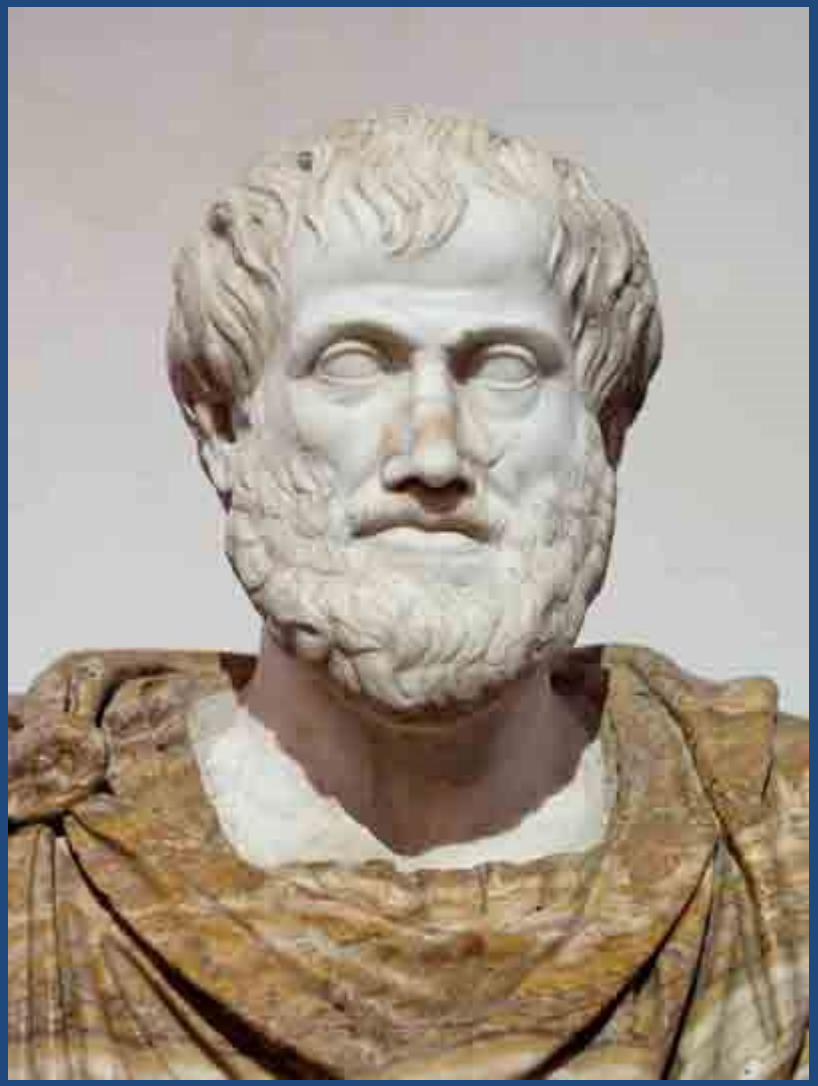
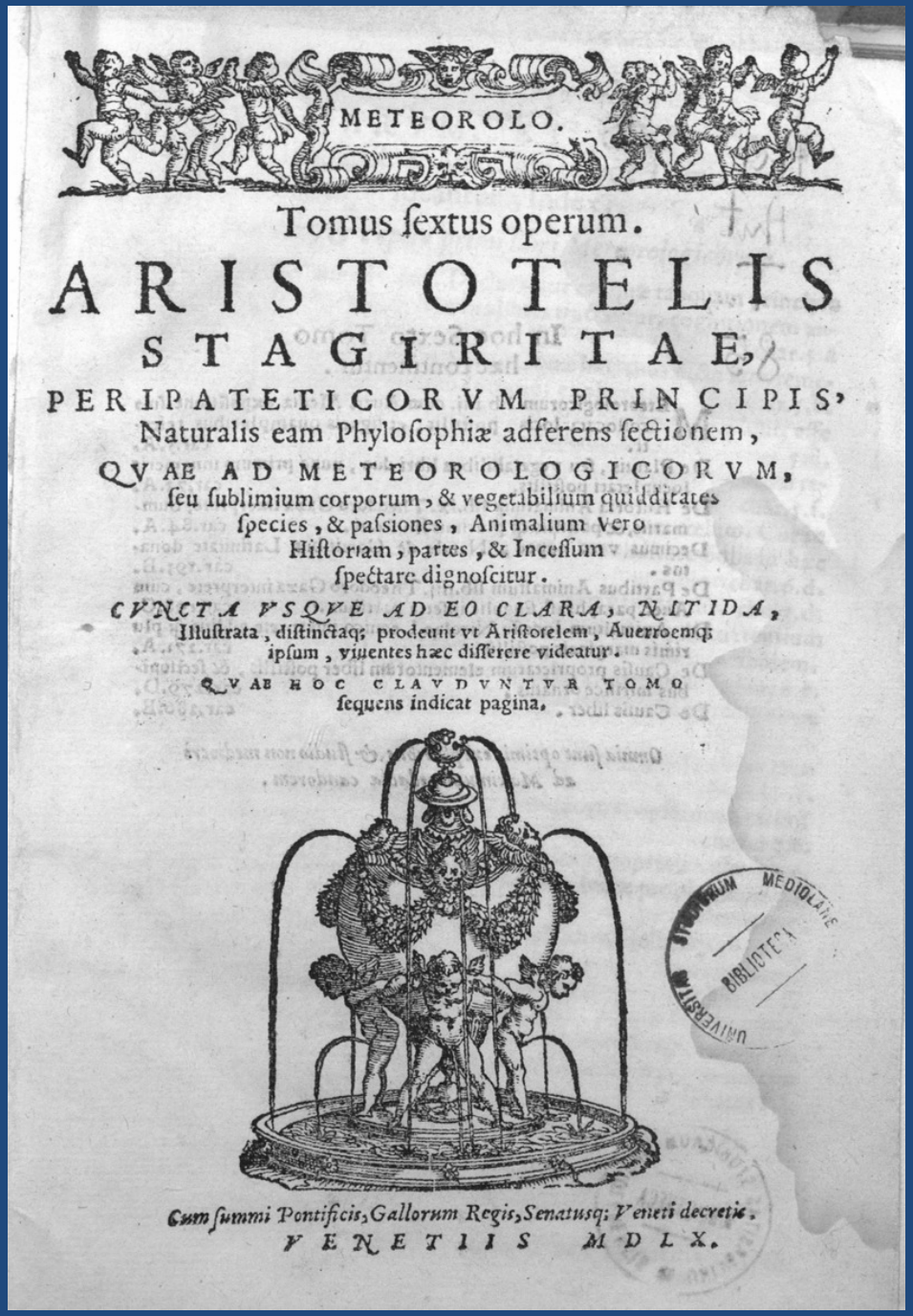
Meteorological observations from 1500 to 2021

Pavel Konstantinov
Associate Professor
Faculty of Geography
Dept of meteorology and climatology



384 B.C. — 322 B.C.

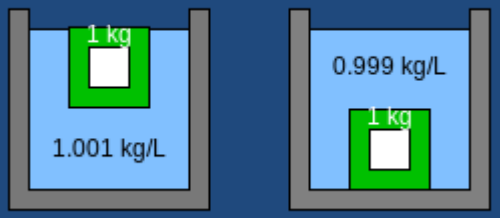

METEOROLO.

