On the origin and meaning of the German word Luft and some meteorological terms concerning atmospheric water, especially fog

Detlev Möller

1 Brandenburgische Technische Universität (BTU), Arbeitsgruppe Luftchemie und Luftreinhaltung, Volmerstr. 13, 12489 Berlin, Germany, moe@btu-lc.fta-berlin.de

Manuscript submitted: 1 March 2013 / Accepted for publication: 12 September 2013 / Published online: 11 December 2014

Abstract
The English and French word “air” is derived from the Latin aer, which comes from the Greek άήρ. In contrast, the German word “Luft” is a common Proto-Germanic word; in Old English “lift” and “lyft”. The word Luft (also Danish, Swedish and Norwegian) is associated with brightness: the German Licht (light), an air (in an atmospheric sense) without fog or clouds. Air and water were originally “elements” in ancient Greek and were transmutable; they represented two kinds of the “layer of mist” (atmosphere). Dark or thick air was mist or cloud, hiding the gods (who lived in the upper air or sky; the aether). Different terms are presented that describe fog and clouds in connection with the history of the process of understanding. Finally, the word Luft (air) as a term for gaseous chemical compounds (“kinds of gases”) is discussed. In addition to the German, all terms are given in Greek, Latin, English and French.

Zusammenfassung

Keywords History of meteorology, history of terminology, etymology, air, atmospheric water

Möller, Detlev 2014: On the origin and meaning of the German word Luft and some meteorological terms concerning atmospheric water, especially fog. – DIE ERDE 145 (4): 212-227

DOI: 10.12854/erde-145-19
On the origin and meaning of the German word *Luft* and some other meteorological terms

1. Introduction

Alexander von Humboldt, the founder of modern Geography and, in particular, Physical Geography, writes: “The two envelopes of the solid surface of our planet – the liquid and the aëriform – exhibit, owing to the mobility of their particles, their currents, and their atmospheric relations, many analogies combined with the contrasts which arise from the great difference in the condition of their aggregation and elasticity” (Humboldt 1850: 302). He further notes: “The aërial ocean rests partly on the solid earth …, we find that the strata of air and water are subject to determinate laws of decrease of temperature”. Air, water and soil\(^1\) (or in modern terms: the atmosphere, hydrosphere and pedosphere) were not only the ancient “elements” forming the earth with all its forms and phenomena but also characterise the states of matter (gas, liquid and solid). “The relative quantities of the substances composing the strata of air accessible to us have, since the beginning of the nineteenth century, become the object of investigations, in which Gay-Lussac and myself have taken an active part ...” (Humboldt 1850: 311). Humboldt cites accurately the concentration of oxygen (20.8\(\%\)) and nitrogen (79.2\(\%\))\(^2\) and named as minor species “carbonic acid gas”\(^3\), “carbureted hydrogen gas”, “sulphureted hydrogen gas” and “traces of ammonial vapours”. Humboldt also clearly states that “Besides these substances, which we have considered as appertaining to the atmosphere ... there are others accidentally mixed with them ... Fogs, which have a peculiar smell at some seasons of the year ... dust which

<table>
<thead>
<tr>
<th>German</th>
<th>English</th>
<th>French</th>
<th>Latin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nebel (Wolke)</td>
<td>mist, myst (cloud)</td>
<td>brouillard (nues)</td>
<td>nebula (nubes)</td>
</tr>
<tr>
<td>Dunst</td>
<td>haze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dampf</td>
<td>damp</td>
<td>vapour</td>
<td></td>
</tr>
<tr>
<td>sichtbarer Dampf</td>
<td>visible vapour</td>
<td>brume</td>
<td></td>
</tr>
<tr>
<td>Schwaden</td>
<td></td>
<td>nuée</td>
<td></td>
</tr>
<tr>
<td>Brodem</td>
<td></td>
<td>buée</td>
<td></td>
</tr>
<tr>
<td>Feuchtigkeit</td>
<td>moisture</td>
<td>humidité</td>
<td>humidus</td>
</tr>
<tr>
<td>Dampf</td>
<td>steam</td>
<td>vapour</td>
<td>vapor</td>
</tr>
<tr>
<td></td>
<td>vapoury air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atmosphärenwasser</td>
<td></td>
<td>invisible vapour</td>
<td></td>
</tr>
<tr>
<td>tropfbares Wasser</td>
<td>drop-able water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dunstkörperchen</td>
<td>petits corps opaques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wassertröpfchen</td>
<td>spères (d’eau)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bläschen, Bläsgen</td>
<td>vesicles</td>
<td>Vésicles</td>
<td>vesicula</td>
</tr>
<tr>
<td></td>
<td>spherules</td>
<td>Spérules</td>
<td>bullulae</td>
</tr>
<tr>
<td>Tropfen</td>
<td>globules, drops</td>
<td>gouttes (d’eau)</td>
<td>guttae</td>
</tr>
<tr>
<td>Tröpfchen</td>
<td>droplet</td>
<td>gouttelettes</td>
<td>guttula</td>
</tr>
<tr>
<td>Rauch</td>
<td>smoke, smoak</td>
<td>fumeé</td>
<td>fumus</td>
</tr>
<tr>
<td>Ausdünstung</td>
<td>exhalation</td>
<td>exhalaison</td>
<td>exhalatio</td>
</tr>
<tr>
<td></td>
<td>effluvia</td>
<td>Efflucence</td>
<td>effluvium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>émanation</td>
<td></td>
</tr>
<tr>
<td>Verdampfen</td>
<td>evaporation</td>
<td>evaporation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vaporization</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>volatilization</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
darkens the air for an extended area ...” (Humboldt 1850: 312f.). Within these few phrases, Humboldt used six different terms (aërisform, aërial, atmosphere, air, vapours and gas) for a phenomenon that today we describe simply by air. Old literature (before the middle of the nineteenth century) used terms which today are accurately defined in atmospheric sciences, both synonymously and also with a different sense. Moreover, it is difficult when reading old literature because the same phenomenon might be described by many different terms. Before the middle of the seventeenth century, almost all scientific books were written in Latin but Latin terms for phenomena mostly originate from Old Greek. Only since the seventeenth century, with an increasing number of scientific books in modern languages (German, French and English), were Latin terms rendered differently, through existing words from the colloquial language, by different authors explaining the variety of terms (Table 1). However, the decrease in the number of terms (i.e., exactly one term for one phenomenon) together with its accurate scientific definition did not begin stepwise before the middle of the nineteenth century.

2. Air (Luft) and light (Licht)

The word Luft (also Old Saxon, Middle High German, Danish, Swedish and Norwegian) finds its primordial roots from medieval texts as the “sphere between earth and heaven” (Grimm). Relations of this Proto-Germanic word (Luft) with cognate languages have not been found because the most frequent meaning of Luft in the old language is a draught of air; Old High German: luft, aër, luft, luht; Gothic: lufts; Old North German: loft²; Old English or Anglo-Saxon: lyft; Middle English (now antiquated): lift⁴, Dutch: lucht. It is likely that the stem of Luft derives from Licht (light, German: licht), which has been recognised from celestial bodies and its radiation as an atmospheric phenomenon (Latin: lucis, luminis, lumen; Greek: λυχνος). The Proto-Germanic word Luft shows many variations which even include a similarly sounding Old-English or Anglo-Saxon word lyft (after Kluge 1999, Duden 1963, Pokorny 1953). The linguistic affiliation between Luft and Licht is expressed in old phrases, particularly in relation to the transparency and clearness of air (or atmosphere); cited from Grimm, Vol. 12, 1889:

“der klaar und heiter luft, aether apertus (Megenberg); feiner heiterer luft, liquidae aureae; der schön luft oder heiter himmel, liber nubibus aether (Maaler)” [clean and bright air; fine bright air; fine air or bright sky].

