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Società Italiana degli Storici della Fisica e dell'Astronomia

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Earliest meteorological observations in Naples in the 18th century

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Outline

- **Introduction: the birth of the first correspondence networks in Europe**
- **James Jurin's network**
- **Niccolò Cirillo's activity within Jurin's network**
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Introduction: the birth of the first correspondence networks in Europe

The 16th and 17th centuries marked the rejection of Aristotelian theories and, mainly in Germany, England, France and Italy, the birth of the modern approach to science, characterized by the invention of ***three basic instruments in meteorology: the hygrometer, the thermometer and the barometer.***

The first instruments for the measurement of the amount of water vapour in the atmosphere were described by Nicholas de Cusa (1401-1464) and Leonardo da Vinci (1452-1519), while a ***thermometer*** *based on the expansion and contraction of air was built by Galileo Galilei (1564-1642) by the end of 16th century. In particular, Galilei compared the temperatures of different places and investigated diurnal and seasonal variations of temperature. Finally, the* ***mercurial barometer*** *was invented by Evangelista Torricelli (1608-1647) who, in 1643, carried out his celebrated experiment on the pressure of the atmosphere.*

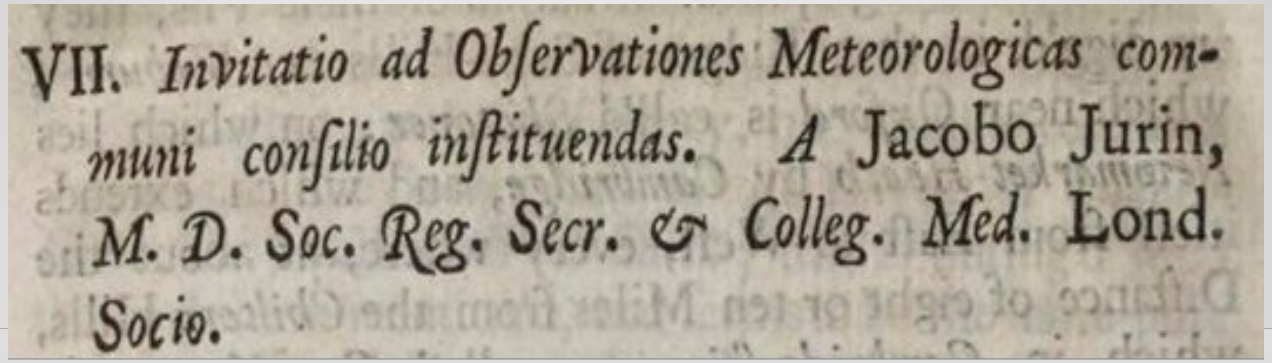
METEOROLOGY IN EUROPE – FIRST ATTEMPTS:

- ***The Medici Network**: the first international network of meteorological stations was set up in 1654 by the Grand Duke Ferdinand II de' Medici and his brother Prince Leopold. Observations had to be carried out with identical instruments, exposure, schedule and protocols and written down in special tables. The network, involving stations at Florence, Vallombrosa, Pisa, Cutigliano, Bologna, Parma, Milan, Warsaw, Innsbruck, Osnabruck and Paris,was organized and led by the Jesuit Luigi Antinori and fluorished from 1654 to 1667 (D. Camuffo, C. Bertolin, Climatic Change 111 (2012) 335-363). It was closely associated with the Accademia del Cimento of Florence and its aim was to provide an answer to the following questions: 1) what is the difference in temperature in various countries, on the plain and the mountains, in middle and higher latitudes? 2) Does ice always melt at the same temperature, regardless of geographical or height differences? 3) How much does the density of liquids change with temperature? 4) What is the difference in temperature between sunshine and shade?*

- ***The Royal Society:*** *the Royal Society actively contributed to the development of meteorology since its foundation in 1660. Two members made fundamental contributions, Robert Boyle (1627-1691) and his assistant Robert Hooke (1635-1703). They developed barometers, thermometers and thermometric scales and investigated the use of barometer in weather forecasting. The Royal Society strongly encouraged the habit of making weather observations regularly and systematically. This activity was pioneered by Hooke and triggered the birth of networks of meteorological stations in different European countries, as France and Germany. In England also J. Locke carried out weather observations and collected date from stations in Oxford, London and Oates.*

- ***Early activity in Germany, France and Italy:*** *in Germany G. W. Leibnitz and S. Reyher started observations in Hannover and Kiel, respectively, while in France P. de la Hire, since 1699, carried out daily weather observations. In Italy meteorological observations were carried out by P. M. Salvago between 1705 and 1724 and by G. Poleni since 1709.*

