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In the Wake of “*De Liefde*” – The Instrumental Meteorological Observations of the *Vereenigde Oost-Indische Compagnie (VOC)**

by

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KEYWORDS. — Japan; *Vereenigde Oost-Indische Compagnie*; Dejima; *Ancien Régime*; Western Visitors; Climate Reconstruction.

SUMMARY. — One of the major challenges in climatology is to deepen our knowledge on the natural variability of the climate. Therefore, all pieces of the climate history puzzle are to be brought together in order to reconstruct the climate over the last millennium. This paper focusses on the early climate descriptions by western visitors in Japan and, more particularly, on the instrumental meteorological observations carried out by physicians working for the Dutch East Indies Company. Emphasis is laid upon the reappraisal of two 18th century data sets of instrumental meteorological observations mostly made at the artificial island Dejima in the harbour of Nagasaki. These instrumental meteorological data complement the Japanese historical climate data.

TREFWOORDEN. — Japan; *Vereenigde Oost-Indische Compagnie*; Dejima; *Ancien Régime*; Westerse bezoekers; Klimaatreconstructie.

SAMENVATTING. — *In het zog van „De Liefde” – de instrumentele meteorologische waarnemingen van de Vereenigde Oost-Indische Compagnie.* — Een der grootste uitdagingen van de hedendaagse klimatologie is de kennis van de natuurlijke variabiliteit van het klimaat te vergroten. Juist daarom is het noodzakelijk alle stukken van de klimaatgeschiedenispuuzel bijeen te brengen teneinde het klimaat over het laatste millennium te reconstrueren. Deze bijdrage concentreert zich op de vroege klimaatbeschrijvingen van Japan aan de hand van westerse bezoekers, en in het bijzonder op de vroege instrumentele meteorologische waarnemingen die door artsen in dienst van de Vereenigde Oost-Indische Compagnie werden uitgevoerd. De nadruk wordt gelegd op twee 18de eeuwse meteorologische tijdreeksen voor het grootste deel waargenomen op het kunstmatige eilandje Dejima in de haven van Nagasaki. Deze instrumentele meteorologische gegevens vullen de historische Japanse klimaatgegevens aan.

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MOTS-CLES. — Japon; Compagnie néerlandaise des Indes orientales; Dejima; Ancien Régime; Visiteurs occidentaux; Reconstruction du climat.

RESUME. — *Dans le sillage du «Liefde» – les observations météorologiques instrumentales de la Compagnie néerlandaise des Indes orientales.* — Un des défis majeurs de la climatologie moderne est d'approfondir notre connaissance de la variabilité naturelle du climat. Il est donc indispensable de rassembler toutes les pièces du puzzle climatique pour pouvoir entamer une reconstruction du climat au cours du dernier millénaire. Notre contribution met l'accent sur les anciennes descriptions climatiques au Japon effectuées par des visiteurs occidentaux et, plus spécialement, sur les observations météorologiques instrumentales faites par des médecins au service de la Compagnie néerlandaise des Indes orientales. En particulier, deux séries climatologiques du XVIII^e siècle observées pour la plupart à Dejima, îlot artificiel situé dans le port de Nagasaki, sont étudiées en détail. Ces données météorologiques instrumentales complètent les données climatologiques historiques japonaises.

1. Historical Background

On the 19th April 1600, more than four hundred years ago, “*De Liefde*” ran ashore at the eastern coast of Japan after crossing the Pacific Ocean from the Chilean coast at 36° South in nearly five months. It was the first Dutch ship arriving in Japan. Its companion ship “*De Hoop*” vanished in a storm during the crossing. Of the original crew, only twenty-four or twenty-five were left — among them, William Adams (1564-1620), the English pilot-major —, and only five or six others were able to stand on their legs. Captain Jacob Quaeckernaek (ca. 1570-1606) belonged to the sick ones. The arrival of “*De Liefde*” forms the start of the more than four hundred years of relations between the Netherlands and Japan.

However, the crew of “*De Liefde*” were not the first Dutchmen in Japan. This honour fell to Dirck *China* Gerritsz Pomp, who sailed with a Portuguese ship from Macao to Hirado and stayed in Japan from July 1585 until March 1586 (VAN LINSCHOTEN 1623).

The crew of the Dutch vessel feared crucifixion since they were aware of Jesuit publications on the occasional treatment of Jesuits and their Japanese converts to the Roman Catholic religion. However, already on the 12th May 1600, Tokugawa Ieyasu received Adams and a Dutchman in his palace in Osaka — at the greatest envy of the Portuguese Jesuits. Very rapidly two more constructive interviews followed. What was not known by Adams and his companions was the fact that Ieyasu was in a final stage of consolidating his power over the whole of Japan. Indeed, on the 21st October 1600, the decisive battle took place, and from this day, for more than two and a half centuries, the power was kept in his dynasty. It was said that the eighteen or twenty guns of “*De Liefde*”, its storage of ammunition and the Dutch gunmen contributed to the victory (WIEDER 1925).

