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REVIEW ARTICLE

Medical observations on meteorological associations in the nineteenth century

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At a time when disease aetiology was still unclear, the medical profession often assumed that climatic environment influenced both the onset and the progression of medical disorders. This encouraged physicians to collect climatic observations in attempts to relate illness to the environment providing a source of unrecognised information data relating to climate. Previously unreported nineteenth century medical sources detailing meteorological data for the Maltese Islands are reviewed in the light of known published sources of climate observations.

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Introduction

The Maltese Islands are a small group of very small islands sited in the Central Mediterranean. The official meteorological data for the Maltese Islands recorded by the Luqa Meteorological Office of the Department of Civil Aviation (1953-86) and the Water Works Department (1883-1953) covering a period of 130 years of rainfall data and 34 years of ambient temperature and other parameters has been collated and reviewed.[1] Earlier rainfall data for the period 1854-1953 collected by different observers or groups of observers from different sites in Valletta is also available. While the year 1841 serves as a landmark year in the process of scientific observations on ambient temperature data in Malta,[2] meteorological data for the late eighteenth century and earlier decades of the nineteenth century was collected and published by several interested workers, generally medical practitioners. This data is however not complete and gaps exist in the data record.

Medical practitioners during the late 18th and 19th century were preoccupied with the prevailing climate since it was commonly believed that climate conditions affected health and disease progression. Thus a late nineteenth century (1895) English medical textbook notes that "the number of births and deaths is more or less affected by the seasons of the year" and proceeds to classify the various infectious disease by their seasonal occurrence. A further section of the same textbook is devoted to meteorology.[3] It is therefore not surprising that medical practitioners practicing on the Maltese Islands were preoccupied with the ambient climate and themselves kept meteorological records in their attempts to understand the aetiology and progression of disease states.

Meteorological Data in the Late 18th Century

The earliest association of climate and health in the Maltese Islands dates to the turn of the eighteenth century (1798-1800), when the physician in charge of the French Troops, Dr. Claude Etienne Robert, discusses the disease prevalent in the Maltese Islands in the light of the local climate. Dr. Robert was a French military doctor who accompanied Napoleon Bonaparte to Malta in 1798 and remained on the Islands as Physician to the French troops until the expulsion of the French from the islands in 1800. Robert was familiar with the local meteorological situation and compares his observations to those of his compatriot D. Dolomeau who had published his work *Essai sur la temperature ou Memoire sur le climat de Malte* in 1783.[4] Dr. Robert gave serious regard to the type of winds prevailing during the seasons and kept daily temperature readings using the Reaumur thermometer available at the Public Library in Valletta. The daily records were not published, but meteorological details are given for the various seasons.[5] The mean seasonal temperature readings recorded by Robert are given in Table 1.

Table 1 Seasonal Climatic Observations 1798-1800

Season	Temperature [Centigrade]	Prevailing Winds
Spring	12-15°	N, NE
Summer	15-25°	E
Autumn	Nearly never rises above 28°	S, SE (scirocco)
Winter	7-10° above freezing point, rarely lower, but never down to 0°	N, NW, W, NE

Robert described the various winds which prevail on the Islands noting that "Les vents de la côte nord sont toujours froids; ceux du côté sud sont toujours chauds… Les vents du nord-ouest sont les plus froids et les plus purs, car ils traversent un long espace maritime; ceux de l'ouest sont moins froids et moins purs, car ils touchent un peu les côtes de l'Afrique. Le vent du nord est assez pur, car il traverse l'Italie et la Sicile, où la végétation est abondante; celle du nord-est et de l'est est pure, car elle traverse un espace maritime assez considérable. Le vent du sud et du sud-est est le pire et le moins pur, car il passe sur le continent africain, et que le canal qui sépare ce pays brûlant et aride de Malte est trop étroit pour qu'il puisse se purifier dans son voyage." [p.15-16].

