Geogr. Fis. Dinam. Quat.
20 (1997), 225-232, 12 figg., 3 tabb.

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ANALYSIS OF EXTREME TEMPERATURE IN TERRA NOVA BAY, ANTARCTICA

ABSTRACT: BRANCUCCI G. & SILVESTRO M., *Analysis of estreme temperature in Terra Nova Bay, Antarctica.* (IT ISSN 0391-9838, 1997).

In a previous study the main statistical-mathematical characteristics of the temperatures, surveyed in the automatic stations around the Italian base of Terra Nova Bay in Antarctic, have been analysed and discussed.
In this note the daily extreme values (absolute maximum and minimum) are carefully considered in order to improve our understanding the dynamics of the temperatures.

KEY WORDS: Extreme temperature, Coreless winter, Katabatic wind, Terra Nova Bay, Antarctica.

RIASSUNTO: BRANCUCCI G. & SILVESTRO M., *Analisi delle temperature estreme di Baia Terra Nova, Antartide.* (IT ISSN 0391-9838, 1997).

In un precedente lavoro sono state analizzate le caratteristiche matematico-statistiche salienti delle temperature rilevate a mezzo di centraline automatiche della base italiana di Terra Nova Bay in Antartide. In questa nota si analizzano i valori estremi (massime e minime assolute) al fine di meglio comprendere la dinamica delle temperature. In particolare, attraverso l'utilizzo di un modello matematico si comparano i valori delle temperature estreme e si individuano:
- Tre «stagioni» con caratteri termici peculiari.
- Si localizza con maggiore precisione il periodo di passaggio di masse d'aria relativamente calde che influenzano la temperatura nel periodo in cui manca il contributo della radiazione solare.
- Si individua un incremento tendenziale delle temperature.

TERMINI CHIAVE: Temperature estreme, *Coreless winter*, Vento catabatico, Baia Terra Nova, Antartide.

CONSISTENCY OF THE DATA

In table 1 the geographical characteristics of the data analysed (columns 1-4) and the periods of operations with the availability of observations (column 5-6) are summarised.

All the stations (fig. 1) present working periods statistically acceptable except for 7354 which is not considered in the following note. The data are confirmed in fig. 2, in which we can observe that the recordings of the stations show a discontinuity in the survey of the series, concentrated particularly in the first years of operation and, for some stations, also in the year 1991-1992; such anomalies are due to instrumental breakdowns.

ANALYSIS OF THE DATA

Figs. 2 and 3 show data concerging the daily maximum and minimum value of temperature. It is clear that the temperature values present three characteristic trends: a considerable decrease in the first period of the year, a more homogeneous course in the middle period and finally a sudden increase. It also clear that there is considerable variability. In the values of both sets considered within the limits of the respective trends, which shows that the standard deviation, through which the variability has been analysed (fig. 4), is greater in the middle periods of the years considered.

For a better definition of the thermic conditions observed, mathematical instruments were used because they allow to attenuate the variability without altering the original series too much. This is possible using various mathematical instruments such as the moving average (Picone, 1990) and the penthadic average (Grigioni, 1991). These methods involve the loss of data at the beginning and at the end of the series considered. Such loss had to be eliminated or minimised in our situation. That is why we decided to use a numeric «filter» to replace the daily datum,

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Research carried out in the framework of a Project on Glaciology and Paleoclimatology of the Italian Programme for Antarctic Research, and financially supported by Enea through a cooperation agreement with Università degli Studi di Milano.

We would like to thank Prof. Arnaldo Longhetto, University of Torino, for his useful advice and critical revision of the manuscript. Dr. P. Grigioni and A. Pellegrini of Enea: U.O. Acquisizione dati Meteorologici in Antartide del Progetto Osservatori Geofisici e Geodetici del Prna for the data supplied necessary to this elaboration.

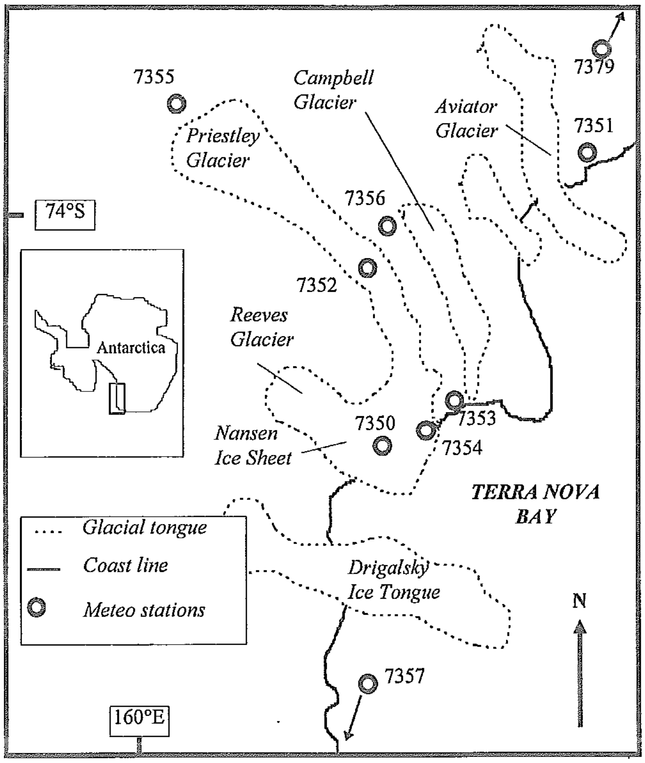

FIG. 1 - Location of the study area.

T_i, with a pondered average (t_j) calculated on the three data immediately previous and on the three immediately following and on the datum itself according to this relation:

$$t_i=\frac{\sum_{n=i-3}^{i+3} p_n \cdot T_n}{\sum_{n=i-3}^{i+3} p_n} \qquad (1)$$

where

$$pn=\frac{1}{T_n-\frac{1}{7}\cdot\left(\sum_{j=n-3}^{n+3} T_j\right)}$$ is the weight of the n^{th} datum. (2)

The main advantage of this method, widely used in the analyses of the temporal series (Katsoulis, 1987; Colacino & Rovelli, 1982), are:

a) it reduces the oscillation range of daily frequency;

b) it does not alter the fluctuation with weekly or monthly frequency.

