

## Joos de Momper's Clouds, Sky and Atmospheric Optics

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February 1998



### Joos de Momper's picture composition and colour structure

In Dutch paintings of the 17<sup>th</sup> century, the sky gains previously unknown significance in landscape artwork. On the path toward this, the Flemish landscape painters, particularly Pieter Breughel the Elder, Joos de Momper and Peter Paul Rubens, take on a key role. The sky already has a determining function in landscape painting.

Joos de Momper (1564 – 1635) is one of the most important Flemish landscape painters, because his landscape paintings show the transition from the "world landscape" of the Mannerists<sup>2</sup> to the naturalistic Dutch landscape painting of the 17<sup>th</sup> century.

Momper's composition virtually always follows the Flemish colour scheme of the three grounds, with few variations: the landscape ranges like a backdrop from the brown-red foreground over green forests in the middle ground to the lilac-bluish distant background.



**Fig. 1:** Joos de Momper: „Autumn“ (c. 1612-1620, oil on oak, c. 55,5 x 97 cm; courtesy of [Herzog Anton Ulrich-Museum, Brunswick](#))

This colour gradation conveys the impression of great depth in Momper's paintings. The warm colours of the foreground and the light grey-blue of the distance are optically linked through yellow and green

<sup>1</sup> This text is a chapter from a more extensive publication of the German Meteorological Society: "Die Vier Jahreszeiten - Der Braunschweiger Gemäldezyklus von Joos de Momper" ["The Four Seasons – the Braunschweig Painting Cycle by Joos de Momper"], German Meteorological Society (Publisher), Berlin, 1998, ISBN 3-928903-16-0, through: FU Berlin, Meteorological Institute, C.-H.-Becker-Weg 6-10, 12165 Berlin

<sup>2</sup> Epoch of art between approx. 1520 and 1590; strongly linked in Italy to the High Renaissance, however, associated more with the gothic tradition in the North. Most important masters: Michelangelo, Tintoretto, Greco, Baldung, Cranach. The depiction of the sky in Mannerism is characterised by an extremely clear atmosphere.

picture elements in the middle ground. This impression is emphasised with diagonal paths or rivers in the depth of the picture.

Momper's colour scheme corresponds to the path of sunlight through the atmosphere. Expressed physically, the perception of light by the human eye is determined by the Rayleigh scattering of sunlight in the visible range by the molecules and particles in the atmosphere. Particularly with landscapes that are flooded with light, this effect causes prevailing warm colour tones in the foreground and the cold colour tones in the background.

With little variation, Momper also uses this scheme in the Braunschweig cycle of paintings, "The Four Seasons", and in the "River Landscape with Guarded Path" (approx. 1620, Adenauer Room in Palais Schaumburg Bonn, Federal Chancellery).

The view of the sky in Momper's paintings is subordinated to this colour composition. The clouds are realistic to the extent that they can be determined according to type, sub-type, etc., but their colour scheme is virtually always in grey blue and their position in the picture is virtually always in the distance. This clearly distinguishes Momper's paintings from the Mannerist portrayal of the sky, as well as from the Dutch masters of the "Golden Age", who discovered the sky as an independent object of landscape painting a generation later.<sup>3</sup>

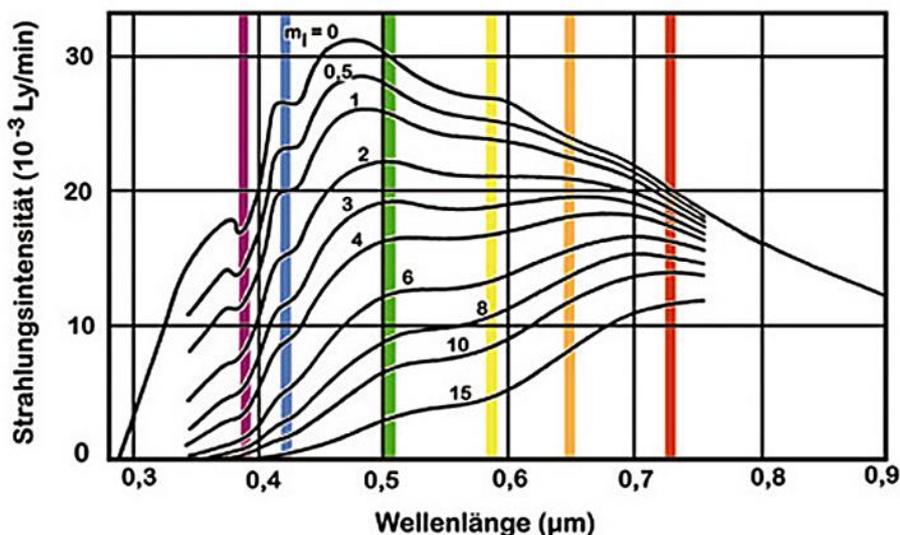


### The scattering of light in the atmosphere and the colours

What our eyes perceive is reflected radiation in a visible range of electromagnetic wavelengths. Without the atmosphere, the sun would look to us like a gleaming disk and the sky would be black. The sky receives its colour from the scattering of the sun's rays by the infinite molecules and particles in the atmosphere. The reflection of the beams of light on objects makes it visible to us.