METEOROLOGICAL DATA IN 1800-1820

Other writers published descriptions of the Maltese climate especially as this pertained to the suitability of the Maltese Islands towards convalescence. Thus the Physician to the Foreign Forces William Domeier who served in Malta during the period April 1806 and June 1808 published a general description on the climate of Malta however without giving any statistical analysis but quoting a mean annual temperature of 20°C and a mean annual rainfall of 15 inches.[6]

On the 28th March 1813, the Maltese ship San Nicola entered Marsamxett Harbour with plague cases on board. In spite of rigorous quarantine measures, the disease spread to the general population and was to cause the death of about 4468 individuals until the infection terminated in September 1813.[7] The aetiology of the disease was still unestablished and was variously attributed to contagion (infection through contact) or infection (communicated by the atmosphere). Meteorological data was collated for the period of the epidemic and these were subsequently published.[8] There were no correlations between the progress of the disease and the meteorological conditions to be noted (Table 2).

Table 2 Climatic Observations Apr-Nov 1813

Month	Max. Temperature [Fahrenheit]	Wind	Number of plague deaths registered
April	71°	*"Strong winds blew during part of the period, particularly in July"*	3
May	82°		111
June	84°		802
July	88°		1595
August	86°		1041
September	88°		674
October	83°		209
November	72°		33

METEOROLOGICAL DATA IN 1820-1850

The first valid scientific observations made in the Maltese Islands appear to be records of temperature data from the years 1820-40 published by S. Schembri in 1841. Unfortunately these data has not been traced.[1-2] Rainfall data started to be collected by C. Grech Delicata collected after 1840. These records form the first important group of meteorological data for the Maltese Islands.[1]

The British physician Sir James Clark who served as Queen Victoria's Physician-in-Ordinary from 1837-1860 wrote a thesis in 1841 describing the climate of Malta with reference to the eligibility of the island as a place of residence for invalids.[1,9] Further observations were published by the British doctor John Davy in 1842 who focused mainly on the prevailing winds and their origin. He also conducted a number of experiments to investigate alleged harmful effects of moonlight on health.[1,10] Other observations on climate data published in the local newspaper

