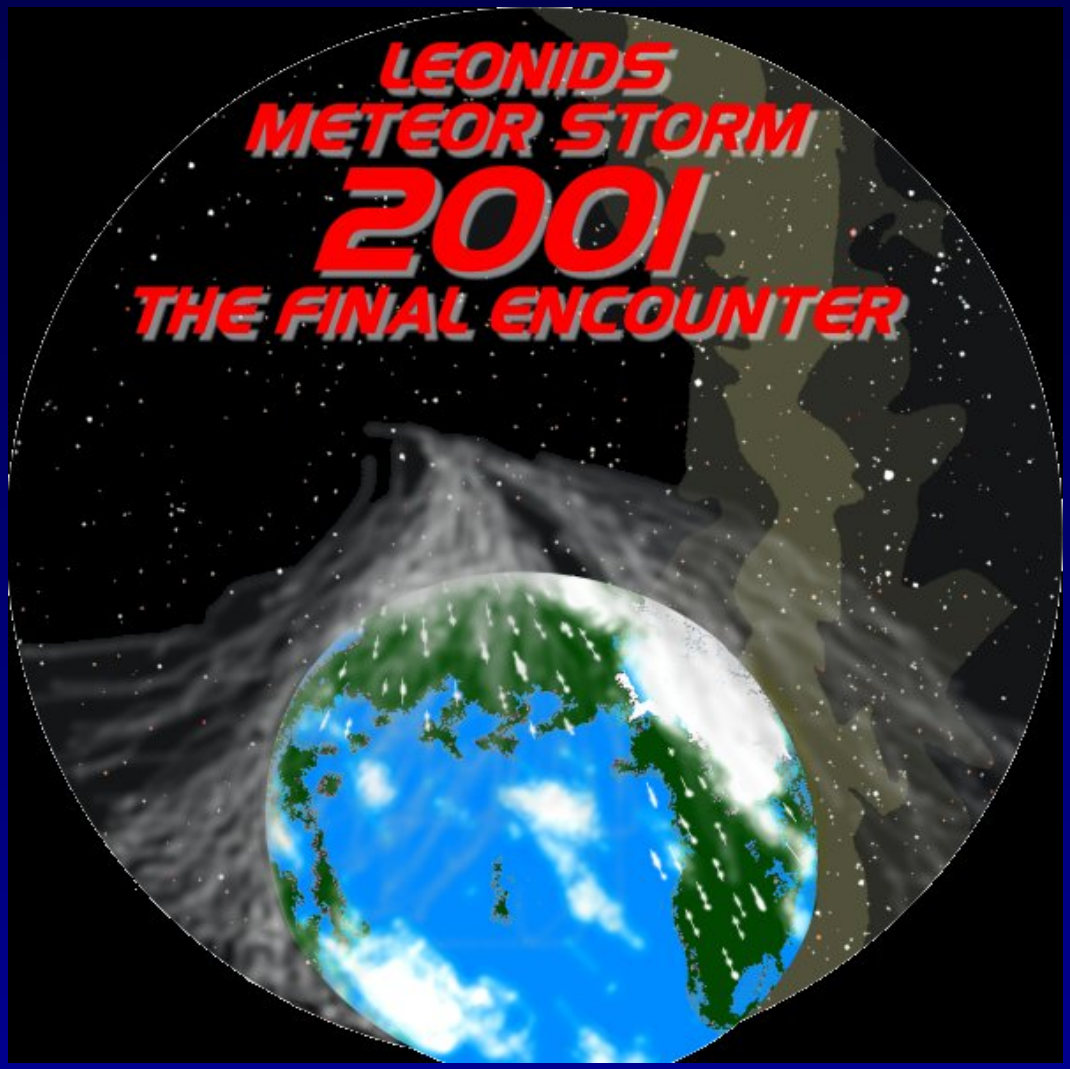
The hunt after Meteorstorms



The hunt after Meteorstorms

Introducing…

Jos Nijland,

Dutch Meteor Society (DMS)
Membership since 1984
HASA-team from 1979 to +/- 1987
Sticht. J.C. v.d. Meulen: since 1997
Primarily visual observer
Photografic: since 1992
Many expeditions from 1990

Casper ter Kuile,

Dutch Meteor Society (DMS)
Membership since 1979
HASA-team from 1979 to +/- 1987
Delphinus-team since 1982
Primarily photographic
Webmaster "**http://www.dmsweb.org**"
Many expeditions from 1990

