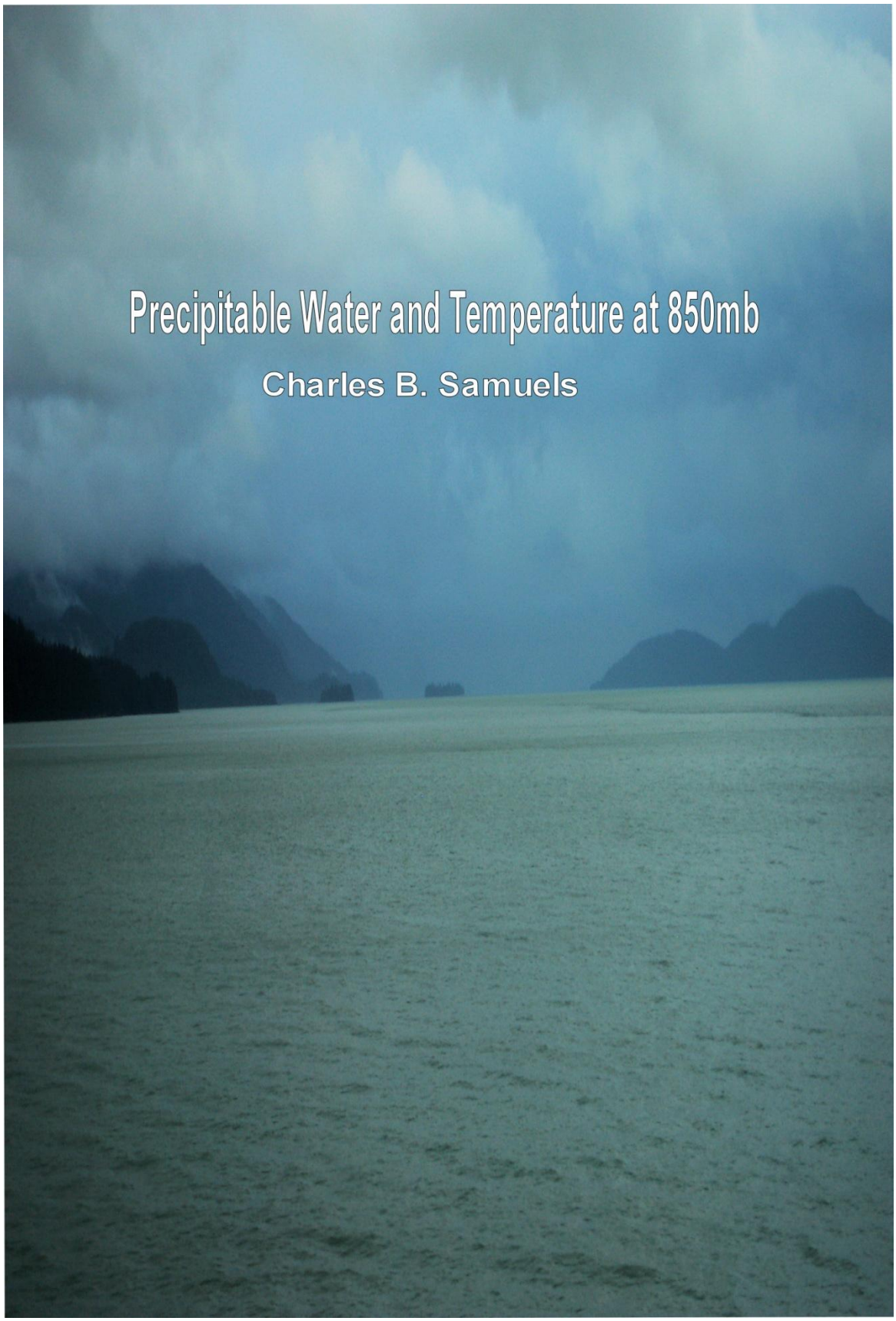
Precipitable Water and Temperature at 850mb
Charles B. Samuels

PRECIPITABLE WATER AND UPPER AIR TEMPERATURES

CHARLES B. SAMUELS

Longwave radiation heats the lower troposphere by being absorbed by liquid water in clouds, water vapor, CO2, and other aerosols.

