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## DATASETS & IMAGES

### GISS Surface Temperature Analysis

#### The Elusive Absolute Surface Air Temperature (SAT)

*Q. What exactly do we mean by SAT ?*

A. I doubt that there is a general agreement how to answer this question. Even at the same location, the temperature near the ground may be very different from the temperature 5 ft above the ground and different again from 10 ft or 50 ft above the ground. Particularly in the presence of vegetation (say in a rain forest), the temperature above the vegetation may be very different from the temperature below the top of the vegetation. A reasonable suggestion might be to use the average temperature of the first 50 ft of air either above ground or above the top of the vegetation. To measure SAT we have to agree on what it is and, as far as I know, no such standard has been suggested or generally adopted. Even if the 50 ft standard were adopted, I cannot imagine that a weather station would build a 50 ft stack of thermometers to be able to find the true SAT at its location.

*Q. What do we mean by daily mean SAT ?*

A. Again, there is no universally accepted correct answer. Should we note the temperature every 6 hours and report the mean, should we do it every 2 hours, hourly, have a machine record it every second, or simply take the average of the highest and lowest temperature of the day ? On some days the various methods may lead to drastically different results.

*Q. What SAT do the local media report ?*

A. The media report the reading of 1 particular thermometer of a nearby weather station. This temperature may be very different from the true SAT even at that location and has certainly nothing to do with the true regional SAT. To measure the true regional SAT, we would have to use many 50 ft stacks of thermometers distributed evenly over the whole region, an obvious practical impossibility.

*Q. If the reported SATs are not the true SATs, why are they still useful ?*

A. The reported temperature is truly meaningful only to a person who happens to visit the weather station at the precise moment when the reported temperature is measured, in other words, to nobody. However, in addition to the SAT the reports usually also mention whether the current temperature is unusually high or unusually low, how much it differs from the normal temperature, and that information (the anomaly) is meaningful for the whole region. Also, if we hear a temperature (say 70F), we instinctively translate it into hot or cold, but our translation key depends on the season and region, the same temperature may be 'hot' in winter and 'cold' in July, since by 'hot' we always mean 'hotter than normal', i.e. we all translate absolute temperatures automatically into anomalies whether we are aware of it or not.

*Q. If SATs cannot be measured, how are SAT maps created ?*

A. This can only be done with the help of computer models, the same models that are used to create the daily weather forecasts. We may start out the model with the few observed data that are available and fill in the rest with guesses (also called extrapolations) and then let the model run long enough so that the initial guesses no longer matter, but not too long in order to avoid that the inaccuracies of the model become relevant. This may be done starting from conditions from many years, so that the average (called a 'climatology') hopefully represents a typical map for the particular month or day of the year.

*Q. What do I do if I need absolute SATs, not anomalies ?*

A. In 99.9% of the cases you'll find that anomalies are exactly what you need, not absolute temperatures. In the remaining cases, you have to pick one of the available climatologies and add the anomalies (with respect to the proper base period) to it. For the global mean, the most trusted models produce a value of roughly 14 Celsius, i.e. 57.2 F, but it may easily be anywhere between 56 and 58 F and regionally, let alone locally, the situation is even worse.

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+ GISS Website Curator: Robert B. Schmunk  
+ Responsible NASA Official: James E. Hansen  
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