Tomus ſextus operum.

ARISTOTELIS
STAGIRITAE,
PERIPATETICORVM PRINCIPIS,
Naturalis eam Philoſophiæ adferens ſectionem,
QVAE AD METEOROLOGICORVM,
ſeu ſublimium corporum, & vegetabilium quidditates
ſpecies, & paſsiones, Animalium vero
Hiſtoriam, partes, & Inceſſum
ſpectare dignoſcitur.
CVNCTA VSQVE AD EO CLARA, NITIDA,
Illuſtrata, diſtinctaq; prodeunt vt Ariſtotelem, Auerroemq;
ipſum, viuentes hæc diſſerere videatur.
QVAE HOC CLAVDVNTVR TOMO
ſequens indicat pagina.

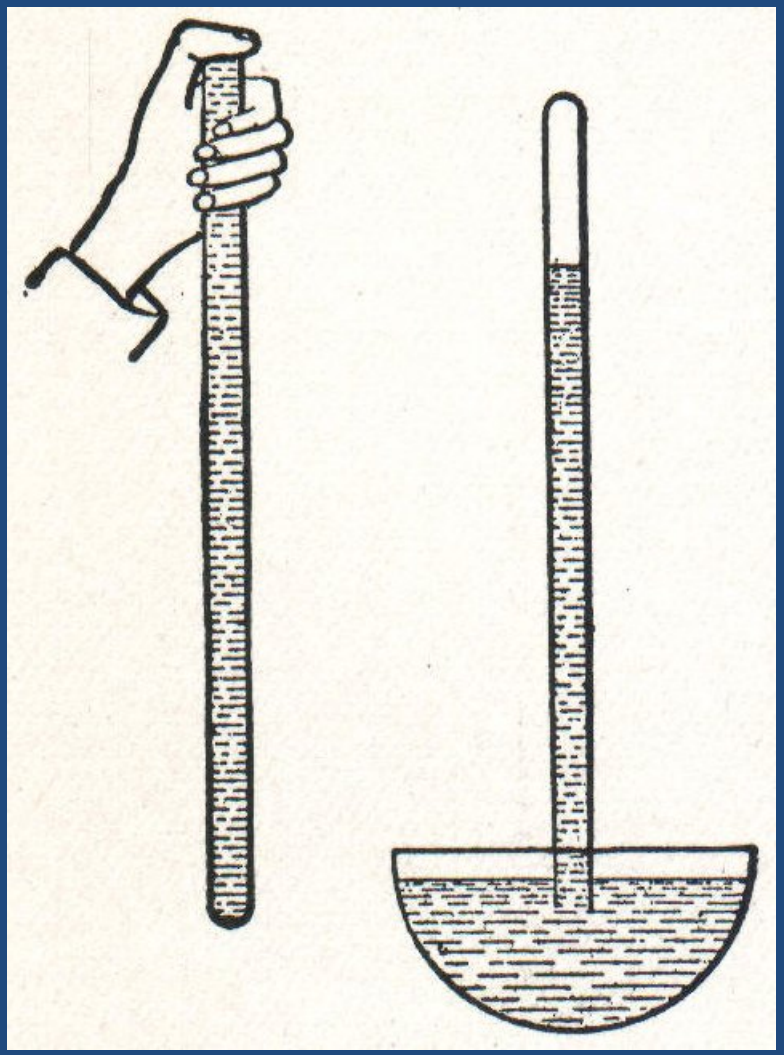
Cum ſummi Pontificis, Gallorum Regis, Senatusq; Veneti decreto.
VENETIIS MDLX.

Galilean thermometer



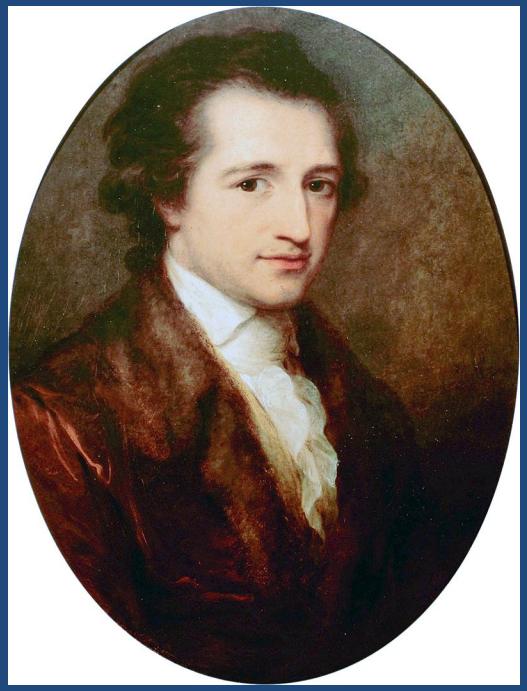
1592 year

Mercury barometer by Torricelli



1643 year

Goethe barometer" (named for Johann Wolfgang von Goethe)



