

Biometeorology of Psychiatric Disorders

J. SAN-GIL, J. L. GONZÁLEZ DE RIVERA AND J. GONZÁLEZ

**EN: EUROPEAN TEXTBOOK OF PSYCHIATRY.
EDITOR: A. SEVA.
EDITORIAL ANTHROPOS, BARCELONA, (1991)**

Biometeorology of Psychiatric Disorders

J. SAN-GIL, J.L. GONZÁLEZ DE RIVERA and J. GONZÁLEZ

I. Time of the year, climate and psychopathology

Since ancient times certain mental diseases have been believed to have a time of the year in which their clinical manifestations were more likely to occur ("predilection" period), and hence the seasonality of certain psychological diseases is a theory that has long been put forward, especially with regard to affective disorders and the most tragic consequence of these, suicide.

The question of whether psychiatric pathology is related to the seasons, as defined above, gives rise to difficulties since, as De Rudder stated in his now classic work on the subject of seasonal pathology *Basis of Human Biometeorology* (1952) "the relation between time of the year, weather and climate is in itself complicated and difficult to grasp in its entirety" and, furthermore, "we have access to only insignificant insight into the direct climatic influences on morbid processes in man". In addition, the fact that a specific psychopathological process increases significantly during a given time of the year (season or otherwise) may indicate that it relies on some physiological or psychological mechanism which is directly affected by a climatic variable and therefore presents an annual variation in relation to this. But it could also be the expression of an autonomous biorhythm of the altered organism, a *circoannual chronopathology* which

is influenced in a more indirect and remote way by external factors. This explains the attempts by different researchers to find a circoannual rhythm of which the "natural" parameters (length, period, phase) coincide almost exactly with the facts although not necessarily with astronomical seasons. Thus, Müller et al. (1984) using the so called "*bioquarters*" proposed by De Rudder (1960) observed a closer relation between different psychiatric indicators and "*bioquarters*" than with the astronomic season. Other authors use 13-28 day intervals (in a year) instead of calendar months (Mawson & Smith 1981); seasons consisting of 91.3 days (Eastwood & Stiasmy 1978) or the *climatological season* (San-Gil et al. 1986) when this is clearly determined in a geographical region. Müller et al. (1984) criticize in clear-sighted fashion the main errors of methodology committed with excessive frequency in the analysis of the possible relationships between mental diseases and time of the year: mistaking the date of admission into hospital and the date of the beginning of onset of symptoms; the mixture of direct atmospheric weather (meteorotropic), climatic and chronobiological influences; overlooking social and anthropo-cultural influences; the entry as a consequence of its easiness, etc. Despite all the above difficulties, the abundant research undertaken in recent years allows us to state that, in our opinion, the seasonal behaviour of certain psychiatric indic-

ators (overall hospital admissions or admissions due to a particular cause, number of emergency psychiatric admissions, etc.) undoubtedly reflects the aggravation suffered by a significant number of patients (especially those with affective disorders) at a given time of the year, statistical evidence is available to support this and the situation has been recognized in the latest edition of the DSM-III-R of the American Psychiatric Association, 1988, which for the first time defines the "*seasonal pattern*" for emotional disorders. Good medical sense advises us to keep in mind that "there are no diseases, only sick people" and that a note should be made in the Clinical Records of chronic patients as to whether or not the problem was linked to seasonality for the purposes of prevention. The following are the most firmly established and most clinically relevant conclusions as taken from an exhaustive study of the subject published by San-Gil et al. in 1988.

In the case of neurotic disorders and anxiety, it is generally agreed that there is no relation with the seasons of the year (Kellner 1966), although some authors point to increased meteorotropism in neurotics (Faust et al. 1973-1974). This would mean that in the more variable seasons, with frequent and often sudden weather changes (Spring and Autumn) a higher incidence of these disorders could occur, although this represents only a pseudo-seasonal phenomenon.

There are few studies which examined the seasonality of alcoholism and drug dependence both of which are closely related to socioeconomic and cultural factors. Nevertheless, Faust et al. (1974), Müller et al. (1984) and San Gil et al. (1989) agree in highlighting spring as the peak season for the admission into hospital of drug addicts. The first two of the above mention-

ed authors have reached the same conclusion in the case of alcoholics also.