- ***Conclusions**: the 18th century was characterized by the invention and improvement of meteorological instruments, while the Royal Society continued to pursue meteorological activity. In particular there was an impressive increase of individuals making regular weather observations as well as of knowledge of weather systems. As a consequence, meteorology became more and more organized and attempts to build up international netwotks of weather observers increased at a rapid pace! **Huge efforts were made by the Secretary of the Royal Society James Jurin (1684-1750), who in 1723 published in the Society's Philosophical Transactions his "An Invitation for Making Meteorological Observation", which marked the beginning of his correspondence network!***


VII. *Invitatio ad Observationes Meteorologicas communi consilio instituendas.* *A* Jacobo Jurin, *M. D. Soc. Reg. Secr. & Colleg. Med. Lond. Socio.*

James Jurin's network

The strength of the Royal Society activity in the 18th century mainly relies on its extensive correspondence. Communications from observers outside London soon became part of the Society's practice. Several fellows started projects aimed at gathering observations and reports on specific subjects, mainly on natural history and philosophy. In this respect a key role was played by ***J. Jurin (1684-1750)****, who served as secretary from 1721 to 1727. His efforts clearly showed how correspondence increased cooperation among natural philosophers.*

*Jurin project, devoted to collect meteorological observations, clearly showed **how correspondence could be used as a scientific method**. At the Royal Society meeting (12 December 1723), in his "A Proposal for Joint Observations on the Weather", Jurin put forward his program:*

"… a true Theory of the Weather is not to be Attained by a knowledge of the Successive Alterations in any one certain place", but "must needs require the joint Assistance of many Observers".

In a letter to Niccolò Cirillo (26 March 1725) he explained his idea:

"My intention and desire [is] by collecting accurate observations made successively over wide areas, to be able eventually to learn for what reasons such great changes in the atmosphere are effected so suddenly. If it is ever granted to the race of Mortals to know this, it is by this kind of method, I think, that it will be revealed".

Jurin's proposal contained the template which correspondents should have followed to write their meteorological reports. His idea was to standardize observations, that is to make uniform the calendars, the measurements, the instruments and the methods. As such participants were requested to record observations twice daily, including temperature, barometric pressure, direction and stregth of winds, description of clouds and amount of rain or snow. **The very critical issue was how to get uniform measures by comparing different thermometric and barometric scales !!**

Jurin's network involved observers in Uppsala, St Petersburg, Berlin, Leiden, Naples, Luneville, Boston and many towns in Great Britain, who regurarly produced weather diaries (A. Rusnock, British J. Hist. Sci. 32 (1999) 155-169). His project gave a significant contribution to the production of scientific knowledge in the 18th century. Despite some reservations, it showed a high degree of international cooperation, the effective use of correspondence and the need of standardized instruments and measurements.

VII. *Invitatio ad Observationes Meteorologicas communi consilio instituendas.* *A* Jacobo Jurin, *M. D. Soc. Reg. Secr. & Colleg. Med. Lond. Socio.*

Diarii Forma.

Dies & Hora 1723. Nov. St. V.		Barom. alt. dig.dec	Therm alt. gr. dec.	Vent.	Tempestas.	Pluvia. dig.dec
1. 8	*a. m.*	29.75	49 . 6	S. W. 1	Cœlum nubibus obduct.	0.035
4	*p. m.*	29.56	47 . 3	S. W. 2	Imbres interrupti. Sol pervices intercurrens	0.043
2. 7	½ *a. m.*	29.24	48 . 5	S. 1	Pluvia fere perpetua	0.725
3. 9	*a. m.*	29.95	49 . 7	N. 1	Cœlum sudum	0.032
5	*p. m.*	30. 4	49 . 2	N. 1	Cœlum sudum	0.000
4. 7	*a. m.*	29. 9	47 . 0	S. W. 1	Nubes sparsæ	0.000
10		29. 7	46 . 2	S. W. 2	Imbres intercurrentes	0.103
12		29. 4	45 . 0	S. 3	Cœlum nubibus undique fere tectum	0.050
3	*p. m.*	28. 8	46 . 0	S. 4	Nubes sparsæ	0.000
5		28. 6	47 . 2	S. W. 4	Eadem Cœli facies	0.000
7		28. 9	48 . 0	S. W. 2	Pluit	0.000
9		28. 9	48 . 2	0	Pluvia fere perpetua	0.305
5. 7	*a. m.*	29. 7	53 . 4	N.E. 1	Sudum. Gelu.	0.250

