

**Senate Standing Committee on Environment and Communications
Legislation Committee**

Answers to questions on notice
Environment and Energy portfolio

Question No: 255
Hearing: Additional Estimates
Outcome: Agency
Program: Bureau of Meteorology (BoM)
Topic: Automatic weather station network
Hansard Page:
Question Date: 6 March 2017
Question Type: Written

Senator Roberts asked:

The first law of thermodynamics underpins most understandings about how the climate behaves and cannot be dismissed lightly. Partitioning of available energy between sensible heat (which manifests as maximum temperature in a Stevenson screen) and evaporative cooling (which is a constant (2.45 MJ) multiplied by rainfall (mm = kg/m²)) is well understood and long accepted in fields such as agriculture and climatology.

1. Is it feasible that average maximum temperature can be high or extremely high in years when rainfall is near average or well above average? If so, how can it be?
2. If it is not feasible, how can climate change impact directly on temperature trends, extremes and trends in extremes independently of rainfall?
3. How can changes in data that are directly attributable to changes at sites (including equipment changes) be ignored?
4. Why is the Bureau's default position to attribute such changes to the climate when it is manifestly obvious that sites have not remained the same?

Answer:

1. Yes, noting the dependency on definitions of high, extremely high and well above average, it is feasible that average maximum temperature can be high or extremely high in years when rainfall is near average or well above average. The physics of the climate system is not governed by the first law of thermodynamics alone. It is governed by thermodynamics coupled to the Navier-Stokes equations. Please see a relevant text such as Holton; *An Introduction to Dynamic Meteorology* and Peixoto and Oort; *Physics of Climate*.
2. It is feasible that average maximum temperature can be high or extremely high in years when rainfall is near average or well above average.
3. Changes at sites (including equipment changes) are not ignored but are explicitly taken into account through the Bureau's methodology for detecting and adjusting artificial biases due to such changes. This methodology is published in scientific literature and is described in detail on the Australian Climate Observations Reference Network (ACORN-SAT) website, www.bom.gov.au/climate/change/acorn-sat/.

4. This is not the Bureau's default position. The Bureau agrees that changes in site location, instruments or observing practices can lead to artificial trends or biases in the data for a station. It is precisely because of this that the Bureau has adopted a methodology for detecting and adjusting for these biases due to site changes. The methodology has been peer reviewed and is published in the scientific literature. More information can be found on the ACORN-SAT website, www.bom.gov.au/climate/change/acorn-sat/.