The relation between light (and sun) and air also follows from the association with growth and life:

“... sie hindern licht und luft, und stehn dem wachthum vor (Günther); noch beraubt dich gott mit der sunnen noch des mens, des lufts und der brunnen (Kaysersberg)” [...] they hinder light and air and prevent growth; still God robs you not of sun and moon, not of air and wells].

3. Air (Luft) and wind (Wind)

The earliest use of the word Luft for wind⁶ can be found in the poem “Crist” (991) attributed to the Anglo-Saxon author Kynewulf who lived in the eighth century in Southern England (King of Wessex 757-786):

“hû þat gestûn and se storm and seó stronge lyft brecað brâde gesceafct” [hurricane and storm and tempest break up the wide world]; Bosworth and Toller (1898).

Mohr (1854) drew attention to the fact that the German language contains words whose pronunciation gives an intrinsic sense (he mentioned “Atmen” – breathing); he writes: “Ein anderes höchst malerisches Wort ist “Hauch”. Es fängt mit h an und endigt damit. Man muss die Bewegung des Hauchens nachahmen, wenn man es ausspricht” (Mohr 1854: 627) [another deeply picturesque word is “Hauch” (breeze breath). It starts with “h” and ends with “ch”. One must imitate the movement of a breeze when pronouncing it]. Pronouncing “Luft” produces a sibilation like a wind and a blow. The poet Georg Rudolf Wockherlin (1584-1653) underlines the “meteorological” elements:

“der luft schiesz dunder, strahl und plitz” [the air shoots thunder, beam and lightning].

Konrad von Megenberg, principal of the Vienna Cathedral School and canon in Regensburg, created the first German encyclopaedia of nature, called “Buch der Natur” (originally “Buch über die natürlichen Dinge”). It was primarily a translation from a Latin source, a shortened and changed version of the “Liber de natura rerum” by Thomas of Cantimpré (about 1200-1270), known as “Thomas-Ilia”. Therein, we find the ancient description of air as an element (after Grimm):
The term “atmosphere”, derived from Greek (ατμόσφαιρα), is unlikely to have been used before the middle of the eighteenth century. The term “atmosphæra” merely described the altitude between the surface of the earth and the bottom of the clouds. The term “atmosphæra” was first named in England by astronomers in the context of moon observations (Boyle 1662: 18), partly synonymously with “air” (… the air or atmosphere …; Boyle 1662: 64). In most cases, Boyle used the word air in terms of a substance: “Since in that part of the Atmosphere we live in, that which we call the free Air (and presume to be so uncompressed) is crowded into so very small a part of that space, which if it were not hindered it would possess” (Boyle 1662: 33f.).

“… the Air may consist of any terrene or aqueous Corpuscle, provided they be kept swimming in the interfluvius Celestial Matter; it is obvious that Air may be as often generated, as Terrestrial Particles; minute enough to be carried up and down, by the Celestial Matter, ascend into the Atmosphere” (Boyle 1662: 91f).

Boyle also used the terms Corpuscles of Air (Boyle 1662: 19), Ambient Air (Boyle 1662: 24), Aërial Particles (Boyle 1662: 28) and Aërial Corpuscles (Boyle 1662: 70), the last one provided with the characteristics of “… gravitating themselves …”, apparently aerosol particles in today’s understanding as hydrometeors and dust particles. In German (until the middle of the nineteenth century), instead of "Atmosphäre" the words Luftkreis ("aerial sphere" – air surrounding the earth or a part of it) and Luftmeer ("aerial ocean") were used, right up until the twentieth century.

The term “atmosphere”, derived from Greek (ἀτμός = vapour, ἀτμος = vapour, damp, mist, αἰσθησις = sphere, ball), is unlikely to have been used before the middle of the eighteenth century. The Dutch astronomer and mathematician Willebrord van Roijen Snell (1580-1626) translated the Old Dutch word damphooghde (in Latin altitudine vaporum, in German Dunsthöhe) into a new Latin term “atmosphæra” in 1608 (Snell 1580-1626) which at first merely described the altitude between the surface of the earth and the bottom of the clouds. The term “atmosphæra” was first named in England by astronomers in the context of moon observations (Weekley 1967, Boskovic 1753). Gottfried Wilhelm Leibniz (1646-1716) used the term “atmosphæra” manifold in his letters (Leibniz). Robert Boyle (1627-1691) often used the term “atmosphere” (Boyle 1662: 18), partly synonymously with “air” (… the air or atmosphere …; Boyle 1662: 64)11. In most cases, Boyle used the word air in terms of a substance: 

In his book μετεωρολογία, Aristotle placed the transformation of four elements (soil, water, air and fire) in

Note the masculine gender of “der Luft” (in the course of time all three genders were used).

In Gehler (1787), one can find the synonymous terms:

Luftkreis, Dunstkreis, Dunstkugel, Atmosphäre der Erde, Atmosphaera terrestrial, Atmosphère de la terre

The term “atmosphere”, derived from Greek (ἀτμός = vapour, ἀτμος = vapour, damp, mist, αἰσθησις = sphere, ball), is unlikely to have been used before the middle of the eighteenth century. The Dutch astronomer and mathematician Willebrord van Roijen Snell (1580-1626) translated the Old Dutch word damphooghde (in Latin altitudine vaporum, in German Dunsthöhe) into a new Latin term “atmosphæra” in 1608 (Snell 1580-1626) which at first merely described the altitude between the surface of the earth and the bottom of the clouds. The term “atmosphæra” was first named in England by astronomers in the context of moon observations (Weekley 1967, Boskovic 1753). Gottfried Wilhelm Leibniz (1646-1716) used the term “atmosphæra” manifold in his letters (Leibniz). Robert Boyle (1627-1691) often used the term “atmosphere” (Boyle 1662: 18), partly synonymously with “air” (… the air or atmosphere …; Boyle 1662: 64)11. In most cases, Boyle used the word air in terms of a substance: 

“Since in that part of the Atmosphere we live in, that which we call the free Air (and presume to be so uncompressed) is crowded into so very small a part of that space, which if it were not hindered it would possess” (Boyle 1662: 33f.).

“… the Air may consist of any terrene or aqueous Corpuscle, provided they be kept swimming in the interfluvius Celestial Matter; it is obvious that Air may be as often generated, as Terrestrial Particles; minute enough to be carried up and down, by the Celestial Matter, ascend into the Atmosphere” (Boyle 1662: 91f).

Boyle also used the terms Corpuscles of Air (Boyle 1662: 19), Ambient Air (Boyle 1662: 24), Aërial Particles (Boyle 1662: 28) and Aërial Corpuscles (Boyle 1662: 70), the last one provided with the characteristics of “… gravitating themselves …”, apparently aerosol particles in today’s understanding as hydrometeors and dust particles. In German (until the middle of the nineteenth century), instead of "Atmosphäre" the words Luftkreis ("aerial sphere" – air surrounding the earth or a part of it) and Luftmeer ("aerial ocean") were used, right up until the twentieth century.

5. Air (Luft) and water (Wasser): air as an element

Until the discovery of the chemical composition of air in the eighteenth century, air was regarded as a body, based on Aristotle’s definition of an “element” (together with water, soil and fire). The idea of transmutation (air ↔ water) survived until the end of the eighteenth century, when it was finally rejected by Lavoisier; however, Boyle (1662) already doubted it from his experiences of “New Experiments Physico-Mechanical Touching the Air” (Boyle 1662: 91): “… thought not that Air may be generated out of the water, yet that in general Air may be generated anew”. For the first time, Boyle used the term ἀεióphile (Boyle 1662: 85) as an “air-loving” substance13, in particular for water; “… that water may be rarefied into true Air”. The close connection between air and water is founded on the ancient Greek. Aristotle recognised that water evaporates from waters and the earth soil (ἀτμος) and condenses in air (“solidifies” πύχνωσις but also named “dense” δασυς by the ancients, from which the Latin dēnso and dēnsus are derived); in Modern Greek “to condense” means συμπύκνωσις (verbatim “contraction”). The Greek prefix συμ corresponds to the Latin con; hence, we see the origin of the modern condensare.