Niccolò Cirillo's activity within Jurin's network

The neapolitan correspondent in Jurin's network was the physician and botanist Niccolò Cirillo (1671-1735). He worked at Incurabili as a physician, then he held the chair of Natural Philosophy in 1705 and of Medicine in 1706. In 1718 he became a fellow of the Royal Society of London and soon began to collect meteorological data on the climate of Naples, requested by Jurin:

”… please be so good as to write the time, along with the date, of each observation. Please enter the actual numbers everywhere; short transverse lines, which occur in various entries, leave me in doubt whether an observation has been omitted or the numbers written by the previous observation are to be understood …”

Sources (from Royal Society)

1) 1 gennaio 1725: Paper, regarding meteorological observations from Naples (Italy) for August to December 1724 by Nicholaus Cyrillus (clp_5_27). The table records date, hour, overall weather condition, wind direction, rainfall and information about Vesuvius;
2) 1 gennaio 1725: Letter, from Nicolaus Cyrillus to James Jurin, dated at Naples (el_c2_66). Discussing thermometers; discussing works on physico-theology;
3) 1 gennaio 1726: letter, from Nicolaus Cyrillus to James Jurin, dated at Naples (el_c2_67). Concerning literary queries and some discussion about his thermometer;
4) 1 gennaio 1727: letter, from Nicolaus Cyrillus to James Jurin, dated at Naples (el_c2_68). Observations accompanying his meteorological diary of 1726;
5) 1 gennaio 1727: Letter, from Nicolaus Cyrillus to James Jurin, dated at Naples (el_c2_69). Concerning the arrangement of the meteorological diary for 1726.
6) 5 agosto 1729: Letter, from William Rutty to Niccolo Cyrillus, dated at London (el_r2_27). Thanks for the meteorological diary with paper on the use of cold for fevers;
7) 1731: A Neapolitan meteorological diary with an account of the late fiery eruption of Mount Vesuvius by Nicolaus Cyrillus to William Rutty (rbo_15_83);
8) 1 gennaio 1731: translation of a part of a letter, from Nicolaus Cyrillus of Naples to William Rutty (el_c2_70). Cyrillus's letter gives observations of the barometer used in his meteorological diary of Naples in 1730. He sends an account of the eruption of Mount Vesuvius during March 1730 which is from his meteorological diary;

9) 1 gennaio 1732: Translation of a letter, from Nicolaus Cyrillus to Cromwell Mortimer (el_c2_72). Concerning corrections to Cyrillus's article on the cold in February in Naples printed in 'Philosophical Transactions' (vol 36, no 410, p 142); concerning observations of Mount Vesuvius during September 1731; sends a paper entitled 'A history of the Earthquake, which in the year 1731 afflicted Apulia and almost the whole kingdom of Naples'.

10) 1 gennaio 1732: Letter, from Nicolaus Cyrillus to Cromwell Mortimer, dated at Naples (el_c2_74); Cyrillus says that he sends the meteorological diary of Naples for 1732 and a paper on the weather in Naples, which is attached. The activities of Mount Vesuvius and Mount Etna are discussed;

11) 1 gennaio 1732: Letter, from Nicolaus Cyrillus to Cromwell Mortimer, dated at Naples (el_c2_71). Concerning corrections to Cyrillus's article on the cold in February in Naples printed in 'Philosophical Transactions' (vol 36, no 410, p 142); concerning observations of Mount Vesuvius during September 1731; sends a paper entitled 'A history of the Earthquake, which in the year 1731 afflicted Apulia and almost the whole kingdom of Naples'.

12) 1 gennaio 1733: Translation of a letter, from Nicolaus Cyrillus to Cromwell Mortimer, dated at Naples (el_c2_75); Cyrillus says that he sends the meteorological diary of Naples for 1732 and a paper on the weather in Naples, which is attached. The activities of Mount Vesuvius and Mount Etna are discussed;

13) 1 gennaio 1733: Letter, from Nicolaus Cyrillus to Cromwell Mortimer, dated at Naples (el_c2_73). Some discussion of Cyrillus's article on cold in February printed in 'Philosophical Transactions' (vol 36, no 410, p 142); stating that the meteorological diary for 1732 would be sent at a later date with a paper on natural history;

14) 12 aprile 1733: Meteorological observations from Italy, India and Norway in 1727, communicated to the Royal Society by Peter Kinck, and abridged by William Derham (rbo_18_38). Observations made at: Naples by Doctor Nicolaus Cyrillus, Bengal by Mr Bellamp, Chaplain to the English Factory, Christiana in Norway by person unidentified.

