Reservations concerning the use of the magnetic needle

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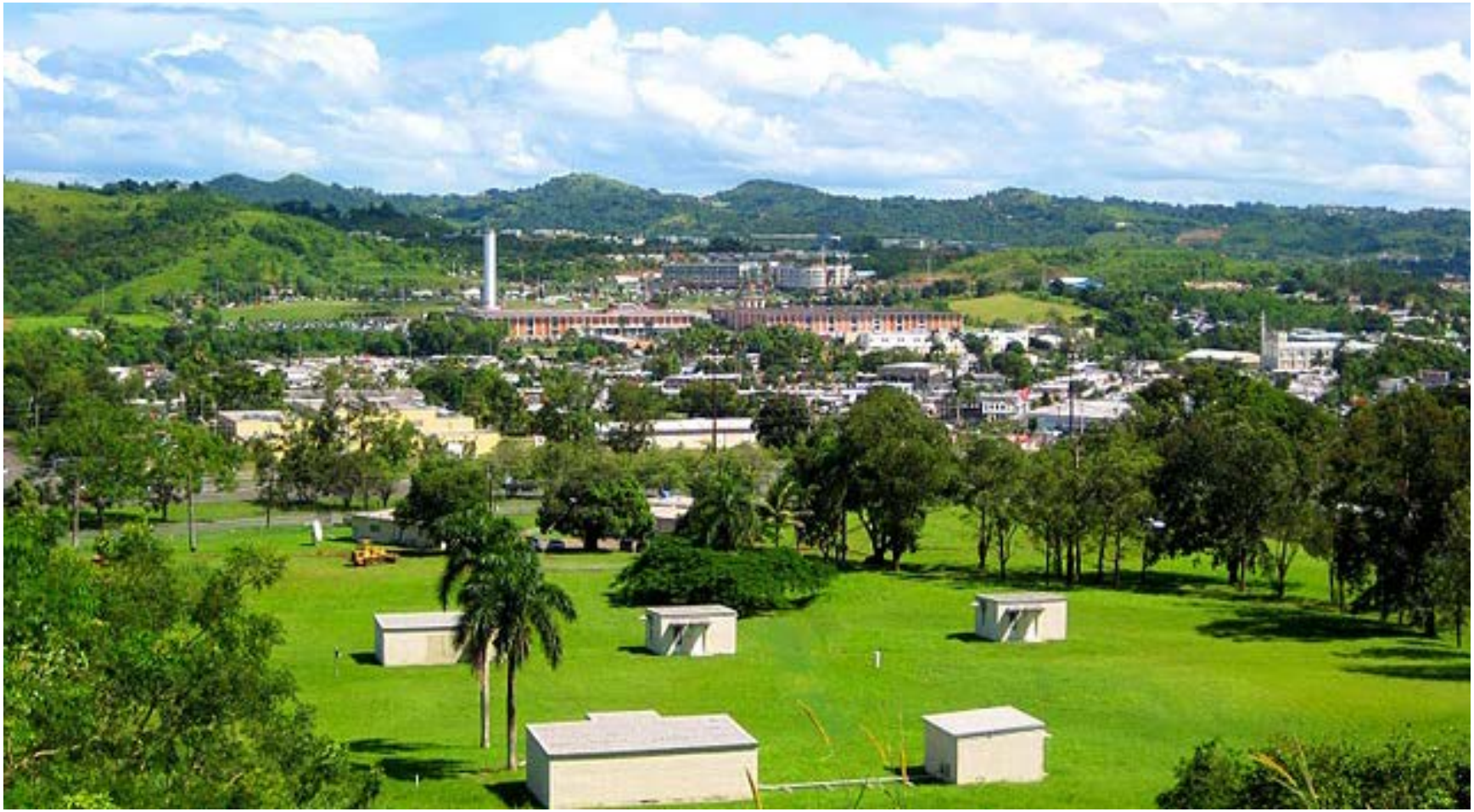


THEO 020 B

Calibrated data from magnetic observatories

- *B* is an estimated measure of the minute-to-minute variation of the Earth's magnetic field; absolute accuracy is not good.
- *A* are accurate "spot" measurements of the Earth's field.
- *B* and *A* are independently acquired measurements of the same physical quantity.
- Our understanding of the properties of the instruments used to measure both *B* and *A* is independent of any measurement we might make of either *B* or *A*. It is a matter of engineering.
- *A* and *B* are combined through data processing to produce a calibrated time series *B*(*A*).
- The calibration method is simple and uncontroversial.
- Documentation and three data sets are archived and made readily available to the user: *B*, *A*, and *B*(*A*).

Sunspot calibration by the magnetic needle

- R is an estimate of sunspot number.
- Y is a measurement of the Earth's magnetic field.
- R and Y are independently acquired data sets. They are obtained by entirely different methods.
- R and Y record phenomena that are, occasionally and in certain respects, physically related. How do we know this? The last few solar cycles of R and Y have been used to estimate, as an inference, a correlational relationship
- It is proposed that this same correlation be used to retrospectively calibrate older R and produce a model R(Y), which is supposed to be interpreted as an improved estimate of sunspot number.
- Is this valid?

Sunspot calibration by the magnetic needle

- Stationarity: Do we know, for a fact, that a correlation derived from recent data also applies to older data?
- Parameterizations: Mursula (2009) questions the removal of trends in Y made by Svalgaard (2007).
- Prediction: The same correlation that might be used to retrospectively adjust historical R should be be objectively tested against future R. Solar cycle 24 might present an interesting challenge. But should we not also require additional predictions against future solar cycles?
- Reproducibility: Results should be reproducible by independent groups of scientists.

Think about the user community.

- Scientists will seek to analyze, in their own way, solar-terrestrial interaction by making new inferences, of their own kind, based on sunspots and geomagnetic activity.
- How valid is an inference based on R(Y) when a scientist has mistakenly thought that he/she has used a quantity based entirely on observations of the Sun?
- How valid is an inference based on R(Y) and Y, where the scientist has mistakenly thought that R(Y) is actually R?

What to do? My thoughts …

- Original unadjusted data (those that are available) should be made easily available to the scientific community.
- Simple products recording sunspots, such as R, should continue to be made available to the scientific community.
- Scientists should be able to publish their derived models, such as R(Y), but products that are intended to be used by the wider scientific community need to be scientifically justified, documented, reproducible, and they should pass reasonable tests of prediction.