First meteorological network

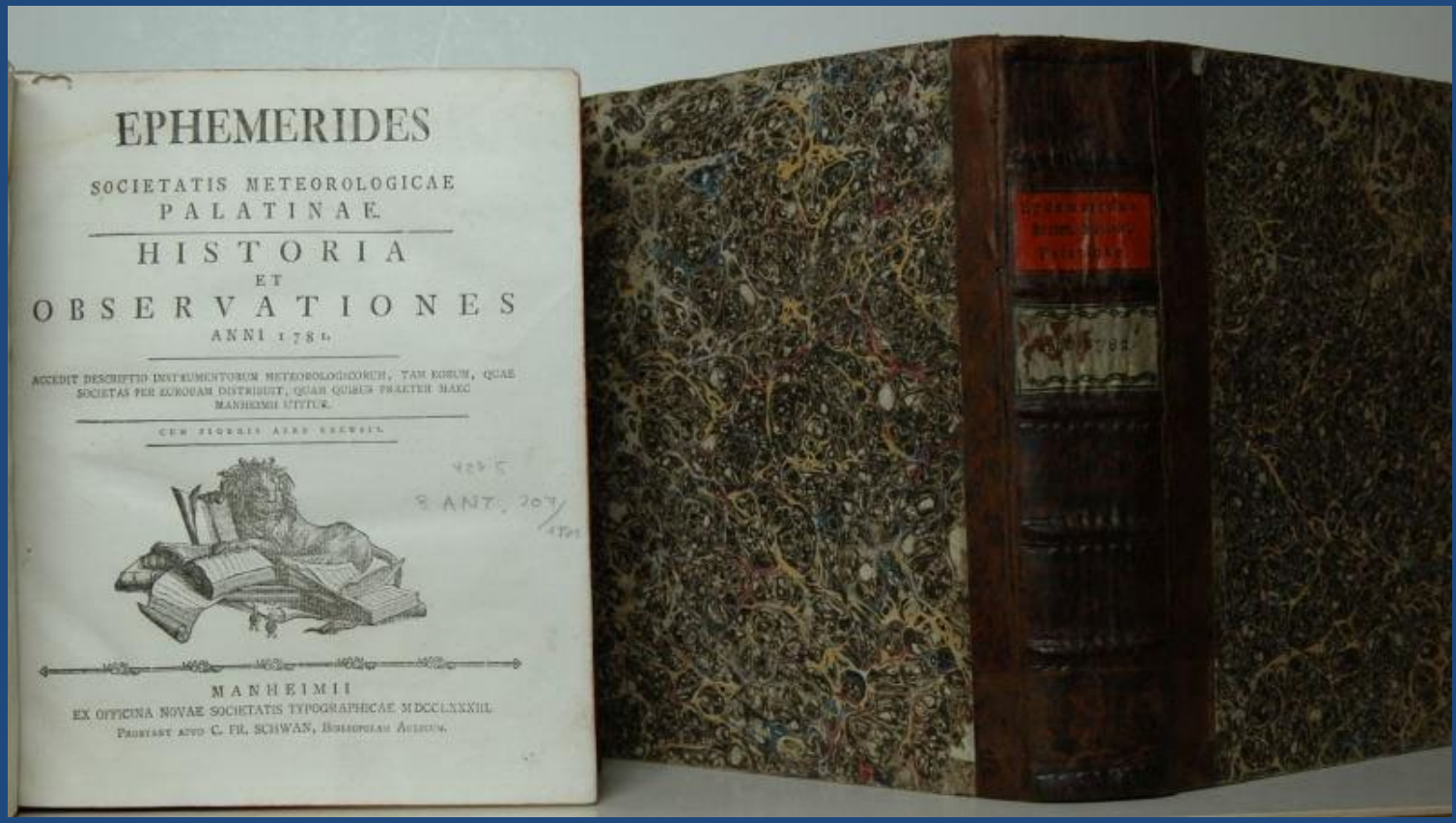
Leopoldo de' Medici was an Italian cardinal, scholar, patron of the arts and Governor of Siena.

10 stations:

- Florence
- Cutigliano
- Vallombrosa
- Bologna
- Parma
- Milan
- Innsbruck
- Osnabrück
- Paris
- Warsaw

1654-1667

The measuring instruments were 2 thermometers , 1 barometer , 1 hygrometer and a declination needle , which had been calibrated and adjusted by Hemmer in Mannheim before they were sent to the observers.


EPHEMERIDES

SOCIETATIS METEOROLOGICAE PALATINAE.

HISTORIA ET OBSERVATIONES ANNI 1781.