Paper, regarding meteorological observations from Naples [Italy] for August to December 1724 by Nicholaus Cyrillus

January 1725

1724.

Cl.mo Viro Jacobo Jurin M.D. Soc. Reg. Secr. & Coll. M. Lond. Socio
Nicolaus Cyrillus in Reg. Unte Neap. Prim. Med. Professor

DIARIUM METEOROLOGICUM NEAPOLITANUM

ANNI Biss. MDCCXXIV.

AUGUSTUS.

Dies. Hora St. N.	Tempestas.	Venti.
15.	Post pertinacissimum trium Menjium, noctu diuque perennantem Æstum siccissimo Cœlo per hebdomadam circa Meridiem è Montibus ad Ortum positis deinde elevare Nubes, cum Fulguribus	S. l. SW. l.

SEPTEMBER.

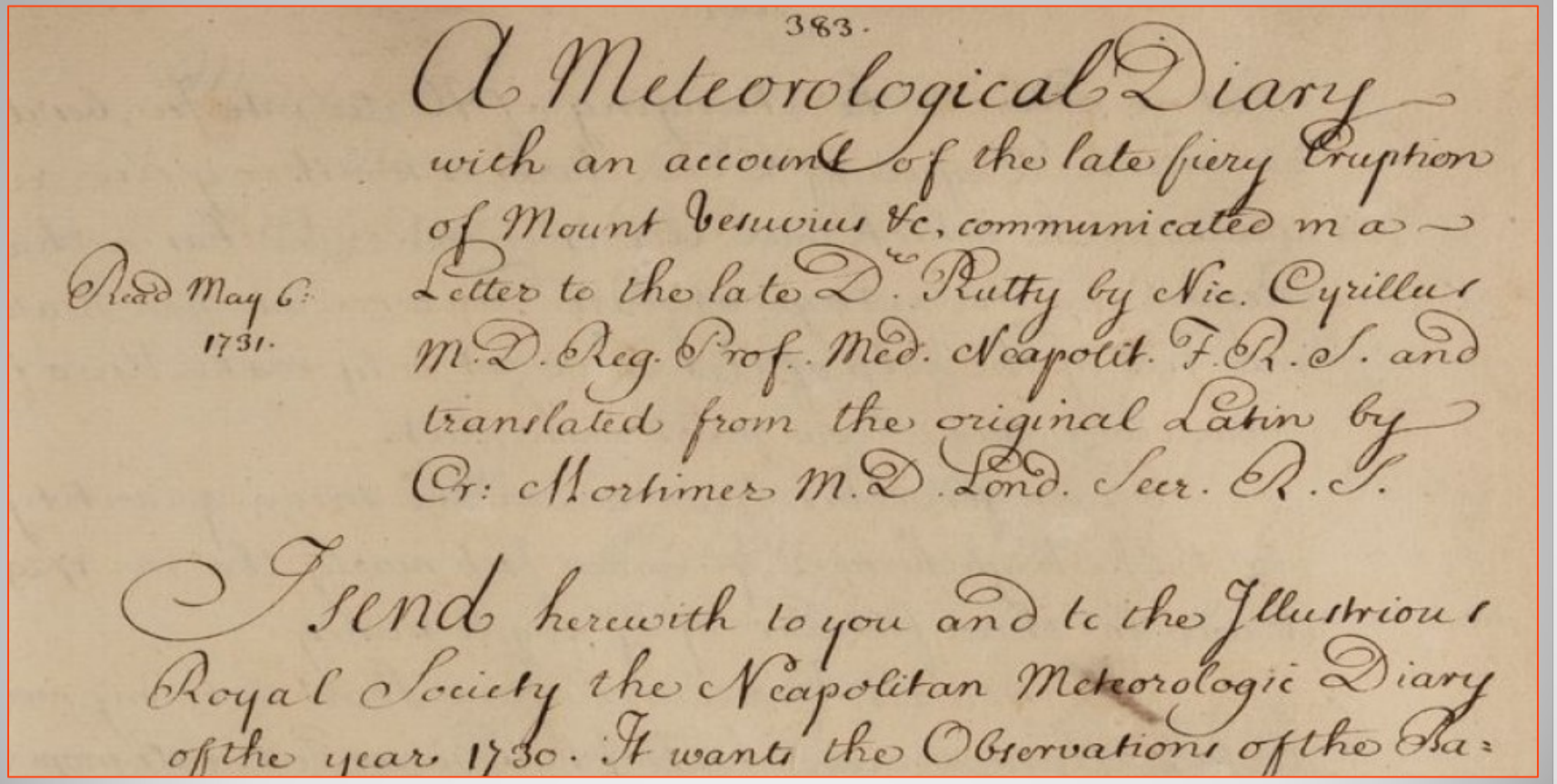
D. H.	Tempestas.	Venti.	Pluvia.	Vesuvius.
4.	Ex Pluviâ in vicinioribus locis Æstus sensim temperatus.	NE. 1.	Mens.	Vesuvius qui die siluerat per intervalla fumum emittit.
10.		S. 1.		
11.	Ante meridiem Nubes cum Tonitrui è regione Australi elevatæ, diu exoptatam Pluviam ante et post Meridiem attulerunt.	S. 2.		Fumum hinc claram Flammam assiduè emittit.
		p. m. NE. 1.	18.	
12.	Aquilones flare Frigus inexpectatum. Nix in Matejo et Aprutio.	N. 2.		
13.				
14.	Frigus remissum. Aër nubilosus.	N. 1.		A meridie cum fragoribus ignitam materiam circumquaque per varia fluenta eructat, jucundo nocturnique spectaculo.
15.	Tempus sudum a. m.	p. m. W. 1.		Eructatio imminuta: rumor assiduus.

