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BOOK REVIEW

Renaissance meteorology and modern science

Craig Martin: Renaissance meteorology: Pomponazzi to Descartes. Baltimore: Johns Hopkins University Press, 2011, viii+213 pp., $50.00 HB

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"Meteorology" in the medieval and early modern period was a field concerned with the topics of Aristotle's *Meteorologica*: the imperfect mixtures risen in the lower atmosphere from the two exhalations (books I to III), together with the perfect mixtures, such as minerals (book IV). Owing to this Aristotelian inheritance, meteorology came to be inscribed as part of the teaching course of natural philosophy in the sixteenth and early seventeenth century (*physica, philosophia,* or *physiologia*). Before approaching these topics, the student would have gone through the principles of change from Aristotle's *Physics* and *On Generation and Corruption* and the study of simple perfect bodies from *On the Heavens*. By the late sixteenth century, some authors come to think of meteorology as "the beginning of physics," meaning by that the beginning of "applied" natural science (*physica specialis*): the study of sublunary mixed bodies. After the treatise on mixture from meteorology, the student would continue with the perfect mixtures from Aristotle's biological works, including *On the Soul*, and some of the *parva naturalia.*

Renaissance Meteorology is a pioneering work aiming to fill a gap in the scholarship on the natural philosophy of the sixteenth and early seventeenth centuries by studying this material. There is shockingly little literature that the author could have taken into account and nothing that comes close to a satisfying overview in English. That being said, the book's thesis is bolder: not only to exhume meteorology as an antiquarian curiosity, but also to argue for its effective influence on the development of early modern science. This makes for a provocative piece of scholarship.

This thesis directs the author's choice of figures and interests in reading them. Apart from Descartes and an incursion in Lutheranism, *Renaissance Meteorology* is mainly concerned with Italian scientists, arguably the territory releasing more innovation in the period. After the introductory chapter where the author pleads his

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case, a chapter on "The Epistemology of Meteorology" looks at the surprisingly skeptical tenets of renaissance meteorology. This skepticism is presented as a feature that brings renaissance meteorology closer to the epistemology of canonical "modern" seventeenth-century figures. Some readers may find it excessive that the author grounds this skepticism in authorities such as Aristotle and Thomas, after the effort of the River Forest school (J. A. Weisheipl, W. A. Wallace) of insisting on the quest for certainty that characterized Latin Aristotelian natural science. The argument here is that, owing to the irregularity and "imperfect" character of the subject matter, Renaissance savants recognized the limited capacity of meteorological enquiry. The irregularity of the meteors and their low accessibility for the senses was indeed an omnipresent theme in the period. But deriving a skeptical thesis that would be specific for meteorology from this theory of matter (pp. 26–29) may leave the reader wanting more clarification. The distinction between perfect and imperfect mixtures is an ontological claim, related to the presence or absence of a *forma mixti* in the compound. For Aristotelianism, *all* sublunary bodies are imperfect, not only the imperfect mixtures; hence, one is faced with the problem of arguing for what makes the imperfect mixtures less knowable than the perfect ones, which were also studied in meteorology.

The next two chapters ("Teleology in Renaissance Meteorology" and "The Ferrarese Earthquakes and Learned Meteorology") follow para-Aristotelian topics. Aristotle (as opposed to Seneca) ignored teleology in meteorological accounts and was followed in this by most of his Latin commentators. Gaetano da Thiene, Francesco Vimercati, or Andrea Cesalpino are examples of followers of this trend. When teleology was considered, it offered an argument for the skeptical thesis, and the author shows this through a very welcome and precise analysis of Pomponazzi and his reports on Aristotle's and Thomas's texts. Following the question of teleology, the book goes into Protestant territory and explores the views of Lutheran writers with respect to the providence of weather in their proper Christian and Stoic context. The chapter on the earthquakes of Ferrara from 1570 to 1574 is a historical contribution to the understanding of this catastrophe, placed in both intellectual and social context. But the author also extracts from this episode the relevant arguments for his thesis: empirical data forced scientists to change seismic accounts and even to model artificial constructions to help their explanations.

The chapter on "The Chemistry of Weather" follows the material of Aristotle's book IV: perfect inanimate mixtures. The chemical tradition has benefited from a lot of scholarly attention, but the merits of the chapter are in exploring the various currents that contributed to the redefinition of the Aristotelian perfect mixtures of Book IV, from the Paracelsians, the Stoic natural philosophy, the rich medieval tradition on mineralogy up to the interesting case of balneological investigations. The contribution of the chemical tradition to the understanding of Aristotelian exhalations is an exciting idea advanced here.