On the other side of the globe, the Netherlands was setting its first steps in the intercontinental trade, taking profit of the weakened position of Spain, now in war with France. In the 1590s trade and privateer expeditions were sent to the farthest parts of the globe. Following the travel accounts of van Linschoten, Cornelis Houtman sailed to the East Indies (1595-97). He was followed by many more. Two expeditions sailed through the Strait of Magellan and crossed the Pacific (ROEPER & WILDEMAN 1999); “*De Liefde*” belonged to the first fleet.

Finally in 1609, the Dutch vessels “*De Roode Leeuw met Pijlen*” and “*De Griffioen*” sailed to Japan with the explicit idea of setting up trade with that country. The presence of the crew of “*De Liefde*”, and not least of Adams, who were settled meanwhile, married to Japanese Christian women, some of them wealthy enterprising independent merchants, facilitated and contributed to the success of this expedition. It belonged to the vision of Ieyasu to have recognized at an early stage the importance of the Dutch seafaring trade, maybe through the information he obtained from Japanese captains who met an increasing number of Dutch ships in East-Asian waters. Other considerations could be the wish of the Shogun [1]* to diversify trade with the Europeans, which was linked to the attitude of the Portuguese Jesuits whose main interest was to convert Japanese to Christianity and to the fear of seeing in Catholicism a potential danger for the newly-found unity of Japan.

2. Early European Visitors to Japan

The visits of Europeans to Japan started just before the mid 16th century and consisted mainly in the beginning of Portuguese missionaries (PINTO 1614, 1628, 1991; FROIS 1994). Rivalries led to the expulsion of the Spanish in 1624 followed by the Portuguese in 1639. The Netherlands played a highly significant role since besides China and Korea, by the Seclusion Act of 1639, it was the only foreign (western) nation to have an uninterrupted presence in Japan from 1600 until 1854, year of the opening of Japan to the West forced by the guns of Commodore Matthew Perry. The Dutch presence was, however, first confined to Hirado, also named Firando in western texts, but their trading post or factory moved in 1641 to the fan-shaped artificial isle of Dejima (fig. 1) near Nagasaki (PLUTSCHOW 1983).

Although the Dutch presence focussed on trade and commercial activities, one or two physicians were in residence at the factory (FUJIKAWA 1911). It was mainly through these contacts that European scientific ideas in the fields of medicine, botany, astronomy, physics, etc., were introduced. Therefore, western science was named *Rangaku*, which means Dutch learning from *Orandagaku*.

* Numbers in brackets [] refer to the notes, p. 400.



Fig. 1. — Isaac Titsingh, *Plattegrond der Nederlansche Faktory op het Eiland Desima bij Nagasaki* (from I. Titsingh: *Illustrations of Japan*, 1822).

Three of those physicians, Englebert Kämpfer, Carl Peter Thunberg and Philipp Franz von Siebold (curiously enough, in contradiction with the Japanese prescriptions, none of them being Dutch), were learned men. They greatly contributed to the introduction of western sciences in Japan, and in turn, their writings containing descriptions of its land, people and customs augmented the knowledge in the West on the remote Japan (KIMURA 1976).

3. Early Climatic, Astronomical and Geophysical Information by Westerners

From the earliest period of the contact of Japan with westerners, only sparse and fragmented climatological, geophysical and astronomical information is available. First, early climatological descriptions given by western visitors in Japan are stated. The examples given here are in no way meant to be exhaustive, but merely illustrate the growing knowledge and interest in Japan by the early visitors from the West. In most cases the original spelling and language from the original published sources has been maintained.

The very first information on the climate of Japan dates from the first Portuguese travels to Japan around the mid 16th century. Jorge Alvares provided the following information already in the year 1547 (FROIS 1994):

Cette terre du Japon tremble parfois, et c'est un pays où il y a beaucoup de soufre. Il y a de nombreuses îles de feu; certaines sont peuplées et d'autres non; la plupart sont de petites îles.

Ce pays du Japon est très venteux et plein de tourmentes. Le temps change à chaque nouvelle ou pleine lune. Surtout au mois de septembre, où il survient un vent si violent que tous le redoutent, car il met à sec les navires, à trois ou quatre brasses à l'intérieur des terres; et s'ils sont à terre, parfois ils se retrouvent en mer.

En ce temps où j'y étais, à trente lieues de là, soixante navires chinois et une nef portugaise se sont ainsi perdus. Ce vent dure vingt-quatre heures; il commence au sud et finit au nord-est, courant dans toutes les directions. Il est connu par une fine pluie qui le précède; avec ce signe avant-coureur, les gens de ce pays peuvent se mettre à l'abri.

In the same way, from a Portuguese source the following information was addressed by Nicolas Lanzillotto to the Governor Garcia de Sá at Goa (India) in the year 1548 (FROIS 1994):

Il [2] dit que cette terre est très saine et qu'il y fait de très grands vents, et que parfois la terre tremble si violemment que les hommes tombent sur le sol.

Gaspar da Cruz (*ca.* 1520-1570), a Portuguese Dominican friar, wrote one of the first detailed European accounts on China. He also described what happens when a typhoon occurs.

