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Goethe and the Clouds

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Today we take the daily weather reports for granted and easily forget that just at the beginning of the 19th century, at the lifetime of Goethe one would not even think of a weather forecast based on science. Not even the atmospheric variables were known that permit such a forecast. It was just empiricism such as the knowledge of peasants, shepherds and sailors that was available. Against this background the cloud classification of Luke HOWARD (1772 -1864) shows its real importance. With his work, "[On the Modification of Clouds](#)", this pharmacist and apothecary from London in 1803 laid the cornerstone for a classification of clouds that in its fundamental outlines is still valid today. If we speak of Goethe's meteorological observations we have to speak of Luke Howard because it was him who coined Goethe's scientific view of meteorology and his poetic reflections of meteorologic phenomena.

The way to the poem "In Honour of Howard"

In an as simple as brilliant way Howard classified the clouds into four basic forms according to the separate vertical levels of the atmosphere. Simple because these basic forms were subdivided phenomenologically; brilliant because behind his considerations there was a sure feeling that the vertical distribution follows certain physical laws.

Howard first names the main cloud types: cirrus (feather cloud), cumulus (heap cloud) and stratus (layer cloud). Between these, mixed type forms exist: cirro cumulus, cirro stratus, cumulo stratus, and added later, cumulo cirro stratus, also named nimbus, a rain cloud and a type of its own. It has to be remarked, however, that his classification does not distinguish neither the mid-level clouds alto cumulus and altostratus nor the rain cloud nimbostratus which reaches from low to mid-atmospheric levels. This, however, does not belittle Howard's scientific achievements.

From Howard's observations we can conclude that he distributed the different cloud types to the different altitudes. The vertical structure of the atmosphere was still rather unknown in his times. It was known from mountain climbing that pressure and temperature decrease with height but the thermodynamic context of pressure, temperature and humidity – and thus the origin of cloud formation – was deciphered by the scientists only later in the 19th century.

Goethe correctly recognized Howard's work as a breakthrough. It is well known that for Goethe empiricism was the key for understanding nature. Hence one understands his enthusiasm for Howard's classification that for the first time gave an empirically founded systematization of the clouds. Consequently he dedicated him his poem "*In Honour of Howard*" (1821):

*"But Howard gives us with his clearer mind
The gain of lessons new to all mankind;
That which no hand can reach, no hand can clasp,
He first has gain'd, first held with mental grasp.
Defin'd the doubtful, fix'd its limit-line,
And named it fitly. - Be the honour thine!"*

(The translation follows D.F.S. Scott, 1949)

Howards System, Seen as Physics

Howard's vertical structural level of the clouds is based on meteorological facts. Alongside with the decrease of pressure with increasing height the atmosphere is characterized typically by a vertical

gradient of temperature. Up to the the lower stratosphere (which in our latitude is around 10 to 12 kilometres high) temperature decreases with height. Clouds consist of condensed water in form of cloud droplets or water in cristalized form, i.e. ice. There also exist clouds with a water/ice combination.

Cloud formation takes place when the temperature drops below a certain value (the dew point temperature). Then the (invisible) water vapour condenses onto tiny particles in the air, the condensation nuclei – a visible cloud is formed. Howard's classification of cirrus- (feather-) clouds, cumulus- (heap-) clouds and stratus- (layer-) clouds refers exactly to the fact that at temperatures lower than $-35\text{ }^{\circ}\text{C}$ every cloud consists completely of ice, at temperatures higher than $12\text{ }^{\circ}\text{C}$ completely of liquid water (due to reasons of cloud physics, water in the free atmosphere does not freeze immediately at $0\text{ }^{\circ}\text{C}$). His great achievement was to analyze this without founded knowledge in his time of the atmophere's vertical structure.

In spite of all progress in cloud physics and in spite of all the refinements that is included in the systematics of the World Meteorological Organization WMO, Howard's purely empirical observations are still valid today. Still today the multitude of clouds can only be described beschreibend; and ever again it happens that the meteorologist on duty when doing his 3-hourly observation work detects cloud forms that can hardly be squeezed into the narrow pattern of meteorological service routines.

Goethe as a meteorologist, Howard as a poet

Goethe in 1815 learnt to know the work of Howard when he, as the director of the institutes for arts and science in the ..., was active in founding a meteorological station on the Ettersberg hill near Weimar. In 1822 he got in mail correspondence with Howard.

Comparing Luke Howard's scientific description of the main cloud types with Goethe's poetic description, the empirically precise scientist from Englad and the poet from Germany are coequal.