Jurin's answer to a letter from Cirillo, dated 1 January 1725 and discussing thermometers, is:

: "To Niccolò Cyrillo, 26 March 1725. London 26 March 1725. To the most Distinguished and Learned Niccolò Cyrillo M.D. Principal Professor of Medicine in the Royal University of Naples, Heartiest Greetings from James Jurin, Secr. Roy. Soc. London. Most Learned Sir, Your letter written on the first of January gave much pleasure to me personally, and filled the whole of the Royal Society also, at whose meeting I read it out a few days ago, with a rare and special delight. And rightly so: for in it you showed so many examples of keen intellect and of subtle and refined judgement and at the same time such kindness and such ardour for the advancement of Natural History, that it could not fail to be most welcome and give the greater satisfaction that you Sir, a man of such eminence, have done the Society the honour of reporting to it so promptly your work for the development of that aspect of Natural Science. And so by the unanimous votes of all I have been instructed to inform you of the Society's warm feeilings of goodwill towards you, and in its name to return our special thanks for your observations, both those which you have already given us and those you have promised; and to urge…..".

A. Rusnock, The Correspondence of James Jurin (1684-1750): Physician and Secretary to the Royal Society, Rodopi B.V. Amsterdam-Atalanta, 1996, p.290.

A Neapolitan meteorological diary with an account of the late fiery eruption of Mount Vesusius by Nicolaus Cyrillus to William Rutty



383.

A Meteorological Diary
with an account of the late fiery Eruption
of Mount Vesuvius &c, communicated in a
Letter to the late D^r. Rutty by Nic. Cyrillus
M.D. Reg. Prof. Med. Neapolit. F.R.S. and
translated from the original Latin by
Cr: Mortimer M.D. Lond. Secr. R.S.

Read May 6:
1731.

I send herewith to you and to the Illustrious
Royal Society the Neapolitan Meteorologic Diary
of the year 1730. It wants the Observations of the Ba=

March

	Therm.	Winds	
8.	40	S. 3.	Cloudy Weather. Strong South Wind. Vesuvius sent forth a great Smoke, and Stream of Fire, with a hollow Rumbling.
9.	38.	W. 1.	and the weather cloudy. The following Night Vesuvius thunder'd, as it were, thrice. In the Day the Windows trem. bled a little.
10. 11. 12.	39. 0.	S. 1.	Cloudy: Rain now and then. The Clouds hid the Smoke and Fire.
13.	41.	S. W. 1.	Weather rather clear. The Smoke is lessend.

14. 47.0. N.2. A little Rain in the night: in the morn: ing Snow on Mountains. In the morning the Snow encreas'd again: in the Evening after eight o' Clock the Fire arose to a vast highth, and threw huge Stones to almost half the perpendicular highth of the Mountain. Pumice Stones red hot of two ounces or more weight were driven several Miles, like a Shower of hail, and fright. end away the Birds. In about an hours Time, the highth of the Flame was somewhat lessen'd: and thro' the middle of the thick Smoke, flashes of Light'ning were often seen.

15. 50.0. N.1. Clear Weather. Thick Smoke scatter'd the Ashes many miles over the Sea.