In the year 1555 in the month of September, the earth opened in many places, and under it were heard noises like the sound of bells; there followed a great wind with much rain, and the wind ran about all the compass. This was the sort of wind which is called in China a Tufão, and many years it bloweth but once a year, and it is raging that it driveth a ship under sail on the land and carrieth it there a great space, and the men cannot keep their feet, not even by leaning and holding on one other, and it doth things worthy of wonder and incredible.

According to Dirck *China* Gerritz Pomp, the first Dutchman who visited Japan, from July 1585 to March 1586, the country (as quoted from Jan Huyghen van Linschoten, 1623):

T'tis een cout lant, ende van veel reghens, sneeu, ende oock ys, heeft sommigh koorn land, maer haer gemeen onderhout ende voetsel is Rijs (It's a cold land, and with much rain, snow, and also ice, it cultivates some corn, but its common food is rice).

In the "*Brevis japaniae insulae descriptio*" by Ioannes Hayus (1605), the Japanese climatic conditions are described as follows:

[...] *adeoque fertilis est, ut bis quotannis messem faciat, in Maio frumenti, in Septembri verò orizae; temperies in estate talis est, qualis in India* ([...]; is so fertile, that every year two harvests take place, in May wheat, in September rice; the average climate in the Summer is like in India).

and the disastrous earthquakes of 1586 (KÆMPFER 1732, pp. 164-165; 1758, pp. 161-165):

Anno reparate salutis 1586. Terra tam terribili concussione tremuit, ut post hominum memoriam tali motum Iaponia non fuerit unquam concussa (In the year of the newfound salvation 1586, the earth trembled with such a great earthquake that Japan has never been shaken since immemorial times) (Iohannes Hayus, 1605, p. 104).

L'an 1586, il arriva un Tremblement de terre si terrible, qu'il n'y en eut jamais de semblable dans le Japon. Les secousses ne finirent qu'après quarante jours, & s'étendirent depuis la Province de Sacaja jusqu'à Miaco [3].

[...] un tremblement de terre très violent qu'il y avoit eu en 1703, & qui joint à un furieux Incendie qui arriva en même tems, avoit presque entièrement abîmé & réduit en cendres la Ville de Jedo, même le Palais de l'Empereur, & que plus de 200 000 habitans avoient été ensevelis sous les ruines.

A 16th century description of the Japanese Empire from the Harleian manuscript 6249 (RUNDALL 1850) gives the following climatological picture:

In these Isles the summer is very hote and burnynge, and the winter extreme coude. Yet is the climate temperate and healthie, not much pestered with infections or obnoxious ayres; but very subject to fierce windes, tempestuous stormes, and terrible earthquakes, insomuch that both ships in the harbour have been over-sete, and driven ashore by the furie of the one, and houses on the land disjoynted and shaken to pieces by the fearful trembling of the other. Of gold and silver mynes, there are many.

The Diary of Richard Cocks (edited by Maunde Thompson, 1883) mentions astronomical events (comets, eclipses, ...), geophysical events such as earthquakes, as well as remarkable weather information. The original spelling as well as the dating in *stilo vetri* or old style is maintained [4]:

February 22, 1616 – There was a great eclips of the moone this night, began about 9 a clock. But the wether proved overcast that we could not observe no star, which we thought to have donne, to find out the true longetude of this place.

The appearance of comets in the months of November and December 1618 is described as follows:

November 5, 1618 – Yisternight at 10 a clock was an earthquake, which for a good while shooke ver much.

November 7, 1618 – This mornynge cold, calme wether, with a hor frost. Dry wether all day; and night following [5].

I forgot to note downe that there was a comett (or blasing star) which hath appeated this 5 or 6 daies som hower before day, easterly, a littell to the southwards; but it is so neaere the sunne that we could not see nothing but the teale, yt being of a hudge leangth, and doth, by littell and littell, draw to the westward, sotherly.

And, as we retorned, about 10 a clock, hapned a greate earthquake, which caused many people to run out of their howses. And about the lyke hower the night following hapned an other, this cuntrey being much subject to them. And

that which is comunely marked; they allwais hapen at a hie water (or full sea); so it is thought it chanseth per reazon is much wind blowen into hollow caves under grownd at loe water, and the sea flowing in after, and stoping the passage out, causeth these earthquakes, to fynd passage or vent for the wind shut up.

November 8, 1618 – Calme cold wether with a hor frost, a stiffe gale of winde most parte of the day after, at S.W. erly. Yet dry both day and night [6].

The people in this place did talke much about this comett seene, that it did prognosticate som greate matter of warr, and many did ask me whether such matters did happen in our countrey, and whether I knew what it did meane or would ensue therof; unto which I answered that such many tymes have byn seene in our partes of the world, but the meanyng therof God did know and not I.

November 9, 1618 – The comet apered this mornynge greater then any tyme before.

November 13, 1618 – The comet doth contynew still till day, drawing towards W. southerly.

November 19, 1618 – An hower before day we saw an other comet (or blasing starr) rising just east, in the constellation of Scorpio. It is a mighty comet, and, in my opinion, bigger then that which was seen when Sebastian, King of Portingall, was slayne in Barberry [7].

November 21, 1618 – The first comet was not seene after this night.

December 23, 1618 – After this night, the comett, or blasing starr, was seene noe more, and ended under the 3d starr in Chorls wayne or Ursa maior.