Furthermore the extreme events, i.e. the temperatures with values, that are too different from the average, have less importance in the general context of the analysis. Their «weight» in (1) is reduced.

In fact, as we can see from (2), the more datum T_n moves away from the average value of the seven days in which it is included, the smaller is the value of the weight p_n associated with it.

The loss of the three initial data for each series, is compensated by the relative original value.

As to the original series the curves transformed by (1) present (fig. 5):

- the same oscillation as the original one, but they ignore the excessively marked peaks;
- they do not present vertical or horizontal translation with respect to the original data;
- furthermore the method provides a clear analysis of the trends of the parameter considered.

TABLE 1 - Geographical location of the Automatic Weather Stations

ID STAT	LAT (S)	LONG (E)	h (m s.l.m.)	DATA First	Last
7350	74° 47' 45"	163° 18' 46"	55	02-1987	12 1994
7354	74° 41' 42"	164° 07' 23"	70	01-1993	12-1994
7353	74° 41' 42"	164° 05' 36"	80	01-1987	12-1994
7351	73° 35' 10"	166° 37' 16"	183	01-1987	12-1994
7357	76° 43' 56"	163° 00' 35"	200	01-1990	12-1994
7379	73° 04' 21"	169° 06' 55"	500	01-1990	12-1994
7352	74° 15' 14"	163° 08' 41"	640	01-1987	12-1992
7356	74° 10' 59"	163° 29' 00"	1700	01-1990	12-1994
7355	73° 38' 18"	160° 38' 35"	1930	01-1989	12-1992

ANNUAL COURSE OF THE TEMPERATURE

The annual course (fig. 5) may be divided into three separate seasons (*sensu* Piccolo, 1990) defined as sequences of days:

- season I (between 0/20-80/100 days);

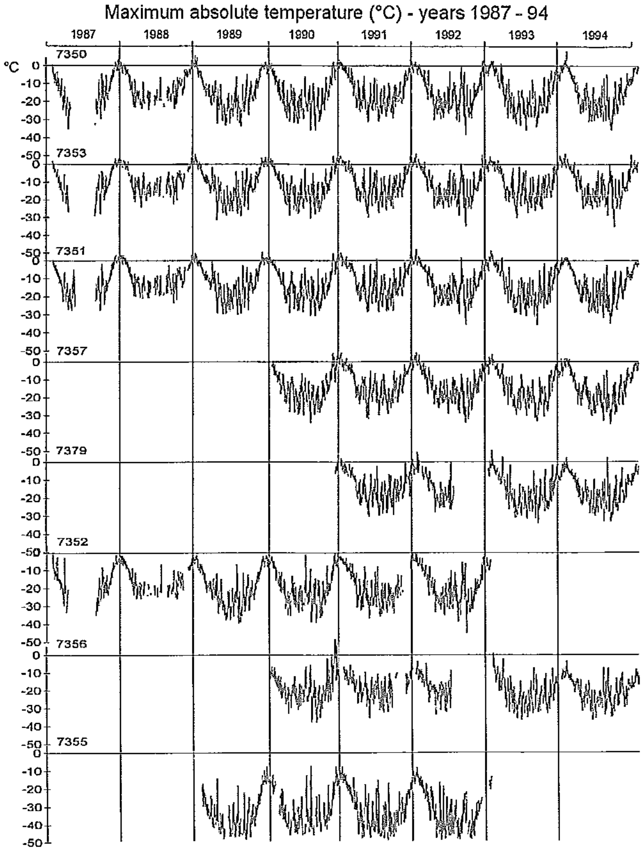
Maximum absolute temperature (°C) - years 1987 - 94

FIG. 2 - See text.

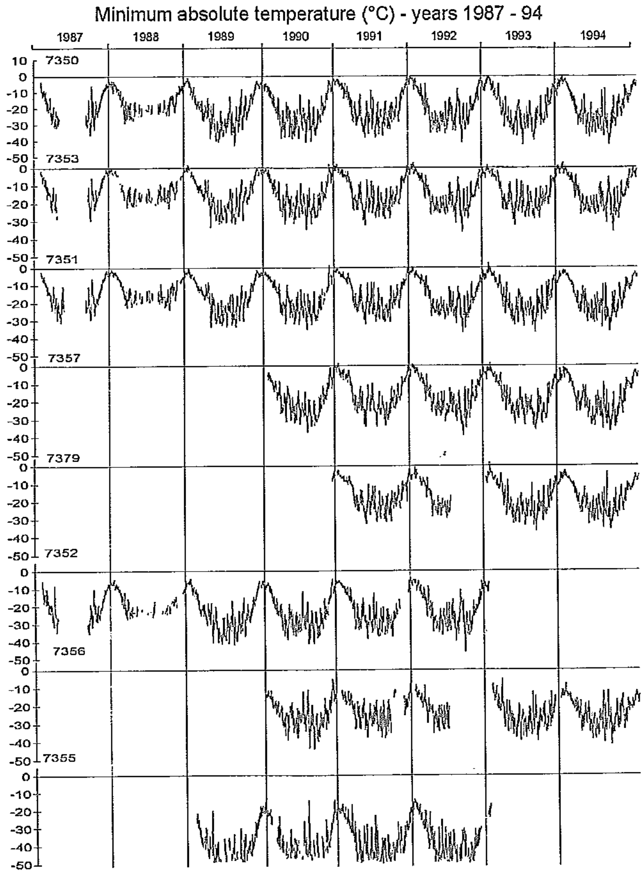

FIG. 3 - See text.