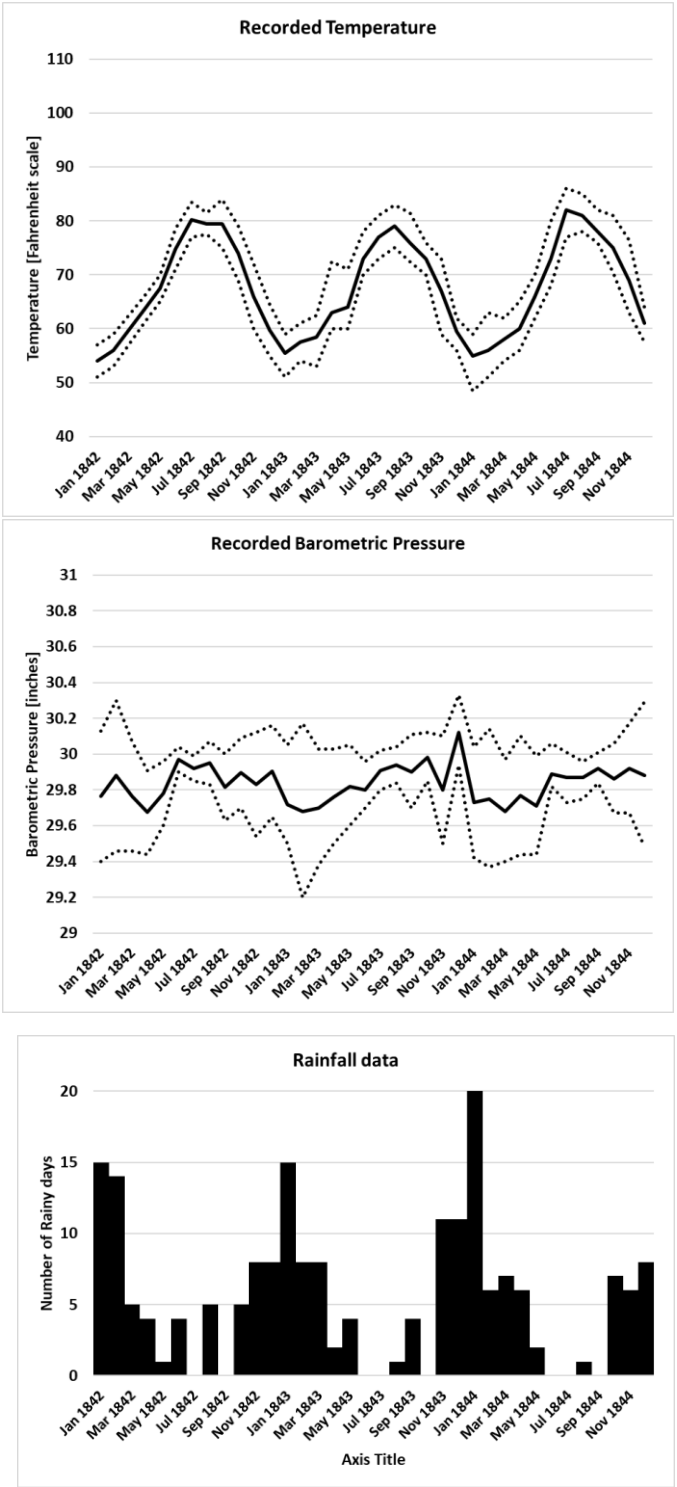
Portafoglio Maltese which gave daily rainfall data, while the *Societa Medica d'Incorragiamento di Malta* published the climate data including atmospheric pressure, mean temperature, wind direction and rainfall for the year 1843.[1,11]

Another British physician who published his meteorological observations during this period was Sir Thomas Spencer Wells. Thomas Spencer Wells was a British doctor who served as a surgeon for six years in the Bighi Naval hospital in Malta from 1841 to 1847. During his stay in Malta, Spencer Wells published several papers in international and local journals, and was influential in introducing surgical anaesthesia to the Islands. He was later to become one of the leading nineteenth century pioneers in abdominal surgery and a renowned leader of the British Surgical establishment.[12] Two of the papers published by Spencer Wells deal with the medical conditions he encountered during his stay in Malta. In these publications, he includes meteorological details for the period 1842-44.[13-14]

Spencer Wells kept accurate data on Maltese climate keeping observations on the minimum and maximum temperature and barometric monthly readings as read at mid-day with the instruments kept in a situation least exposed to local influences or changes. The prevailing winds and the number of rainy days during that month were also recorded. The climatic data recorded by Spencer Wells in Malta during 1842-44 are summarised in Figure 1. No relation between climate changes and the occurrence of disease states were reported, except that the death rate from phthisis (tuberculosis) was greater during or immediately after a prevalence of winds from the shores of Syria or Libya, i.e. the Scirocco and Liebeccio winds. It was remarked that the disease in common with all respiratory disorders ran a particularly rapid course when the Scirocco wind prevailed.[13,43]

The Maltese physician Nicola Zammit published the data on dewfall and evaporation for the period 1851-54. This data is presently unavailable.[1,11]

Figure 1 Meteorological Data for 1842-1844: Monthly Averages



METEOROLOGICAL DATA IN 1850-1910

During the latter part of the eighteenth century, meteorological observations started to be made by non-medical personnel. Monthly rainfall averages started to be published annually after 1851 in the Blue Books. The Royal Engineers set up and operated a full meteorological station. The Jesuit Fathers in 1883 set up two meteorological observatories, while rainfall data was regularly collected by the Water Works Department after 1888. The data after 1854 are published in the Annual Abstracts of Statistics.[1] Further meteorological data was collected by the Education Office during the late nineteenth century and published monthly in the Malta Government Gazette. This included information regarding the temperature, rainfall and general state of the atmosphere as noted at the University, the Public Library, and the Primary Schools in Malta and Gozo.[15]

