NOTE ON SOARING CLIMATOLOGY

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Summary: This note suggests that water evaporation data can provide a simple but reliable climatological index to be used in order to determine the best time and space locations for soaring contests and record flights.

In the search of the best epoch and location for the 1993 Brazilian soaring championship, a study of some avail-

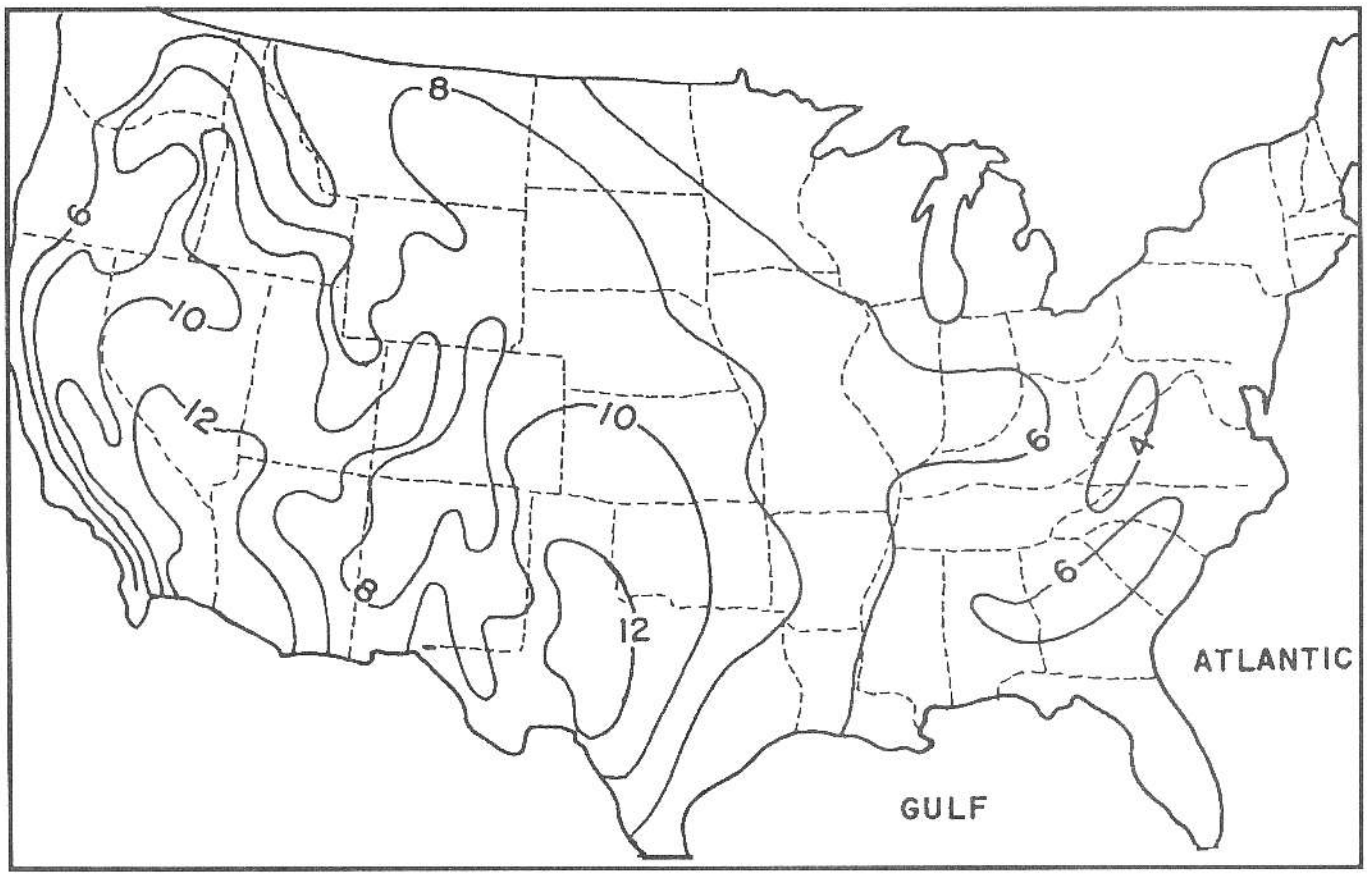

FIGURE 1. Normal July evaporation from reservoirs and shallow lakes in U.S. in inches.