- season II (between 80/100-260/280 days);
- season III (between 260/280-360/20 days).

The above mentioned limits are expressed in days from the beginning of the year, but, in order to apply the interpolations subsequently used, we let the origin of the season be at a hypothetical moment ϕ coinciding with the beginning of the season itself. The limits change in relation to the station and the year considered. Figs. 6 and 7 confirm that:

- season I is characterised by a heavy decrease in temperature;
- season II is characterised by a more «homogeneous» course but with strong inner oscillations;
- in season III the temperatures are characterised by a clear increase.

In order to compare the seasonal courses in the various years and stations, mathematical models were used because they allow a synthetic description of the seasons themselves with their parameters.

SEASONS I AND III

For the season I and the season III a linear relation was adopted:

$$T(t)=at+b \qquad (3)$$

where

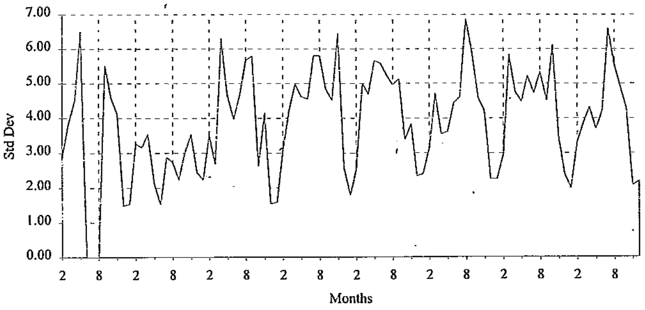

FIG. 4 - All station standard deviation average. Period 1987-1994.

$T(t)$ = temperature [°C];
a = angular coefficient [°C * days $^{-1}$];
b = intercept [°C];
t = time [days]

The distinction between the periods is determined by the sign of the angular coefficient:

- $a<0$ for season I and $a>0$ for season III.

The individualisation of the model for season II was less immediate. The linear relation, in fact, is less appropriate because, as we have previously affirmed, the intermediate period of the year in characterised by strong variabilities.

Therefore it is possible to use polynomial relations for complex courses such as:

$$a_0 + a_1t + a_2t2 + a_3t3 + \dots \qquad (4)$$

or relations characterised by a linear combination of sinus and cosine:

$$\delta sin(\varepsilon t)+\phi \cos(\gamma t)+ \dots \qquad (5)$$

Various attempts showed that polynomial (4) allows a better approximation of the data.

Such approximation, obviously, improves when the degree of the polynomial used increases but at the same time its complexity and difficulty in interpretation increases as well. The best compromise between interpretation and simplicity of use is a second degree polynomial:

$$T(t) = \alpha + \beta * t + \delta * t^2 \qquad (6)$$

where

$T(t)$ = *temperature* [°C]; α = [°C]; β = [°C * *days*$^{-1}$]; δ = [°C * *days*$^{-2}$]; t = *time* [*days*]

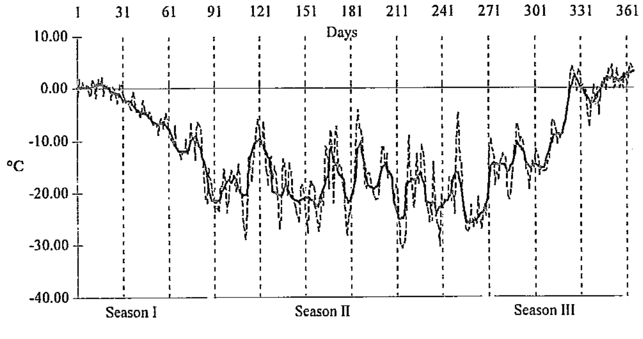

FIG. 5 - Comparison between the original data (dashed line) and interpolated data (bold line).

DISCUSSION OF THE RESULTS

SEASONS I AND III

In tab. 2 the parameters of the linear relation used are summarised, for each station and each year considered, for the maximum (T_x) and minimum (T_n) temperatures. It is clear that the high values of the coefficient of correlation (columns c and c') suggest that the model adopted is suitable for the description of the data surveyed.

If we consider the angular coefficient (columns a and a') we may notice that it involves a certain parallelism between the interpolating straight lines, as it assumes similar values. This means that, apart from the absolute values, the instruments survey data which are substantially comparable. The angular coefficient also shows a progressive reduction in the absolute value, that is the interpolating straight line assumed a more «horizontal» course, particularly between the heights 200 m and 1700 m (stations 7356 and 7357) with respect to the heigts 0 m and 200 m and those