Emotional disorders present the greater seasonality. In some studies this finding is backed up by strong statistical evidence while in others it is seen more in terms of a pseudo-seasonal-phenomenon, related to a meteorological situation common but not exclusive to the season in which the disorders occur most frequently (the Föhn wind / suicide relation). Research into manic-depressive illnesses has shown the existence of one or two peak periods of occurrence in Spring or Autumn as well as the appearance of a semiannual and annual periodicity according to the diagnostic group to which certain patients belong. Thus, Rhimer (1980), using the diagnostic criteria of Fehigner et al. (1972) describes the manic-depressive bipolar type I patients as having a semiannual cycle with peak manifestations of mania in Spring and Autumn while the peaks for depression are in Summer and Winter. The bipolar type II patients show only one seasonal peak in the Spring. Frangos et al. (1980) find that the peak period for manic episodes as well as for depression is in the Spring and Müller et al. show higher than average figures for the first "bioquarter" (November-December-January) which corresponds to late Autumn/early Winter. Slater (1938) showed that many manic-depressive patients regularly suffered onset during a certain period of the year, a concept which ties in with that discussed by Eastwood & Stiasny (1978) "anniversary depression" a term which expresses the individual's expectation of being admitted to hospital at a certain time of the year as a psychological factor which has a bearing on the seasonal incidence of hospital admissions for affective disorders.

The manic episode or mania has its

highest level of manifestation in late-Summer/early-Autumn, a fact recognized as far back as the period of Greek civilization (Aretaeus 6th century B.C.) and still accepted today (Symonds & Williams 1976, Walter 1977, Myers & Davies 1978, Hare & Walter 1978, Parker & Walter 1982).

Undoubtedly the aspect of seasonality and psychopathology which has been studied most thoroughly is that of the relationship between depression and its possible consequence, attempted suicide (successful or not) and the time of year. In his book *Health, Weather and Climate*, Sulman (1976) states that more than 5000 publications deal with this question, a fact which is indicative not only of scientific and popular interest in this subject but also of the need to summarize such an extensive bibliography for the purposes of this chapter. Furthermore, according to Zung & Green (1974) between 62 and 92 % of those who committed suicide suffered from depression, while the proportion of patients with depressive disorders who commit suicide is between 10 and 50 %, which justifies taking together for examination the biometeorological indicators linked to both phenomena. In a critical summary of the literature, three facts stand out:

1. In ancient times, before scientific studies were undertaken, it was commonly believed that most suicides took place in Autumn, at least on the European continent (temperate area in the Northern Hemisphere). This viewpoint was a consequence of the idea, prevalent since ancient times, that gloomy weather, "dark and cold", typical of the season, caused humans to become sad, a tradition reinforced by Montesquieu in 1748.

2. With the publication of more rigor-

ous studies, it has become clear that most researchers find Spring/early Summer to be the favoured time both for suicide deaths (Guerry 1829, Westerlund 1898, Saelan 1864, Durkheim 1897, McGeorge 1942, Daigren 1945, McKinlay 1948, Swin-scow 1951, Takahashi 1964, Cerbus 1960, Eastwood & Peacocke 1976, Barraclough 1978) and for depression-related indicators: admissions for depression, depressive phase in M-D patients, beginning of the depressive episode, etc. (Kraines 1957, Angst et al. 1964, Lester 1971, Zung & Green 1974, Zung, Green & Durham et al. 1974, Cerbus & Dallara 1975, Eastwood & Peacocke 1976, Eastwood & Stiasny 1978, Parker & Walter 1982, García-Carretero et al. 1986).

3. In recent years, and in the most methodologically sound pieces of research, we see the reappearance of the dual cycle (half yearly and yearly), which was witnessed for affective disorders as a whole. Thus, R. Meares et al., in England and Wales (1981) and Nähyä (1982), in Finland, describe how the seasonal variation of suicide according to sex appears to comprise the sum of two harmful terms corresponding to 1/1 and 1/2 years. The masculine pattern is unimodal (one annual period wave) with its peak in Spring (or in August, which is the month before Spring in the Southern Hemisphere: Parker & Walter 1982), while women present a bimodal pattern in both hemispheres (two annual waves with a semiannual period) with peaks in Spring/early Summer and Autumn. Moreover, in Näyä's analysis it is indicated that Autumn suicides are characteristic of modern urban occupations, and have a bimodal pattern. Traditional rural occupations, (agriculture/stockbreeding) peak in Spring, and their pattern is uni-

modal, with a curve which follows the variation in sunshine throughout the year.

As for schizophrenic psychosis, it is surprising to note the scarcity of research into its possible seasonality. Moreover, the best studies, methodologically speaking, have produced contradictory results: Tromp (1959) found that psychomotor restlessness in a group of carefully chosen patients was a *pseudo-seasonal* phenomenon, related to the arrival of warm continental air during the Winter, i.e., a meteorotropic phenomenon, to which we shall refer later. Müller et al. (1984) fix the peak in the 1st *bio-quarter* (November, December, January), which coincides with the findings of Tromp, while Faust & Sarreiter (1973) and Hare & Walter (1978) found that Summer was the season in which schizophrenia prevailed.