Another short sequence with weather information from the diary of Richard Cocks is given below:

March 3 (Ninguach 2), 1622 – There was an earthquake this evening about 9 a clock at night, which shook much for a small tyme.

March 7 (Ninguach 6), 1622 – Great aboundance of rayne per night, with an earthquake at 9 a clock at night.

March 8 (Ninguach 7), 1622 – A stiffe gale most parte of day and night following, which might be accompted a tuffon or harrecano with aboundance of rayne all day. We could doe nothing about procuring our dispach this day, per means of the tempestious weather.

The logbooks of the European ships that sailed to Japan often contain detailed weather information of their travels. Such information as given below is taken from the diary of C. J. Coen on the ship *Castricum* during the travel of Maarten Gerritsz. Vries (1589-1647) in the year 1643 to Japan, Yeso [Hokkaido], Krafto [Sakhaline] and the Kuriles [Kuril Islands or Kurile Islands] (LEUPE 1858). The climatic information of the sailing along the Japanese eastern coast is given below as an example:

21 May 1643 – In the morning clear weather, S.W. wind with topsail wind, overcast sky, in the night variable wind, nice calm weather but bad water.

22 May 1643 – About 2 hours after noon, we got a cool wind from the east, in the night the wind S.S.E. and S.E. and E.S.E.

23 May 1643 – In the morning we were sailing, a misty air, the whole morning it was quiet and misty, after the noon, we got a nice wind from the S.E.

24 May 1643 – In the morning, the wind S.S.W., in the night the wind S.S.W., S. and S.E., rain at night.

25 May 1643 – In the morning, at sunrise, it started to be blow strongly from the S.S.E. so that the ship became very agitated, and fell also a heavy fog, which lasted until approximately 2 hours before the noon, it cleared up and it became rapidly quiet but with agitated waves. Slightly after the noon, it became very clear weather, slightly after the noon it was very clear weather, about 3 o'clock after noon, we got a topsail wind from the W.N.W, but gradually to the N.W., in the night nice quiet weather, the wind going to the west.

26 May 1643 – In the morning nice, clear and sunny weather, at about o'clock in the afternoon, we got a nice wind from the S.E., turning to the S. and the S.W., and following to the W.

27 May 1643 – In the morning it was nice weather, with a clear sky, the wind at variable, in the west with bad water.

4. Englebert Kämpfer and Western Medicine

Englebert Kämpfer was born in Lemgo in Westphalia in 1651. He studied medicine and natural sciences and went to Sweden in the year 1681. He took part in the embassy that was sent by the King of Sweden to Persia and underway stayed in Russia. He decided to take service as a physician with the Dutch East Indies Company, arrived in Batavia [8] in September 1689, and finally reached Dejima in September 1690. He left Japan in November 1692. He was able to join the Dutch embassy to the Shogun in Yedo [9] in 1691 and 1692. These travels were paramount for Kämpfer's knowledge of Japanese botany, zoology and for the interactions with the Japanese physicians. His observations are embodied in his writings "*Amœnitates Exoticae*" and the monumental "History of Japan" respectively published in 1712 and 1727-28 (BOWERS 1966, BOWERS & CARUBBA 1970, BEUKERS *et al.* 1991).

The latter work was published after his death and was translated from the German manuscript by the Swiss physician Johann Gaspar Scheuchzer (KÄMPFER 1727) acting under orders of Sir Hans Sloane (1660-1753), President of the Royal Society. Sloane was himself a physician, author of a catalogue of plants of Jamaica and of a description of his travels to Jamaica and the Antilles including an account of the air, waters and diseases of that place. It is clear that Kämpfer's observations on Japanese medicine were not yet fully influenced by the teaching of Thomas Sydenham (1624-1689); indeed his education was terminated slightly before the general spread of the revitalization of the Hippocratic hypothesis from the early 18th century onwards (DEMAREE 2004). Therefore, the stressing of the hypothesized link between health and weather, and in particular the search for its evidence through carrying out climatological observations, is still missing.

Already in 1729, Kämpfer's "History of Japan" was translated into French and into Dutch and published in the Netherlands (KÄMPFER 1732, 1733). The German edition of Kämpfer's manuscripts by Christian Wilhelm Dohm (KÄMPFER 1777-79) had to wait until the last quarter of the 18th century, nearly one century after Kämpfer's stay in Japan.

The medicine professed by Kämpfer was essentially of Hippocratic and Galenic origin. In the spirit of the Hippocratic thesis in which a relationship between weather, climate, environment and health is hypothesized, Kämpfer made a number of observations and reflections. For example, he explained the Japanese treatment of the advanced stage of colic named *Senki* by acupuncturists, as making nine points with a golden needle in order to allow for the exit of the exhalations which are supposed to house between the bowels (KÄMPFER 1712, *Observatio XI*; FINKE 1792, Tome I, p. 194; KÄMPFER 1996).

In his *Observatio IX*, on "Moxa: An excellent Cautery Much Employed by the Chinese and Japanese", Kämpfer referred to Hippocrates:

[...] Nevertheless, when the question of the causes of diseases is raised, all these people instantly, and as if they were a chorus, place the blame upon winds and vapours. They appear to assign almost every pain and condition, as does Hippocrates, to winds.

