



Ballon ascent at the Stockholm Observatory in 1784 in the presence of King Gustav III. (Uppsala University Library)

## 250 Years of Weather Observations at the Stockholm Observatory

Weather observations at the Stockholm Observatory have been carried out since 1756 and the 250-year measurement series is one of the world's longest unbroken observation series. The first observer was the secretary of the Royal Swedish Academy of Sciences, the astronomer and statistician Pehr Wilhelm Wargentin (1717-1783). He lived on the second floor in the then newly-built observatory and placed his thermometer outside one of his windows. Wargentin is a well-known figure in Swedish scientific history

as the father of Swedish population statistics, and also for his studies of Jupiter's moons.

When the observatory was renovated and extended in 1875 the thermometer was moved to a metal cage outside a window on the first floor. The current observation site, from 1960, is only about 10 metres away. These few small relocations make Stockholm's long observation series one of the world's absolute best. The high quality of the series has recently been documented in several scientific studies.



The leafy Observatory hill in autumn 2005.  
Photo Anders Moberg





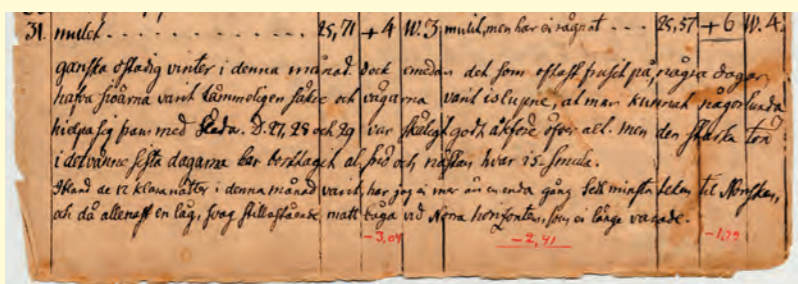
Panorama from the roof of the Stockholm Observatory at 1:00 p.m. on 15 February 2003

Photo Rolf Roslund

Januari månad. Meteor. off. Stockholm år 1756.

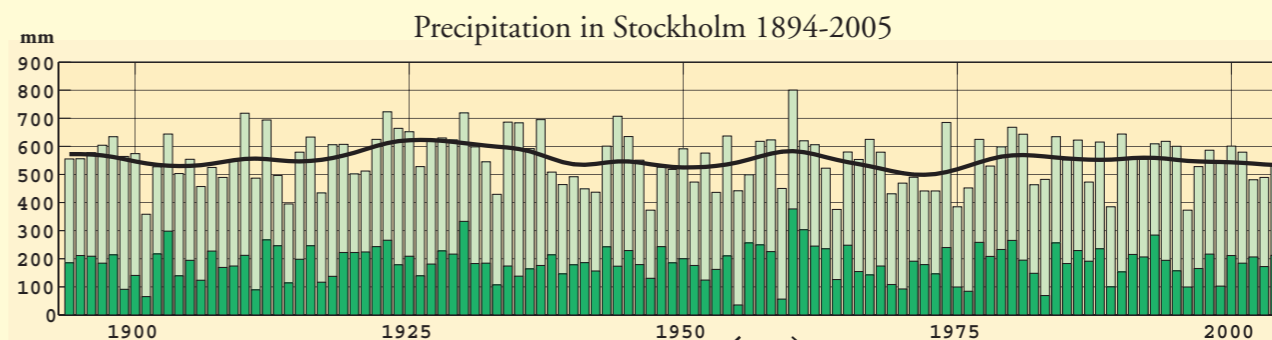
Day	Temp	Wind	Notes
1. Klart.	15.11	8	klart hela natten. en stark vind på morgonen.
2. Klart. Stark vind på morgonen.	15.32	9	klart hela natten. en stark vind på morgonen.
3. Mulet till råttase. Simbegr.	15.38	10	klart hela natten. en stark vind på morgonen.
4. Mulet. Högsta foga.		7	klart hela natten. en stark vind på morgonen.
5. Högsta foga.	15.27	9	klart hela natten. en stark vind på morgonen.

The first journal from Stockholm in January 1756 finishes with the following comment: "Rather changeable winter this month. However since it has often been freezing, for several days the lakes have been fairly safe and the roads ice-covered, so that it has been possible to use a sled. Day 27, 28 and 29 were reasonably good for travelling. But the significant thaw over the last two days has removed all the snow and almost every ice fleck."