TABLE 2 - Linear relation parameters for each station and each year

				Tx			Tx				Tn			Tn
				Season I			Season 111			Season I			Season III	
			(°/day)	(°)		(/day)	(°)		(°/day)	(°)	R	(°/day)	(°)	
stat	m	year	a	b	c	a'	b'	c'	a	b	c	a'	b'	c'
7350	55	87	-0.280	-3.490	-0.970	0.210	-17.450	0.860	-0.330	-6.560	-0.980	0.200	-29.660	0.830
7350	55	88	-0.210	1.960	-0.910	0.170	-14.590	0.910	-0.240	-2.510	-0.950	0.190	-20.550	0.910
7350	55	89	-0.290	2.960	-0.980	0.250	-19.380	0.940	-0.270	-2.200	-0.990	0.250	-24.440	0.940
7350	55	90	-0.210	1.590	-0.960	0.270	-19.510	0.940	-0.240	-3.010	-0.960	0.280	-25.100	0.960
7350	55	91	-0.150	1.130	-0.970	0.250	-18.780	0.920	-0.250	-0.860	-0.950	0.300	-25.470	0.940
7350	55	92	-0.210	1.870	-0.970	0.240	-20.560	0.960	-0.250	-0.470	-0.990	0.240	-23.900	0.940
7350	55	93	-0.210	2.410	-0.920	0.250	-20.660	0.940	-0.270	1.070	-0.940	0.280	-25.490	0.950
7350	55	94	-0.250	3.230	-0.980	0.180	-16.950	0.910	-0.310	1.280	-0.980	0.190	-21.470	0.920
7353	80	87	-0.280	-0.600	-0.950	0.190	-14.390	0.860	-0.290	-3.260	-0.980	0.230	-20.060	0.920
7353	80	88	-0.200	3.360	-0.910	0.160	-12.240	0.840	-0.200	0.350	-0.910	0.170	-15.350	0.820
7353	80	89	-0.190	3.200	-0.980	0.200	-14.860	0.910	-0.190	0.320	-0.990	0.230	-19.500	0.940
7353	80	90	-0.210	3.910	-0.960	0.240	-15.660	0.930	-0.210	0.840	-0.960	0.260	-20.040	0.950
7353	80	91	-0.220	4.940	-0.930	0.230	-15.960	0.930	-0.230	2.520	-0.910	0.240	-19.980	0.950
7353	80	92	-0.180	3.170	-0.960	0.220	-17.180	0.930	-0.190	1.090	-0.960	0.230	-20.710	0.950
7353	80	93	-0.210	4.820	-0.920	0.230	-15.960	0.930	-0.220	2.380	-0.910	0.240	-19.980	0.950
7353	80	94	-0.180	3.170	-0.960	-0.050	-0.100	-0.430	-0.190	1.090	-0.960	0.240	-20.960	0.950
7351	183	87	-0.280	-1.250	-0.960	0.200	-15.950	0.860	-0.300	-3.320	-0.970	0.230	-21.330	0.910
7351	183	88	-0.210	3.710	-0.930	0.160	-12.730	0.850	-0.180	-0.700	-0.960	0.170	-16.960	0.800
7351	183	89	-0.190	2.910	-0.980	0.220	-16.590	0.910	-0.180	-0.970	-0.960	0.230	-21.060	0.940
7351	183	90	-0.200	3.260	-0.940	0.250	-17.610	0.920	-0.140	-1.740	-0.960	0.260	-21.870	0.950
7351	183	91	-0.200	3.680	-0.920	0.220	-16.720	0.930	-0.090	-2.650	-0.900	0.240	-21.340	0.940
7351	183	92	-0.170	2.440	-0.970	0.230	-18.480	0.940	-0.120	-1.940	-0.970	0.230	-22.610	0.960
7351	183	93	-0.210	3.840	-0.930	0.240	-19.800	0.930	-0.170	-0.450	-0.940	0.250	-23.440	0.940
7351	183	94	-0.210	3.840	-0.930	0.160	-15.950	0.850	-0.220	-0.830	-0.960	0.190	-19.750	0.920
7357	200	90	-0.210	1.480	-0.950	0.240	-17.310	0.920	-0.240	1.600	-0.910			
7357	200	91	-0.220	3.420	-0.890	0.250	-18.250	0.960	-0.220	-3.530	-0.960	0.270	-22.690	0.950
7357	200	92	-0.180	1.440	-0.960	0.220	-18.500	0.940	-0.220	-3.530	-0.960	0.250	-21.490	0.970
7357	200	93	-0.170	-0.140	-0.870	0.220	-20.990	0.920	-0.180	-0.540	-0.950	0.240	-22.060	0.950
7357	200	94	-0.290	3.140	-0.970	0.170	-16.460	0.860	-0.140	-3.210	-0.860	0.230	-24.260	0.940
7379	500	90					-2.830	0.550	-0.280	0.310	-0.960	0.190	-20.270	0.890
7379	500	91	-0.170	-0.130	-0.920	-0.170	-18.170	0.890	-0.170	-2.670	-0.900	0.210	-22.060	0.930
7379	500	92	-0.170	0.260	-0.910	0.000	1.100	-0.610	-0.150	-2.450	-0.900	0.210	-22.060	0.930
7379	500	93	-0.190	0.250	-0.890	-0.020	-20.950	0.920	-0.190	-1.990	-0.920	0.230	-24.260	0.940
7379	500	94	-0.240	0.090	-0.980	-0.050	-17.700	0.860	-0.240	-2.030	-0.980	0.160	-20.700	0.900
7352	640	87	-0.320	-5.600	-0.710	0.220	-22.370	0.910	-0.280	-10.430	-0.950			
7352	640	88	-0.200	-2.770	-0.940	0.160	-15.750	0.710	-0.240	-4.830	-0.960	0.180	-19.540	0.630
7352	640	89	-0.250	-1.940	-0.980	0.270	-25.240	0.960	-0.250	-4.690	-0.980	0.280	-28.990	0.960
7352	640	90	-0.260	-1.540	-0.970	0.270	-24.100	0.950	-0.250	-4.900	-0.970	0.290	-28.890	0.960
7352	640	91	-0.240	-1.810	-0.910	0.200	-15.660	0.750	-0.260	-3.740	-0.940	0.200	-17.120	0.580
7352	640	92	-0.210	-2.700	-0.980	0.250	-25.260	0.950	-0.210	-5.230	-0.970	0.260	-28.620	0.960
7356	1700	90	-0.170	-8.750	-0.960	0.310	-24.160	0.940	-0.170	-11.970	-0.950	0.270	-30.330	0.870
7356	1700	91	-0.190	-5.400	-0.890	-0.120	-0.860	-0.460	-0.170	-11.730	-0.870	0.190	-19.720	0.760
7356	1700	92	-0.130	-8.990	-0.950				-0.130	-12.040	-0.950	0.280	-30.980	0.910
7356	1700	93	-0.210	-3.390	-0.840	0.270	-25.830	0.790	-0.190	-10.420	-0.850	0.280	-30.980	0.910
7356	1700	94	-0.180	-8.650	-0.960	0.100	-21.950	0.670	-0.210	-10.670	-0.960	0.120	-25.810	0.790
7355	1930	89	-0.260	-23.410	-0.880	0.320	-39.130	0.970	-0.300	-25.400	-0.920	0.320	-45.220	0.970
7355	1930	90	-0.230	-10.220	-0.600	0.310	-37.370	0.940	-0.130	-18.130	-0.200	0.330	-44.440	0.940
7355	1930	91	-0 300	-10.750	-0.930	0.280	-36.820	0.930	-0.190	-19.160	-0.870	0.280	-41.760	0.920
7355	1930	92	-0.260	-12.110	-0.960	0.430	-37.620	0.750	-0.270	-16.660	-0.970	0.450	-42.160	0.700

