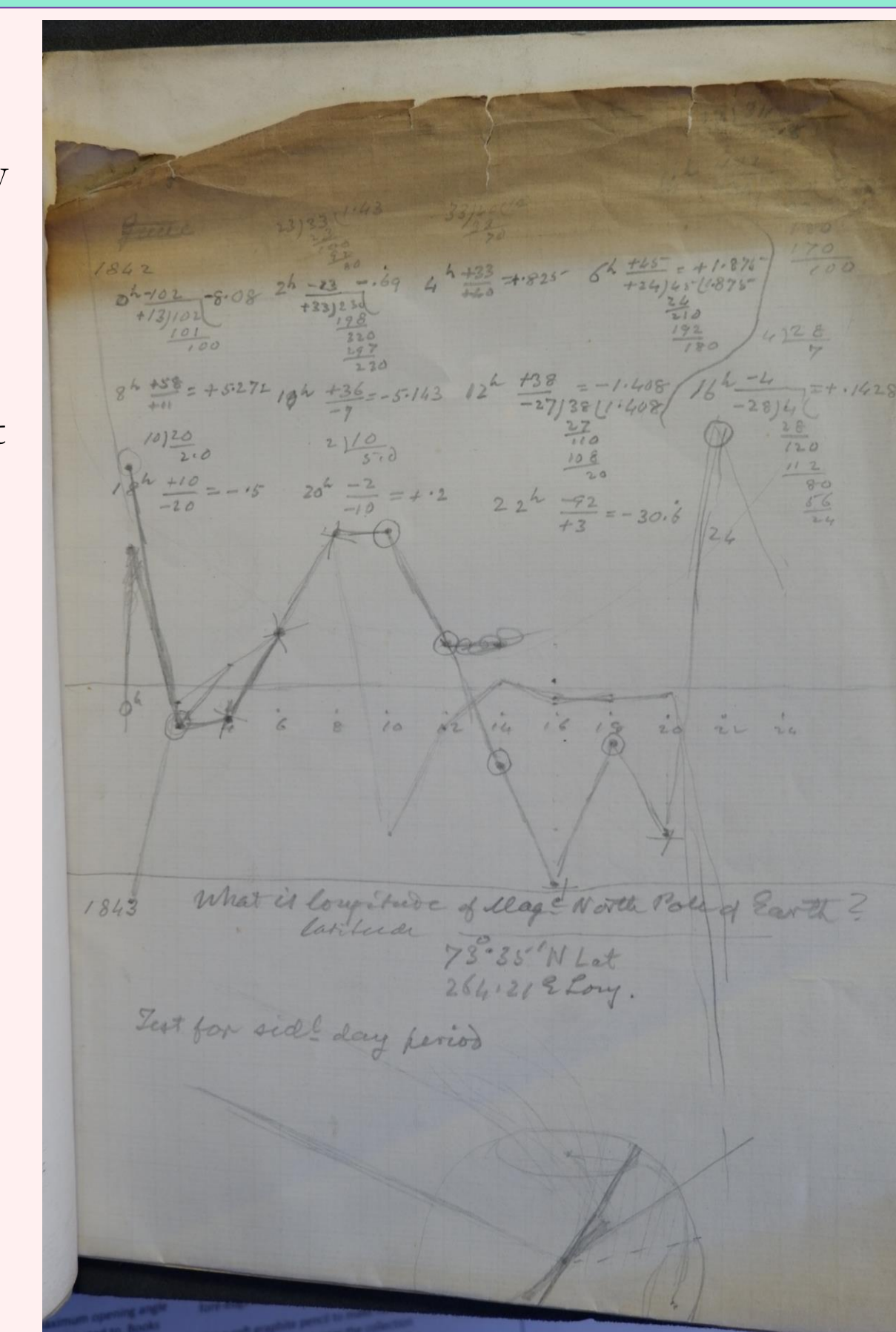
Future Investigations:

There remain important questions on this topic:

- To what extent did engineering and economics influence the graphical methods that became popular within the natural sciences?
- When exactly did professors start teaching their pupils about analysing their data using curves? Was Forbes one of the first?
- Did mechanical institutes teach such things before universities?
- How did the British experience of this change differ from that of the continent?

Summary

- The origins of the popular use of curve plotting as a graphical method for scientific analysis are found in the early 19th century.
- Our findings suggest that the main drivers of this change were the sorts of investigations into diurnal phenomena that were popular at the time and the mathematically self-taught amateurs who pursued those topics.
- These amateurs may well have been influenced by engineering, economics or surveying techniques of the time.
- The influence of the wider availability of graph paper did play a part in the ubiquity of graphical methods of this sort today, but this seems to be a later phenomenon occurring around the end of the 19th century⁵.



Rough graph from an 1863 manuscript by George Biddell Airy. This graph shows how scientists had become more relaxed using curves, it had been accepted as a natural tool for analysis. Source: University of St Andrews Special Collections

Selected References:

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