Kämpfer's description of his travels to the Shogun contains occasional weather information such as:

City of Okazaki: Early in the morning of April 18th [1692] an earthquake occurred in calm weather and lasted the duration of one Lord's Prayer or perhaps a little longer.

April 21st [1692]. Although the present heavy rain had already started two days ago, [...] (KÄMPFER 1999, Book 5, p. 408).

In Kämpfer's travel notes of his second journey to the Shogun's court in 1692, there was made mention of a thermometer [10] as follows:

March 19th [1692] City of Miyako [Kyoto]. Also his two stewards [of the third Governor], who were already fifty years old, were very humble. They showed us a thermometer, which they had received from us as a gift some thirty years ago. Those present drew closer, and we had to explain to them the indicators of the day and the moon and the grading of the thermometer.

Kämpfer also brought the following concise description of the climate of Japan:

Japan boasts of a happy and healthful Climate. The Air is very inconstant and subject to frequent changes, in the Winter loaded with Snow, and liable to sharp Frosts, in the Summer on the contrary, particularly during the Dog-days, intolerably hot. It rains frequently throughout the whole Year, but with the greatest profusion in the Months of June and July, for which are this reason call'd *Satsuki*, that is, Water-months. However the rainy Season in Japan is far from coming up

to that regularity, which is observ'd in other and hotter parts of the East-Indies. Thunders and Lightning happen very frequently (KÆMPFER 1727, p. 102).

It is followed by the description of the sea and its currents, the waterspouts (seen as water-dragons), the mountains and the rivers, earthquakes, volcanoes and the hot and cold mineral waters of which some of them are recommended as treatment against venereal and other diseases. Such a climate description is very much similar to the ones produced in Europe by the end of the 17th century.

5. The Meteorological Observations of Carl Peter Thunberg

Eighty-five years later, another exceptionally trained physician and natural scientist took charge as a physician of the Dutch East Indies Company at Dejima. It was the Swede, Carl Peter Thunberg, born in Jönköping in Småland, South Sweden, in 1743, who studied medicine in Uppsala. After spending a few years at the Dutch Cape of Good Hope factory, Thunberg arrived in Japan in the summer of 1775. In the spring of 1776 he took part in the Dutch Embassy to the Shogun at Yedo. He left Japan for Europe by the end of 1776 and returned to Uppsala where he became the successor of Linnaeus (WALLIN 1993).

His travels through Europe, Africa and Asia during the years 1770-1779 were published in Sweden (THUNBERG 1791), and immediately translated in German (THUNBERG 1792, 1792/94), in French (THUNBERG 1794, 1796) and in English (THUNBERG 1796). The French edition of the year 1796 was translated and completed by Louis Mathieu Langlès (1763-1824) and for the part of natural sciences by Jean-Baptiste Lamarck (1744-1829).

The first known set of instrumental meteorological observations (1st September 1775 – 31st October 1776) were carried out by Thunberg (DEMAREE & MIKAMI 2000). His observations were presented and read at the *Hollandsche Maatschappye der Weetenschappen* in Haarlem on 2nd March 1779 [11]. They were consequently published in the *Verhandelingen* in 1780 (THUNBERG 1780). Thunberg was put on the list of the candidates of the Society on 3rd August 1780 [12] and was subsequently elected member of that learned society on 21st May 1781 [13].

It may be questioned that Thunberg's observations are the first systematic instrumental meteorological observations in Japan. Although no definite answer has been given until today, some other possibilities were suggested by Tsukahara (TSUKAHARA 2010, p. 233).

Thunberg's *Travels* also hold the data set. The temperature was noted four times a day (in the morning just before sunrise, at 12 o'clock at noon, at 3 o'clock in the afternoon, and in the evening when dark) using a Fahrenheit-scaled thermometer. Thunberg described the instrument as "with a double glass, and filled with quicksilver, and was affected by the slightest change of weather.

I always kept it hanging on the outside of my chamber window, by the side of the wall, against a wooden post in a northern aspect, and in the open air”.

At the very beginning of his meteorological notes, Thunberg wrote on 1st September 1775, “On the Island Decima [14, 15]”, followed on 14th October 1775 by “At the ship near Papenberg”, and again on 26th October 1775 “On the Island Dezima”. Does this back-and-forth travel explain the somewhat rather scarce meteorological information at the starting period? His observations were chiefly made at Dejima, a part of them being made during his journey to the court in Jedo [Tokyo]. According to these notes, the journey to the court started from Dejima on 4th March 1776, the party arrived in Osacca [Osaka] on April 8th, in Miaco on April 11th, in Jedo on May 1st, and started travelling back to Nagasaki on 26th May, arriving in Miaco on June 7th, in Osaka on June 11th, in Kokora [Kokura] on June 23rd, and finally back to Dejima on June 29th. Thunberg’s meteorological observations ended on 31st October, 1776. Thunberg left Dejima on 23rd November 1776 to board the ship *Stavenisse* near *Papenberg* and left Japan on 3rd December 1776. It may be noted that the time span of Thunberg’s meteorological observations does not exactly correspond with the day of his arrival to and departure from Japan.

