

Paintings as a Climate Archive?

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For more than one and a half decades, the GFZ German Research Centre for Geosciences has been engaged in the analysis of the reality content of images, especially the Dutch landscape paintings of the 17th Century. Initially, the focus lay on the research question whether the pictures are suitable to be used as climate archives. Very soon it became apparent, however, that landscape paintings offer no reliable proxy data for climate research. Natural archives are far more precise. Historical and art historical arguments may provide information on the limits of the validity of scientific content of the painting. Conversely, however, it could be shown that the natural sciences in collaboration with art history and other social science disciplines allow an improved access to the interpretation of the paintings. In particular, for the analysis of climatological, meteorological, and geological aspects of landscape painting, geosciences prove to be a valuable tool.



Adriaen van der Venne, "Winter Scene" (1614), oak wood, 43 x 68 cm, Cat. No. 741B, Painting Gallery Berlin, SMB, (Photograph: Jörg P. Anders)

Already for more than 15 years, the German Research Centre for Geosciences GFZ has been dealing with the reality content of images, especially 17th century Dutch landscape paintings. The background to this work is based on questions regarding the extent to which these masterpieces are true to nature and their significance as a painting-based climate archive. A key result of this project with the Painting Gallery Berlin in Berlin was the [exhibition "Little Ice Age"](#) held in 2001/2002.



Fig. 1: Pictures of cattle herds five to seven thousand years ago in the area of the present-day Sahara are not only an expression of early art, they are also witnesses of climate change. Rock paintings in Northwest Sudan, lower Wadi Howar, Southeast Sahara, 5 to 3 thousand years before the present.

For as long as human beings have used pictures to express themselves and communicate, they have made their natural environment the subject of their depictions. Information about the weather and climate can be found almost everywhere, with known early examples being the cave paintings at Lascaux in France and the "Swimmers in the Desert" at Gilf Kebir in south-eastern Sahara. The latter provides clear evidence that this part of the desert was once humid and green.

Further west, one finds another famous rock painting, the "White Goddess of Tassili" (approx. 3500 BC, south Sahara, Aounrhet, Algeria). This picture includes what is probably the first representation in human history of a rainbow. Stanley D. Gedzelman (no date) gives an excellent historical overview of meteorology and climate in art.

Thus, there are numerous representations of climatic phenomena in pictures, which directly raises the question of whether these representations would be suitable as proxy data for climate research. An initial, fundamental approach is already shown by Hans Neuberger. In 1967, he studied more than 12,000 paintings in 41 museums in Europe and the USA for data on blueness of sky, cloud types and extent of cloud cover and visibility (Neuberger, 1967). These paintings were classified into groups according to their origin, namely US American, French, English, Dutch, German, Italian and Spanish. These groups should at the same time represent different climatic regions. Neuberger's approach is a good example to show the types of problems and difficulties encountered when interpreting paintings as climate indicators.

The range of pictures studied by Neuberger ranges from the Renaissance (from about 1400) to modern paintings produced in 1967, thus, from the perspective of the history of art, there is an enormous spectrum of cultures, painting

techniques and styles. Therefore, when we refer, for example, to the cited example of the blueness of the sky, we are referring not only to the history of art, but also to the pigments available at the time. Thus, it was only when modern oil paints became available in the 19th century, that it became possible to portray Nature on the spot, in the open air. Up until then, painting had, for the most part, taken place in the studio.

Similar provisos apply to the study of visual ranges in painting. After the Renaissance invention of aerial perspective, panoramic views dominated painting for centuries until Mannerism. Hazy, which is nearly always present in the atmosphere, hardly ever appears in these paintings, and when it does, it is only there as a stylistic device. Normally, the view is unclouded up to a clear horizon, while in Nature, because of aerosols, a clear sunlit atmosphere also always becomes white as it nears the horizon. Flemish and Dutch paintings were the first to begin portraying the sky in a nearly natural or lifelike manner.



Fig. 2: *Isack van Ostade, "Icy landscape with sleigh and frozen boats" (17th century), oak wood, 21 x 24.5 cm, Cat. No. 1709, Painting Gallery Berlin, SMB (Photo: Jörg P. Anders)*

Above the ice plain a deck of stratocumulus clouds covers the sky on a late afternoon. Through some gaps the light of the setting sun tints the cloud red. The view goes to southwest, roughly. The Little Ice Age surely has influenced the Dutch landscape painting of the 17th century. Never before had the natural environment of man been painted in such a true-to-life depiction.



Fig. 3: Ludolf Backhuysen, "Harbour view with bulwark, Zeeburg", (1673), oil on canvas, 39.7 x 48 cm, Leipzig, Museum der bildenden Künste, Inv. No. 870 (Photo: MdBK Leipzig)

Depiction of fair weather to the rear of a cold front. Convective clouds with sharply defined bases and small rain showers (cumulus congestus) can be seen and mid-level clouds above (altocumulus). The cloud photo (right) shows such a sky. (Photo: F. Ossing).