In a contrast to the above, ever since Tramer (1929) detected the excess of schizophrenics born in the first quarter of the year (Winter and early Spring), consistent evidence of this seasonal phenomenon has been found in the USA (Knobloch & Pasamanick 1958, Torrey et al. 1977, Pulver et al. 1981) in Great Britain (De Sauvage Nolting 1939, 1951, 1953, 1955, Hare et al. 1975, 1979, O'Hare et al. 1980), in the Scandinavian countries (Dalenq 1968, 1974 Videbech et al. 1974, Odegard 1974 McNeil et al. 1976) in the Netherlands (De Sauvage Nolting) and in the Southern Hemisphere, in Parker & Neilson's works (1976) in New South Wales and Dalen's (1975) in South Africa. The reason for this phenomenon remains unknown, although different theories have been put forward to explain it:

A) Environmental theory: some seasonal environmental factor might be responsible for the damage caused in the central ner-

vous system, increasing the risk of becoming ill (Torrey 1980). The environmental elements which have been considered are as follows: climatic (temperature during the previous summer - Knobloch & Pasamanick 1958 - and in the cold period of the year, during which there is an excess of births - Torrey, 1980, Hare & Morgan 1981), indirectly seasonal elements, like variations in diet (lack of Vitamin C in Winter - De Sauvage Nolting); and those of a purely seasonal nature (increase of virosis in Winter).

B) Genetic: the "*genetic gain*" hypothesis supposes that the schizophrenic genotype provides particular resistance against allergens and infections, which would explain the increased survival rate among schizophrenic newborns compared with the rest of the population (Huxley 1964, Buck et al. 1977, Jones & Frei 1979).

C) Constitutional: this theory maintains that birth during the first months of the year implies greater constitutional damage (obstetric complications, viral infections) which may render the subject liable to a subsequent development of schizophrenia (Dalen 1974, Hare 1976, McNeil & Kaij 1978).

D) Date of conception: the parents of schizophrenic patients have a particular "reproductive pattern", with a greater number of conceptions in Summer, which would account for the increase in births of people with this mental disease during the first quarter of the year.

Finally, regarding mental diseases i_n general and/or overall psychiatric admissions, authors since Esquirol (1938) agree that Summer is the season of highest occurrence (Hutington 1915, Slater 1938 Myers & Davies 1978).

II. Weather, meteoropathology and meteorotropism

The present century has witnessed an increase in scientific observations regarding the relations between partial aspects of the global concept we call "weather" and most of psychiatric pathology. In our opinion these observations form an unsystematic block of information which gives the reader the impression that "everything can be related to everything" (San-Gil et al. 1988) and, although we must give due recognition to methodological difficulties and the efforts of researchers, these observations do not constitute knowledge which is of use in current practice. To prove the point the following examples suffice: Nixon (1924) associated anxiety with "meteorological phenomena in general"; Reiter (1953) established a relationship between suicide and electromagnetic waves from 1 to 12 kHz, which are called "atmospheric"; Zung et al. (1973) link the rate of admissions for depression to day-length; Mawson & Smith (1981) found a relationship between admissions for mania and relative humidity, etc. The exceptions are Föhn type ionized winds and meteorological situations with important biological and psychic influence, to which reference is made in the section dealing with meteorological stress.

In contrast to this, there is a paucity of Meteorotropic Analyses of Psychiatric Pathology, undoubtedly because it is a much more complex aspect requiring wide knowledge of meteorology and, consequently, greater cooperation between specialists in both disciplines, something which is both desirable and infrequent. As was explained in the section devoted to "definitions", Meteorotropic Analysis of a medical variable involves the classification

of common meteorological situations into previously established types of weather and a subsequent study to determine *if* the response of the medical variable to these types is non-uniform. From these the corresponding "meteo-sensitivity" is observed. Tromp (1959) directed and coordinated a study of this kind, concerning the degree of agitation (psychic and motor) and the irritability of a group of schizophrenic patients. The study, in our view, is a classic one due to the methodology used, and although the author does not use the concept of weather-type, as defined later by the WHO, he does refer to overall meteorological situations. The study was undertaken in seven psychiatric institutions in the West Netherlands, with the collaboration of 21 specialists attached to these hospitals. An important conclusion reached was that the state of agitation of the patients was related more to the type of air mass than to the weather factor considered in isolation (barometric pressure, wind speed and direction, humidity, passing of a front, etc.). In short, the restlessness and agitation observed increased with the arrival of continental warm air, while the flows of cold air had the opposite effect. In addition, the meteorological situations commonly considered to be "unpleasant" (intense rain, snow storms, etc.) did not affect the agitation curves unless they coincided with a simultaneous change in the air mass. Some apparently paradoxical effects were detected also, such as the alleviation of the state of agitation in the groups of patients in periods of very high temperatures during heat waves.