Working with upper air data, we noticed that precipitable water in the air column over many upper air stations strongly correlated with temperatures at levels below 300 mb. Precipitible Water is a satellite derived value that includes the amount of water in the entire air column.

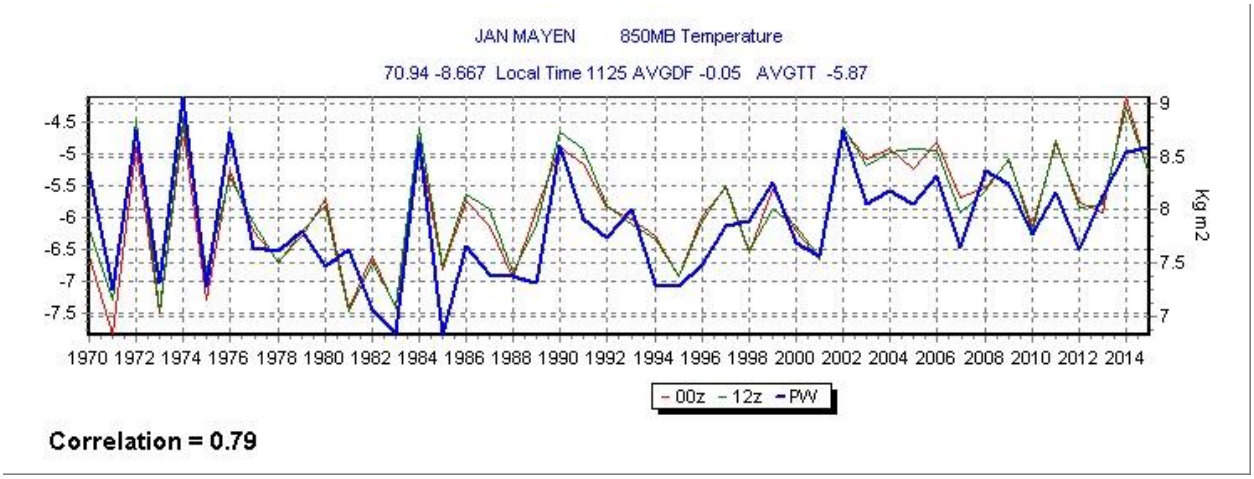

Figure 1. Jan Mayen 850mb 00z and 12z temperature and precipitable water.

As can be seen here, the amount of precipitable water (PW) and temperatures at 850mb have very similar curves. The correlation of .79 on the graph is the correlation between 00z sounding temperature and precipitable water (PW) for the 850mb level for that location.

Strong correlations also exist for levels up to and including the 400mb level. At 300mb the correlations drop to near zero. The reason for the sudden drop is the lack of moisture above the 400mb level, whichs is about 23,000 feet. At other upper air stations in different climatic zones the correlations are very different. Examples are: Tucson, AZ the correlation for the 850mb level is close to zero due to a lack of moisture at that low level and at Key West, FL corellations are strong to the 150mb level due to the large amounts of PW in thunderstorms.

The primary purpose of this work is to eliminate the effects of PW on the temperature at the 850mb level and thereby reveal the effects of other aerosols. At

some stations in the desert (Tucson and El Paso for example) the air is very dry at the 850mb level and such stations were not used in the statistics

DATA SOURCE

Upper air data used in this article comes from balloon-borne radiosonde data obtained from https://www.ncdc.noaa.gov/data-access/weather-balloon/integrated-global-radiosonde-archive. The data used is the annual average. Precipitable water data came from the National Center for Environmental Prediction and is also a yearly average. https://www.esrl.noaa.gov/psd/cgi-bin/data/composites/printpage.pl.