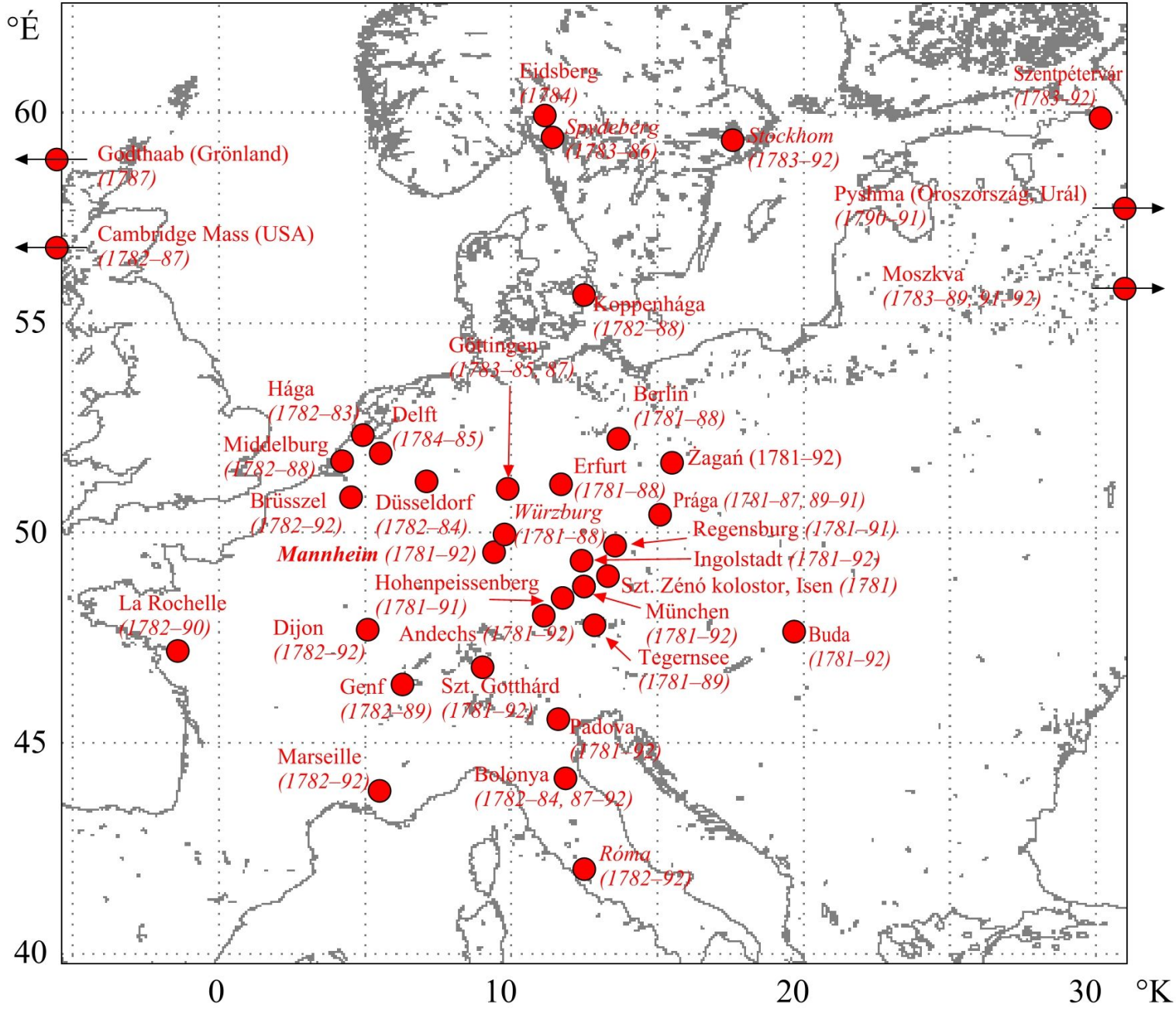
MANHEIMII

The Societas Meteorologica Palatina, or Meteorological Society of Mannheim

1781-1795

Junius.						
Dies	Barometr. Correct.	Therm. intern.	Therm. ext. I.	Therm. ext. II.	Hygrom. Correct.	Declinat.
16	25. 1. 88	15. 0	14. 9		29. 4	17. 40
	25. 1. 64	15. 7	16. 7		41. 4	17. 48
	25. 1. 16	15. 4	14. 4		34. 8	17. 49
17	25. 1. 00	15. 4	15. 0		30. 3	17. 34
	25. 0. 79	16. 5	18. 4		42. 8	17. 36
	25. 0. 44	15. 6	16. 0		29. 4	17. 30
18	25. 0. 01	14. 5	12. 7		28. 2	17. 30
	25. 0. 06	15. 4	14. 7		33. 7	17. 36
	24. 11. 60	14. 7	12. 9		31. 5	17. 35
19	24. 11. 19	14. 9	13. 2		29. 7	17. 35
	24. 10. 94	15. 7	16. 9		35. 1	17. 35
	24. 10. 72	14. 4	12. 9		29. 3	17. 34
20	24. 11. 06	13. 7	10. 6		16. 3	17. 30
	24. 10. 59	14. 9	14. 9		30. 9	17. 30
	24. 10. 26	13. 7	10. 2		32. 1	17. 32
21	24. 9. 67	10. 6	9. 4		5. 6	17. 29
	24. 10. 06	10. 7	9. 7		5. 1	17. 27
	24. 11. 00	10. 2	9. 1		2. 4	17. 27
22	24. 11. 75	12. 7	9. 4		0. 2	17. 28
	25. 0. 15	12. 4	9. 2		0. 1	17. 31
	25. 0. 55	12. 0	9. 4		0. 2	17. 32
23	25. 0. 80	10. 7	9. 3		− 0. 2	17. 30
	25. 0. 45	12. 2	11. 4		+ 2. 1	17. 35
	25. 0. 21	11. 4	10. 4		0. 3	17. 34
24	24. 11. 75	12. 4	11. 4		1. 4	17. 30
	24. 11. 56	10. 7	10. 2		17. 1	17. 27
	24. 11. 42	12. 7	10. 2		23. 4	17. 24
25	24. 11. 49	10. 3	10. 4		22. 6	17. 21
	24. 11. 85	10. 4	12. 9		23. 7	17. 21
	25. 0. 02	12. 9	10. 4		0. 1	17. 20
26	24. 11. 92	12. 9	10. 4		0. 2	17. 21
	25. 0. 10	12. 7	9. 5		0. 6	17. 24
	25. 0. 16	12. 2	7. 9		0. 3	17. 24
27	25. 0. 21	11. 4	8. 4		0. 2	17. 24
	25. 0. 85	10. 0	8. 6		0. 1	17. 27
	25. 1. 97	10. 4	7. 2		− 2. 3	17. 27
28	25. 2. 69	10. 2	6. 5		− 5. 3	17. 21
	25. 2. 65	8. 7	7. 6		− 4. 2	17. 24
	25. 2. 90	8. 4	7. 5		− 2. 1	17. 24
29	25. 2. 43	9. 6	7. 9		− 2. 7	17. 27
	25. 2. 25	10. 7	10. 4		+ 2. 1	17. 30
	25. 2. 29	10. 2	10. 0		7. 9	17. 31
30	25. 1. 54	10. 9	10. 4		2. 0	17. 35
	25. 1. 40	10. 1	14. 9		20. 4	17. 36
	25. 1. 31	11. 7	11. 5		8. 6	17. 36

Junius.					
Ventus	Pluvia	Evapor.	Luna	Coeli facies	Meteora
N 1			♒	= a. c. l.	
NNO 1	155	1109		= a. c. ſſo. rap.	
SO 1				= c. ſſo.	
SO ½			♒	= a.	
NO 2		1042		= a. ſſo. rap.	
NO 1				= c. n. ſſo.	in S h. 7 ac nocte.
N ½			♓	= a. ſſo.	
S 1	144	879		= a. ſſo. rap.	∴ med. [illegible].
SO 1				= c. ſſo.	
NSW 1			♓	= a. t. c.	
NW ½		914		= a. c. ſſo. rap.	h. 5 ad 8; dein nocte
S 1				= a. c. ſſo.	
S 1			☾ ♈	= c. l.	spue ad h. 8.
SO ½	648	237		= a. ſſo. rap.	
NO 1			☾ h. 24 m. vesp.	= a. c.	
NSW 1			♈	= a. c. t. ſſo.	frequens
SW 1	60	429		= c. l.	
NSW 1				= c. l.	∴
SW 1½			♉	=	∴
SW 2	264	—		=	∴
SW 2				=	∴
NO 2			♉	=	∴
NO 2	479	120		= a. c. t. ſſo.	
NO 2				=	∴
SSW 1			♊	= a. c.	∴ dispers.
S 1		367		= a. c. ſſo. rap.	in S.
SSO 1				= c. ſſo.	
SSW 1			♊	= a. c.	
NNW 2	18	765		= cn. ſſo. rap.	in S et N. med. 2.
N 1				=	h. 8. ∴
N 1			♊	=	∴ fon.
SW 2	458	104		=	∴
S 1				=	∴
SW 1			♋	=	∴ a longe.
NO 2½	369	—		=	∴
NO 2			● h. 11 m. mane	=	∴
NNO 2			♋	=	∴
NO 2	287	102		=	∴ h. 4 paucum.
ONO 2				=	∴
O 2½			♌	=	∴
ONO 3	15	478		= c. l. ſſo.	
S 2				= c. ſſo.	
SO ½			♌		∴ potiss. infra.
O 1		421		= a. c. ſſo. rap.	h. 5 et nocte.
SW 1				= c. l. ſſo. rap.	