In spite of the increasing interest in climate by non-medical bodies, the association of climate change to disease persisted in medical thought. The Maltese physician Nicola Zammit published the data on dewfall and evaporation for the period 1851-54. This data is however presently unavailable.[1,16] The Public Health Department published its first annual report for the year 1896. The report included an annual meteorological return based on monthly averages, and this continued to be reported regularly until the 1950s. The 19th century meteorological data was made available to the Chief Government Medical Officer by Rev. Fr. J. Dobson S.J. of St. Ignatius College. The data pertaining to wind direction and strength was made available by the Collector of Customs.[17] The St. Ignatius College meteorological readings for the period 1883 to 1902 were published in the Stonyhurst College Meteorological Reports. These published reports are not available locally,[1,18] but the data for the post-1896 years were published in the Department of Health reports and figuratively summarised in Figure 3.[17]

The 19th century Annual Public Health Reports also commented on the higher incidence of diseases of the digestive system during the summer months. It was believed that the essential cause for infantile enteritis resided in the soil and that under favourable meteorological conditions, particularly temperature, would gain access to the air, water and food causing the higher incidence of the infection during the summer months. By 1899, the Department of Health was undertaking investigations to attempt correlate the incidence of enteritis to soil temperature at various depths, the study being conducted at the Argotti Gardens at Floriana. The soil temperature data at a depths of 1-3 feet for the months of July-September were published for the period 1899-1900 (Figure 2).[19]

Figure 2 Mean [minimum-maximum] soil temperature data at 1 feet depth correlated to infant mortality from enteritis.