Example stratus: Howard names this layer cloud shortly and precisely as "*a widely extended, continuous, horizontal sheet, increasing from below.*"



Stratus (Cap de Rosiers, Kanada, 27.07.1991, 13:05 LT, photo: F. Ossing)

Goethe describes the stratus cloud very poetically:

*"When o'er the silent bosom of the sea
The cold mist hangs like a stretch'd canopy;
And the moon, mingling there her shadowy beams,*

*A spirit, fashioning other spirits seems;
We feel, in moments pure and bright as this,
The joy of innocence, the thrill of bliss."*

Example cumulus: Howard sketches this cloud clearly and briefly as "*convex or conical heaps, increasing upward from a horizontal base*". Once again, the real accomplishment lies in a short, but precise definition.



Cumulus (Sonneberg/Harz, 15.06.1974, 11:00 CET, photo: F. Ossing)

Goethe subtends this with his poetical accomplishment:

*" ... High as the clouds, in pomp and power arrayed,
Enshrined in strength, in majesty displayed;
All the soul's secret thoughts it seems to move,
Beneath it trembles, while it frowns above."*

Example cirrus: Howard describes this feather cloud as "*parallel, flexuous, or diverging fibres, extensible in any or in all directions*", a short definition that still today can cope with the standards of the World Meteorological Organization.



Cirrus (Coesfeld, 22.12.1974, 10:50 CET, photo: F. Ossing)

To Goethe the cirrus appears in this way:

*" ... Then like a lamb whose silvery robes are shed,
The fleecy piles dissolved in dew drops spread;
Or gently waft to the realms of rest,
Find a sweet welcome in the Father's breast."*

And finally the example of the nimbus: here Howard's definition seems not to be secure, this rain cloud could be a thunderstorm (cumulonimbus), a raining cumulus cloud, or a layer cloud with precipitation: *"Nimbus. The rain cloud. A cloud or system of clouds from which rain is falling. It is a horizontal sheet, above which the cirrus spreads, while the cumulus enters it laterally and from beneath."*

Goethe also sees the rain falling from the nimbus but definitely refers to a thunderstorm:

*"Now downwards by the world's attraction driven,
That tends to earth, which had upris'n to heaven;
Threatening in the mad thunder-cloud, as when
Fierce legions clash, and vanish from the plain;..."*

Goethe, by the way, reproduces the atmospheric water cycle in his "In Honour of Howard": *"As clouds ascend, are folded, scatter, fall..."*. The atmospheric water vapour condenses to cloud droplets (here: stratus), in cumulus clouds these cloud droplets rise up to the freezing level and form snow crystals from which develop raindrops that fall out of the cloud. Especially in thunderstorms (cumulonimbus) the upper part of the cloud changes into cirrus (the "anvil" of a thundercloud). This water cycle is also mentioned in Howard's paper.



"Nimbus": does L. Howard mean *Nimbostratus* (Akkrum, NL, 19.08.1981, 16:05 CEST, photo: F. Ossing) ...



...or, like Goethe, the cumulonimbus (Potsdam, 17.08.2000, 14:50 CEST, photo: F. Ossing) ?

It may be remarked here that Goethe takes on clouds and other meteorological phenomena not only in this poem but also frequently in his complete works. as an example we recall here the vision of Dr. Faustus who in the clouds, "*formlessly huge and towering it hangs in far icy eastern hills*", means to recognize Helena (Faust II).



"... towering it hangs in far icy eastern hills ", shower cloud with icy upper part (Neustadt i.H., 27.08.78, 12:30 CET, photo: F. Ossing)

Meteorological Blur: where is the Mid-level?

Already Schöne (1969, S. 29) alludes that Goethe uses the nomenclature of Howard as a construction kit. Wherever he finds that Howard's systemization has to be altered Goethe develops own termini in which his understanding of the atmosphere condenses.

This is consequent in so far as Howard's cloud classification in fact inhibits some blurs.

Let us reconsider the above mentioned "nimbus" cloud. We have seen that rain may fall from a thunderstorm, a cumulus or from a nimbostratus. These three clouds belong to different atmospheric levels: the cumulus is part of the low clouds, nimbostratus is a mid-level cloud, and the cumulonimbus, a thunderstorm, vertically expands through all the three level. Howard accordingly calls the rain cloud a "nimbus or cumulo-cirro-stratus". This meteorological unsharpness corresponds to a linguistical unpreciseness.