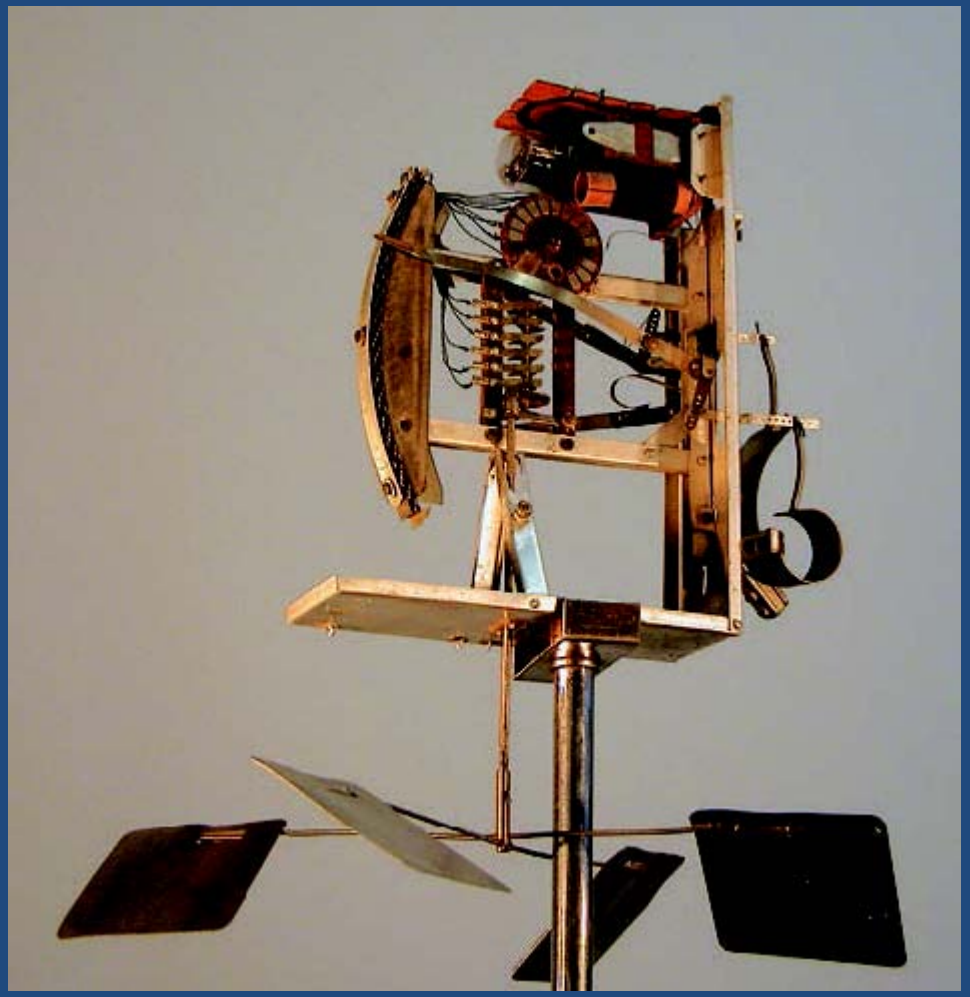

°É
60
55
50
45
40
0
10
20
30
°K
Eidsberg (1784)
Spydeberg (1783–86)
Stockhom (1783–92)
Szentpétervár (1783–92)
Pyshma (Oroszország, Urál) (1790–91)
Moszkva (1783–89, 91–92)
Godthaab (Grönland) (1787)
Cambridge Mass (USA) (1782–87)
Koppenhága (1782–88)
Göttingen (1783–85, 87)
Hága (1782–83)
Delft (1784–85)
Middelburg (1782–88)
Berlin (1781–88)
Żagań (1781–92)
Erfurt (1781–88)
Brüsszel (1782–92)
Düsseldorf (1782–84)
Würzburg (1781–88)
Prága (1781–87, 89–91)
Regensburg (1781–91)
Mannheim (1781–92)
Ingolstadt (1781–92)
Hohenpeissenberg (1781–91)
Szt. Zénó kolostor, Isen (1781)
München (1781–92)
La Rochelle (1782–90)
Dijon (1782–92)
Andechs (1781–92)
Buda (1781–92)
Tegernsee (1781–89)
Genf (1782–89)
Szt. Gotthárd (1781–92)
Padova (1781–92)
Marseille (1782–92)
Bolonya (1782–84, 87–92)
Róma (1782–92)

USSR
Pavlovsk.
30 january 1930

Invention of “traditional” Meteorological Zonde


Павел Александрович Молчанов (1893 — 1941)

PAVEL MOLCHANOV



Named "271120", it was released 13:44 Moscow Time in Pavlovsk, USSR from the Main Geophysical Observatory and reached a height of 7.8 kilometers measuring temperature there (-40.7 °C). Thirty-two (32) minutes after the launch, the radiosonde sent one of the first aerological message to the Leningrad Weather Bureau and Moscow Central Forecast Institute