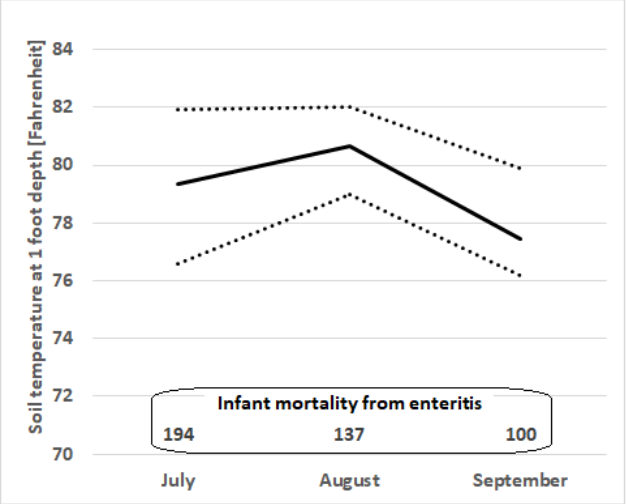
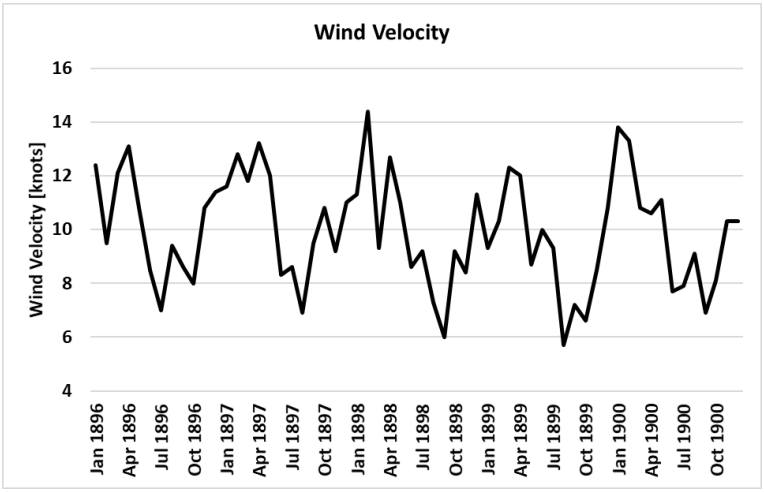
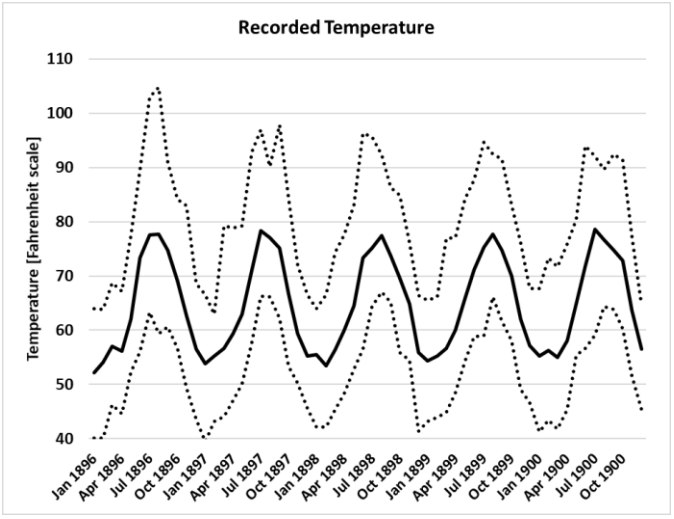
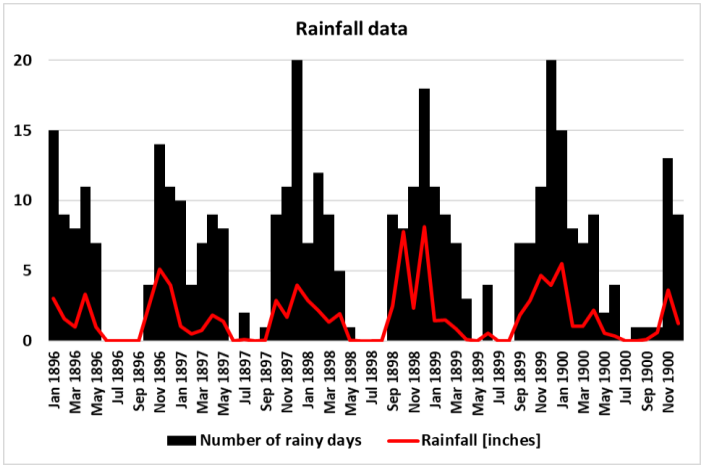
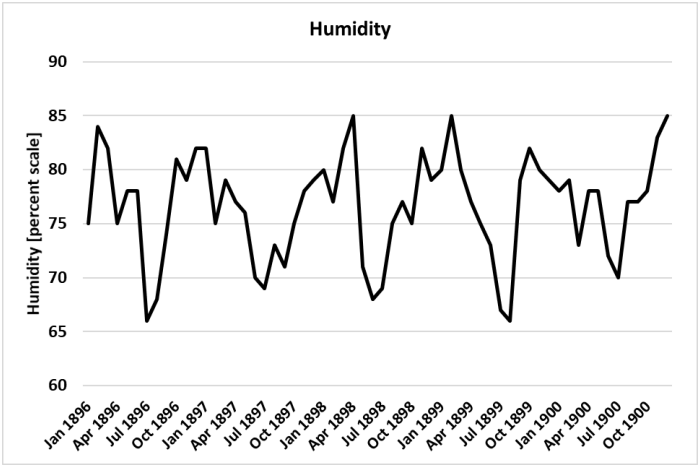