NORMILAZTION OF DATA

It is well known that the primary greenhouse gas is water vapor, which also includes liquid water (clouds). CO2 and other aerosols have a much smaller effect but are spread more or less evenly in the atmosphere, whereas water vapor is concentrated, both spatially and temporally. For that reason it is very difficult to model the influence of water vapor on temperature, The year long averages of PW eleminate the problem of concentration.

By normalizing the PW curve with the temperature curve we can subtract the effects of PW on Temperature. A computer program was written that first finds the ratio of PW to temperature and then applys that ratio to PW and subtracts it from the temperature.

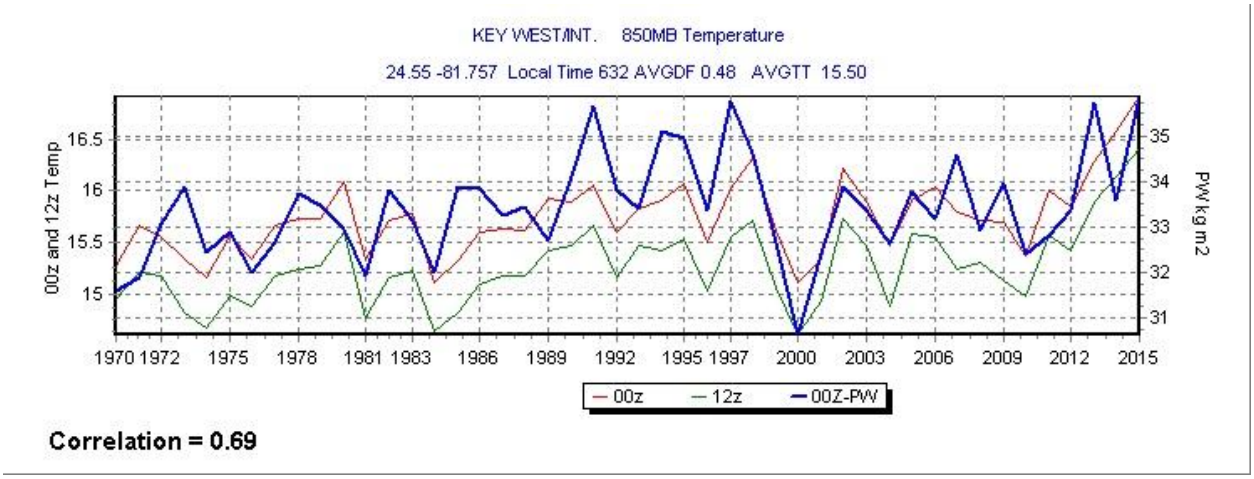

Fig 2. Key West Temperature and Precipitable Water Before Normilization

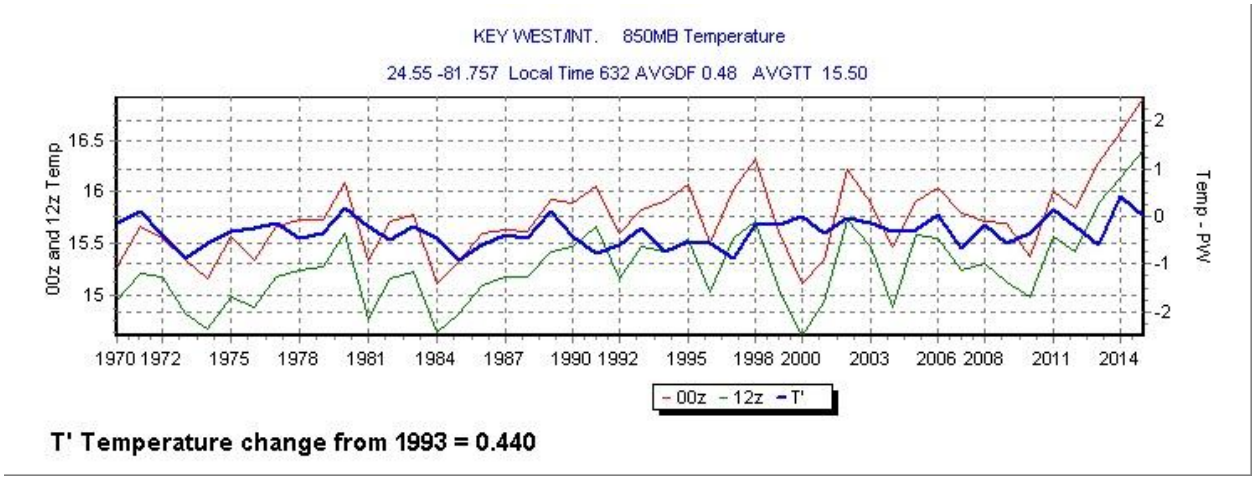

Fig 2. Key West after PW Normilazation and subtraction.

The above graph for Key West 850mb level shows that before normilazation the 00z and 12z temperature were rising rather steadily, but after removing the effects of PW, the dark blue line (T') shows a slight decline to 1993 and then .440 total heating after that.

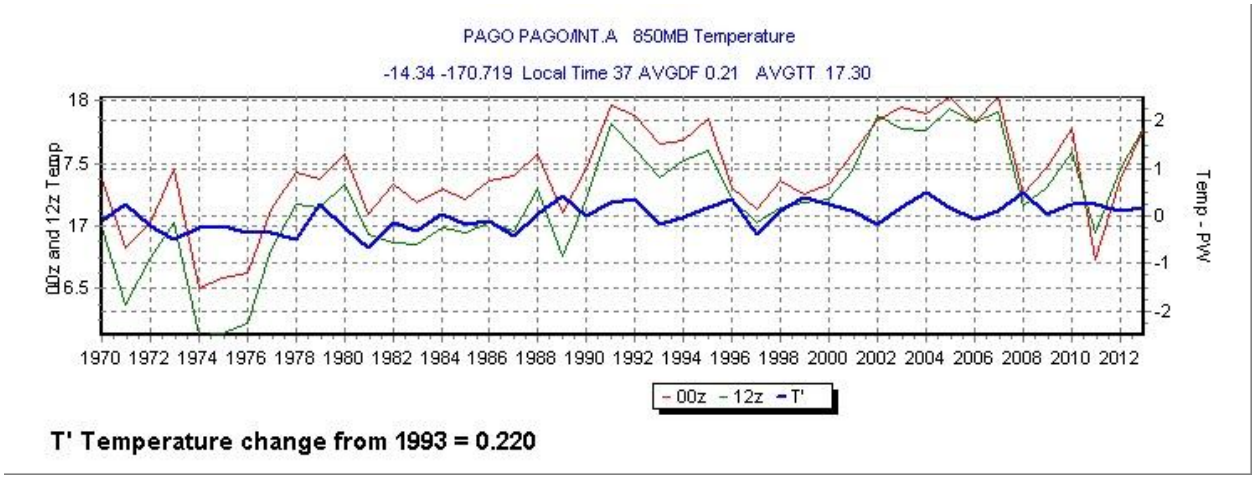

Fig 3. Pago Pago 0.220 degree temperature change after 1993.