In his book μετεωρολογία, Aristotle placed the transformation of four elements (soil, water, air and fire) in

DIE ERDE · Vol. 145 · 4/2014

215
focus. Each of these elements occupies its own region but with the understanding that the matter of ἀήρ (air – aër) and ὕδωρ (water – idor) cannot be treated separately. The changing states of elements are produced, according to the ancient philosophy, by two forces: heat and cold. Whereas older Greek philosophers treated water (Thales) or air (Anaximenes, Heracleites) as elementary bodies, Aristotle (and his scholar Platon) did not consider the four elements as different basic materials but as carriers of different properties, belonging to a single primary matter (Meyer 1914). Aristotle attributed to each element paired properties (warm, cold, dry and wet): water is wet and cold and air wet and warm. However, he deemed the four elements insufficient to explain nature and, therefore, introduced οὐσία or αἰθήρ (aether) as a fifth element, having an ethereal and more spiritual (the quinta essentia in the Middle Ages) property.

While the lower layer of the atmosphere (the celestial hemisphere from the ancient view) was characterised as ἀήρ, the upper layer was named αἰθήρ; both were regarded not only as different areas but also as different matters (since Homer). However, only air (ἀήρ) was seen as transmutable. Hence, ἀήρ exists as βαϑύς (thick air) and appears to the eye as fog or cloud (Gilbert 1907: 18). Whereas αἰθήρ denotes the clean upper air or sky (the igneous sphere) and ἀήρ constitutes the lower layer of air, the “atmosphere” (in the German sense Dunstkreis, i.e., the misty sphere) is filled with fog and clouds and being in darkness (....to mask the gods).

Initially, water (as precipitation) is celestial and feeds the terrestrial waters. Conversely, terrestrial water rising to heaven and transforming there into fog and clouds stands as a continuous process of becoming and metamorphosis of ἀήρ (Gilbert 1907: 25). The ancient element “fire” was regarded in the sense of heat until the end of the eighteenth century (de Luc 1787). However, in 1806, Wilhelm August Lampadius (1772-1842, professor of Chemistry in Freiberg/Saxony) writes: “Das atmosphärische freye Feuer verbindet sich mit dem Wasser zu einem eigenen elastischen Fluidum, dem Wasserdampf; das Feuer ist fortleitendes Fluidum; das Wasser wägbare Substanz” [atmospheric free fire combines with water into its own elastic fluid, the water vapour; fire is the conducting fluid; water is the ponderable matter].

While Homer understood air as a gloomy substance (atmosphere), characterised by fog and clouds, Anaximenes recognised air as being invisible, only recognisable through heat and cold, wetness and motion (Gilbert 1907: 474). Insofar as the primordial term ἀήρ must be understood as fog (dimming), Anaximenes already understood πνεῦμα as compression of ἀήρ, whereas Anaximander identified πνεῦμα with the thinly dispersed substances of ἀήρ (what these might be remains beyond our imagination).

Aristotle further subdivided the lower layer of the air. For an understanding of fog (and clouds), the area that immediately adjoins the earth (nowadays called the boundary layer) is of great importance, through “reflected radiance of solar heat” and is characterised through “rising water vapour” (ἄτμις). Aristotle denotes a cloud as πύχνωσις ἀέρος (thick air). Aristotle’s meteorology was regarded as so absolute that it found general acceptance and distribution. Hellmann (1908) writes: “The system established by Aristotle remained for nearly 2000 years the standard textbook of our science” (i.e. Meteorology), see Table 2.

6. Air (Luft) and fog (Nebel): vapour condensation

At this point, Albertus Magnus (about 1200-1280) should be mentioned with his work “De Meteoris Libri”, which completely corresponds to the work of Aristotle but with his own supplements. In his work “De Passionibus Aëris” Meteorology is briefly presented. Magnus had greatness and two scholars: Thomas von Aquin or Thomas Aquinas (1224-1275) and Thomas de Cantimpré. From the latter, we cite two “typical” phrases on clouds and fog from his work “De Naturis rerum” (after Hellmann 1904: 123f):

“Nubes quasi nimborum naves dicuntur; ferunt enim pluvias de terra per vapores ad aera sublimatas ... Nebula fit dum humidae exhalationes vaporaliter trahuntur in aera vel radiis solis repelluntur ad terram” [clouds are quasi called ships of rising air ... Fog exists as long as humidity evaporates in air where sunbeams are banished from the earth].

In the above-mentioned book, “Buch der Natur” (from about 1350), Konrad von Megenberg completely adopted the chapter “Von dem nebel” (De nebula) from Cantimpré (Hellmann 1904). In the following, the opening sentences of chapters 10 “Von dem luft”, 16 “Von dem regen”, 17 “Von dem tauge” and 26 “Von dem nebel” are presented in (still understandable today) Middle High German (Pfeiffer 1861):
"Der luft ist von nâtûr warm und fäuht, aber diu wirm [Wärme] ist gaistleicher [geistig, spiritualis] an dem luft denne an dem feur …; Der regen kümpt von wässrigem dunst, dem der sunnen hitz auf hât gezogen in daz mitel reich des luftes …; Taw wirt auz gar behendem zartem wäsrigem luft, der sô lind und sô zart ist, daz er die kelten der miteln reichs des luftes niht rleiden mag; Der nebel kümt von grobem wässrigem dunst, dâ vil swærs erdisches rauchs zuo gemischt ist, alsô daz in diu sunne niht aufgeheben mag hôch von den erden in die lüfte" [the nature of air is warm and wet but the heat in air is spiritual unless in fire …; rain results from aqueous vapour, which rises aloft into the middle realm of air through solar heat …; dew consists of slight aqueous air, so balmy and gently that it cannot go to the cold middle realm of air; fog comes from coarse aqueous vapour, add much heavy telluric smoke so that it cannot rise from earth into airs when the sun rises].

"Of hawel, of deu, of reyn-forst, and of hor-forst that freoseth so lowe, of clouden and of myst, for a lothing hit is, for alle hi cometh of water breth that the sonne draweth up i-wis." [In "Heiligenleben" ("Fragment of Popular Science from the early English metrical Lives of Saints") the climatic situation of England is wonderfully expressed, declaring "fog as plague" (Wright 1861: 137):

"Or cowle, or deu, of reyn-forst, and of hor-forst that freoseth so lowe, Of clouden and of myst, for a lothing hit is, For alle hi cometh of water breth that the sonne draweth up i-wis."

In the "Anglo-Saxon Manual of Astronomy" (written in the 10th or 11th century) one finds the definition of air (Wright 1861: 17)14:

"Aer is Lyft; ignis, fyr; terra, eorðe; aqua, waeter. Lyft is lichamlic ge-sceafte swyde þynne; seo-pfer-gæð ealne middan-eard, ... [air is atmosphere; ignis fire; terra earth, aqua water. Air is a very thin corporal element; it goes over the whole world, ...].