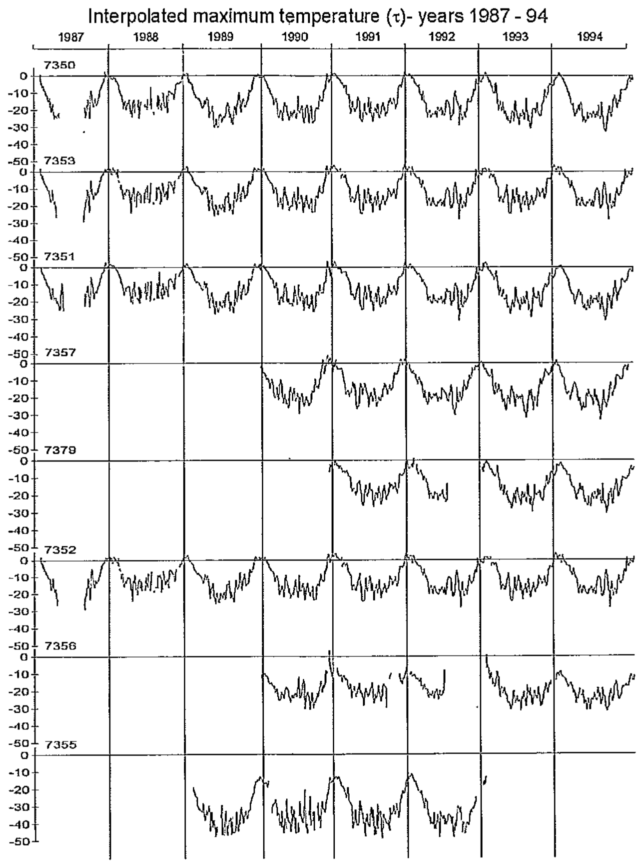

FIG. 6 - See text.

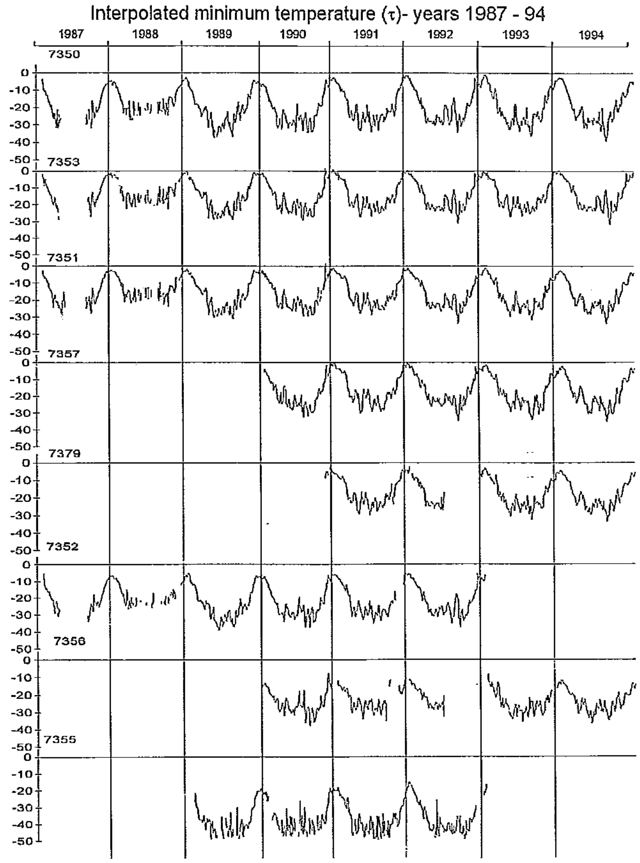

FIG. 7 - See text.

higher than 1700 m. The same kind of differentiation is also confirmed by the value of the intercept (tab. 2, columus b and b') and it is already highlighted by the original values of the temperatures, due to a thermic reversal phenomenon (Brancucci & Silvestro, in press).

SEASON II

The second order polynomial model (parabola) adopted to analyse this period of the year does not register the same approximation of the linear relation. This is essentially due to two reasons:

- the variability of the temperatures in this period;
- the low order of the polynomial.

It is also necessary to emphasise that the years 1987-1988 have been excluded from this analysis as they lack data (figs. 6 and 7).

PARAMETER δ

In the equation (6), parameter δ indicates the orientation of the concavity of the interpolating parabola: if $\delta > 0$ the concavity is upward, if $\delta < 0$ the concavity is downward (fig. 8). The latter case shows that there are increasing temperature in this season which is the coldest (tab. 3, columns δ and δ').

Again with reference to the equation (6) we can calculate the coordinate of the vertex of the parabola $V_{(x,y)}$ from the relation:

$$V_x = \frac{-\beta}{2\delta}\ \text{(days) and}\ V_y = \frac{-\beta 2 - 4\alpha\delta}{4\alpha}\ (^\circ\text{C})$$

The relation between δ and V_x was analysed considering that the upward concavity ($\delta < 0$) may be related to the heating due to the passage of Atlantic air masses (*coreless winter*, Grigioni & *alii*, 1990) and that the vertex V_x, as it is expressed in days, makes it possible to individualise the «moment» of their passage.

Fig. 9 (a, b) shows the percentage of frequency of the cases $\delta > 0$ and $\delta < 0$.