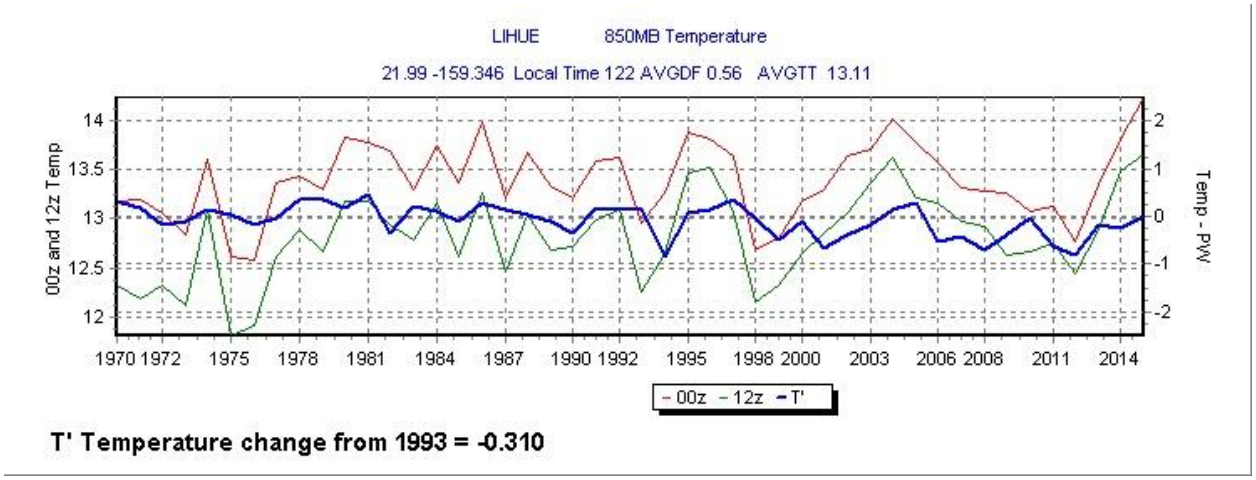

Fig 4. Lihue Steadily Declining Temperature.

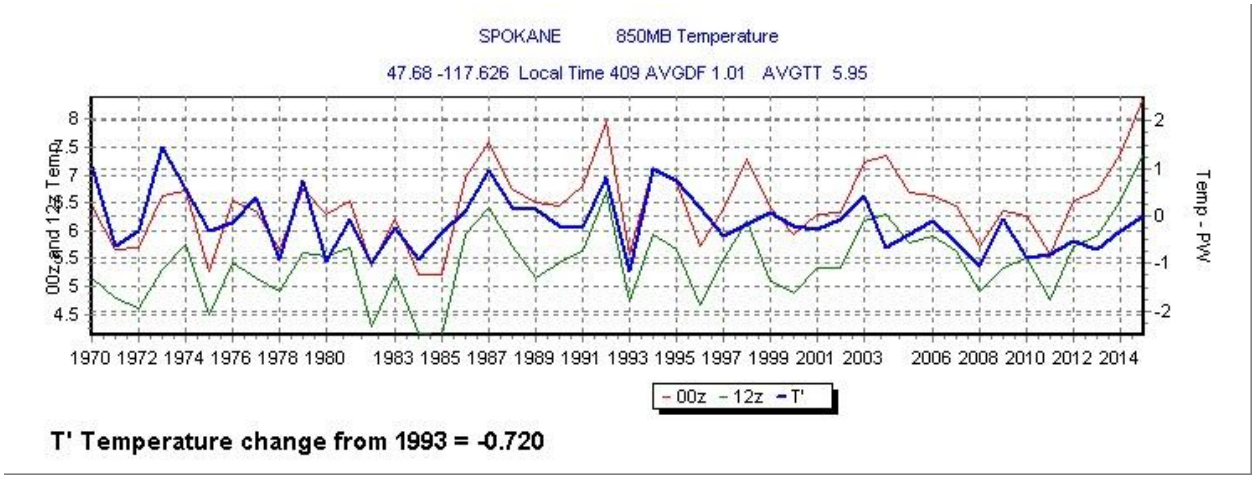

Fig 6. Spokane, Wa. Almost a degree of cooling for T' after 1993

Similar plots were made for 32 Asian stations and 30 U.S. stations. The average change in T'temperture per station for the period 1993 to 2015 was 0.015 degrees. The Asian stations were much higher than the U.S. stations, averaging .028 per station while the US was only 0.0021.

CONCLUSIONS

A review of these and many more graphs world wide shows that any increase in temperature at that level is caused by increased clouds and water vapor . If CO2 is causing heating of the atmosphere, it is well hidden. Note! The heating amount shown on the graph was calculated using a Least Squares algorithm.