In the journal on 31 December 1768 Wargentin wrote: "No-one can recall such a mild Autumn: the ground is as green as in the Spring, and today I have picked sufficient young nettles, dandelions and other herbs to cook green cabbage tomorrow, which is New Year's Day."

29 January 1850 was "Blizzard Tuesday" when over 100 people were killed in a snowstorm. Worst hit is the area just south of Stockholm.



The green bars show the annual precipitation, with the dark green showing the rain during the summer months (June–August). The curve shows the variations as a 10-year moving average. Before 1894 the precipitation measurements are too low to be credible, so the older part of the measurement series has not been included.

In Stockholm the average annual precipitation for the period 1894–2005 was 555 mm. The summer precipitation averages 187 mm, and is typically about a third of the annual precipitation.

1901 was a very dry year with a hot summer, with the record for the lowest annual precipitation during 1894–2004 which was 358 mm.

The 1920s were on average the wettest decade.

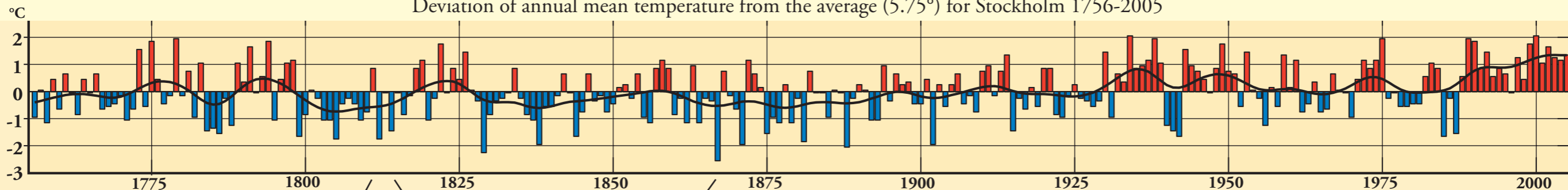
Two of the worst dry summers occurred in 1955 and 1959. The total rainfall during July–August 1955 was a pathetic 35 mm.

1960 is the wettest year with 801 mm and also the wettest summer.

One of the worst thunderstorms in recent history occurred on 16 August 2001. The storm had built up during the day and moved north towards Stockholm. Two people were killed by lightning, and several others were injured. The average number of days with thunder in Stockholm is around 10–12 per year.

The rainiest weather during the last 250 years occurred on 8 September 1857 when 156 mm poured down during 24 hours. The rain caused significant damage to the roads, which is clear from the following quote from the newspaper "Aftonbladet" on 9 September 1857. "The heavy thunderstorm rain, which during a large part of yesterday poured over the city, has in many places caused damage and destruction. ... In several places Drottninggatan was cut off by wide streams, gushing down from Brunkeberg and the adjacent higher parts of the city. Several drainage pipes burst due to the force of the water ... Some places were struck by lightning, including the Mint House in Kungsholmen, where lightning passed through the metal roof into the rolling room, then into the machine room, where after breaking some of the machine's smaller iron pipes it left through a window. Also Bolinders workshop in the same area, where lightning knocked over a worker in the foundry..."

Deviation of annual mean temperature from the average (5.75°) for Stockholm 1756-2005



The red bars indicate years that have been warmer than average; the blue bars are colder years. The black curve shows smoother variations on a 10-year time scale. Stockholm's temperature series has been recalculated taking into account the fact that the city has grown, and therefore become warmer. The graph therefore illustrates the variations in the climate as fairly as possible. The average of 5.75° refers to the original, more rural environment.

The highest temperature ever recorded on the Observatory hill, 36°, was measured on 3 July 1811.

The lowest temperature ever recorded on the Observatory hill, -32°, was measured on 20 January 1814.

The 19th century was, apart from the 1820s, mostly cold. 1867 was the coldest year with an extremely cold start to the growth season in May–June (the average temperature for May was only 3.4°). The situation was worsened by a warm and catastrophically dry summer the following year. Crop failure and famine motivated emigration to North America.