Fig. 4: Allart van Everdingen, "Ships on a stormy sea", oil on wood, 26.5 x 37.5 cm, Leipzig, Museum der bildenden Künste, Inv. No. 1007 (Photo: MdBK Leipzig)

Dramatic weather beneath the arc cloud of a strong thunderstorm. The photo (right) shows the detailed accuracy of the painting and testifies the sharp meteorological view. (Photo: F. Ossing).

A purely statistical analysis of 12,000 such paintings of different origins and dates, as performed by Neuberger, is thus not possible for reasons relating solely to the history of art.

However, limiting the analysis to a defined region in a defined historical period also will not necessarily guarantee that the paintings will provide reliable information about climate.

The Dutch landscape painters of the 17th century form a special case in the history of art, because they were the first to focus on near to natural depiction.

For that very reason, these Dutch landscapes and their clouds have been the subject of continued discussion for more than a hundred years.

The paintings of this period attain a new quality with respect to cloud types and cloud coverage of the sky. Obviously, previous painting had already included portrayals of clouds, which can be classified by class, type and subtype according to the current system of the World Meteorological Organization (WMO 1987). Nevertheless, Dutch landscape painting is without doubt of unrivalled significance, since here, for the first time in the history of art and going beyond the requirements of royal court, religion or iconography, the natural environment of humans is presented in a lifelike and accurate manner.

One special phenomenon in these paintings is that, in the majority of landscapes, the sky takes up more than two thirds of the canvas and the clouds play a central part in the composition of the picture.

Lamb (1982) has already pointed out the influence of the Little Ice Age on Dutch painting. There is no doubt that this period of cooling left its mark on the Dutch masterpieces. On the other hand, the clouds painted here, regardless of realism, do not as a whole correspond to the statistical average of European weather (Ossing, 2001) and thus cannot serve as reliable proxy data for climate research.

Walsh (1991) established that the Dutch masters often painted either very dramatic or very fine weather, and thus portrayed the skies in a very selective manner. For the most part, they portray either convective clouds (cumulus) or brisk weather. Average weather, or the comparatively nondescript stratocumulus, which is the most common cloud type in our atmosphere, are seen more rarely. Other cloud types and subtypes (WMO 1987) are not presented as frequently as they appear in the real atmosphere¹. This is due to the fact that the Netherlands of the 17th century constituted the first free market in paintings in history, in which the requirements of pictorial composition were accompanied by the stylistic requirements of the art market (North, 2001).

As a result of the "Little Ice Age" project, we therefore speak of the paintings as "invented realities" (Gemäldegalerie Berlin, 2001). Extrapolating from the meteorological aspects of these paintings to the climate of the Little Ice Age will thus be misleading. It can however be considered a certainty that the Dutch society of the 17th century, stamped as it was by the weather and the sea, would hardly have given such a wide space to meteorological phenomena in its landscape paintings if it were not for the dramatically noticeable effects of the Little Ice Age on daily life (ibid, see also Gottschalk, 1971ff).

This argument applies in general to the interpretation of art works as a climate archive: weather and climate are indeed reflected in the art of all periods, but not in the sense of a linear relationship. The historical development of painting, technical issues such as the availability of colours, fashions, social and religious aspects, in short, all the questions covered by the history of art, would have influenced climatological interpretations and thus cause climate proxy data to have an insecure foundation. Natural climate archives, such as varves, tree rings and ice cores are far more reliable.

¹ Walsh's further conclusions, that the Dutch masters of the 17th century rarely painted realistic clouds must however be clearly rejected. On closer examination, none of his meteorological arguments (1991) can be verified. See also the various contributions at: <http://bib.gfz-potsdam.de/pub/wegezurkunst/>

On the other hand, the natural sciences can be a valuable tool for art history. Dendrochronology is not only a method used in climate research, but can also help in the analysis of paintings and picture frames. Meteorology contributes to the discussion about the realism with which the sky is portrayed, while geomorphology and geology aid in the interpretation of the depicted landscape. It is this interdisciplinary approach that enables progress in the history of art as it does in science.

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Acknowledgements

I wish to thank Prof. Dr. Bernhard Lindemann, Director of the [Painting Gallery Berlin, SMB Preussischer Kulturbesitz](#), in Berlin, and Dr. Jan Nicolaisen, Head of the Department of Painting and Sculpture at the [Museum der bildenden Künste in Leipzig](#) for their diverse suggestions and support, as well as for permission to reproduce their paintings.

This text is from: <http://bib.gfz-potsdam.de/pub/wegezurkunst/>

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Translation from:

GFZ-Journal System Erde, Nr. 1/2012, p. 90-95, [doi:10.2312/GFZ.syserde.02.01.17](https://doi.org/10.2312/GFZ.syserde.02.01.17), Potsdam, Germany, 2012

Translation by *Hamburger Sprachendienst*