Recently, San-Gil et al. (1988), studying the relationship between emergency psychiatric admissions and meteorological conditions on the island of Tenerife, carried out a threefold analysis (seasonal, me-

teorological and meteoropathological), and found that total daily emergency admissions, depressive syndrome, suicide attempts, acute psychosis, acute drug addiction pathology and psychomotor agitation syndrome depend to a significant extent on the overall meteorological situation or kind of weather, whereas only the drug addiction-related admissions presented seasonality. The meteoropathological study was carried out as a second step, *after* establishing the sensitivity to each weather-type of each *diagnosis* or *cause of emergency admission*: it was noted that there was a direct influence exerted by temperature, and an inverse influence of Relative humidity and Barometric pressure during heat waves on suicide attempts and the psychomotor agitation syndrome. A negative correlation was also found between depressive syndrome and wind speed during this kind of weather. The daily emergency admissions are positively related to Pressure and Relative humidity during storms with Northerly winds, etc. This method permits the correct comparison of the bio/psychic effects of meteorological situations which occur in distant Geographical Areas provided that the kinds of weather are similar. Furthermore, it enables Preventive Medicine to be practiced when meteorological forecasts are made.

III. Meteorological stress

Following the modern conception of Stress as any situation of the organism in which the equilibrium of homeostatic mechanisms is altered in a significant way (Glez. de Rivera 1980), we define meteorological stress as the "Significant distortion of homeostatic body mechanisms secondary to the influence of changes in either isolated or combined weather compo-

nents". The weather factors (temperature, humidity, pressure and wind) constitute together with the cloud cover and the particular phenomena or "meteors" (rain, snow, etc.) the complete weather picture. Some weather patterns have proved to alter human functioning in a significant way, and may be rightly considered as "stressful weather". The strongly ionized wind known as "Foëhn" and the "heat waves" are two of the most common instances of "stressful weather".

Foëhn (latin *favonius*, greek *phoenix*, meaning "Hot wind from the south") is the common term in Central Europe for a meteorological situation which ends in a dry, warm, electrically charged and biologically active wind coming from a southern direction. - The phenomenon begins when hot and humid air is forced to ascend by orographic accidents well above the condensation level (in Central Europe, about 2,000 metres), descending on the opposite side as "Foëhn". There are many places on Earth where those conditions are met, to the despair of Foëhn-sensitive people. So we have the *Tramontana* in Catalonia and northern Italy, the *Tauerwind* in Salzburg, the *Maledetto Levante* in Italy, the *Autun* in the Pirenees, the *Mistral* in the Rhone valley and Provence, the *Halmiak* or *Almwind* in Yugoslavia, and the *Siroco* or *Viento Sur* in the Canary Islands.

From a meteorological point of view, the key factor is the formation in the Föehn zone of a very active area of friction between two layers of air, associated with the passing of a warm front. In this band of air so called *Kelvin-Helmholtz Waves* are formed, which are responsible for two phenomena: a) intense turbulence and barometric pressure variations (from 0.1-1 millibar); b) the recognized electric properties of the Föehn wind (the existence of

"sferics"-electromagnetic discharges with a frequency ranging from 1 to 100 kHz. and a duration of about 1/1000 sec.) and an intense ionization of the air (mainly positive sign of about 4000/cu. cm.).

Heat waves and desert-winds. - The tropical continental air mass, which is originated over the Sahara Desert, frequently

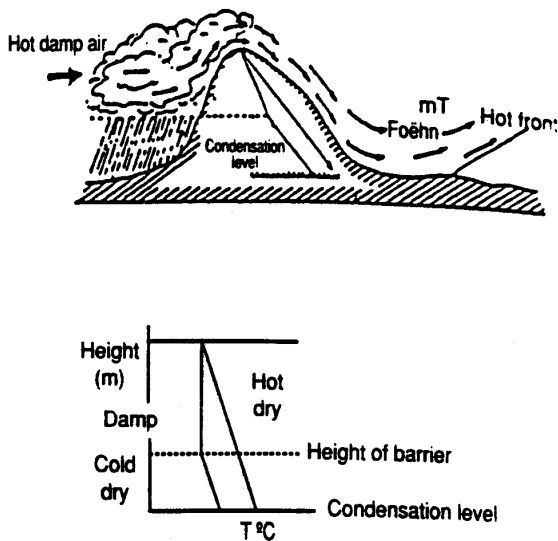


FIGURE 1. The Föhn effect

moves onto neighbouring areas, giving rise to so called *heat waves*, a meteorological situation which constitutes a particular characteristic of the climate of the affected areas. The extreme strength of heat waves is well known by the population of Mediterranean countries, the Canary Islands, Israel, etc. In the majority of cases these heat waves occur suddenly, and are characterized by high temperatures (10°C above the mean seasonal temperature), very low humidity (below 25%), the absence of clouds, and the existence of haze or "dust clouds" which usually accompany the blustery winds which are also commonplace. These hot winds are known by a particular name in the regions in which