While fog is always equated with "thick air" and darkness, the terms ὰμίχλη (mist), ἀχλύς (gloom), αὕρα (breeze of air – aura), νεφέλη or νέφος (Nephele-
The closeness of the first two terms to brume is reflected in combinations with the word kling of rain and fine cold dust rain), Sprühregen (mist and overcast sky), embrun Sachs of atmospheric moisture, and also in French (after exist more than a hundred terms for different types on language (OED). Nevertheless, in Japanese, there must be noted that Nebel [brouillard], Dunst [brume], Schwaden [nuée] and Broden [buée] were used exclusively for water. In English, “steam” is used only for water vapour, whereas damp, vapour(s), smoke, vapeur(s), fumée(s) are also used for other (evaporating, escaping) substances. Incidentally, Luft/Lüfte (air/airs) was used for all gases, in addition to atmospheric air, for a long time after van Helmont introduced the term Gas (gas, gaz). In the nineteenth century “Gas” became the synonym for town gas, see Section 7. The German term “Ausdünnung” (in modern usage, evaporation of water, exhalation and more generally, emission for all other substances) denotes the process (evaporation) as well as the product (vapour, gas); French: émanation, effluviation, évaporation, vaporisation, volatilisation; English: evaporation, effluvium. The German word “Dunst” is defined by Johann Georg Krünitz (1728-1796) in the “Oekonomische Encyclopädie” (Vol. 9, 1785) in the sense of fog, fume and vapours (in modern terms, “trace gases”). Similarly in Grimm: “Luther gebraucht in der Bibel das Wort nicht, nur Dampf” [Luther did not use this word in the Bible, only vapour]. Goethe (Faust I, Walpurgisnacht) writes: “Da steigt ein Dampf, dort ziehen Schwaden, hier leuchtet Gluth aus Dunst und Flor” [there rises a vapour; there flow billows and here lights glow from haze and bloom].

In ancient times, no further ideas on the form and constitution of vapours, fog and clouds originated. The question of what fog and clouds consist of was first asked by the great French philosopher and scientist René Descartes (1596-1650) in his work “Les METEORRES. Discours Premier” (1637). He describes atmos-

cloud Nymph in Greek mythology) were in use. From nephos, the Latin terms: nubes, nubilus and nebula are derived (expressing its gloom and darkness); Old High German: nebul, Old Slavic: nebo (in modern Russian: sky), Sanskrit: nabhas (fog, vapour, clouds, air, heaven). Grimm’s Wörterbuch defines „Dunst“16: “Im eigentlichen Sinne: eine Menge von Wasserdämpfen, die in tropfbar-flüssigem Zustande unmittelbar an oder über der Erdoberfläche schweben und die Luft mehr oder weniger undurchsichtig machen“ [in a proper sense: A lot of water vapours that float in droplet liquid state near to or at the earth’s surface and making the air more or less non-transparent]. The English “fog” is defined as (OED) “thick, obscurring mist”. The origin of this term is dated to around 1540 and it is linguistically similar to Old Norwegian fok, Dutch vocht and German feucht (moist). The Old English terms nebele and nifol (dark, gloomy) were taken from Latin. The differences between “haze”, “mist” and “fog” are not reflected in German17 where one term (Nebel) characterises these words, which is likely to be an effect of the moist “English climate” on language (OED). Nevertheless, in Japanese, there exist more than a hundred terms for different types of atmospheric moisture, and also in French (after Sachs 1911) there are several totally different terms in use: embrun (mist and overcast sky), brume (sprinkling of rain and fine cold dust rain), crachin (drizzle). The closeness of the first two terms to brume is remarkable. However, in German, there are descriptive combinations with the word Regen: feiner Regen (fine rain), Starkregen (heavy rain), Nieselregen (drizzle), Sprühregen (mist, spit, sprinkling of rain), Eisregen (freezing rain) etc.

Obviously, the English term “mist” derives from ὄμίχλη18; as does the Swedish and Norwegian mist. In German, mistig means (in colloquial language) dirty19. Today, “mist” is separated from “fog” mostly by droplet size: Mist consists of larger drops that have a larger tendency to precipitate (more exactly: to sediment)20. In Old English, instead of “mist”, the term “brume”, derived from the Latin bruma (winter) was used. In French, brume is the meteorological term for fog with a visibility of more than 1 km (which in German is called Dunst)21 and brouillard for fog with a visibility of less than 1 km (in German Nebel). From that stem brumaille and brouillasse (fine thin fog and fog shower). Seerauch (Meererauch, Flussrauch) is evaporating fog above water (sea smoke, sea mist, water smoke, steam mist), which in French is fumée de mer.
pheric phenomena empirically but based on careful observations (of course, at that time without measurements). Descartes distinguishes exhalaisons (in terms of vapours) and vapeurs (in terms of haze and steam and the German Dunst), whereas solely vapeurs represent water particles. Vapeurs (he did use it only in the plural; the best German equivalent is Dunst) he considers as being transparent. Only after condensant & reserrant (condensation and compression) are clouds (nués) and fog (brouillas) formed. He writes (p. 122): ‘... si elles s’estendent isues alla superficie de la terre, on les nomme des brouillas; mais si elles demeurent suspenduës plus haut, on les nomme des nuës” [... one named the vapours, dispersing at the earth surface, fog; when vapours, however, hang on high, they are called clouds]. Although the term vapeurs [Dünste] is used for water vapour as well as for water droplets, Descartes writes (p. 122): “Et il est à remarquer que ce qui les fait ainsi devenir moins transparentes, que l’air pur, c’est que lorsque leur mouvement’s alentist, & que leurs parties sont assés proches pour s’entretoucher, elles se loignent & s’assemblent en diuers pétits tas, qui sont autant de gouttes d’eau, ou bien de parcelles de glace” (it is taken into account that what vapours make more non-transparent than clean air is only based on the fact that its motion slows and its particles come so close to each other that they contact each other and combine into small heaps, being either water drops or ice particles]. This corresponds to our present molecular-mechanistic view of condensation. His “petit parties des vapeurs” are nothing more than water molecules in air. Descartes describes the water particles as “... longues, vñes, & glissantes, ainsi que de petites anguilles” [long, interlinked and slippery as small eels]. Descartes also writes only on drops (gouttes, from Latin guttae = Tropfen, guttula = droplets, Tröpfchen) but never from bulles [vesica, Blase] or vésicules [small vesica, Bläschen]; the water drops (in contrast to water particles, i.e., molecules) are “exactement rondes” [perfectly circular].

Only 20 years later (around 1660), Otto von Guericke carried out experiments linking air-filled and air-less flasks. Due to the expansion (without recognising that the saturation arises due to cooling) he observed the formation of fog (nebulas) or a cloud (nubes). In Chapter 11, “Versuch, mittels dessen Wolken, Wind und Regenbogenfarben in Glasgefäßen erzeugt werden können” [experiment to produce clouds, wind and rainbow-colours in glass vessels] he writes: “Quod tantò magis apparat, quantó magis vitrum interne humiditatisbus refertum est; tunc enim plures ac piosiores exurgunt bullulae, ita ut (...) nebulam constitutau; quae per intromissionem aliquid aéris ... tunc nebula illa in nubes dispersitur [this phenomenon becomes clearer the larger the humidity in the flask is]; after that, more numerous and larger vesicles evolve so that a proper fog forms; but if there is free access to air, the clouds or fogs disappear ...]. Shortly before that phrase, Guericke writes on guttulis minimis (small droplets) but later he uses the term bulla (in German Blase) definitely for a bubble in water. It is unclear whether later scientists stem the term “Bläschen” (vesicle, in Latin vesicula) from bullulae (bulla = water blister). Generalised, a “vesicular” is a more or less globular envelope filled with water. However, the fog vesicle is a “reverse” bulla, an aqueous envelope filled with air. Although the Latinised term “atmosphaera” had already been introduced in 1608, Guericke uses the term “aerea sphæra” (aerial sphere, Lufthülle in German). Guericke concludes from his experiments on cloud formation in the atmosphere, where his explanation of “compression” is nothing else than the “thick air” in antiquity. It seems that he adopted the knowledge of Descartes without changes.

Christian Gottlieb Kratzenstein (1723-1795) writes in his “Abhandlung von dem Aufsteigen der Dünste und Dämpfe” [treatise on ascending vapours; it is impossible to find a translation for “Dünste und Dämpfe” – both are “vapours” in English); Kratzenstein (1744): “Dünste sind die kleinsten in der Luft schwimmenden Theilchen (wässerichten Materien) unterschieden den Dämpfen ... Die Dünste bestehen aus kleinen Bläßgens ... Die Dunstbläsgens, welche in der Luft schweben, sind inwendig mit Luft gefüllt ...” [Dünste are the smallest particles floating in air (aqueous matter), which differ from vapours ... Dünste consist of small vesicles ... The vesicles, floating in air, are internally filled with air ...].