VII. *An Account of an extraordinary* Eruption *of Mount* Veſuvius *in the Month of* March, *in the Year* 1730, *extracted from the* Meteorological Diary *of that Year at* Naples, *communicated by* Nichol. Cyrillus, *M. D. R. S. S.*

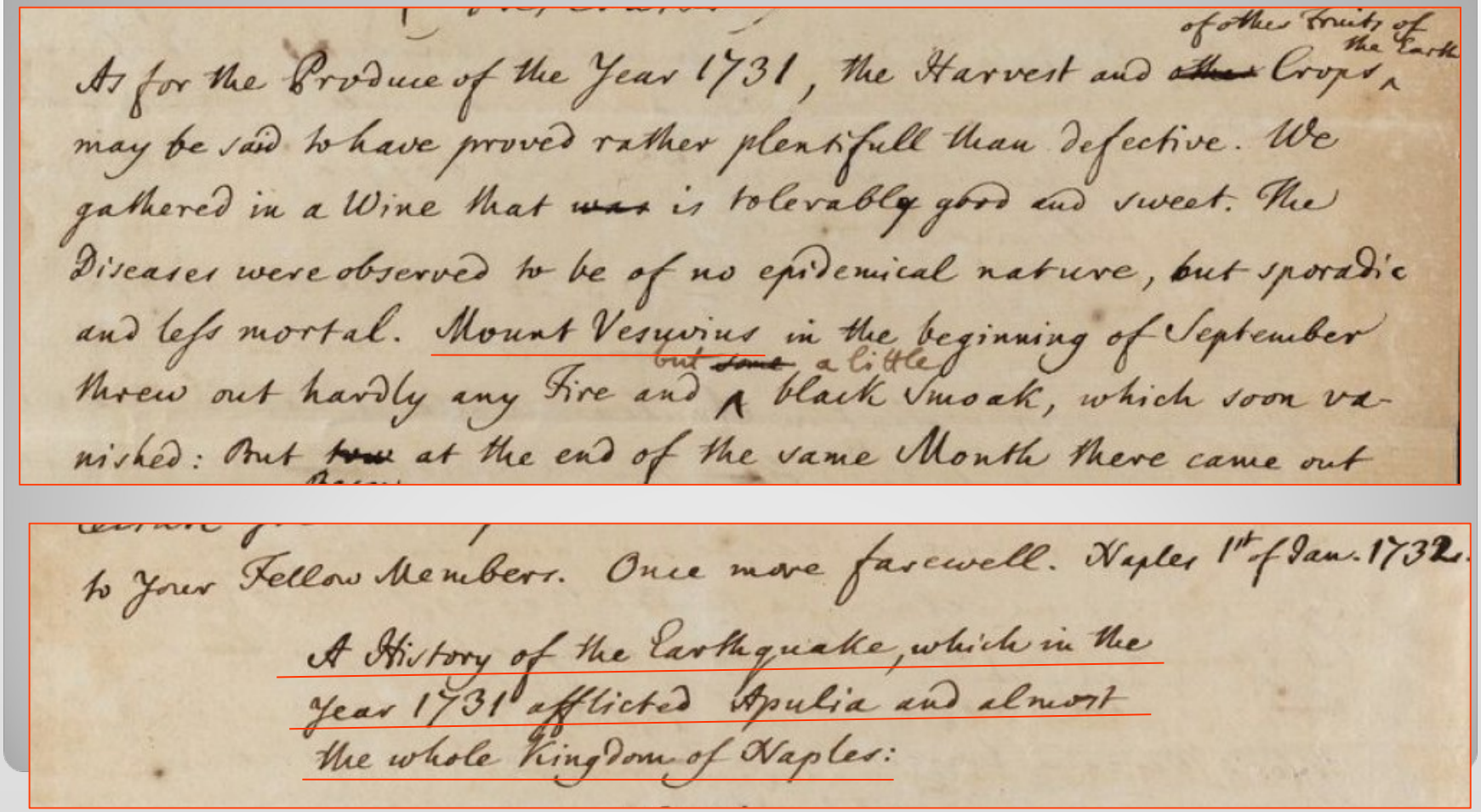
THE Thermometer uſed in this *Diary*, was made by Mr. *Hauksbee*, in which the Freezing-Point is marked at 65 Degrees under the Point extreme Hot; but the Doctor obſerves, that at *Naples* Water will freeze when this Thermometer ſtands at 55 Degrees only: Which, he is of Opinion, ſeems to argue, that there is ſomething elſe beſides an intenſe Degree of Cold required for freezing Water; that the Air of *Naples* abounds in it, more than the Air of *London*; and that this may probably be of a ſaline Nature; becauſe when we turn Water into Ice by the Help of Snow, it is neceſſary to mix Salt with it.