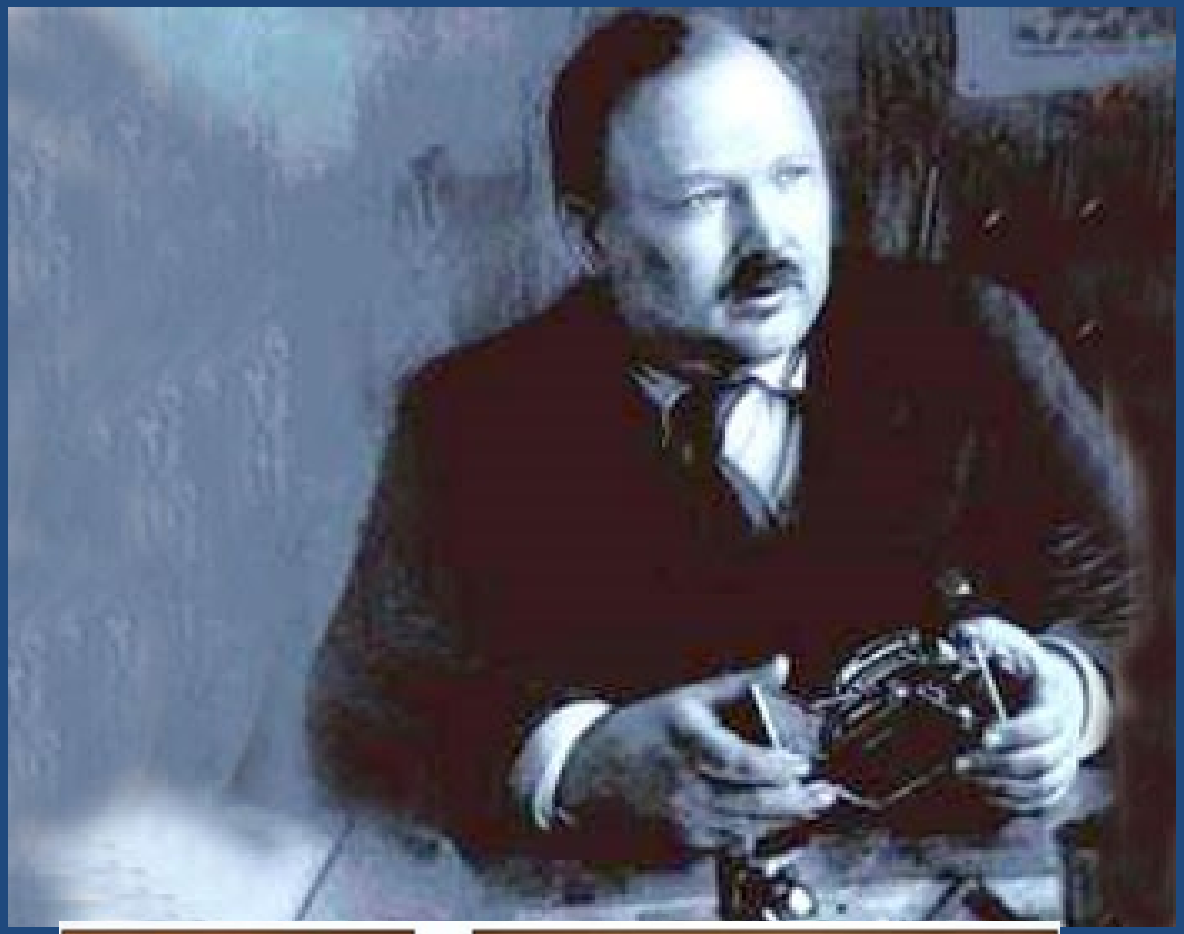


Рис. 3
МРЗ-3А

Рис. 4
МРЗ-3А*

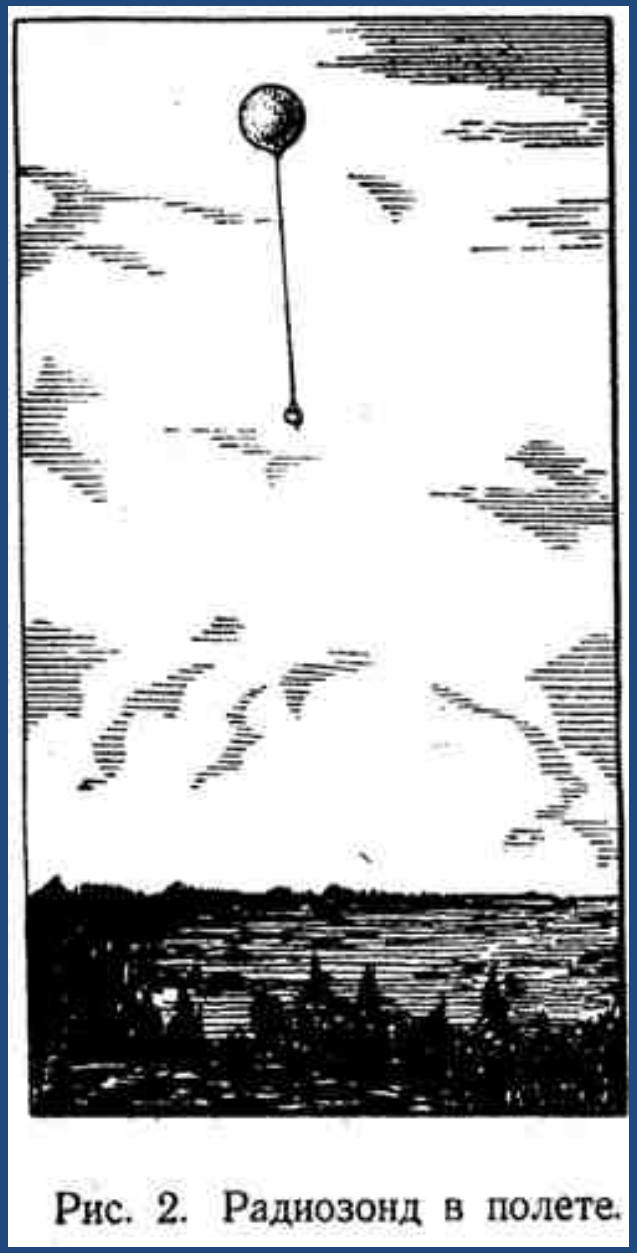
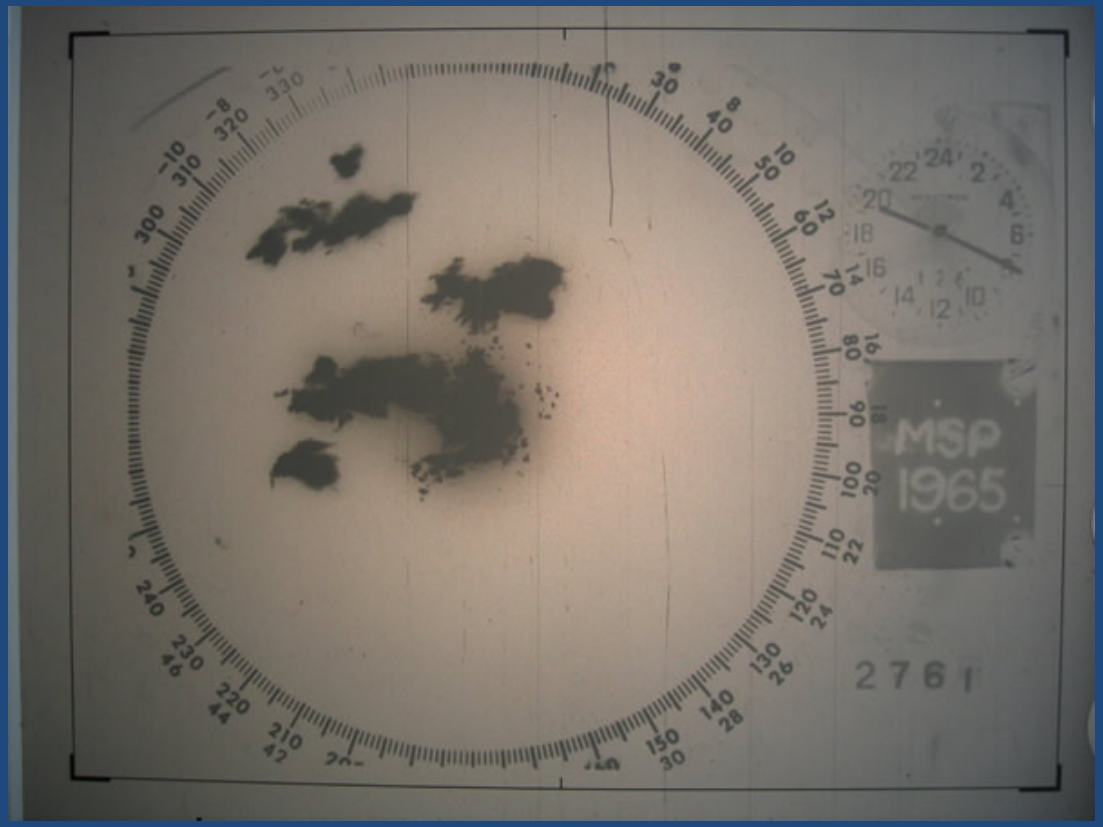
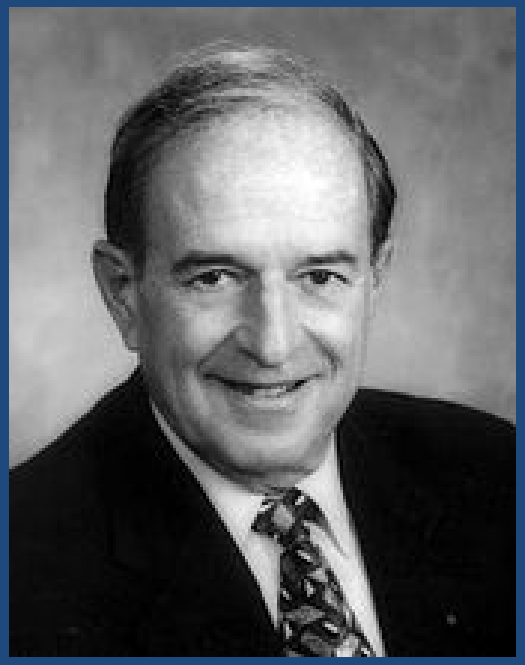