Charles Le Roy (1726-1779) uses the term “suspension de l’eau dans l’air” to describe fog and clouds. The paraphrase “suspension of water in air” for fog (and thus, Le Roy’s understanding of naturally “drop-able water”) is already a modern scientific description of an aerosol26; suspendō (Latin) = making or keeping floating.

Horace Bénédict de Saussure (1740-1799) separates four types of “vapours”: vapeur élastique pure, vapeur élastique dissoute, both in the modern sense water vapour and then two “condensed types”: vapeur vésiculaire, vapeur concrète. He published his findings in
“Essais sur l’hygrométrie” (1783). The Encyclopædia Britannica (1771) defines fog as follows: “FOG, or Mist, a meteor, consisting of gross vapours, floating near the surface or any part thereof”. Gehler (1833) notes that fog comprises “… aus wässerigen Dunstbläschen, oder aus Wasserdunste, …” [... from aqueous vapour vesicles or water vapour, ...]. Dunst is already defined, writes Gehler (1826), under the keyword Dampf [vapour]. Diffusely, he tried to distinguish between gas and vapour, as well as to construct identities (by noncompliance of Mariotte’s law through vapours). However, today in Physics, vapour is identical to gas but shows the feature that it is in contact with the liquid or solid phase (e.g., water); in colloquial language, water vapour is still equated with fog (correctly: steam). Hence, Gehler equates the terms Dampf and Dunst but notes that in English one differentiates between vapour and steam. As discussed above, today we no longer define Dunst as Dampf (in the sense of a gas) but as small dry, as well as wet, particles but also as very small aqueous particles suspended in the air (haze).

7. Air/airs and gas/gases: air as a chemical substance

Whereas the (qualitative) description of air quality using terms such as: clean [reine], foul [unreine], good [gute], bad [böse], stuffy [stickige], corrupted [verderbte], cold [kalte], cool [kühle] and warm [warme] had been used verbally since biblical times, different kinds of air [Luftarten or Luftgattungen] were first discovered by alchemists. This was not yet a complete analysis of atmospheric air but the identification of the formation of different gases (called “airs” at that time) as a result of alchemistic experiments. The term “gas” was still unknown. In his book “Ortus medicinae i.e. initia physicae inaudita”, published posthumously in Amsterdam in 1653, the alchemist and physician Johann Baptist (Jan) van Helmont (1577-1644) wrote (he believed that all matter could be reduced to air and water):

“ideo paradoxi licentia, in nominis egestate, halitum illum gas vocavi, non longe a chao veterum secretum” [I call this breeze gas, because it is not far from the chaos of the old].

He explains why a new term (hunc spiritum, incognitum hactenus, novo nomine Gas voco) is necessary (Adelung 1796: 425):

“... dass unsere Naturkundige ein schicklicheres Wort, welches nicht so sehr das Gepräge der Alchymie an sich hätte, ausfändig machten” [...] that our natural scientists might find a seemlier word, not so much having the imprint of alchemy].

Obviously there was a requirement to distinguish the vapours and airs found in chemical experiments from (atmospheric or common) air through a new term. It is notable that at that time, atmospheric air was still regarded as a consistent chemical body. The medieval physician and alchemist Theophrast von Hohenheim28, who was known under the name of Paracelsus, in that sense, called the “airspace” chaos. Air and chaos were synonyms to him (Loewi 1936). The primordial Greek term χῶρος denotes an empty space and the beginning. However, emptiness cannot be identified with nothing. According to ancient cosmogony, after which the word was born from the chaos and hence, chaos was creativity; having all opportunities (Genz 1994). From the primordial chaos (or mysterium magnum) arose through “separatio” the four elements: water, fire, soil and air. These elements caused further emergence and subsequent decomposition30:

“... dis mysterium magnum ist ein muter gewesen aller elementen und gleich in solchen auch ein grossmutter aller stern, beumen und der creaturen des fleischs ... und ein element ist ein muter, deren seind vier, luft, feur, wasser, erden; aus den vier mutern werden alle ding geboren der ganzen welt ...” [this mystery magnum was a mother of all elements and contemporary a grant mother of all stars, trees and creatures of bodies ... and an element is a mother, of that are four, air, fire, water, soil; from these four mothers all things of the whole word were born ...].

The great achievement of Paracelsus was to use alchemy to search for medical substances. Perhaps he was the first who considered substance-forming properties to be more chemical then philosophical, creating a preconception of chemical elements (however, only introduced scientifically by Boyle). Vital processes, telluric and cosmic physics (for Paracelsus, the atmosphere acts as the special matter “chaos”) had already been connected through substantial relationships31 (Buggle 1929: 96). Today, there is also the belief that Helmont introduced the term “gas” from the term “chaos” (the essays by Paracelsus were well known to
Table 3  Historic terms of gases (airs, kinds of airs, vapours) in German and (in footnotes) in English, French and Latin; instead of air [Luft] in early alchemistic times spirit [Geist] was also used as a general term.

<table>
<thead>
<tr>
<th>Term</th>
<th>Formula</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>dephlogistisirte Luft, Dephlogiston, Lebenluft, gute Luft, reine Luft, einathembare Luft, Feuerluft, künstliche Luft, Empyrealluft, säurezeugendes Gas, Sauerluft, Sauerstoffgas</td>
<td>O₂</td>
<td>a, c</td>
</tr>
<tr>
<td>hepatische Luft, Leberluft, stinkende Schwefelluft, Schwefelleberluft, geschwefeltes Wasserstoffgas, gasförmiger sulphurisierter Wasserstoff</td>
<td>H₂S</td>
<td>d</td>
</tr>
<tr>
<td>flüchtige alkalische Luft, laugenartige Luft, alkalische Luft, urinöse Luft, laugensalzige Luft, flüchtig-alkalische Luft</td>
<td>NH₃</td>
<td>e</td>
</tr>
<tr>
<td>Phosphorluft, phosphorische Luft, gephosphortes Wasserstoffgas, phosporisierter Wasserstoffgas, gasförmiges phosporisierter Wasserstoff, entzündliches Phosphorgas</td>
<td>PH₃</td>
<td>f</td>
</tr>
<tr>
<td>spathsäure Luft, spathsäures Gas, spathgesäuertes Gas, flusspathsäure Luft, Flußspathsäure, luftige Flußspathsäure</td>
<td>HF</td>
<td>g</td>
</tr>
<tr>
<td>inflammable Luft, brennbare Luft, entzündbare Luft, entzündliche Luft, brennende Luft, Brennluft, Wasserstoff gas</td>
<td>H₂</td>
<td>h, x</td>
</tr>
<tr>
<td>Sumpfluft, schlechte Luft</td>
<td>CH₄</td>
<td>i</td>
</tr>
<tr>
<td>fixe Luft, Luft säre, luftsaures Gas, Sauerluft, Kalkgas, Kreidensäre, wildes Gas, künstliche Luft, wildes oder weinigtes Gas, Kalksäre, Kalkspathsäure, Kalkgas, kohlengesäuertes Gas, mephitische Säure, mephitisches Gas, Kohlensäre</td>
<td>CO₂</td>
<td>j</td>
</tr>
<tr>
<td>reduzierte fixe Luft</td>
<td>CO</td>
<td>k</td>
</tr>
<tr>
<td>salzsaure Luft, seesaure Luft, kochsalzaure(s) Luft (Gas)</td>
<td>HCl</td>
<td>l</td>
</tr>
<tr>
<td>dephlogistisirte Salzsäure</td>
<td>Cl₂</td>
<td>a, m</td>
</tr>
<tr>
<td>vitriolische Luft, vitriolsaures Gas, Schwefelluft, schwefelsaures Gas, luftförmige phlogistisirte Vitrioläsäre, unvollkommene Schwefelsäure in Dampfgestalt</td>
<td>SO₂</td>
<td>n</td>
</tr>
<tr>
<td>vitriolsäure Luft, vitriolsaures Gas, flüchtiges schwefelsaures Gas, luftförmige Schwefelsäre, luftförmige phlogistisirte Vitrioläsäre, Schwefelluft</td>
<td>SO₃</td>
<td>o</td>
</tr>
<tr>
<td>Salpetergeist, Salpeterluft, Salpersäure, Luft säre, gemeine Salpeterluft, HNO₃</td>
<td>p, x</td>
<td></td>
</tr>
<tr>
<td>salpersaures Gas, unvollkommene Salpersäure in Dampfgestalt, dephlogistisirte Salpeterluft, dephlogistisirte Salpersäure</td>
<td>HNO₂</td>
<td>a, q, x</td>
</tr>
<tr>
<td>essigsäure Luft, Essigluft, vegetabilisch-saure Luft</td>
<td>CH₄:COOH</td>
<td>r</td>
</tr>
<tr>
<td>phlogistisirte salpetrige Luft</td>
<td>N₂O</td>
<td>a, s</td>
</tr>
<tr>
<td>salpeterartige Luft, salpeterhalbsaures Gas, Salpetergas, Salpeterluft, nitroxe Luft, oxydirter Salpeterstoff, salpetrige Luft</td>
<td>NO</td>
<td>b, t, x</td>
</tr>
<tr>
<td>salpersaure Luft, phlogistisirte Salpersäure, Salpeterdämpfe</td>
<td>NO₂</td>
<td>a, u, x</td>
</tr>
<tr>
<td>phlogistisirte (oder phlogistische) Luft, verdorbene Luft, unreine Luft, Stickluft, Stickgas, Salpeterstoff, Salpersäuregas, azotisches Gas, Stickstoff</td>
<td>N₂</td>
<td>a, v</td>
</tr>
</tbody>
</table>