The hunt after Meteorstorms

Contents of the Presentation

- Observing
- Meteorology for expeditions
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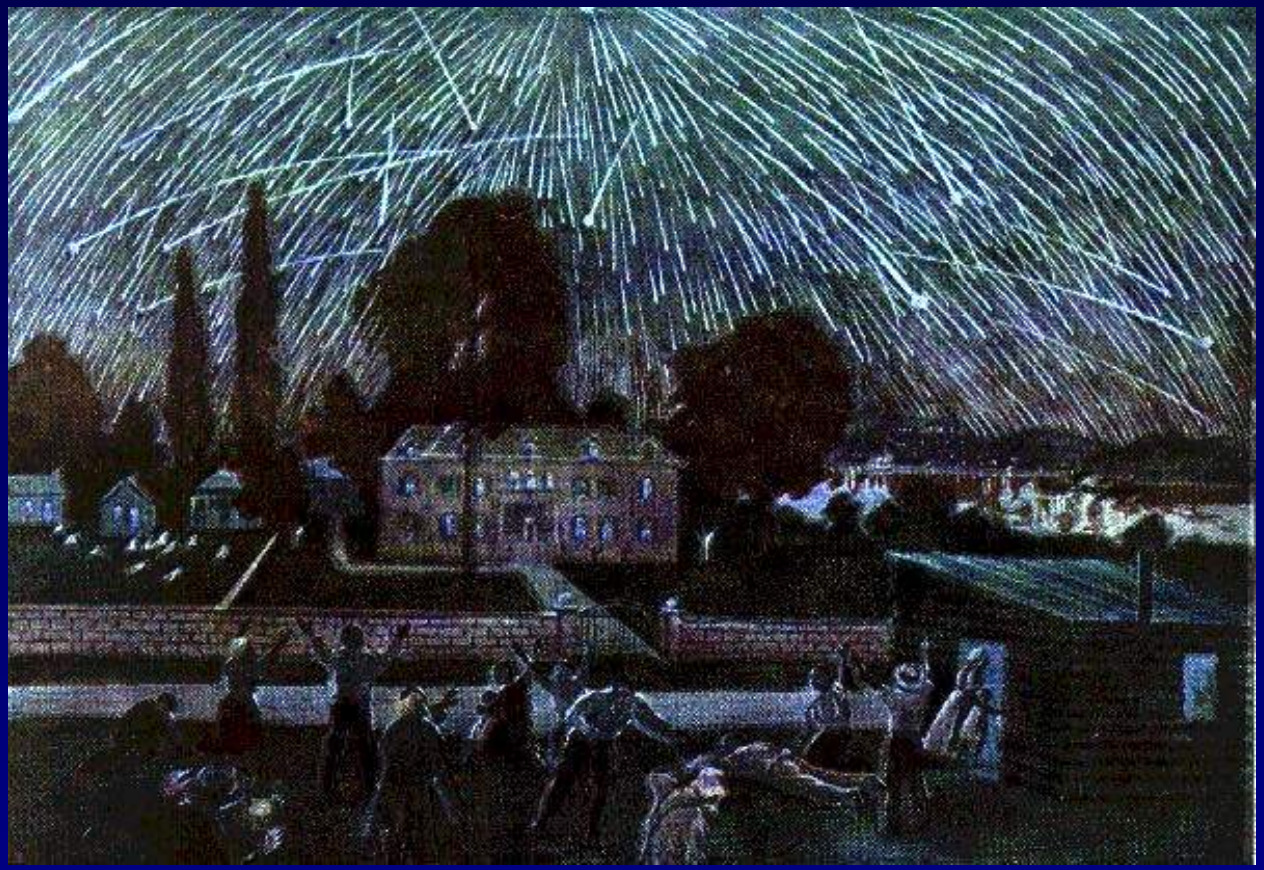
- Video Sino-Dutch Leonid Expedition 1998

The hunt after Meteorstorms



Maximum of Leonids in 1833
Plantages, Noord-Amerika

The hunt after Meteorstorms

Raining Leonids, 17-11-1966, 10 min, 30 cm
New Mexico State University Observatory