Рис. 2. Радиозонд в полете.

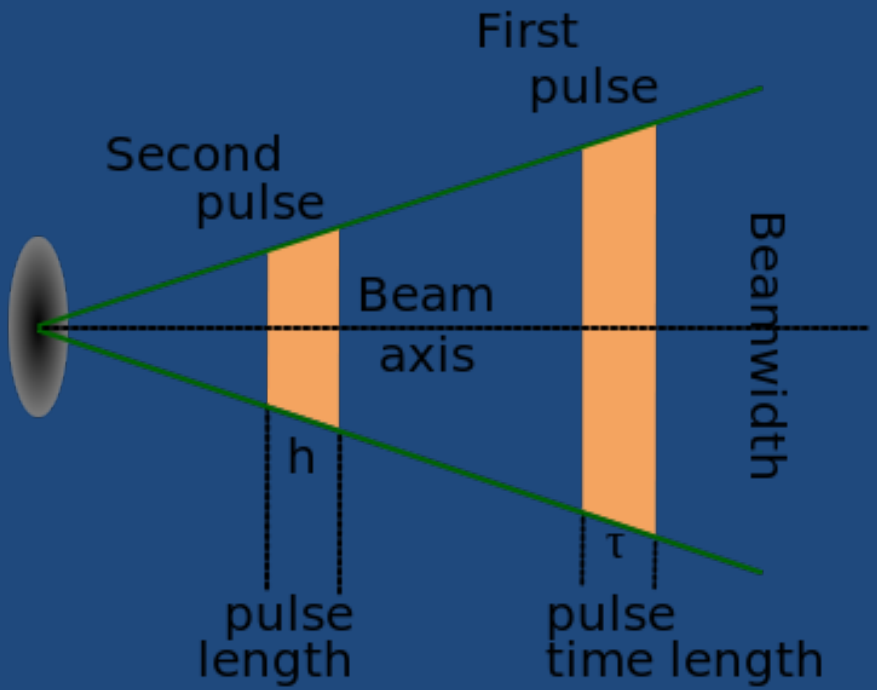
WEATHER RADARS



1960 год. Торнадо над Миннеанаполисом на фоне локатора



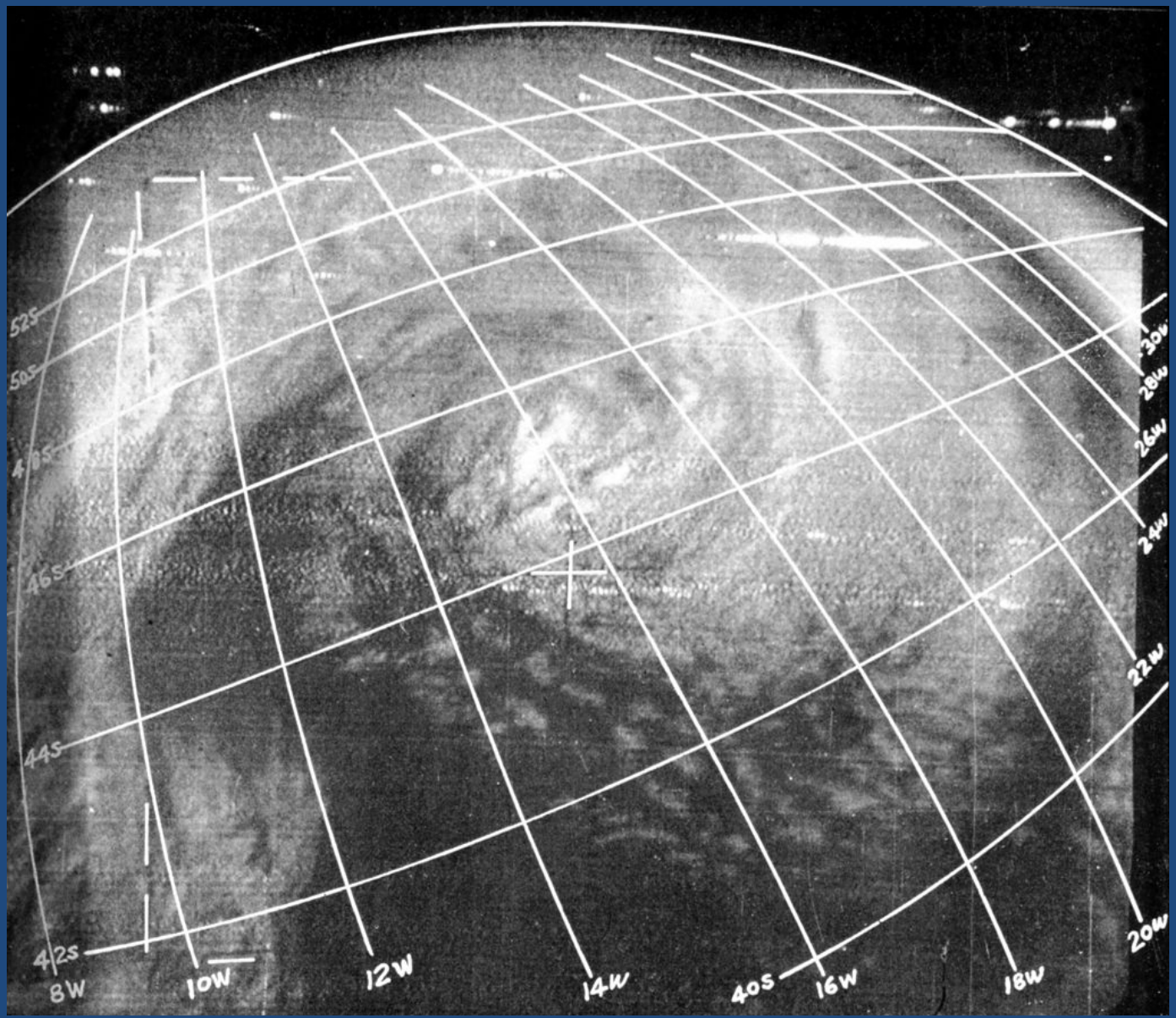
David Atlas


First
pulse
Second
pulse
Beam
axis
Beamwidth
h
τ
pulse
length
pulse
time length

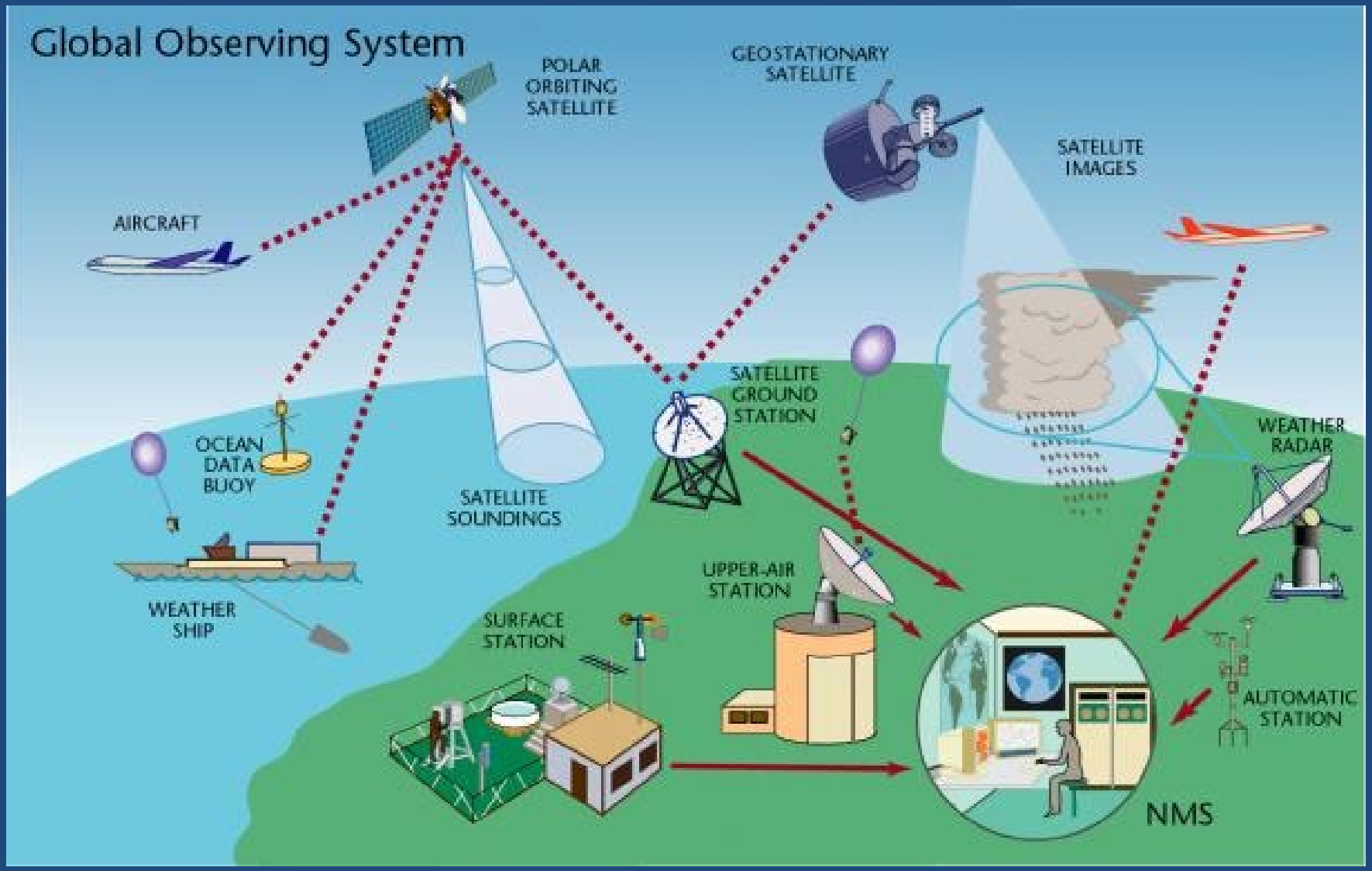
USA.
1 April of 1960

First meteorological satellite TIROS-1

First satellite image



WMO Global Observing System



WMO Station – Europe (Poland)

WMO station network

WMO station network in Arctic

Airport weather station

- Wind speed and direction
- Atmospheric pressure
- Rainfall
- Rain and snow
- Noise
- Temperature and humidity
- Illumination
- Solar radiation
- Particulate matter concentration

Agricultural weather station

- Temperature and humidity
- Wind speed and wind direction
- CO2 concentration
- PM2.5 PM10
- Noise
- Solar radiation
- Sunlight
- Ultraviolet light
- Atmospheric pressure
- Rainfall
- Rain and snow
- Soil temperature humidity and EC
- Soil nitrogen, phosphorus, and potassium
- Soil ph

What's up now?

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COMMENT · 03 JANUARY 2018

Build a global Earth observatory

Markku Kulmala calls for continuous, comprehensive monitoring of interactions between the planet's surface and atmosphere.

Markku Kulmala

SMEAR network

SMEAR network