a Both spellings were used: phlogistirt and phlogistisirte; the differentiation between dephlogistirt (Dephlogiston) and phlogistirt is not clear until nowadays. Phlogiston denotes a hypothetic gas that evolves when matter burns.

b Differentiation is not always dear.
c good, pure, vital, fire air; dephlogisticated air, empyreal air; air dephlogistiqué, gaz oxygène; aër veris, aër purissimis, aër dephlogisticatus, gaz dephlogisticatum, gas oxygenum
d hepatic air, heptic air, fetid or sulphur air, sulphuretted hydrogen gas; air hépatique, gaz méphitique, acide crayeux, acide carbonique; aër fixus, aër factitius, gaz aëreum, gas mephiticum, caracemum, gaz silvestre, gaz vinoum, mephitis vinosa, acidula, acidum mephiticum, acidum aëreum s. atmosphaericum, acidum cretae, gas acidum carbonicum

g acid of spar, acid of sparry; air (gaz) acide spathique, gaz acide fluorique; gas acidum fluoricum, gaz fluoris
minerals, gas acidum spathosum, acier acidus spathosus, mephitis fluoris minerals
h air inflammable, inflammable air; air inflammable, also (Ingenhousz) gaz inflammable, aer inflammabilis, mephitis inflammabilis, gas carbonum, gas pingue (Helmont), gaz inflammable, aer inflammabilis
i marsh gas, swamp gas; carburetted hydrogen; gaz palustre, gaz inflammable des marais
j air of Hales, fixed air, (mephitic) acid air; acid of aerial, acid of calcareous, acid of chalk, acid of charcoal; air fixe, acide mephitique, gaz méphitique, acide crayeux, gaz acide carbonique; aër fixus, aër factitius, gaz aëreum, gas mephiticum, caracemum, gaz silvestre, gaz vinoum, mephitis vinosa, acidula, acidum mephiticum, acidum aëreum s. atmosphaericum, acidum cretae, gaz acidum carbonicum
On the origin and meaning of the German word Luft and some other meteorological terms

him), according to Dutch pronunciation; omitting the “o” and pronouncing “ch” like “g” (Egli 1947). However, it is also possible that the term is derived from Geist32 (ghost or spirit, Latin spiritus), which at that time was common for gases and airs in alchemy. Kopp (1847: 178) writes:

“Woher das Wort zunächst gekommen ist, weisz man nicht; nach Juncker, dem bekannten Schüler Stahl’s, soll es aus Gäscht, dem bei der Gährung entstehenden Schaume, abgeleitet sein” [where the word originally comes from, we do not know; according to Juncker, the well-known scholar of Stahl, it should stem from Gäscht, the foam forming during fermentation].

Lavoisier writes in his work “Opuscules physiques et chimiques” (2e éd., Paris 1802: 5):

“Gas vient du mot hollandais Ghoast, qui signifie Esprit. Les Anglais expriment la même idée par le mot Ghost, et les Allemands par le mot Geist qui se prononce Gaistre. Ces mots ont trop de rapport avec celui de Gas, pour qu’on puisse douter qu’il ne leur doive son origine.”

In Deutsches Wörterbuch, Vol. 4 (1897), the term Gas is defined as follows: “Gattungsnname für Luftarten, oder luftförmige Flüssigkeiten wie die Wissenschaft den Begriff bestimmt, die sich von den Dämpfen unterscheiden durch die Unmöglichkeit oder Schwierigkeit sie in tropfbare Gestalt zu bringen; auch von der gewöhnlichen Luft sind sie verschieden und wurden im Gegensatz zu ihr zuerst erkannt, während dieselbe jetzt selber von der Wissenschaft als gasförmig, als ein Gasgemenge bezeichnet wird” [common noun for kinds of air or gaseous mixture].

Helmont is said to have called (after Adelung 1796) common air [gemeine Luft] a gas, or more specifically, gas ventosum. After Gehler, the terms gas atmosphericum and Dunstkreisluft [aerial spherical air] were used synonymously33. In Krünitz (1779: 404) it is written: “Das Gas nennen Helmont und andere Chemiker die unsichtbaren flüchtigen Theile, welche von selbst aus gewissen Körpem ausdampfen ... z. e. die Dämpe der in eine spirituous oder in eine faulige Gährung gerathenen Materien, tödtliche Dämpfe aus brennenden Kohlen, die Schwaden in Bergwerchen, u.s.w., und selbst den spiritus rector gewisser Substanzen, z. e. des Bisams, denn es wurde zuerst unter die spiritus oder Geister der Dinge gezählt” [as gas, Helmont and other chemists call the invisible volatile parts that escape spontaneously from certain bodies ... e.g., vapours of a spirituous or in fermentation processing matter, deadly vapours from burning coals, damp in mining etc., and even spiritus rector of certain substances, e.g., that of musk because it was called first among the spirits and ghosts of things].
Robert Boyle proposed in his book “Memoirs for a General History of the Air” (1692) the formation and study of different kinds of air but he writes nothing on its realisation. Ramsay (1907) believed that having carried out such experiments, the composition of the air had been discovered hundreds of years before. As already mentioned, the terms Luft [air] and Gas [gas] were used in parallel later on, but they were spoken of also in the form of Luftarten, Luftgattungen [kinds of air] and luftförmigen Stoffen [aerial substances]. Until the end of the nineteenth century, the known types of airs (gases) were subdivided into two main classes, those which support combustion and breathing (einatembare Luftarten – inhalable airs), and those which fade light and kill animals (mephistische Luftarten – mephistic airs). Among the former common air and dephlogisticated air (oxygen) are included which do not allow further subdivision. The second class (mephistic) is subdivided into inflammable and non-inflammable categories and then subdivided again into those mixable with water (in other terms, water-soluble) and those that cannot be mixed with water (Table 3).