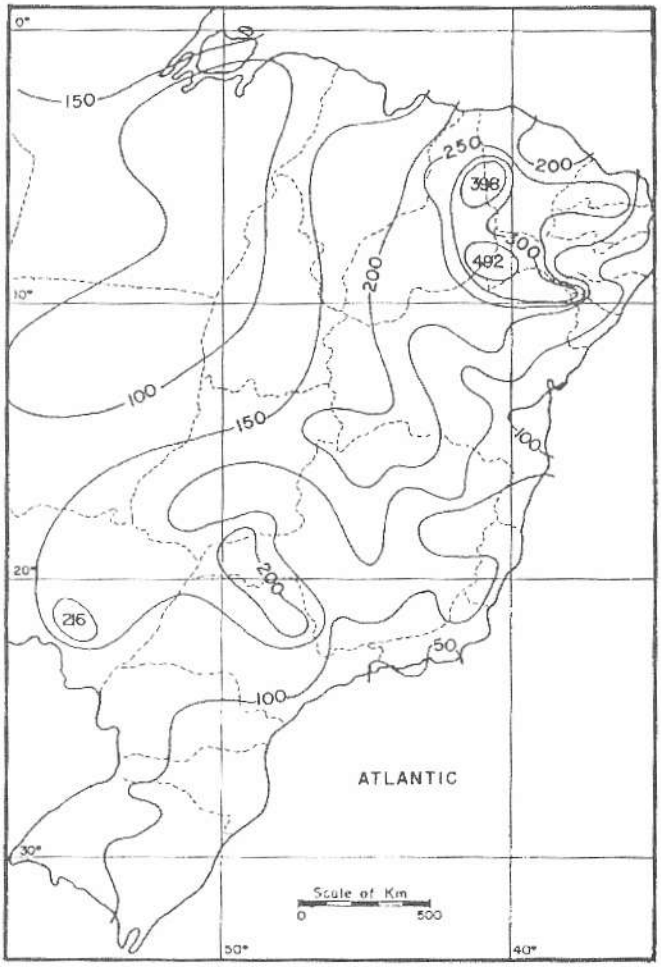

Figure 2: Normal October evaporation in Brasil (mm)

able meteorological data for the 1961-1990 period (DNMet, 1992) was carried by the author. Plotting of monthly mean values of rainfall, cloud cover and temperatures, provided some first clues.

Due to the absence of altitude (700 hPa) temperature and no rain days (<0,1 mm) data, the exact Lindemann Index (Lindemann, 1988) computation was not possible and the use of a pseudo value of it, with a constant F=1 factor and a standard temperature lapse rate (7 deg/Km) was attempted, but resulted in a too coarse resolution.

However, the plot of the water total evaporation parameter alone, showed an interesting space correlation with some known places for good thermal soaring weather and with some recent Brazilian record, breaking flights.

This correlation is also found in the U.S. as shown by the evaporation map for July (Visher, 1984) presented in Figure 1 and where peak evaporation values of up to 12 inches a month are found in two areas, one of which includes the sites used for the last three U.S. World Soaring Championships, Marfa (1970), Hobbs (1983) and Uvalde (1991).

In this same area, the 1000 Km distance world record, was set in 1968 by Parker flying only thermals and a 6.1 lb/sqf wing loading Sisu glider. Also, recently a hang glider record distance flight was flown there.

As for the U.S., the Brazilian water evaporation plots, show an extensive area with total evaporation values above 300mm during south hemisphere spring time, and located in the Brazilian northeast as shown by Figure 2.

Care must be taken, when comparing both countries evaporation values, since for the same conditions the pan measurements of the Brazilian data, should give higher values (~50%) than reservoirs and shallow lakes evaporation as those of the presented American data.

Anyway, although the above remark, and that due to latitude differences, summer days are much longer in Texas, a good chance of breaking Brazilian speed records and even some world ones, exist by flying in that region.

For now, its 3000 Km distance from existing Brazilian gliding clubs, precludes the region to be chosen as a national contest site, but a soaring expedition to it is being considered in order to check its potential to be proposed as a World Soaring Championship site, for the year 2000.