The greatest degree of heat in Nagasaki was 98 °F in August 1776 while the lowest went down to 35 °F in January 1776, in the morning. The cold weather was universally allowed to set in this year later than other years; and was of shorter duration, insomuch, that we began to make fires in our rooms later than usual.

Besides instrumental thermometric observations, Thunberg’s records contain also notes on the “state of the weather”. Herein the character of the rainy days (rain, mizzling rain, thunder showers, small rain, hard rain, rain and thunder, ..., snow, hoar frost) is described. The notes further contain limited information on the wind directions. It should be noted that the oldest paper (THUNBERG 1780) contains some information which has not been reproduced in the books afterwards. The most important words are without doubt the mention of the medical information “*Rheumatismi en de Tuccis algemeen* (Rheumatisms and caughts general)” on 27th January 1776 which puts Thunberg in the neo-Hippocratic spirit of his time. Noteworthy for its lyric expression is the mention on 20th January 1776:

’s *Nagts ys gevoren zo dik als 3 Ducatons* (In the night ice frozen as thick as three ducats).

Thunberg described the natural environment of Japan as follows:

In general it may be asserted, with the greatest truth, that the soil of Japan is in itself barren; but in consequence of the labour and manure bestowed upon it, together with heat and a sufficient quantity of rain, it is brought to a considerable degree of fertility.

The heat in summer is very violent, and would be unsupportable, if the air was not cooled by winds from the sea.

In like manner the cold in winter is extremely severe, when the wind blows from the north and north-east. It is always felt to be more intense than it really is, as indicated by the thermometer; as from the violence with which the wind blows, it pierces the body like arrows of ice.

The weather is very changeable the whole year throughout, and the ground receives rain in abundance. It rains almost the whole year round; but particularly in the *Satsaki* or rainy months, as they are called, which commence at midsummer. This abundance of rain is the cause of the fertility of Japan, and, of what is the consequence of this, its high degree of population.

Thunder is by no means unfrequent; but tempests and hurricanes are very common, as also earthquakes (THUNBERG, *Travels*, 1796, pp. 233-234).

Thunberg joined to his meteorological observations the following description of the climate of Japan. Although he recognized unfortunately not to have a barometer, he noted a number of rules on the wind directions and the climate:

1. That the east and north, and north-east winds, which blow from the land, are very cold. The south and west, and south-west, which blow from the sea, are always much warmer; and when it rains, the weather immediately grows milder.

2. In the summer time, the wind blows at Nagasaki almost every afternoon from the south, which is a refreshing wind; in the nights and mornings it blows from the east.

3. When a fog rises in the evening, and the clouds gather, it generally rains on that night; but if there be a fog in the morning, it generally proves fair.

4. When the sky in the winter is clouded over in the east and south, rain, with blowing weather, and storms, generally succeed; but as soon as it clears up in the west or north, the weather turns out fair.

5. In the months of December and January, I twice observed fine flakes of snow in the air, which, however at Dezima, melted before it could reach the ground. I was told, that in other years a great deal of snow had fallen, which had lain for some time.

6. Lightning, thunder, and thunder-showers, occur sometimes in June and July, but chiefly in August and September, as well in the evenings, as all night long (Thunberg, *Travels*, 1796, pp. 235-236).

7. During the twenty-six days we passed at Yedo, the weather has always been humid and the sky overcast: morning and evening it rained more or less heavily. One felt also several very weak earthquakes to which we didn't even attract our attention (Thunberg, *Voyages*, 1796, Tome III, pp. 172-173).

6. Further Meteorological Observations

A second, much less known, set of meteorological observations at Dejima covers the time span January-November 1778/1779. This set was first published in the Proceedings of the Batavian learned Society (Anonymous 1784) and was

quoted by Louis Mathieu Langlès in his French edition of Thunberg's *Voyages* (1796), *Tome III*. Langlès named these data "*Observations météorologiques faites à Nagasaki en 1779*"; however, doubt may remain on the exact year, 1778 or 1779, since in the original publication the headings of pages 84 & 85 read "*Japon 1778*" while pages 86 & 87 mention "*Japon 1779*". However, from the original title in the "*Verhandeligen*", it was thought that the observations were referring to the year 1779.

The data consist of the monthly highest and lowest temperature values, monthly means in the morning, noon and evening of the temperature (fig. 2), the monthly number of days with wind directions, rain, storm, frost, thunder, etc. Again a Fahrenheit temperature scale is used and it is legitimate to ask if the same thermometer as Thunberg's is not being used here. It is strongly suggested (TSUKAHARA 2006) that these anonymous meteorological observations were carried out and reported by Arend Willem Feith (1745-1782), who was appointed five times as the *opperhoofd* of Dejima, from the following arguments: (1) A.W. Feith was *opperhoofd* for the period 12.11.1777 to 28.11.1779, a time span fully including the period of the observations whenever the year of the observations would be 1778 or 1779; (2) A.W. Feith was one of the three members of the Batavian Society of Arts and Sciences who stayed in Japan; (3) A.W. Feith was also *opperhoofd* of Dejima (28.10.1775 to 22.11.1776) when Thunberg was carrying out his observations; (4) the climatological time series stops at November 1779 when A.W. Feith left Dejima. According to these arguments, A.W. Feith seems more or less to continue Thunberg's observations.