The hunt after Meteorstorms

Koen Miskotte, Perseids '86, Provence

Koen Miskotte, Perseids '86, Provence

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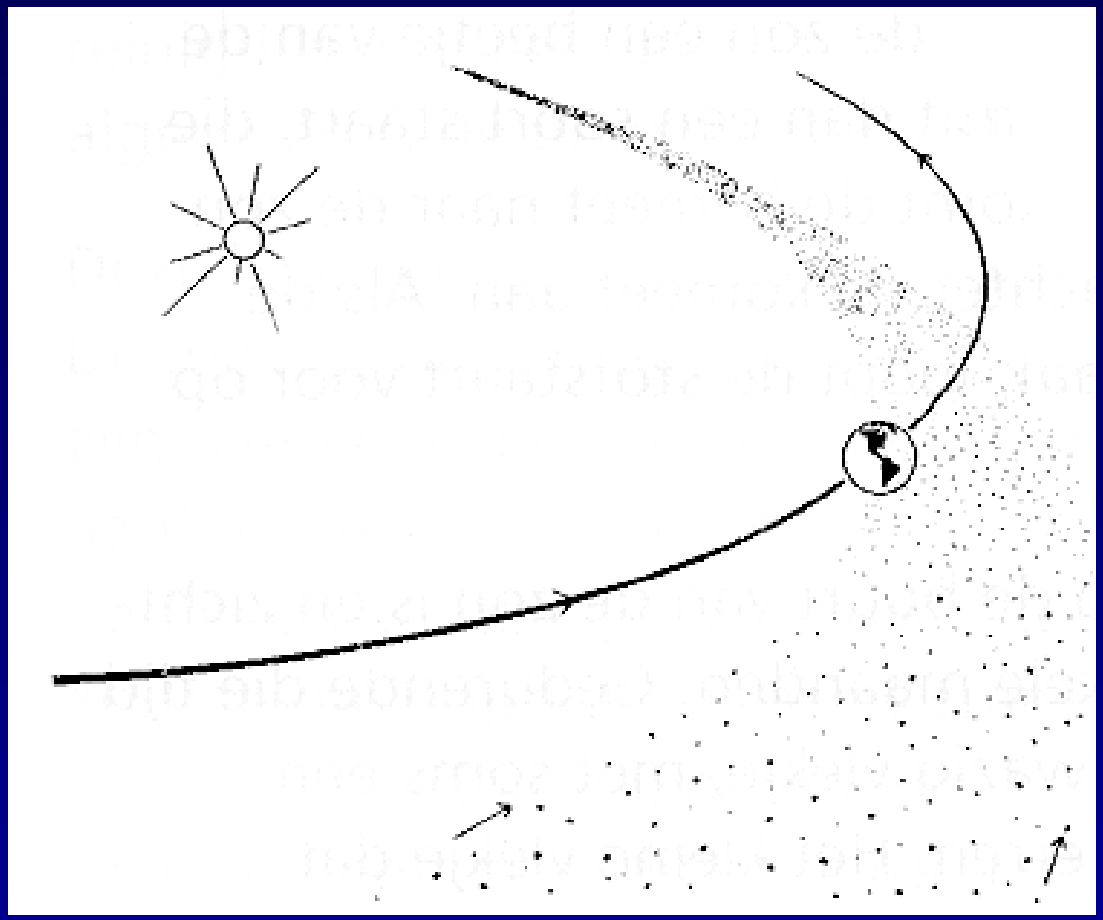
Comets and Meteors



Handbook Observing Meteors, DMS/LSV

The hunt after Meteorstorms

Some Characteristics of Meteors

Origin:	dust from a comet
Size:	0.1 mm- 10 cm
Mass:	0.1 - 10 gram
Velocity:	+/- 10 - 72 km/sec.
Duration:	0.2 - 2 sec.
Brightness:	+6 - -4 magnitude
Frequency:	5 - 120 meteors/hour
Height:	120 - 50 km