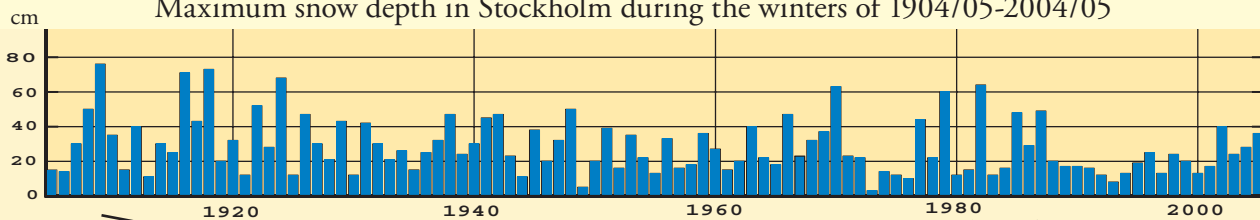
During the 20th century the temperature increased with a first peak during the 1930s. Apart from the famous war years 1940–42 also the 1940s were generally warm.

The last 18 years have been dominated by warm years, with particularly mild winters. The years 2000 and 1934 are the two warmest years in the Stockholm series.

Since 1901 the highest temperature of 35.4° was recorded on 6 August 1975 and the lowest -28.2° on 25 January 1942. During the cold January of 1987 the lowest temperature was -25.1°.



## Maximum snow depth in Stockholm during the winters of 1904/05-2004/05



Snow depth was first measured in the early 1900s. The season 1904/05 is classified in this figure as 1905. Comparisons with snow information from Uppsala suggest that the snow depth values for the first 20 years are somewhat high for Stockholm.

March 1909 was the month with most snow, when the snow depth increased from 8 cm on the 3rd to 76 cm on the 18th. Everyone had to plod through the deep snow, as it was not possible to remove all the snow by hand or horsepower in those days.

Significant snow depth, 64 cm, 7-10 February 1982.

There is a tendency towards reduced snow depth for more recent years. Mild winters dominate after 1986/87, which was a really hard winter.

During the winter of 2001/02 it was tough to keep the streets clear. A long period around Christmas and New Year with continuous snow resulted in chaos. The snow depth up on the hill had reached 40 cm by the beginning of January.

### Observation site, autumn 2005



Radiation shield for the resistance thermometer



Thermometer screen



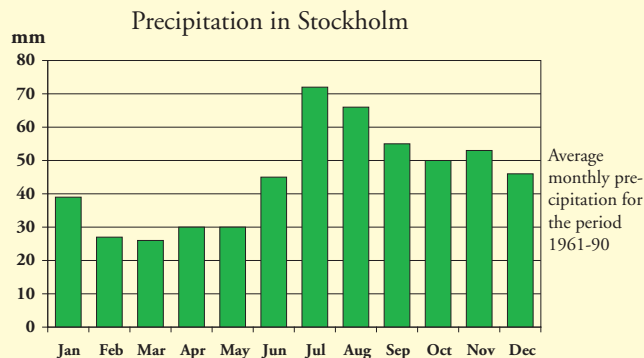
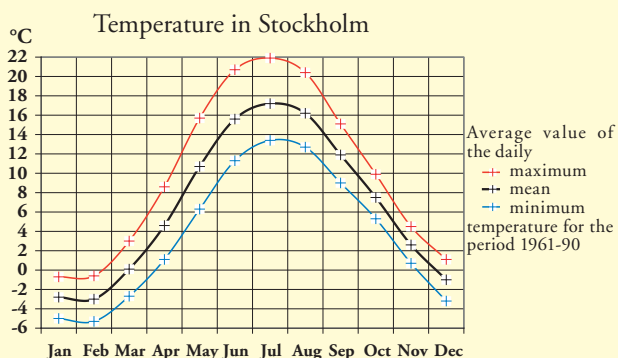
Photo Rolf Roslund



Precipitation gauge with wind shield

**The temperature** has been read from thermometers hanging in the white Stevenson screen that protects them from direct sun between 1960 and 2004. Already from 1947, when the morning reading was moved from 8:00 a.m. to 7:00 a.m., the temperature was read on a thermometer in a screen in the same place as now during May-September to avoid the direct morning sunlight on the window screen. After 2004 the mercury thermometers were replaced by resistance thermometers, located behind the new radiation shield which can be seen at the observation site above.

**Precipitation** is now measured in a can of durable aluminium. The opening has an area of 200 cm<sup>2</sup> and the precipitation is poured into a much narrower measuring glass that enables readings with an accuracy of a tenth of a millimetre. Snow has to be melted before being measured. The precipitation gauge is equipped with a wind shield to reduce under-sampling in windy weather. In the summer an evaporation shield is placed in the can. Older rain gauges were significantly larger with an opening of 1 000 cm<sup>2</sup> and were therefore also heavier. Due to the large trees on the Observatory hill the gauge is well-protected from wind, providing more reliable measurements.



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