they blow: Leveche in Morocco, Simoon or Sarkiye in Northern Africa, Siroco in Italy and the Canary Islands, Vent d'Espagne in France, Levante in Spain, Meltemia Etesiae in Greece, Sharav in Israel, etc. and they are generally known as "*desert winds*": In addition to the physical qualities already mentioned, these winds are heavily ionized and "*sferics*" similar to those described in the case of the Föhn wind, are produced within them, especially at the beginning and the end of the heat waves.

Both Föhn winds and desert winds (and other dry and electrically-charged winds) produce environmental tension capable of provoking the alarm reaction described by Selye in his theory of stress, in addition to causing problems of ionic balance and dehydration. Although we are far from understanding completely the psychobiological phenomena produced by the Föhn wind and those winds associated with heat waves originating in the Sahara Desert, the research carried out during the last years, mainly by the Bioclimatology Unit of the Hadassah-Hebrew University Medical Centre, under Sulman, has highlighted three important facts:

1) Except for dehydration and ionic alterations (greater during heat waves), the Psychobiological action of both climatological situations is similar, due to the similarity in their physical properties.

2) Due to a mechanism of "tiredness" or "debilitation", the organism of elderly people becomes increasingly incapable of reacting to the stressful situations commented upon above, and they lose their former endocrinological capacity. This causes a "deacclimatization", i.e. as the years pass, instead of becoming more adapted to certain types of weather which,

TABLE I. *Weather Reactions to Hot Dry Winds*

<i>Three types of weather reaction</i>	<i>Typical troubles that can arise within the three groups:</i>
1. Catecholamine deficiency exhaustion syndrome, 44% of patients, troubles increasing every year.	Hypotension, tiredness, apathy, exhaustion, depression, confusion, reduced concentration, ataxia, adynamia, hypoglycemic attacks with the urge to eat between meals.
2. Serotonin release irritation syndrome, 43 % of patients, 1 to 2 days before Sharav or Foehn when the ionization of the weather front attacks the patient.	Insomnia, irritability, tension, migraine, nausea, vomiting, scotoma, amblyopia, edema, heart palpitation, heart pain, asthma, dyspnoea, rheumatic and scar pain, flushes with sweating or shivering, hay fever, conjunctivitis, laryngitis, pharyngitis, tracheitis, giddiness, tremor, sinusitis, hyperperistalsis, pollakiuria.
3. Hyperthyroidism, "forme fruste" 13 % of patients, urinary neurohormones almost all increased.	Mixture of the symptoms of the 1st and 2nd groups with typical thyroid gland complaints: sensitivity to heat and cold, accelerated pulse, heightened BMR (basic metabolic rate), sweating, diarrhea, allergic reactions, reddening of the skin, acne, weight loss despite increased appetite, excessive activity combined with exhaustion.

(From F.G. Sulman, *Health, weather and climate*, 1976.)

after all, are "natural" for the inhabitants of the affected areas, the opposite occurs: homeostatic mechanisms are repeatedly subjected to such considerable strain or overload that they find it increasingly difficult to react.

3) In the sensitive population there are three clearly distinct types of reagents (Table I) which must be treated differently according to their neuroendocrinological reaction pattern.

Nowadays, the sociological importance of both types of weather is recognized, because of their capacity to produce particular discomfort in sensitive people, with an increase in aggressiveness and irritabil-

ity, and an anxiety which explains the increase in suicides, accidents, and probably criminality during the days in which these types of weather prevail. In addition, these types of weather have been found to alter people's responses to various tests (a deterioration of reaction in intelligence tests and an increase in scores on the Eysenck psychotism scale and in tests for neuroticism).

Appendix: Glossary of Meteorological Terms

Weather: the atmospheric situation in a particular place and time is called weather.

The "photograph" or "snapshot" image of the atmosphere captures appropriately the concept of weather, for it provides clear reference to its physical situation, described by means of the so called "*weather factors*" (temperature, humidity, pressure and wind), the "*cloud cover*" and the particular phenomena or "*meteors*" taking place (rain, haze, snow, etc.).

Meteorological pathology: "Study of the influence of specific single meteorological components (temperature, humidity, etc.) or groups of components on the origin and frequency of diseases and on the physiological phenomena of the diseases of man" (Tromp 1963). The type of study in which these relations are shown is called a Meteoropathological Analysis.

Air mass: Large masses of air whose paths and physical properties exhibit, in the horizontal direction, only small and continuous differences, extending over hundreds or even thousands of kilometers and in the vertical direction over more than one kilometer.