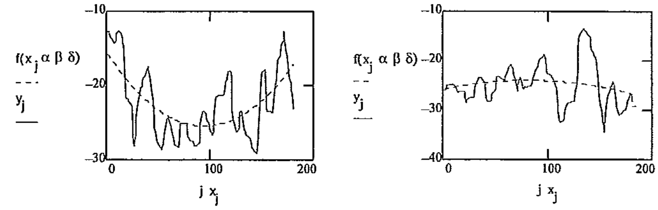

FIG. 8 - Example of interpolation with equation (6). δ>0 (left), δ<0 (right).

TABLE 3 - Manca titolo

					Tx					Tn		
					Season II					Season II		
stat	m	year	a	b	δ	Vx	Vy	a	b	δ	V'x	V'y
7350	55	89	-15.51	-0.20	1.16E-03	88.00	-24.54	-21.09	-0.23	1.28E-03	90.00	-31.47
7350	55	90	-21.27	0.00	-4.98E-05	14.00	-21.26	-27.66	0.01	-1.48E-04	41.00	-27.42
7350	55	91	-17.64	-0.08	4.42E-04	88.00	-21.06	-22.98	-0.11	6.25E-04	89.00	-27.95
7350	55	92	-22.92	0.06	-2.81E-04	113.00	-19.34	-28.91	0.08	-3.34E-04	112.00	-24.75
7350	55	93	-20.38	-0.07	4.25E-04	86.00	-23.49	-23.60	-0.12	6.74E-04	90.00	-29.09
7350	55	94	-19.54	-0.09	4.35E-04	99.00	-23.82	-22.68	-0.12	5.37E-04	107.00	-28.83
7353	80	89	-15.92	-0.01	-5.88E-05	-111.00	-15.20					
7353	80	90	-15.92	-0.01	-5.88E-05	-111.00	-15.20	-19.21	-0.04	5.31E-05	375.00	-26.67
7353	80	91	-15.20	-0.05	2.94E-04	83.00	-17.20	-18.76	-0.06	3.05E-04	100.00	-21.80
7353	80	92	-17.85	0.02	-9.80E-05	113.00	-16.60	-20.99	0.01	-7.20E-05	65.00	-20.69
7353	80	93	-15.20	-0.05	2.94E-04	83.00	-17.20	-18.76	-0.06	3.05E-04	100.00	-21.80
7353	80	94	-17.85	0.02	-9.80E-05	113.00	-16.60	-20.91	0.01	-6.03E-05	58.00	-20.71
7351	183	89	-12.97	-0.18	9.72E-04	94.00	-21.60	-16.00	-0.23	1.17E-03	97.00	-26.86
7351	183	90	-16.75	-0.01	-9.22E-05	-67.00	-16.34	-20.85	-0.02	-9.64E-05	-86.00	-20.13
7351	183	91	-15.57	-0.05	2.66E-04	91.00	-17.78	-19.33	-0.07	3.18E-04	111.00	-23.25
7351	183	92	-19.64	0.04	-2.03E-04	95.00	-17.80	-23.07	0.02	-1.61E-04	54.00	-22.60
7351	183	93	-17.27	-0.10	5.52E-04	86.00	-21.39	-20.69	-0.08	4.04E-04	102.00	-24.87
7351	183	94						-19.88	-0.09	3.75E-04	0.00	0.00
7357	200	90	-15.94	-0.07	1.85E-04	176.00	-21.69	-19.77	-0.07	1.36E-04	262.00	-29.09
7357	200	91	-15.71	-0.05	2.37E-04	109.00	-18.54	-19.52	-0.08	3.63E-04	110.00	-23.89
7357	200	92	-18.78	-0.01	-1.66E-05	-286.00	- 17.42	-23.68	0.03	-2.64E-04	58.00	-22.78
7357	200	93	-17.68	-0.06	1.81E-04	156.00	-22.09	-19.75	-0.09	2.89E-04	147.00	-26.01
7357	200	94	-16.31	-0.10	4.02E-04	125.00	-22.58	-19.26	-0.11	3.68E-04	148.00	-27.31
7379	500	91	-16.23	-0.07	3.87E-04	96.00	-19.78	-19.95	-0.08	3.80E-04	102.00	-23.93
7379	500	92	-19.79	-0.02	2.94E-05	276.00	-22.04	-23.01	-0.04	2.07E-04	86.00	-24.53
7379	500	93	-20.11	-0.05	2.78E-04	82.00	-21.96	-21.44	-0.08	4.27E-04	98.00	-25.55
7379	500	94	-18.03	-0.09	4.09E-04	104.00	-22.45	-20.06	-0.10	4.55E-04	114.00	-26.01
7352	640	89	-20.82	-0.19	1.06E-03	90.00	-29.38					
7352	640	90	-25.61	0.02	-1.75E-04	55.00	-25.07	-28.75	0.00	-7.84E-05	6.00	-28.75
7352	640	91	-21.56	-0.09	4.30E-04	100.00	-25.84	-25.30	-0.09	4.41E-04	99.00	-29.65
7352	640	92	-25.87	0.04	-2.70E-04	82.00	-24.06	-28.65	0.03	-1.64E-04	76.00	-27.71
7352	640	93						-15.55	-0.21	1.12E-03	0.00	0.00
7356	1700	90	-22.01	0.03	-2.59E-04	52.00	-21.30	-27.09	0.03	-3.04E-04	41.00	-26.57
7356	1700	91	-18.77	-0.13	1.07E-03	62.00	-22.91	-24.34	-0.12	8.46E-04	68.00	-28.29
7356	1700	92	-21.59	-0.03	4.16E-04	33.00	-22.04	-26.42	-0.02	4.51E-04	25.00	-26.71
7356	1700	93	-22.48	-0.08	5.10E-04	79.00	-25.70	-23.70	-0.33	3.88E-03	43.00	-30.85
7356	1700	94	-22.13	-0.09	5.09E-04	87.00	-26.02	-22.57	-0.25	1.67E-03	76.00	-32.24
7355	1930	89						-39.15	-0.12	6.02E-04	0.00	0.00
7355	1930	90	-34.95	-0.04	2.12E-04	99.00	-37.02	-43.38	0.03	-1.13E-04	140.00	-41.18