8. Conclusions

The primordial term ἀήρ must be understood as fog (Homer). Aristotle attributed to the element “air” paired properties (wet and warm). However, he deemed the four elements (air, water, soil and fire) insufficient to explain nature and, therefore, introduced οὐδέα or αἰθήρ (aether) as a fifth element. Aristotle denotes a cloud as πῦχνωσις ἄερος (thick air). While the lower layer of the atmosphere (the celestial hemisphere from the ancient view) was characterised as ἀήρ, the upper layer was named αἰθήρ; both were regarded not only as different areas but also as different matters (since Homer). The lower layer (ἀήρ) Aristotle characterised through “rising water vapour” (ἀτμίς) and a cloud he denotes as πῦχωσις ἄερος (thick air). However, only air (ἀήρ) was seen as transmutable. The idea of transmutation (air ↔ water) survived until the end of the eighteenth century, when it was finally rejected by Lavoisier. The German word Luft (also Old Saxon, Middle High German, Danish, Swedish and Norwegian with many variations: luft, luftus, loft, lyft, left, lift, lopt, lucht, luht, locht) finds its primordial roots from medieval texts as the “sphere between earth and heaven” (Old-English or Anglo-Saxon word “lyft” and Middle English “lift”; Dutch “lucht”). The linguistic affiliation between Luft (air) and Licht (light – in older German also Liecht, Lieht, Liehte, lecht) is expressed in old phrases, particularly in relation to the transparency and clearness of air (or atmosphere). The term “atmosphere” (vapour layer) is best reflected by the German word Dunstschicht, long time in use instead of “atmosphere”. Willebrord van Roijen Snell translated the Old Dutch damphooghde (in Latin altitudine vapidum, in German Dunsthöhe) into a new Latin term “atmosphæra” in 1608, which at first merely described the altitude between the surface of the earth and the bottom of the clouds, shortly afterwards used by Gottfried Wilhelm Leibniz as “atmo sphere” and Robert Boyle as “atmosphere”. In German (until the middle of the nineteenth century), instead of Atmosphäre the words Luftkreis (“aerial sphere” – air surrounding the earth or a part of it) and Luftmeer (aërial ocean) were used, right up until the twentieth century. Now “atmosphere” is the term for the “aerial sphere” and “air” is the (chemical) matter filling the atmosphere; however, both terms are still used synonymously (for example: “air chemistry” or “atmospheric chemistry” as the discipline to study the chemical composition of air and chemical reactions therein). A (qualitative) description of air quality using terms such as clean, foul, good, bad, stuffy, corrupted, cold, cool and warm was used verbally since biblical times, different kinds of air (airs, vapours) were first discovered by alchemists. Obviously there was a requirement to distinguish the vapours and airs found in chemical experiments from (atmospheric or common) air through a new term “gas”, introduced by Jan van Helmont. The word “gas”, however, became common only in the last decades of the 19th century by use of “town gas” for illuminating, heating and cooking. Before establishing modern Meteorology in the middle of the 19th century, air(s), vapour(s), gas(es), fog and cloud(s) were not well defined scientifically. Whereas the terms “gas”, vapour”, “fog” and “cloud” are now well defined, it seems that the term “air” has never lost its multiple meanings. We should therefore use “atmospheric air” (“common air” in the past) and define it as the multi-substance and multiphase (gas, aqueous, solid) mixture in the atmosphere.

Notes

1 Today, soil means the upper part (pedosphere) of the solid earth whereas the rocky part (lithosphere) is situated below. In ancient times, soil was the synonym for the solid earth.
2 Only at the end of the 19th century was it known that about 1% of this figure is due to novel gases.
On the origin and meaning of the German word Luft and some other meteorological terms

3 Citing Boussingault and Lewy, Humboldt (footnote on p. 311) mentioned that “the proportion of carboxonic acid in the atmosphere … varied only between 0.00028 and 0.00031 in volume” – a very modern view (Möller 2014).

4 Old Greek ἁέρας, also gr. ἀέρος = up in air, misty; in modern Greek: αέρας, Engl. air, Lat. aer, Ital. aria, Portu. ar, Roman. aer, Span. aise

5 The Old North German loft also means the upper floor and the loft in a house (Low German: lucht), a meaning that is continuous in Swedish and Danish loft.

6 The modern English term “lift” (elevator) continues the Old Greek sense of “to raise or rise” (of air).

7 Old terms: liecht, loht (Old High German), liehte (Middle High German), lecht (Middle Dutch and Middle Low German); the similarity with English light is evident (means also “easy”, in German “leicht”; see the difference to “thick air” below). Similar to Norwegian and Danish lys, Swedish ljus and like French lumière, Romanian lumina, Italian lume (and lucè), Spanish and Portuguese luz, all derive from Latin lumen and lux.

8 We also might assume that the word Luft comes from the imagination of tangible air and vehement sense; affiliation to Sanskrit rābh- as = stormy, force, and Greek λαβρός = severe, wild. In Carinthian läftig = rapid, fast.

9 In old German books, instead of atmosphere (“Atmosphäre”), the term “Dunstkreis” and the words Luftmeer und Luftocean (ocean of air) are often used (Reimann 1857; Umlauf 1891); atmosphaera, atmosphere.

10 Dutch: “Dunstglocke mistigheid (see the discussion with the term mist below).

11 In contrast to the terrestrial globe (p. 19 in Boyle) as the total solid earth

12 Möller (2002) defined air as the chemical mixture (consisting of gases, hydrometers and dust particles) that fills the atmosphere.

13 Lampadius (1806) used the term Atmospärilien for the first time in German in the sense of all constituents of the air with the exception of gases.

14 The meanings for cloud, rain and hail are similar between Anglo-Saxon and German: wolcnu [Wolke], renas [Regen], hagol [Hagel].

15 Acherōn is a mythological river in the underworld, identified by poets with the underworld (= darkness).

16 In English, there exist many terms for Dunst: mist, haze, damp, vapour, brume, fume, aura. According to Deutsches Wörterbuch (Vol. 2, Col. 1559, shortened) also: “für dünne, nasse oder trockene Flüssigkeit, die in die Luft steigt, meist sichtbar ist, doch auch nur durch den Geruch empfunden wird; vergl. dampf, duft, brodem, qualm, schwadem” [for thin, wet or dry liquid, rising into air, usually visible but also only conceived by smell; compare vapour (dampf, brodem – last term not more in use in German ], flavour (duft), plume ( qualm), billow (schwaden)]. Old High German dunst; Middle High German, Swedish and Danish dunst. In Gothic, Old-Saxon, Old Friesian, Low German and Dutch dunst does not exists; it is related to the Gothic pinasan and the lost pinan (stretch); Old North German, Anglo-Saxon and English “dust” (Staub). Nowadays, we translate atmospheric Dunst with haze.

17 The chapter “Of Mists and Fogs” in Prout (1834: 312) is reduced in the German edition (Prout 1836: 214) to “Vom Nebel” [of fog]. The opening sentence of this chapter in Prout (1834) “When mists, from other causes, are general and extend to considerable heights above the earth’s surface, they acquire the name of fogs” was deleted completely in the German edition, because mist = fog = Nebel. “Scotch mist” means very thin rain (Lloyd and Noehden 1836). In many British publications of the nineteenth century the term “mist” was used instead of “fog”. Giberne (1890) wrote: “A mist is commonly distinguished from a fog as being made of rather larger drops, therefore feeling more wet”.

18 In Latin mingō and mejo (from that also derived the English “mist”, see also notes 17, 20 and 21); in its primordial meaning also: urinate; but in Sanskrit mih, megha (cloud, mist). The English “misty” (foggy) was in Old English “mistig” (see note 28).