Weather type: Particular distribution of pressure systems and air masses over a specified geographical region, associated with typical general characteristics of weather. (World Meteorological Organization: *International Meteorology Vocabulary* 1966). Using this concept as their basis, meteorologists elaborate "weather types catalogues", enabling daily situations to be classified in such a manner that the weather type in itself becomes an independent variable.

Meteorotropism, meteorotropic disease and meteorotropic analysis: any phenomenon is said to present "meteorotropism" or "meteorotropical" behaviour or weather sensitivity if it can be shown that it is affected differently by the different types of weather. In order to carry out this kind of research

(Meteorotropic Analysis) correctly, it is necessary to classify the daily meteorological situations according to the *Catalogue of Weather Types* of the area. One of these catalogues, currently used by specialists in Europe is the *Catalogue of European Large Scale Weather Types*, report of the German Weather Service in the US zone (1959). Many symptoms, syndromes and diseases present meteorosensitivity.

Climate and climate analysis: the concept of *climate* represents the average weather conditions of a region in a double sense. Firstly, it supposes that in a given calendar (month, season) typical weather types which are characteristic of that period tend to be recurrent over the years; and secondly, that the result of such recurrence and similarity in the atmospheric situation over a particular orographic area over thousands of years becomes a feature of the region: its climate. This is described statistically by means of an ideal "mean situation" of the general parameters which define the weather for each region and each time of the year. This mean situation is established by averaging weather components over a period of at least thirty years, and this set of mean values is what defines the "normal values" of climate. Daily fluctuations of these ideal values are called "anomalies". For example, the "normal value" of the temperature in a particular place in June is calculated by averaging the mean temperature in June over at least thirty consecutive years. We call Climatic Analysis those studies which attempt to discover and/or establish the relations between mean values of a medical range and "normal values" of climate (which by their very definition will always be a mean value).

Seasonality and seasonal analysis: any medical variable (number of births, num-

ber of emergency admissions, etc.) has a "seasonal" behaviour or shows "seasonality" when its occurrence at different periods throughout the year which are defined as Seasons (Astronomical or Climatological) - is not uniform, and this lack of uniformity is statistically significant. Studies of this kind are called Seasonal Analysis. We must draw a distinction (De Rudder 1952) between diseases which are *properly seasonal*, "*pseudo-seasonal*" processes and '*indirect seasonal effects*'

Acclimatization and acclimation: Tromp (1963) defines *acclimatization* as the "complex of reversible changes of physiological response which increase the efficiency of individual organisms while they remain in an environment outside the neutral zone". *Acclimation* denotes the long-term changes taking place during a life time in order to obtain a better adaptation to the usual climate conditions.

Biometeorological indicator: these are the variables observed and actually measured by the researcher (number of suicides per day, number of admissions for depressive syndrome per day, etc.) which are supposed to be influenced by biometeorological or bioclimatic action. In practice, they constitute the basis of medical data which will be statistically analysed in relation to meteorological and/or climatic variables.

REFERENCES

- ANGST, J., GROF, P., HIPPIUS, H. et al., "La psychose maniaco-dépressive est-elle périodique ou intermittente?", *Cycles Biol. et Psychiatrie*, Geneva, George & Cie, 1968.
- ARETAEUS (600 B.C.), Cit. by LUCE, G.G., *Body time. The natural rhythms of the body*, St. Albans, Paladin, 1973.
- DALEN, P., "Month of birth and schizophrenia", *Acta Psych. Scandinavica* 203 (1968), 55-60.
- , "Season of Birth", *A Study of Schizophrenia and other Mental disorders*, Amsterdam, North Holland-American Elsevier, 1974.
- DE RUDDER, B., *Grundriss einer Meteorobiologie des Menschen*, Berlin, Güttingen, Heidelberg, Springer Verlag, 1952.
- DE SAUVAGE NOLTING, W.J.J., "Considerations regarding a possible relation between the vitamin-C content of the blood of pregnant women and schizophrenia, debilitas mentis and psychopathic", *Folia Psychiat. Neurol. Neerl.* 58, 4 (1955), 285-295.
- DURKHEIM, E., *Le suicide*, Paris. (Trad. in 1952 as: *Suicide: a study in sociology*, by J.A. Spaulding & Simpson, London, Routledge and Kegan Paul, 191-206.)
- EASTWOOD, M.R. & PEACOCKE, J., "Seasonal patterns of suicide, depression, and electroconvulsive therapy", *Brit. J. of Psych.* 129 (1976), 427-475.
- EASTWOOD, M.R. & STIASNY, S., "Psychiatric disorder, hospital admission, and season", *Arch. Gen. Psychiat.* 35 (1978), 769-771.
- FAUST, V., NEUWIRTH, R. & SARREITHER, P., "Wetter und psychische Krankheit. Eine retrospektive Koinzidenzuntersuchung über 13 Jahre an 17,268 hospitalisierten Patienten mit dem Wetterlagen-Klassifikationssystem", *Dtsch. Med. Wschrh.* 98 (1973), 924-929.
- FAUST, V. & SARREITHER, P., "Jahreszeit und psychische Krankheit", *Med. Klinik* 70 (1975), 467.
- FEIGHNER, J.P., ROBINS, E., GUZE, S.B., WOOD-RUFF Jr, R.J. WINDKUR, G. & MUNOZ, R., "Diagnostic criteria for use in psychiatric research", *Arch. Gen. Psychiat.* 26 (1972), 57.
- FRANC, R., CLAVERIE, J. & MORON, P., "Météoropathologie et épidémiologie des intoxications volontaires dans la grande agglomération toulousaine", *Dépression et Suicide*, Pergamon Press, 1981, 172-177.
- FRANGOS, E., ATHANASSENAS, G., TSI-TOURIDES, S., PSILOLIGNOS, P., ROBOS, A., KATSANOU, N. & BULGARIS, Ch., "Seasonality of the episodes of recurrent affective psychoses", *Jr. of Affective Dis-*