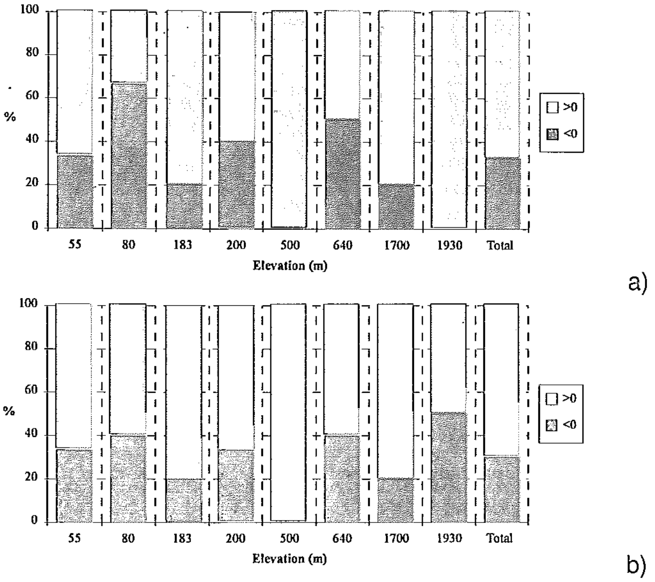

FIG. 9 - Relation between percentage of δ > 0 and δ < 0. Above: Maximum temperature; Below: Minimum temperature.

We observe that frequencies $\delta > 0$ are higher close to the sea level and are rarer, even if present, at higher elevation. This may be explained if we consider that relatively warmer air masse rise and slide on the colder air masse with a consequent increase in temperature at higher altitude (fig. 12).

Fig. 10 (a, b, c, d) shows the frequencies of the concavities, positive or negative, in relation to the number of days spent from the beginning of season II ([1]). We may see that:

- when $\delta > 0$:

– maximum temperatures have a principal maximum averaging 90 days and a secondary maximum of 120 days (June, July in reference to year);

([1]) Class 0 includes all those parabolas the vertex of which is outside season II; in these cases the interpolating curve is monotonous and it presents neither maximum nor minimum well defined. Such phenomenon may be due to the *Coreless Winter* one but it is probably less intensive.

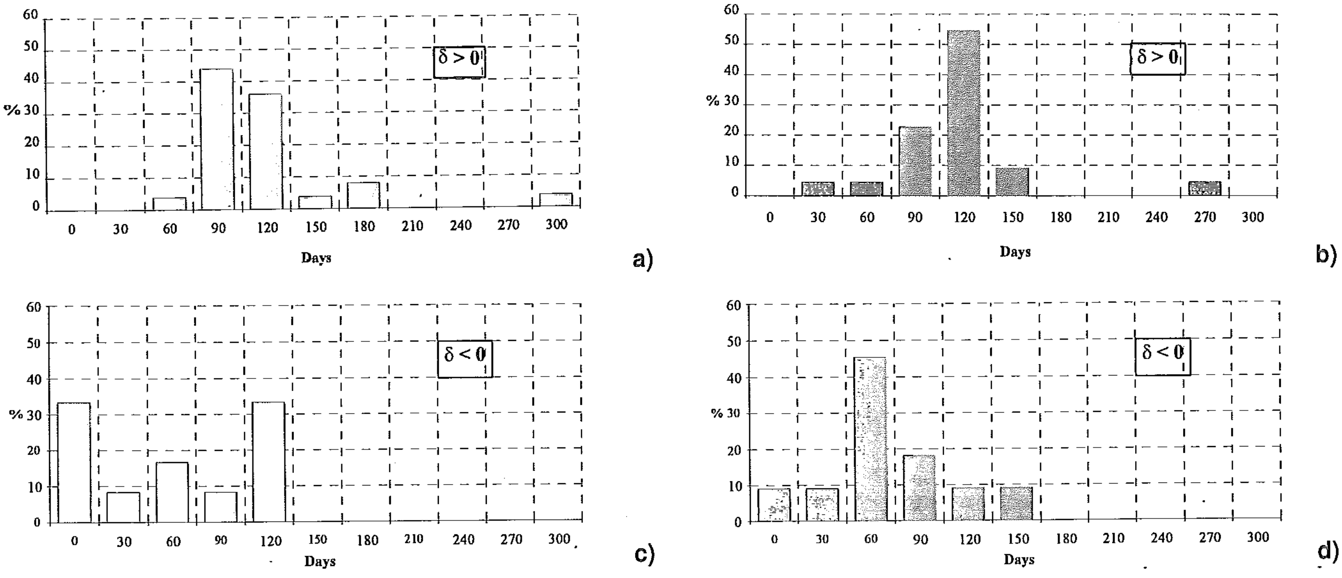

FIG. 10 - Frequency of vertex which δ > 0 and δ < 0 related to co-ordinate of V_x. a) and c) maximum temperature; b) and d) minimum temperature.