The visible range of sunlight is comprised of radiation in various wavelengths, which result in a colour spectrum from violet and blue to green and yellow to red. The white light is created by the combination of these colours. The English physicist, Lord Rayleigh, was able to prove in 1871 that sunlight is scattered in all directions by air molecules. Furthermore, he showed that the shortwave rays (i.e. violet and blue with wavelengths of  $L=0.38$  to  $0.45 \mu\text{m}$ ) are more intensely scattered by these small particles than the longwave light (orange and red,  $L=0.65$  to  $0.75 \mu\text{m}$ ).

The scattering intensity of the light therefore increases as wavelength decreases. The blue of the sky results from a weighted average of all scattered radiation in the visible range, in which the majority is comprised of the shortwave blue portion. Conversely, the red tone of the setting sun is also based on this effect, as due to the long path through the atmosphere, the blue and green portions are scattered away from the direct sunlight and orange and red outweigh these.



**Fig. 2:** Spectral energy distribution of direct sunlight depending on the radiated air mass  $m_l$  (Ossing; according to Feußner and Dubois 1930)<sup>4</sup>

<sup>3</sup> Neumann, Nathalie/ Ossing, Franz/ Zick, Christian: "Wolken-Ge-Bilde", ["CloudScapes"], interactive comparison of the depiction of the sky in Dutch landscape painting of the 17th century with sky photography, chapter of the CD-ROM Wolken-Malerei-Geschichte["Cloud Painting History"], Publisher: German Meteorological Society (DMG) Brandenburg/Berlin, Berlin 1996

<sup>4</sup> Feußner, K. u. Dubois, P. (1930): „Trübungsfaktor, precipitable water, Staub.“ in: Gerlands Beitr. z. Geophysik 27, 132–175

When the sun is at its zenith, the path of the ray of sunlight is at its shortest through the atmosphere. This corresponds to an "optical air mass"  $m_1=1$ . The lower the sun is, the longer the path of the beam is through the atmosphere. The chart clearly shows that at  $m_1=1$ , the maximum ray intensity is at green-blue, at  $m_1=15$ , it is in red.

The blue-grey tone of distant parts of the landscape, which Momper always uses in his pictures to create optic depth in the paintings, is based exactly on this scatter effect. Mountains that are far away also appear blue-grey in nature, if they are darker than the sky. Their dark tone is "washed" with the blue scattered light of the atmosphere between the distant mountains and the observer. In contrast, nearby objects are coloured far less by the scattered light, so that they retain their "warmer" tone, such as the yellow field of grain on the photo.



**Fig. 3:** Distant objects appear with a blue tone because of Rayleigh scattering. (Photo: F. Ossing)



### **The Painting in the Federal Chancellery, Bonn**

In this little-known work by Momper, the image planes and their colour scheme can be clearly identified. Large red-brown boulders at the right-hand front edge of the picture, brown-green leaves on the tree on the right and a red-brown house at the top edge of the bottom third of the picture provide the foreground backdrop. A forested green crag on the right of the picture, a yellow sand surface in the middle and a forest on the left-hand middle edge of the picture create the level of the optical centre of the picture. The eye is guided there through the river and the path, which lead into the depth from the foreground. Both of the green/yellow covered watchtowers also mediate between the foreground and middle ground. The background is ultimately formed by the blue-green mountains in the distance and the river, which receives the same colour scheme toward the horizon. In the distant sky, there are dove-grey cumulus or cumulonimbus clouds, just like after a rain front that is moving away (Fig. 5).



**Fig. 4:** J. de Momper, "River Landscape with a Guarded Path" (117 x 84 cm, oil on wood, approx. 1620, Adenauer Room in Palais Schaumburg, Bonn, with kind permission of the Federal Chancellery Bonn)



**Fig. 5:** Thunderstorm moving away (cumulonimbus capillatus) with midlevel clouds (altocumulus cumulonimbogenitus), Trondheim, Norway, 12 August 1976, 17:55 CET (photo: F. Ossing)

## The cycle of seasons paintings in the Herzog Anton Ulrich Museum, Brunswick

The four paintings of the Braunschweig cycle of seasons (Inv. No. 64 - 67) were presumably painted by Joos de Momper during the years between 1612 and 1620. The format of the pictures painted on oak wood is 56 x 97 cm.<sup>5</sup> Also in these, the colour sequence that characterises Momper's paintings is found: brown-red tones in the foreground, yellow-green colours in the middle ground and grey-blue colour tones in the distant background of the picture.