March Ther. Winds.

The same acconut, extracted from the 1730 Meteorological Diary was the subject of a communication in the Philosophical Transactions, 37 (424) (1732) 336-338.

letter, from Nicolaus Cyrillus to Cromwell Mortimer

01 January 1732



As for the Produce of the Year 1731, the Harvest and ~~other~~ Crops of other fruits of the Earth may be said to have proved rather plentifull than defective. We gathered in a Wine that ~~was~~ is tolerably good and sweet. The Diseases were observed to be of no epidemical nature, but sporadic and less mortal. Mount Vesuvius in the beginning of September threw out hardly any Fire and but a little black Smoak, which soon vanished: But ~~from~~ at the end of the same Month there came out

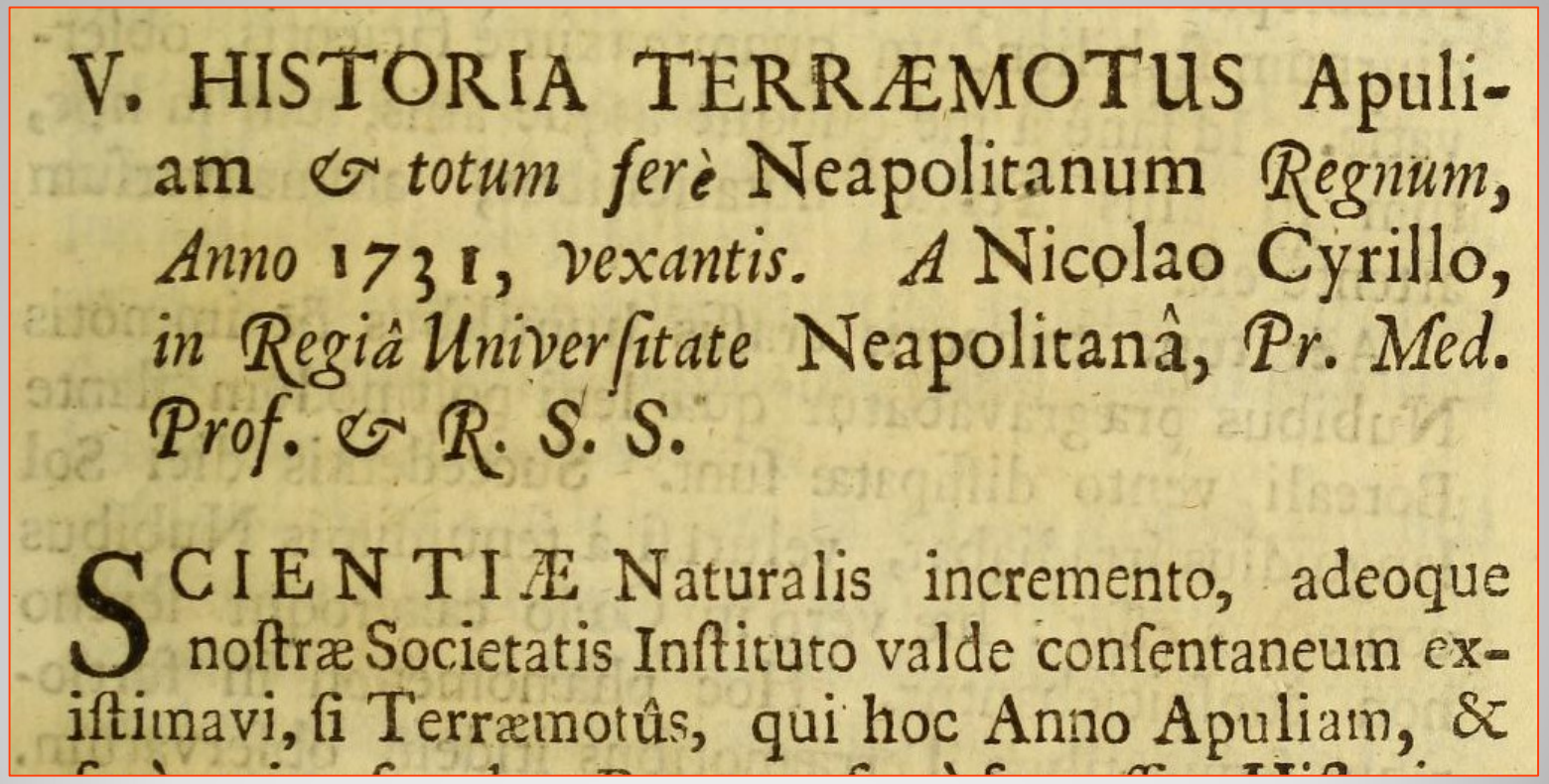
to Your Fellow Members. Once more farewell. Naples 1st of Jan. 1732.