The high point of the book is given by two last chapters dedicated to big names: Niccolò Cabeo, the Paduan Jesuit, who wrote an extensive and remarkable treatise on meteorology in the middle of the seventeenth century (*In quatuor libros meteorologicorum Aristotelis commentaria*, Rome, 1646), and René Descartes, who wrote a smaller treatise (*Les Météores*, Leiden, 1637) but claimed more value for it.

Cabeo is an outstanding figure that supports the author's thesis about the "modernizing" practices of late Aristotelians very well. Cabeo's main virtues, taken as a basis for a "new Aristotelianism," are his experimentalist advocacy (praised for instance by Mersenne) and his "physicalisation" of Aristotelian forms. Later in the century, Cabeo's commentary on the meteorology was even re-titled as *Philosophia experimentalis* (1686). Cabeo is placed in the corpuscular tradition issuing from Aristotle's *Meteorologica* IV, intersecting the alchemical tradition traced back to Pseudo-Gerber and having the more known Daniel Sennert as chief proponent in the seventeenth century. The author goes further to argue for the role played by Cabeo and this tradition in the emergence of the corpuscular philosophy, while recognizing that Cabeo himself appears to not have been influenced by Galileo. The date of Cabeo's treatise however, 1646, seems rather to demand a parallelism between him and the "mainstream" corpuscularians such as Galileo or Descartes, since by then the corpuscularian trend was already well on its way. Cabeo's numerous "anti-modernist" positions—against Copernicanism, against Gilbert, against Galileo, and his student, Benedetto Castelli—do support an argument for his being placed in the Jesuit scientific counter-offensive, specifically in the more physicalist side of the Jesuit order, in the line of Benedictus Pererius.

Cabeo's setting is used in the last chapter of the book, "Causation and Method in Cartesian Meteorology," to argue for assimilating Descartes to this "new Aristotelianism," as the author labels it. The chapter points out the lack of novel features of Descartes's meteorology with respect to this background (although Cabeo himself writes a decade after Descartes). This is a contentious issue for Cartesian studies, provocative for the simple reason that Descartes argued ceaselessly for the novelty of his *Météores* as opposed to what was taught in the schools, particularly in the Jesuit colleges. The status of hypothesis in Descartes is too well researched in the literature for me to discuss here the probabilism advanced by the author (cf. only Descartes's formula from *Regula II*, AT X 362, "rejicimus illas omnes probabiles tantum cognitiones").

With regard to meteorology proper, the thesis is that "many key Aristotelian approaches to explanation and causation are found throughout Descartes' treatise without being changed at all or with only minor changes" (p. 125). Besides comparisons of subject matter between Descartes and Aristotelian treatises such as that of Cabeo, the main argument is given as follows: "the supposed novelty of eliminating substantial forms from meteorology was in fact no novelty at all in Descartes' time, since earlier Aristotelians from Albertus Magnus to John Poinsot had already defined the field as one that was overwhelmingly concerned with efficient and material causation." The premise seems to be that not using formal causation amounts to eliminating substantial forms. Substantial forms, though, are key concepts in Aristotelian physics, and meteorology is no exception in using them, because the entire field is based on the use of elemental qualities (hot, cold, wet, and dry) that inhere in the substantial forms of the meteors. Elemental qualities could not be conceived in Aristotelian meteorology without referencing the substantial form that sustains them: this conceptual connection grounds its omnipresent hylomorphism. Moreover, the very ontological basis for the delimitation of the field, namely the distinction between perfect and imperfect mixtures, is based on the presence or

absence of a new substantial form in the meteor that would or would not replace the original elemental form. Descartes's project in 1637 was to present a meteorology devoid of "real qualities" against the Aristotelian tradition. Regardless of the various corpuscularian explanations offered by the *Météores*, the novelty of Descartes in the field rests primarily in this ontological move: it reduces the distinction between perfect and imperfect mixtures by liberating it from the hylomorphic structure of mixtures altogether. According to the current status of the literature on this topic, the elimination of real qualities was literally unheard of in Aristotelianism, and it only arrived in the first two decades of the seventeenth century, with Beeckman, Bacon, Galileo, and Descartes. Cabeo does offer a reductive view of this ontology, but he comes much later, in the 1640s, and he positions himself in many respects in the anti-Aristotelian polemical camp.

Historians of the Renaissance will welcome this book as a well researched and noteworthy addition to the literature. The author has drawn on an impressive collection of sources, many of them previously unexplored, and manages to convincingly pull Cabeo to the center stage of Jesuit studies. In the context of the lack of English literature on the topic, the book could have benefited from exploring more continental works, such as the monumental *La géographie des humanistes* of François de Dainville (Paris: Beauchesne, 1940). Either way, for taking up this project with estimable scholarly command and making it relevant for the study of the natural philosophy of the period, the community of Renaissance studies owes its gratitude to the author.