The use of the bare evaporation data, as climatological parameter for Catanduva-SP (in the region chosen for the Brazilian '93 soaring championships), as exemplified in Figure 3, would indicate that the soaring conditions in the fall would be much worse than the spring

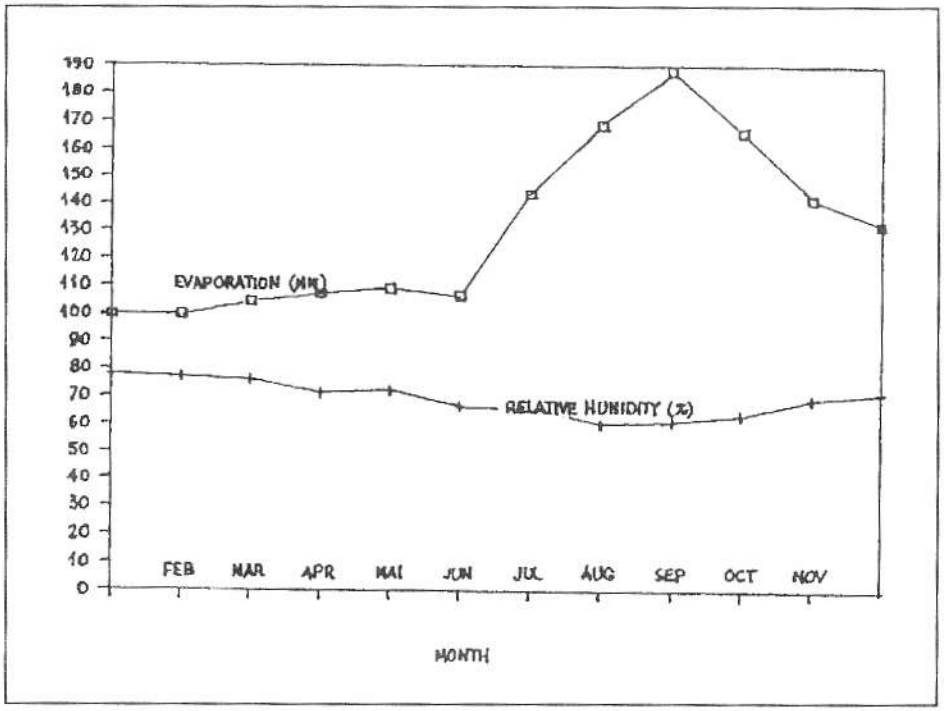

Figure 3: Evaporation and humidity (at Catanduva, S.P., 30 years mean).

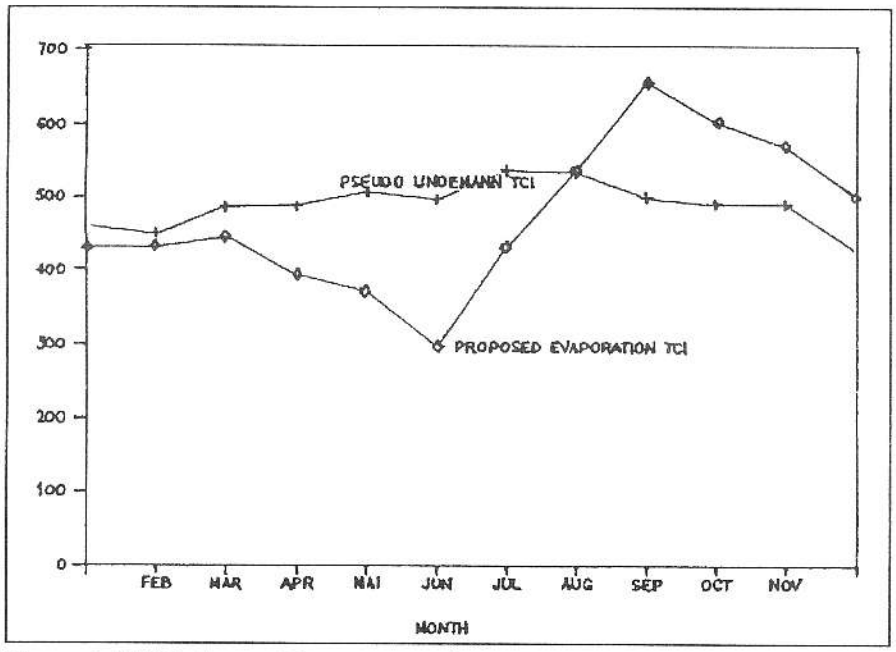

Figure 4: TCI Indexes, 30 years mean (at Catanduva, S.P., Met. Station).

conditions, winter being only slightly worse than that.