A History of the Earthquake, which in the Year 1731 afflicted Apulia and almost the whole Kingdom of Naples:

others who live at Iuvenazzo and Foggia, I shall make up the following Account.

On the 9th of March 173$\frac{0}{1}$, O.S. at 8 in the morning, an Earthquake happened over almost all the Kingdom of Naples, but was most violent in Apulia. While it lasted, there were observed in it all its different Species taken notice of by the Antients. First, the Tremor; next the Shake, called ἔμπνευσις by Aristotle, or Succussatio by Poridonius in Seneca, and last the Inclination or tottering of the Earth, like that of a Ship. These different motions followed one another by turns and successively, during the Space of three Minutes and some Seconds. My Friend did not take notice, whether the tottering and oscillations of the Earth agreed with the Direction of the Parallels of the Earth: according to the con-

Also in this case the same paper, on the Apulia Earthquake of 1731, was the subject of a communication in the Philosophical Transactions, 38 (427-435) (1733-1734) 79-84.



V. HISTORIA TERRÆMOTUS Apuliam & *totum ferè* Neapolitanum *Regnum*, *Anno* 1731, *vexantis*. *A* Nicolao Cyrillo, *in Regiâ Universitate* Neapolitanâ, *Pr. Med. Prof.* & *R. S. S.*

SCIENTIÆ Naturalis incremento, adeoque noſtræ Societatis Inſtituto valde conſentaneum exiſtimavi, ſi Terræmotûs, qui hoc Anno Apuliam, &

letter, from Nicolaus Cyrillus to Cromwell Mortimer,

01 January 1733

Nicholas Cyrillus, Primary Professor of Physick
in the University of Naples and F.R.S.
to Dr Cromwell Mortimer Secretary of the R. Soc.

The Natural History of the Air and Earth at
Naples for the Leap Year 1732.

1. It rained plentifully in the January and December; for
in the first Month the Quantity amounted to 131 measures,
and in the latter to 111. In October also we had 108.
But very little Rain fell in March and May. So that
upon comparing the Seasons of the Year, we find Winter and
Autumn to be more inclined to Rain, but Spring and
Summer to fair Weather, yet more particularly the Spring.
This is indeed usual to our Climate, and agrees most with
the temperature of the Air during the dry Summer Season.

It will be better therefore to measure as near as possible the Strength of Winds according to the method proposed by Dr Jurin N° 379 of the said Transactions, which accordingly we made use of in our Observations. That method is, directed to have recourse to the Motion of Trees, which being carefully observed, the Degrees of the Power of the Winds may be determined by one of those four Numbers 1, 2, 3, 4 to be marked down in the Mete-

V. The Thermometer made by Mr Hawksbee afforded the following Phenomena. The greatest Heat this Year was observed from the 9th of July till the first days of August. On the 23d and 24th of July, as also on the 17th

as has been observed in it's place. In the Month of December, when there appeared some Ice, the Thermometer was fallen to 55 and 56. In this place I think worth observing, that on the Table which is fixed to the Hawksbeian Thermometer the 65 Degree is marked with the Word Frost. However I have found by many Years Observation that it froze Ice, when the Liquor in the same Thermometer, that had been sent to me from England, was fallen down no farther than 55 Degr. Hence it cannot be denied, but that a less Degree of Cold will produce Ice here at Naples than at London.

Conclusions

- The Neapolitan Niccolò Cirillo was among J. Jurin's correspondents. He carried out observations, ranging from weather conditions and wind directions to rainfalls and the activity of Mount Vesuvius.
- He gave an account of the eruption of Vesuvius during March 1730 and of the earthquake, which in 1731 affected Apulia and almost the whole Kingdom of Naples.
- Archival documents (from Royal Society) testify Cirillo's activity within Jurin's network. The emerging picture is a unifying vision of meteorology, as a comprehensive science including any Earth phenomenon, which was widespread among scientists and naturalists in 18th and 19th centuries, leading to a common belief of a deep relationship between earthquakes, eruptions and atmospheric phenomena.

Thank You!!