- orders 2 (1980), 239-247.
- GARCIA-CARRETERO, L., LLORCA-RAMÓN, G., VILLORIA-MEDINA, M.J., BLÁZQUEZ-GARRIDO, J.M. & LEDESMA-JIMENO, A., "Relaciones entre las urgencias psiquiátricas y los factores meteorológicos", *Actas Luso-esp. Neurol. Psiquiatría* 14 (1986), 85-94.
- GONZALEZ DE RIVERA, J.L., "Psicosomática", J.L. González de Rivera, A Vela & J. Arana (eds.), *Manual de Psiquiatría*, Madrid, Karpos, 1980.
- GUERRY, MA., "Tableau des variations météorologiques comparés aux phénomènes physiologiques", *Annales d'hygiène publique et de la Médecine Legale* 1, 2 (1829), 228-234.
- HARE, E., "Season of birth in schizophrenia and neurosis", *Am. J. of Psych.* 132, 11 (1975), 1168-1172.
- HARE, E. & WALTER, S.D., "Seasonal variation in admissions of psychiatric patients and its relation to seasonal variation in their births", *J. Epid. Community Health* 32 (1978), 47-52.
- JONES, I.H. & FREI, D., "Seasonal births in schizophrenia. A southern hemisphere study using matched pairs", *Acta. Psych. Scandinav-ica* 59 (1979), 164-172.
- KNOBLOCH, H. & PASAMANICK, B., "Seasonal variation in the births of the mentally deficient", *Am. J. Public Health* 48, 9 (1958), 1201-1208.
- LARCAN, A., MARTIN, J., LAMBERT, H., LAPREVOTE-HEULLY, M.C. & LEONARD, C., "Conduites suicidaires et conditions météorologiques", *Annales Médico-Psychologiques*, 1 Paris, T.I., 134 années, (1974), 51-56.
- LESTER, D., "Seasonal variation in suicidal deaths", *Brit. J. of Psych.* 118 (1971), 627-628.
- MAWSON, D. & SMITH, A., "Relative humidity and manic admission in London area", *Brit. J. Psych.* 138 (1981), 134-138.
- McNEIL, T., KAIJ, L. & DZIERZYKRAY-ROGALSKA, M., "Season of birth among siblings of schizophrenics", *Acta Psych. Scandinavica* 54 (1978), 267-274.'
- MEARES, R., MENDELSON, F. & MILGROM-FRIEDMAN, J., "A sex difference in the seasonal variation of suicide rate: a single cycle for men, two cycles for women", *Brit. J. of Psych.* 138 (1981), 321-325.
- MONTESQUIEU, C., *De l'Esprit des Lois*, Paris, Garnier Frères, 1927.
- MÜLLER U. LEIMKÜHLER, A.M. & RINGEL-NIEMZIK, M., "Estudios sobre una relación entre la estación anual y la enfermedad psíquica" (Spanish ed.), *Fortschr. Neural Psych.* 52 (1984), 312-324.
- MYERS, D.H. & DAVIES, P., "The seasonal incidence of mania and its relations to climatic variables", *Psychol. Med.* 8 (1978), 433-440.
- NÄYHÄ, S., "Autumm incidence of suicides reexamined: data from Finland by sex, age and occupation", *Brit. J. Psych.* 141 (1982), 512-517.
- NIXON, C.E., "Individuality and environment as etiological factors in the psychoneuroses", *Clif. State J. Med. San Franc.* 22 (1924), 17-20.
- ODEGARD, O., "Season of birth in the general population and in patients with mental disorder in Norway", *Brit. J. of Psych.* 125 (1974) 397-405.
- O'HARE, A., WALSH, W. & TORREY, F., "Seasonality of schizophrenic births in Ireland" *Brit. J. of Psych.*, 137 (1980), 74-77.
- PARKER, G. & NEILSON, M., "Mental Disorder and Season of Birth. A Southern Hemisphere Study", *Brit. J. Psych.* 129 (1976), 355-361.
- PARKER, G. & WALTER, S., "Seasonal variation in depressive disorders and suicidal deaths in New South Wales", *Brit. J. Psych.* 140 (1982), 626-632.
- PATRICK, V. & PATRICK, W.K., "Cyclone '78 in Sri Lanka. The Mental Health Trail", *Brit. J. Psych.* 138 (1981), 210-216.