These conclusions are not in agreement with the actual soaring experience for the region, as well as for other soaring sites of the SP state, and they seem to result from the effects of the humidity on the evaporation, spring being there a much dryer season than fall, as shown by the relative humidity values plotted in the same figure.

Introducing a humidity correction, on the evaporation values, a "Thermal Convection Index" can be created which, as shown in Figure 4, shows up the characteristic poor soaring weather of the winter season, and also brings to a more reasonable level the fall inferiority to spring.

The proposed Index is obtained by multiplying the total evaporation, by a mean wet bulb temperature, estimated from the relative humidity and mean temperature values, and this last one being corrected to sea level in order to permit the comparison of different altitude sites, that is:

T.C.I. = EVAP x WBT/5 with,

EVAP = total monthly water evaporation (mm)

WBT = 5.6 (RH - 1) + SLMT (0.35 x RH + 0.65) and

SLMT = MT - .007 x PH where:

RH = relative humidity (%)/100

MT = mean temperature (C deg.)

PH = pressure altitude (m)

The use of the "Wet Bulb" temperature, was preferred to the "Dew Point," due to the more linear behavior of the first, in the considered ranges of temperature and humidity.

Besides the better temporal resolution provided by the use of the proposed T.C.I., as compared to the use of bare evaporation data, the spatial resolution seems also to be kept as shown in Figure 5 for the Brazilian northeast.

The correlation of the proposed index with thermal convection and good soaring conditions in other countries and continents, especially in Europe, South Africa and Australia shall be verified before it could be adopted as an ideal soaring climatological parameter.

An additional correction of the Index to take the wind into account, could be considered but we can expect the wind influence to be small when compared to that of the convection, which seems to be the main mechanism responsible for the replacement of the moisted surface air by dryer one and so for the evaporation (and also for its reverse, condensation and rain).

In summary, evaporation, being function of temperature, convection, humidity, wind and vegetation is an indicator of the atmosphere available energy to bring aloft the water molecules (Stanley, 1980) and so indirectly, sailplanes.

It also seems to explain why the good soaring days and places are also extremely good...beer drinking ones!

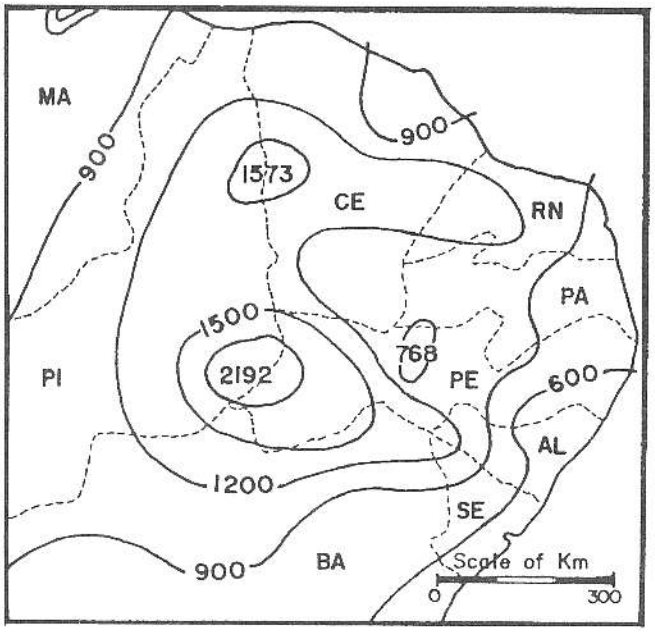

Figure 5: Proposed T.C.I. for the Brazilian NE Region in October.

BIBLIOGRAPHY

DNMet, "Normais Climatologicas (1961-1990) SPI/EMBRAPA, Brasilia, May, 1992.

Lindemann, C., "Soaring Climatology of Thermal Convection," Technical Soaring, Vol. 12, Number 3, S.S.A., Hobbs, NM, U.S.A., July, 1988.

Gedzelman, S.D., "The Science and Wonders of the Atmosphere," John Wiley & Sons, New York, U.S.A., 1980.

Visher, S.S., "Climatic Atlas of the United States," Harvard University Press, Cambridge, 1954.