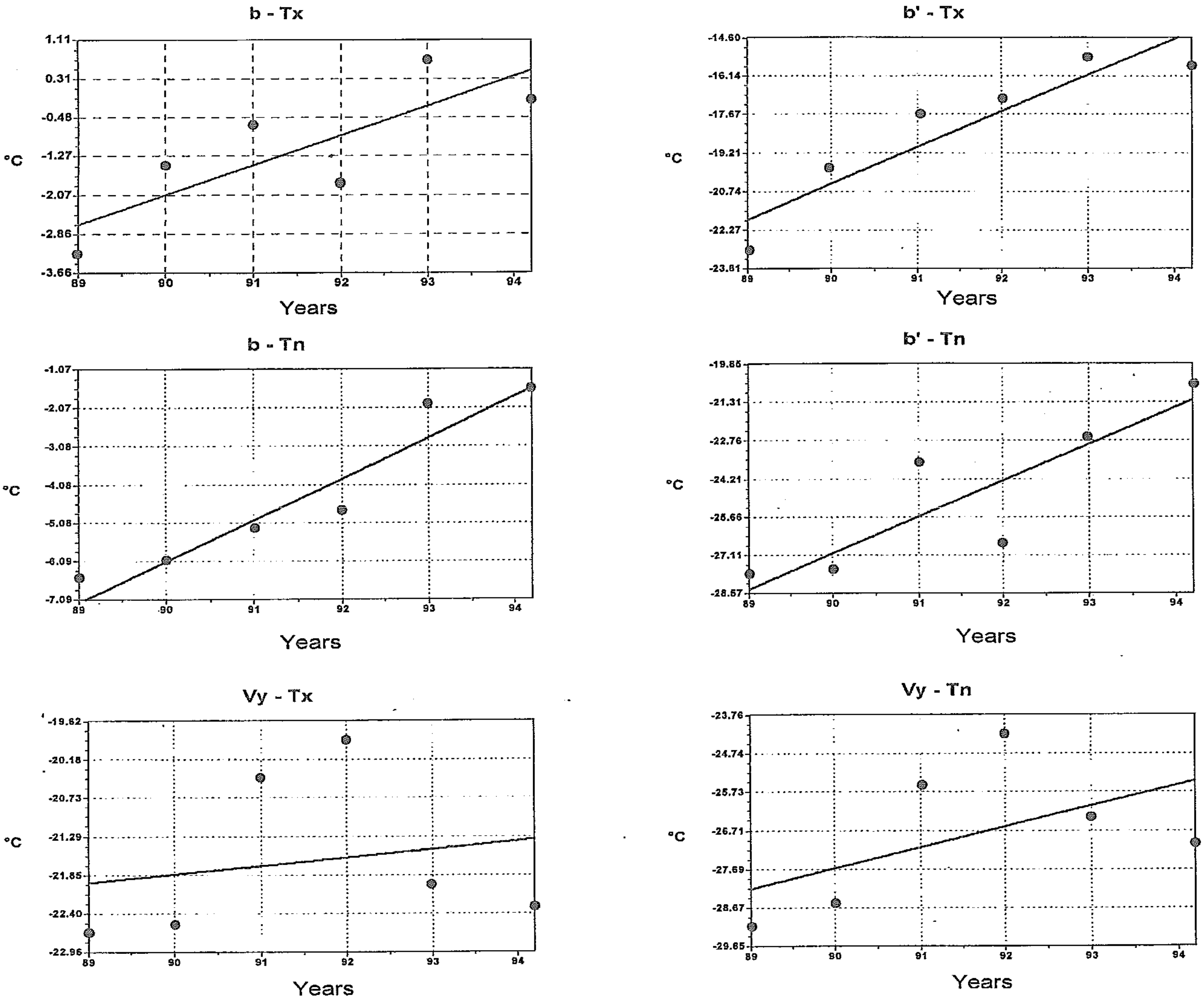

FIG. 11 - Relations between b-Tx and b-Tn season I; between b'-Tx and b'-Tn season III and between Vy-Tx and Vy - Tn season II.

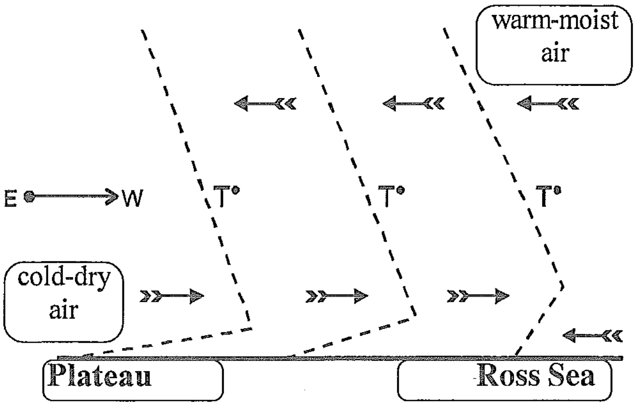

FIG. 12 - *Coreless winter* phenomenon (from Grigioni & *alii* 1990).

– minimum temperatures record a maximum averaging on 120 days (July).

It is clear that July is the month which in some years records the absolute minimum (*δ>0*), in others it is the month in which there are heating phenomenon *(δ>0)*. In the latter case it may be noticed also that the set of minimum temperatures has a certain heating.

A more accurate study is in progress on this evidence.

◉ when $\delta > 0$

– for maximum temperatures we may see a greater dispersion of the values, but the maximum is always on 120 days.

INTERANNUAL VARIATIONS

From the interpolating relations, analysing the coefficient b, b' and V_y, we may estimate the tendency of the temperatures in the season individualised.

From the intercept b and b' of the linear relation (3) and from the coordinate y of the vertex of the parabola (6) the average for each year between 1989 and 1994 was calculated. It is represented in figure 11 from which we may see that the temperature has a clear tendency to an increase. These results, although indicative for the reduced number of years available, are in accordance with the results obtained also by other authors in different zones (Villach & Bellagio, 1987; model of Manabe & *alii* in Braaten & *alii*, 1992).

CONCLUSION

The use of a mathematical model for the interpolation of climatic data makes possible a synthetic and comparative analysis of the daily extreme temperatures surveyed by Italian stations in Antarctica.

In particular, such models made it possible:

– to individualise three seasons with particular thermic characteristics;

– to individualise with a more temporal precision the passage of relatively warmer air masses which influence the temperature of season II which lacks sun radiation.

– to individualise the increasing trend of the temperatures in the period observed.

Therefore we think that the «refining» of the models, above all for season II, and their application also to the other climatic components, allows a better analysis of the climatic dynamics in an extreme environment such as the one which we have examined.

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