19 On the other hand, the German word “Mist” means dung, but in a colloquial sense also “brasst farthing” – again, evidence of “gloom” and “evil” in mist (fog) ...

20 Such weather in colloquial German is called “Mistwetter”: dark, cold and wet. Ehrenberg (1849: 122) cites the weather record of the British vessel Roxburgh on 4.2.1839 at Cape Verdean: “Der Himmel war überzogen, das Wetter mistig [obviously the English misty was used in the record] …” [sky was overcast, weather misty]. The term “mistig” (nibel – foggy) is unusual in German; the adjective means: full of “mist”, dirty.

21 After Sachs (1911) brume means “thick fog”, i.e., fog with visibility less than 1 km – also exactly reverse in modern meaning. Brüine is translated after Sachs (1911) as “Staubregen” [dust rain], an unknown word in modern German. Nowadays, brüine = Sprühregen = drizzle (identical with crachin); brume sèche = haze = Dunst after METAR (meteorological aerodrome report)

22 Today the adjectives “trocken” (dry, sec) and “nass” (wet, humide) are used in atmospheric science only for the process of deposition to distinguish between dry and wet deposition. In German, there is still a distinguished between “feuchter Dunst” (moist haze, i.e., fog with visibility between 1 and 5 km) and “trockener Dunst” (dry haze, greater visibilities but still with a discernible opacity of the atmosphere). The latter represents cloud condensation nuclei in larger numbers, activated and exceeding the deliquescence point (almost 60-70 r.h.).
The similarity with German Dampf is significant (Old High German: dampf).

Atmospheric air (as gas mixture) has also been characterised with the following terms (Krünitz 1779): atmosphärisches Gas, gemeine Luft; Latin gas atmosphaericum, aër atmosphaericus vulgaris communis, Gas ventosum; gas atmosphérique, air commun, air de l’atmosphère.

Grimm sets a linguistic relation between “Dunst” and the English (Old North German and Anglo-Saxon) “dust” = Staub. The term aerosol was first introduced by Schmauß (1920). The terms sol, colloid and colloidal state were introduced by Thomas Graham (1861). Wolfgang Ostwald (1909) – son of Wilhelm Ostwald – clearly saw that the system, which he characterised as heterogeneous or multiphase, must be studied and not only the colloid, i.e., the dispersed phase. Ostwald (1909) states fog as an example for the combination of gas-liquid and atmospheric dust for the combination of gas-solid.

Dämpfe, Dünste and Lüfte, also fumus, vapor, exhalatio; Old High German: dampf; Middle High German: tampf; Danish, English, Dutch and Low German: damp; Old North German: dampi; Polish: dim. It belongs to the strong verb dimpfen (reek, smoke). It is related with Old High German daum, Middle High German toum and Austrian Dam (Auskündnung) and Swedish dam (flushy cloudy dust).

Paracelsus, practically Philippus Aureolus Theophrastus Bombastus von Hohenheim (1493-1541); the 16th and 17th centuries are therefore considered as the iatrochemical alchemistic compilations (several hundreds) were published as “Liber Natura, sive Chaos veterum; generalem metallorum generationem, etc.” In: Liber vexacionen, John Stacy (1656): 83-89 (Glasgow University, Bibliography MS Ferguson 237).

However, he also retains the three basic substances in alchemy: sulfur, mercurius and sal, which correspond to the physical phenomena of combustibility (oiliness), liquefaction (evaporation) and solidification (solidity).

Dutch and Low North German: geest; Anglo-Saxon: gæst (also Old Friesian) and geest. The origin is seen in whiff [Hau]ch and breath [Atem]. Luther writes (Hib 4, 9): Der himel ist durchs wort seines munds [by the word of the LORD were the heavens made; and all the host of them by the breath of his mouth]. Insofar the synonymy between breath, spirit, vapour, wind and kinds of air is given.

Humboldt writes on kinds of air [Gasarten] in “Versuche über die chemische Zerlegung des Luftkreises” (Braunschweig 1799): “Doch ist im Buche selber noch immer mehr von Luft als Gas die Rede” (Deutsches Wörterbuch) [experiments on the chemical decomposition of the air: “... however, in this very book, the term ‘air’ is used more often than the word ‘gas’.

References


Boskovich, R.J. 1753: De lunae atmosphaera dissertatio. – Rome


Boyle, R. 1662: New experiments physico-mechanical, touching the spring of the air, and its effects. – 2nd edition. – Oxford. – Reprint UMI, Ann Arbor, Michigan, USA, 2008

Bugge, G. (Hrsg.) 1929: Das Buch der großen Chemiker. Band I: Von Zosimos bis Schönbein. – Weinheim

De Luc, J.A. 1787: Idées sur la météorologie. – Paris


Duden, K., G. Drozdowski and P. Grebe (Bearb.) 1963: Etymologie: Herkunftswörterbuch der deutschen Sprache. – Der große Duden 7 – Mannheim et al.


Ehrenberg, C.G. 1849: Passatstaub und Blutregen: Ein großes organisches unsichtbares Wirken und Leben in der Atmosphäre. – Berlin


On the origin and meaning of the German word Luft and some other meteorological terms


Giberne, A. 1890: The ocean of air: meteorology for beginners. – London

Gilbert, O. 1907: Die meteorologischen Theorien des griechischen Altertums. – Leipzig


Guericke, O. v. 1672: Experimenta nova (ut vocantur) de vacuo spatio. – Reprint from the first edition in Latin. – Halle 2002

Gänther, J.C. 1735: Sammlung von Johann Christian Guent bers aus Schlesien bis anhero edirten deutschen und lateinischen Gedichten. – Breslau, Leipzig 1735


Humboldt, A. v. 1850: Cosmos: A sketch of a physical description of the universe. – Vol. 1. – New York


Kopp, H. 1847: Geschichte der Chemie 4. – Braunschweig. – Reprint 1931. – Leipzig


Lampadius, W.A. 1806: Systematischer Grundriß der Atmosphäre. – Freiberg


Loewe, R. 1936: Gas. – Zeitschrift für vergleichende Sprachforschung auf dem Gebiete der indogermanischen Sprachen 63 (1/2): 118-122

Maaler, J. 1561: Die Teütsch Spraach. Alle wörter, namen, vn arten zu reden in Hochteütsch spraach, dem ABC nach ordentlich gestellt, vnn mit gutem Latein ganz fleissig vnn eigentlich vertolmetscht, dergleychen bißhär nie gesähen. – Zürich

Megenberg, K. v.o.j.: Das Buch der Natur. – o.O.


Mohr, F. 1854: Älteste Nachricht über Ozon und seine Benennung. – Annalen der Physik und Chemie 91: 625-627

Möller, D. 2003: Luft: Chemie, Physik, Biologie, Reinhaltung, Recht. – Berlin

Möller, D. 2014: Chemistry of the climate system. – Berlin

Prout, W. 1834: Chemistry, meteorology and the function of digestion considered with reference to natural theology. – The Bridgewater treatises on the power, wisdom and goodness of god as manifested in the creation 8. – London


Ramsay, W. 1907: Die Gase der Atmosphäre und die Geschichte ihrer Entdeckung. – 3. Auflage. – Halle
On the origin and meaning of the German word *Luft* and some other meteorological terms

*Reimann, E.J.* 1857: Das Luftmeer. Eine physikalische Darstellung für gebildete Laien. – Gotha

*Sachs, K.* 1911: Enzyklopädisches französisch-deutsches und deutsch-französisches Wörterbuch. – Berlin

*Saussure, N.-Th. de* 1804: Recherches chimiques sur la végétation. – Paris


*Umlauft, F.* 1891: Das Luftmeer. Die Grundzüge der Meteorologie und Klimatologie, nach den neuesten Forschungen gemeinfasslich dargestellt. – Wien


*Wright, T.* 1841: Popular treatises on science written during the Middle Ages in Anglo-Saxon, Anglo-Norman, and English. – London