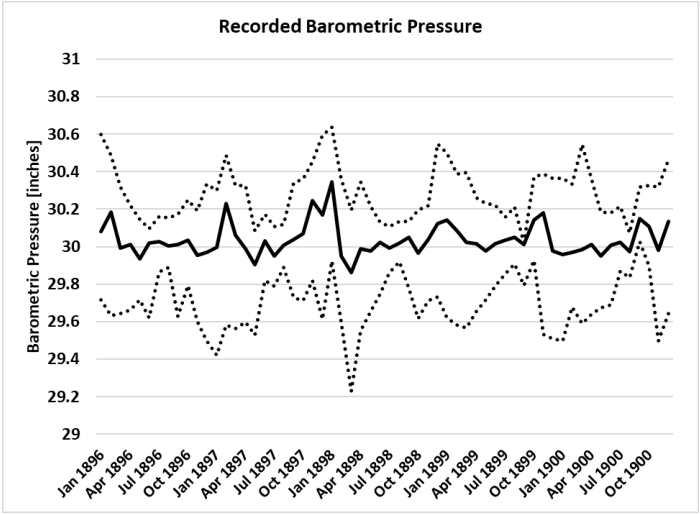
Figure 3 Meteorological Data for 1896-1900 – Monthly Averages











Meteorological studies were also carried out by the Mediterranean Fever Commission in relation to climate in the aetiology of Brucellosis. Dr. R.W. Johnstone correlated the mean monthly temperature and rainfall for the period 1894-1903 with the number of cases of Brucellosis occurring in the civil and military population and showed a correlation with ambient temperature. The reason for this correlation was not elucidated. Further results pertaining to the 1905-1906 period were published in 1907. [20]

Table 3 *Brucella* culture in soil after exposure to sun

Date & time of exposure to sun	Total exposure duration	Maximum temperature	Post-exposure culture
20th June 1904 12:15-13:00 hrs	45 minutes	53.3°C	Yes
+ 21st June 1904 08:50-11:50 hrs	225 minutes	57.2°C	Yes
+ 22nd June 1904 08:45-11:45 hrs	345 minutes	52.2°C	No
+ 1st July 1904 10:30-12:30 hrs	465 minutes	56.1°C	No

Studies were also conducted to assess whether the *Brucella melitensis* bacterium in soil was resistant to exposure to ambient temperature. A series of petri dishes containing white and red soils inoculated with *Brucella melitensis* were exposed for variable times to sunlight (Table 3). Further studies confirmed that heat derived from sunlight exposure with an ambient temperature of 63.3 – 67.2°C destroyed any *Brucella melitensis* bacteria in soil up to a depth of at least ½ inch.[19]

CONCLUSION

Meteorology in Malta became a science during the late 19th century when data pertaining to climate was collected and published on a regular basis. This data allows for statistical evaluation of climate conditions emphasising the secular trends. Early nineteenth century data collected by interested individuals is also available in scattered publications. The collation of this early 19th century data would help extend the available climate statistics for the Maltese Islands.

The association between disease and ambient climate is now accepted to be a indirect one with varying meteorological conditions determining the prevalence of disease-spreading vectors, e.g. insect vectors, and providing ideal conditions for microbial growth and/or survival. Climatic factors have also been postulated to directly or indirectly affect biological systems. A study on male-female ratios at birth had shown that the ratio of gender at birth in the European continent varied with latitude and a meteorological relationship was proposed to explain this relationship.[21] A subsequent study confirmed a possible relationship between gender ratio and climatic factors determined by seasonal fluctuations. However, the study was not strong enough to confirm a statistical significant relationship.[22]

The environmental stresses brought about by the excessive release of carbon dioxide and other greenhouse gases are affecting the global climate. These changes in the global climate are associated with a wide range of health risks, ranging from increased mortality to changing infectious diseases epidemiology increasing the likelihood of outbreaks of

waterborne and vector-borne diseases. Unless urgent action to reverse the global climate change is taken, an estimated 250 000 extra annual deaths will occur over the period 2030-2050.[23]

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