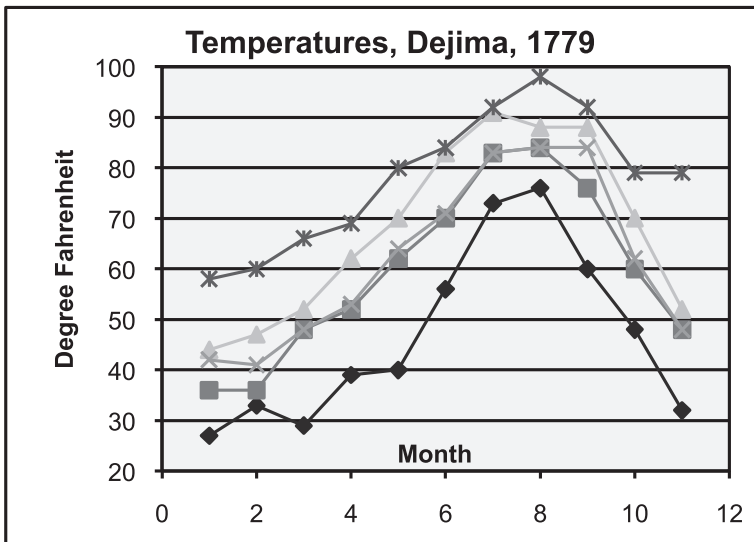


Fig. 2. — Monthly highest and lowest temperature values, monthly means in the morning, noon and evening of the temperature (degrees Fahrenheit) at Dejima in the year 1779 (Anonymous 1784).

Isaac Titsingh (1820, 1822, 1824) was also *opperhoofd* of Dejima for the period 24.11.1781 to 26.10.1783. He gave contemporaneous accounts of the eruption of the volcano Asama which took place in August 1783. As this volcano erupted in the same time span as the disastrous Lakagígur eruption in Iceland which gave rise in the summer of the year 1783 to a long-lasting dry fog all over western Europe, and probably over the whole Northern Hemisphere (DEMAREE *et al.* 1998), it is still not clear if and how much Asama may have contributed to the regional and worldwide impact of volcanic eruptions on climate and environment (MIKAMI 1982, MIKAMI & TSUKAMURA 1992).

In the beginning of the month of September, 1783, I received from Yedo the following particulars of the dreadful ravages occasioned by the eruption of the volcano, Asama-ga-daki, in the districts of Djozou and Zinzou. On the 28th of the 6th month of the third year Ten-mio (July 27, 1783), at eight o'clock in the morning, there arose in the province of Sinano, a very strong east wind, accompanied with a dull noise like that of an earthquake, which increased daily, and foreboded the most disastrous consequences.

On the 4th of the seventh month (August 1st), there was a tremendous noise and a shock of an earthquake; the walls of the houses cracked and seemed ready to tumble; each successive shock was more violent, till the flames burst forth, with a terrific uproar from the summit of the mountain, followed by a tremendous eruption of sand and stones: though it was broad day, every thing was enveloped in profound darkness, through which the flames alone threw at times a lurid light. Till the 4th of August the mountain never ceased to cast up sand and stones.

The large village of Sakamoto and several others situated at the foot of the volcano were soon reduced to ashes by the ignited matter which it projected, and by the flames which burst from the earth. The inhabitants fled; but the chasms every where formed by the opening of the ground prevented their escape, and in a moment a great number of persons were swallowed up or consumed by the flames; violent shocks continued to be felt till the 8th of the seventh month, and were perceptible to the distance of twenty or thirty leagues: enormous stones and clouds of sands were carried by the wind toward the east and north. The waters of the rivers Yoko-gawa and Karousawa boiled; the course of the Yone-gawa, one of the largest rivers of Japan, was obstructed, and the boiling water inundated the adjacent country, doing incredible mischief. The bears, hyenas, and other beasts of prey, fled from the mountains, and flocked to the neighbouring villages, where they devoured the inhabitants, or mangled them in a horrible matter. The number of dead bodies floating upon the rivers was incalculable. [...]

Isaac Titsingh continued his narration of the Asama eruption by another more circumstantial account of the event that was, again, transmitted from the capital. Titsingh left Japan in November 1784 but he was also able through correspondence to document geophysical events occurring in the years after his departure.

It is known that Isaac Titsingh frequently wrote about climatic conditions in his diary (TSUKAHARA 2010). The “*Catalogue raisonné du Cabinet Titsingh*” contains in III.3 Meteorology the (missing) item “*Un Petit cahier in-folio écrit*

en hollandais de la main du Défunt, contenant des observations Météorologiques” (LEQUIN 2003). It is not known where these meteorological observations were carried out as Titsingh was stationed in various VOC-posts.