- POKORNY, A.D., DAVID, F. & HARBERSON, S., "Suicide, suicide attempt and weather", *Am. J. of Psych.* 120 (1964), 337-381.
- PULVER, A.E., SAWYER, J.W. & CHILDS, B., "The association between season of birth and the risk for schizophrenia", *Am. J. of Epid.* 114 (1981), 735-49.
- REITER, R., "Neuere untersuchungen zum Problem der Wetter abhängigkeit des Menschen", *Arch. Met. Geophysik u. Bioclimatol., serie B* 327 (1953).
- RIHMER, Z., "Season of birth and season of hospital admission in bipolar depressed female patients", *Psyc. Research.* 3 (1980), 247-251.
- ROHDEN, H., "Einfluss des föhns and das Körperlich, seelische Befinden", *Arch. Psychol.* 89 (1933), 605.
- SAN-GIL-MARTIN, J., GONZALEZ DE RIVERA, J.L. & GONZALEZ-GONZALEZ J., "Tiempo atmosférico, clima y psicopatología", B. Sandin (coord.), *Aportaciones recientes en Psicopatología*, Madrid, Ediciones Novamedic, 1986, 27-54, Chap. 2.
- , "El concepto de tipo de tiempo en el análisis meteorotrópico de una variable médica: comentario metodológico", *Memoria del 111 Congreso Interamericano de Meteorología*, Mexico, DF, 1988, 233-236.
- , "Estacionalidad y psicopatología", *Psiquis* 9 (1988), 11-23.
- , "El tiempo atmosférico y la Patología Psiquiátrica: meteorotropismo y psicopatología", *Psiquis* 9 (1988), 214-218.
- , "Meteorotropismo y estacionalidad de las urgencias psiquiátricas en la isla de Tenerife", *Psiquis* 10 (1988), 349-359.
- SLATER, E., "Zur Periodik des manisch-depressiven Irreseins", *Z. Ges. Neurol. Psych.* 162 (1938), 794-801.
- SULMAN, F.G., *Health, weather and climate*, Amsterdam, Elsevier Publ., 1976.
- SWINSCOW, D., "Some suicide statistics", *Brit. Med. J.* 1 (1951), 1417-1423.
- SYMONDS, R.L. & WILLIAMS, P., "Seasonal variation in the incidence of mania", *Brit. J. of Psych.* 129 (1976), 45-8.
- TAKAHASHI, E., "Seasonal variation of conception and suicide", *Tohoku J. Exp. Med.* 84 (1964), 215-227.
- TORREY, E.F., TORREY, B.B. & PETERSON, M.R., "Seasonality of schizophrenia births in the United States", *Arch. of Gen. Psychiat.* 34 (1977), 183-186.
- TRAMER, M., "Ober die biologische Bedeutung des Geburtsmonates, ins besondere für die Psychoerkrankung", *Schweiz. Arch. Neurol. Psy.* 24 (1929), 17-24.
- TROMP, S.W., "Biometeorological analysis and monthly variations in restlessness and ill-temperedness of mental patients in the western part of the Netherlands (period Nov. 1956-1 Dec. 1958)", *First Report Psychiatric Institute "Hulp en Heil"* (at Leidschendam), Bioclimatological Research Center, Leiden, 5, 5 (April 1959). *Medical Biometeorology, weather, climate and living organism*, Amsterdam, Elsevier Publ., 1963.
- VIDEBECH, T., WEEKE, A. & DUPONT, A., "Endogenous psychoses and season of birth", *Acta Psych. Scandinavica* 50 (1974), 202-18.
- WESTERLUND, F.W., *Själfmorden i Finland 1861-1895*, Helsingfors, Finska Litteratursällskapet Tryckeri, 1898.
- ZUNG, W.W.K. & GREEN, R.L., "Seasonal variation of suicide and depression", *Arch. Gen. Psych.* 30 (1974), 89-91.