For our topic, the spring picture is particularly interesting, as it shows a rainbow prior to shower clouds pulling away. The whitish colouring of the rainbow indicates that snow or sleet must be contained in the precipitation causing the rainbow. A rainbow is created by sunlight being refracted by raindrops, while snow and sleet cannot create a rainbow. The cloud is also typical for the season, in which rain is mixed together with snow or sleet when it falls; real April weather.



**Fig. 6:** Joos de Momper: „Spring“ (c. 1612-1620, oil on oak, c. 55,5 x 97 cm; courtesy [Herzog Anton Ulrich-Museums, Bunswick](#))

Momper was a very precise observer of nature, however, this rainbow shows meteorological discrepancies (see below, "Rainbow and light refraction"). In contrast, Momper has a very sharp eye when it comes to depicting the clouds: the lifelike shower cloud can be identified as a heap cloud (cumulus congestus or cumulonimbus), which is typical for the season. The sun shines through the gaps in the cloud from the right into the scenery.

Actually, such weather does not correspond to the setting shown in the painting. The white laundry that has been placed on the lawn to dry and bleach would certainly not be laid out during showery weather, but rather in "good dry weather" (Steland, p. 15). Therefore, the rain cloud that is pulling away and the rainbow can iconographically represent newly blossoming life after the dark winter.

<sup>5</sup> Steland, Anne Charlotte (1986): *"Die vier Jahreszeiten. Zu einer Bilderfolge von Joos de Momper"* ["The Four Seasons. A Series of Pictures by Joos de Momper"], hrsg. v. [Herzog Anton Ulrich-Museum Braunschweig](#), 67 S., Braunschweig



**Fig. 7:** April weather with a convective cloud (*cumulonimbus calvus*); a snow-rain shower is falling from the cloud. 8 April 1975, 15:35 CET, Coesfeld-Klye, Westphalia (Photo: F. Ossing) <sup>6</sup>



## Rainbow and light refraction

The dominant cloud in the "Spring" painting in the 'Braunschweig Cycle' is a powerful shower cloud that is moving away (*cumulus congestus* or *cumulonimbus*) with a weak rainbow in the right-hand top section of the picture. At the same time, bundles of rays are falling into the picture from the left. Rainbows exclusively appear in opposition to the sun, their centre is always 180° away from the sun. Therefore, anyone looking at a rainbow always has the sun behind him, as shown by the photograph: the photographer's shadow runs exactly toward the centre of the rainbow (Fig. 8).

However, in Momper's painting, the sun shines from the left into the picture, so that the path of its light forms an angle of around 90° to the rainbow. This depiction is impossible according to the laws of atmospheric optics.

Furthermore the rainbow is too high in the sky. The height of the sun above the horizon is nearly 40 degrees in the painting. With sun heights of more than 42 degrees, the main rainbow disappears completely, so it should be decidedly flatter in the painting.

Peter Paul Rubens, a late contemporary of Momper's and also an excellent landscape painter, had the same problems when depicting his rainbows. The refraction of light in a rainbow was first discovered by Descartes in 1637; it took another 30 years before Newton was able to explain the colours of the rainbow. <sup>7</sup>

<sup>6</sup> Information on climate in the 17<sup>th</sup> century, the origin of seasons and sky moods can be found in the article "Wolken und Wetter über den Vier Jahreszeiten" ["Clouds and Weather over the Four Seasons"] by Werner Wehry and Bernhard Mühr on the CD-ROM "Die Vier Jahreszeiten" ["The Four Seasons"]. (cf. Ref. 1).

<sup>7</sup> The "Shipwreck of the *Äneas*" landscape (c. 1620, 61 x 98 cm, Painting Gallery Berlin SMB) by Peter Paul Rubens also shows a rainbow, which is created by the sun shining into the picture from the side. However, in reality, rainbows can only be seen at an angle of 180 degrees to the sun. Rubens's extraordinary skills as a landscape painter are described and commented on in detail in: Brown, Christopher, 1996: "Making & Meaning: Rubens's Landscapes", National Gallery Publications, pp. 128, London



**Fig. 8:** Rainbow, Sierksdorf/Holstein, 27.08.1978, 18:40 CET (Foto: F. Ossing)

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• The authors thank the Federal Chancellery, Bonn, for the opportunity of presenting the previously little-known painting of Joos de Momper: *"River Landscape with Guarded Path"* from the Adenauer room in Palais Schaumburg Bonn to the wider public.

The reproduction of the paintings, *"Spring"* and *"Autumn"*, from the Braunschweig seasons series by J. de Momper takes place with the kind permission of the Herzog Anton Ulrich Museum in Braunschweig.

We take this opportunity to thank the German Meteorological Society, particularly Prof. Dr. Werner Wehry, Berlin, for their open and straightforward support with the realisation of this chapter.

*Translation by Hamburger Sprachendienst and Dr. Robert Trumbull, GFZ*

**Source:** <http://bib.gfz-potsdam.de/pub/wegezurkunst/>

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