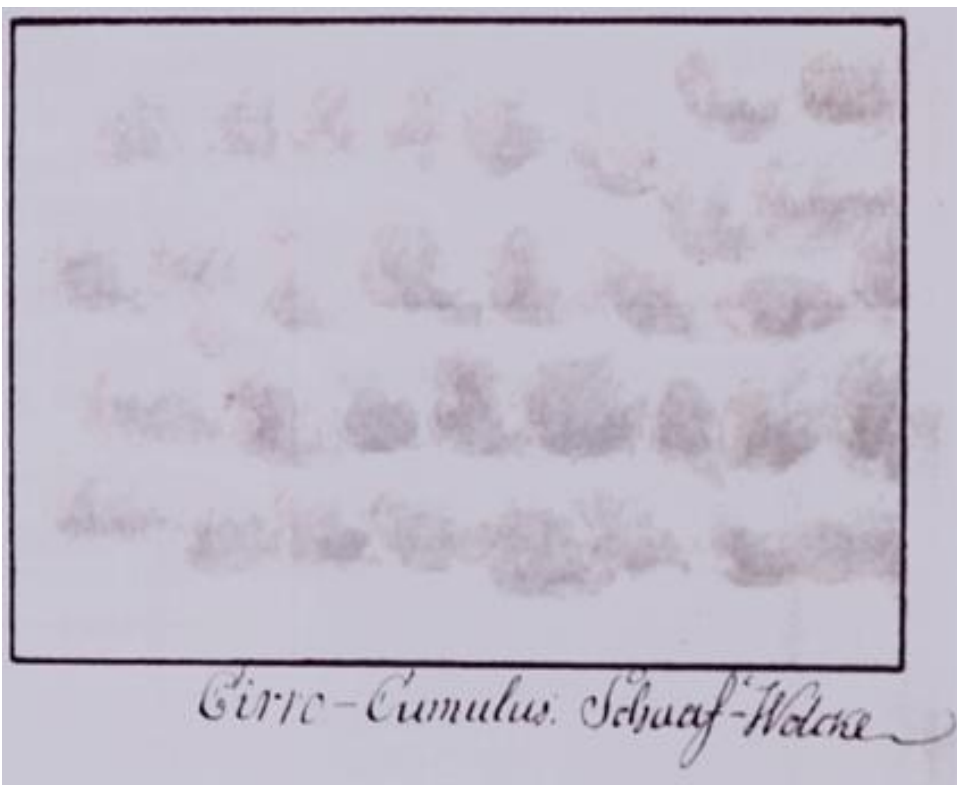
Modern meteorology defines low, midlevel and high clouds based on cloud physical reasons: while - generally spoken - low clouds consist of cloud droplets, high clouds are a conglomeration of ice crystals. Midlevel clouds are a mixture of cloud droplets and ice.

Luke Howard could not know this physical background, his pioneer work was exactly that he created a cloud classification that is valid still today without this knowledge. On the other side, however, from this there results a distinction between midlevel and high clouds that is only diffuse. The midlevel altostratus as an own cloud type is not found and under the category "cirro-cumulus" there are subsumized altocumuli or even stratocumuli.



Altocumulus sky (Bay du Vin, New Brunswick, Kanada, 30.07.91, 20:05 LT, photo: F. Ossing)

This impreciseness is reflected in a picture of „sheep cloud“ that Goethe labelled himself as "cirro-cumulus" (Goethe-Nationalmuseum Weimar, Inv.Nr. 1533). This picture definitely shows midlevel altocumuli with shading in the clouds body, and not cirrocumuli that do not show such a shading.



Altocumulus clouds, named erroneously as "Cirro-Cumulus" by Goethe (1817, pencil and Aquarell on paper, Goethe-Nationalmuseum Weimar, Inv.Nr. 1533)

What is left:

As a privy council and minister of the Duchy of Saxony -Weimar Goethe had the arts and science under himself. His weather theories, especially his „Versuch einer Witterungslehre“ (Attempt on a Weather Theory, 1825) today seems strange to us, when he tries to explain the weather-driving forces of high and low pressure systems by the earth's body that breathes the air in and out. Goethe as a theoretically erroneous theorist is opposed by the weather practitioner Goethe. Under Goethe's supervision, starting with the Weimar Weather station that was established in 1815, a weather observation network was installed as one of the first in Germany. The records taken here can be understood as one of the roots of scientific climatology and meteorology in Germany. Long before he learnt to know Howard's paper, Goethe engaged himself with the weather, drew cloud sketches and measured temperature and pressure.

With the reception of Howard's classification, however, an intensification of Goethe's meteorological ideas takes place. It speaks in the favour of Goethe's self mockery when he puts himself on in a soliloquy:

*"Disciple of Howard, strangely
You look around and above you every morning
To see whether the mist falls or rises
And what clouds are showing.."*

- exactly, when in the morning we take a glance out of the window to see if the weather forecast is right, „the mist falls or rises“, before we leave the door. Maybe that in our days and in our latitude we are no more as dependent on the weather as 250 years ago. But still today weather is a part of nature that touches us directly every day.

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A cloud catalog including more than 50 photos and description is found here:

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Comprehensive information (in German) on Goethe's work:

<http://www.goethezeitportal.de/wissen.html>