Malte-Brun summarized the climate of Japan as follows, based upon earlier authors:

These [Japanese] Islands experience by turns the extremes of heat and cold. The summer heat, however, is frequently alleviated by the sea breezes. In winter the north and north-west winds are exceedingly sharp, and bring along with them an intense frost. During the whole year the weather is variable, and much rain falls, particularly in the *satsaki* or rainy month, which begins at midsummer. According to observations, the highest degree of heat at Nagasaki is 98° in the month of August, and the greatest cold 35° in January. The snow lies some days on the ground even in the southern parts. Thunder is heard almost every night in summer; storms, hurricanes, and earthquakes are very frequent. The genial rains conspire with human labour and manure to overcome the natural sterility of the soil (MALTE-BRUN 1827, p. 51).

7. Epilogue

Although the 19th century falls outside the scope of this presentation, it may be noted that other Dutch physicians, in line with their 17th and 18th century predecessors, carried out meteorological observations. From 1819 onwards instrumental meteorological observations were carried out at Dejima (KONNEN *et al.* 2003). In 1824 Franz von Siebold asked for a barometer among other instruments. In 1830 von Siebold presented to the government a collection including “physical and meteorological observations and determinations of the highest Japanese mountains with the barometer” (MACLEAN 1973, p. 292). Siebold’s climate description of Japan became more elaborated. Siebold insisted on the climatic differences between the China Sea and the Pacific Ocean coasts (VON SIEBOLD 1897):

In the hottest part of the year, in July and August, when the south and south-east winds are to be most dominant, makes this disproportion stand out according to the geographical latitude of the places. At Deshima the average temperature is 79 °F and at Jedo 76 °F. At the south and south-east coasts which are then exposed to the winds, the thermometer hardly shows more than 85 °F, however at the south and south-east coasts of Kiusiu, particularly in the from winds protected bays, it often reaches 90 till 98 °F, and sometimes 100 °F.

Japan is extremely rich in the field of climatological records confined in historical documents. A large number of old Japanese diaries preserved in local libraries, museums or archives contain precious quasi-daily continuous weather descriptions. Some of these diaries start already in the second half of the 17th century and span a period of two centuries. This richness in weather descriptions

complements the instrumental meteorological observations (to name only a few: YOSHIMURA 1995; MIKAMI 1988, 1996, 1999; FUKAISHI & TAGAMI 1993).

In the first half of the 19th century, instrumental meteorological observations were carried out by Japanese researchers as well as the Dutch at Dejima. The situation changed completely after the opening of Japan in 1854 when a larger number of meteorological series became available. Zaiki made a complete inventory and produced long-term time series (ZAIKI 2004, ZAIKI *et al.* 2006). Finally, a regular weather observation system as a government service was started in Tokyo on 1st June 1875.

NOTES

- [1] Shogun: literally, “military commander”, they were the *de facto* rulers of Japan though they were nominally appointed by the Emperor.
- [2] A Japanese named Anjirō.
- [3] Miaco: former name of Kyoto.
- [4] In England and Ireland the Gregorian calendar was introduced only in 1752.
- [5] This sentence is not present in Thompson’s edition of Richard Cocks’ diary. It is taken from Rundall’s Memorials of the Empire of Japan (1850), pp. 99-100.
- [6] *Idem.*
- [7] The battle of the Three Kings at Ksar el Kbir, Morocco, 4th August 1578.
- [8] Former name of Jakarta, Indonesia.
- [9] Former name of Tokyo, also Jedo, Iédo or Edo.
- [10] This brings us to estimate the construction date of the instrument to be around 1660. In case the instrument would be a thermometer — some doubts remain — and taking into account the Dutch context, it could be a thermoscope such as those devised by Cornelis Drebbel (1572-1633).
- [11] “Heeft de Heer [Jan] Engelman, uit naam van den Heer Jean Deutz, Schepen der Stad Amsterdam, Directeur deezer Maatschappye, gepresenteerd, de Thermometrische Waarneemingen in Japan, gedaan door den Heer Carel Pieter Thunberg en is besloten deselven te drukken, en den Heer Deutz voor de communicatie te bedanken” (Archief van de Hollandsche Maatschappye der Weetenschappen, Notulen, d. 2 Maart 1779, p. 1007).
- [12] “Is besloten, den Heer Carolus Petrus Thunberg, M.D. &c. &c., door den Heer J. Deutz tot Lid deezer Maatsch. voorgeslaagen, als genoegzaam door zyne verdiensten bekend, op den lyst der Leden in May 1781 te creeren, aan te tekenen” (Archief van de Hollandsche Maatschappye der Weetenschappen, Notulen, den 3 Aug 1780, p. 1079).
- [13] “[...] tot Leden: Carolus Petrus Thunberg, Medic. Doctor & Professor op de Hooge Schole te Upsal” (Archief van de Hollandsche Maatschappye der Weetenschappen, Notulen d. 21 May 1781, p. 1129 & 1130).
- [14] Thunberg’s ship arrived at the entry of Nagasaki port on 13th August 1775. On 14th October, the Dutch ship was forced by the Nagasaki governor to leave Nagasaki port for Papenberg, a small rocky island situated out of the port. Thunberg was forced to stay aboard the ship waiting for departure, and to stay there until replaced by the physician leaving Dejima and returning to Batavia.
- [15] Dejima, also written Deshima, Decima, Dezima.

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