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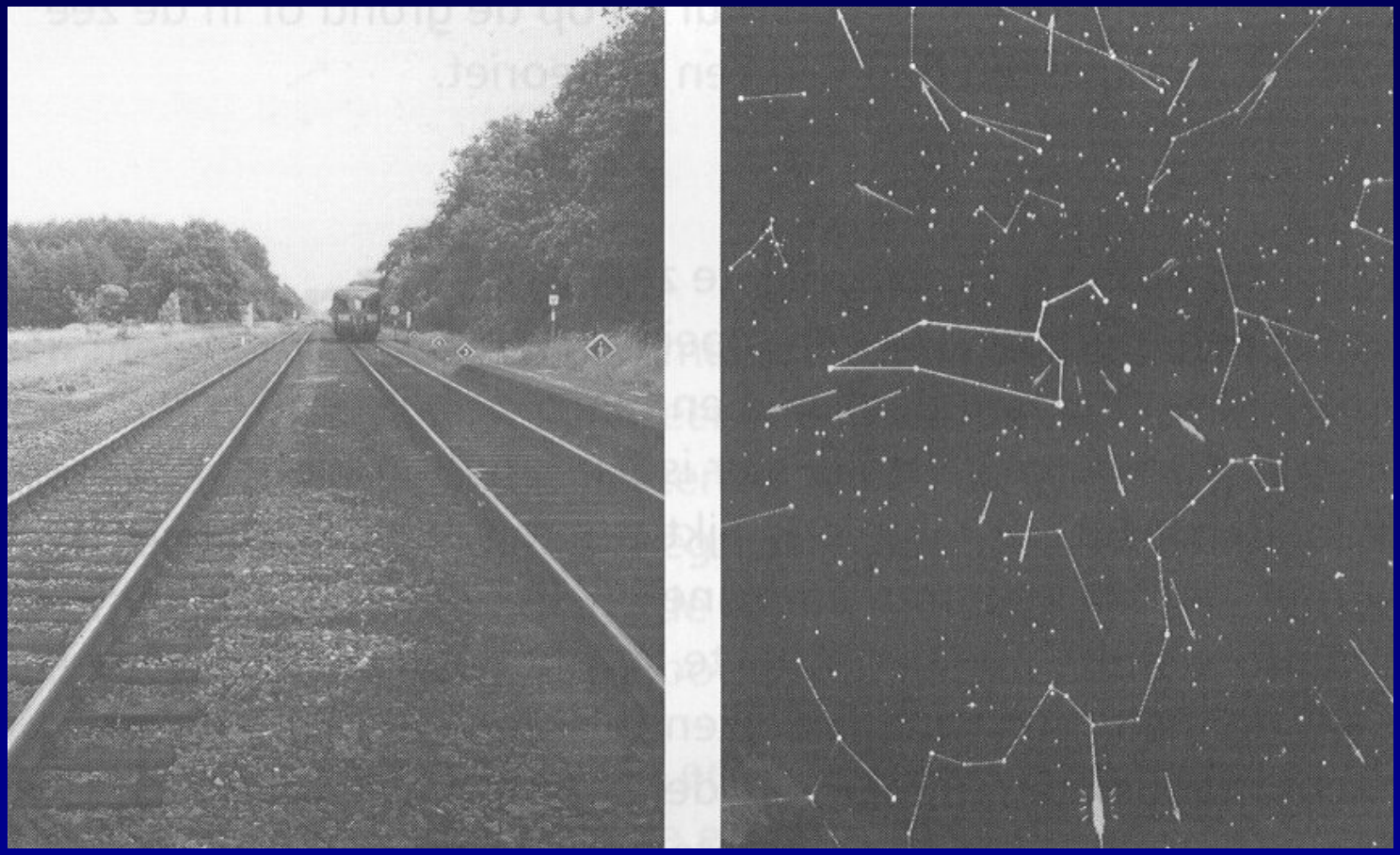
Radiant



Handbook Observing Meteors, DMS/LSV

The hunt after Meteorstorms

Meteorstreams

IMO Handbook Visual Observations

Stream	Maximum	ZHR	Speed	Characteristics
Quadrantids	3/4 january	120	41	sharp max., 1995
Lyrids	21/22 april	15	49	short max., 1996
Aquarids	28 july	20	41	slow, bright
Capricornids	30 july	4	25	slow, bright
Perseids	12/13 august	100	59	rich stream, 1993
Cygnids	18 august	3	25	very slow, bright
Draconids	8/9 october	var	20	1933, 1946, 1998
Orionids	21/22 october	20	66	quick, 1993
Taurids	6 & 13 november	5	28	fireball
Leonids	**17/18 november**	**15**	**71**	**1998, 1999, 2000, ????**
Geminids	13/14 december	110	35	rich stream, 1996
Ursids	22 december	10	33	short max., 2000

IMO Handbook Visual Observations

The hunt after Meteorstorms

Observing Meteors in the Netherlands

(Leonids 2000)

The hunt after Meteorstorms

Overview of observing methods

- Visual observations
- Photographic observations
- Video observations
- Radio observations

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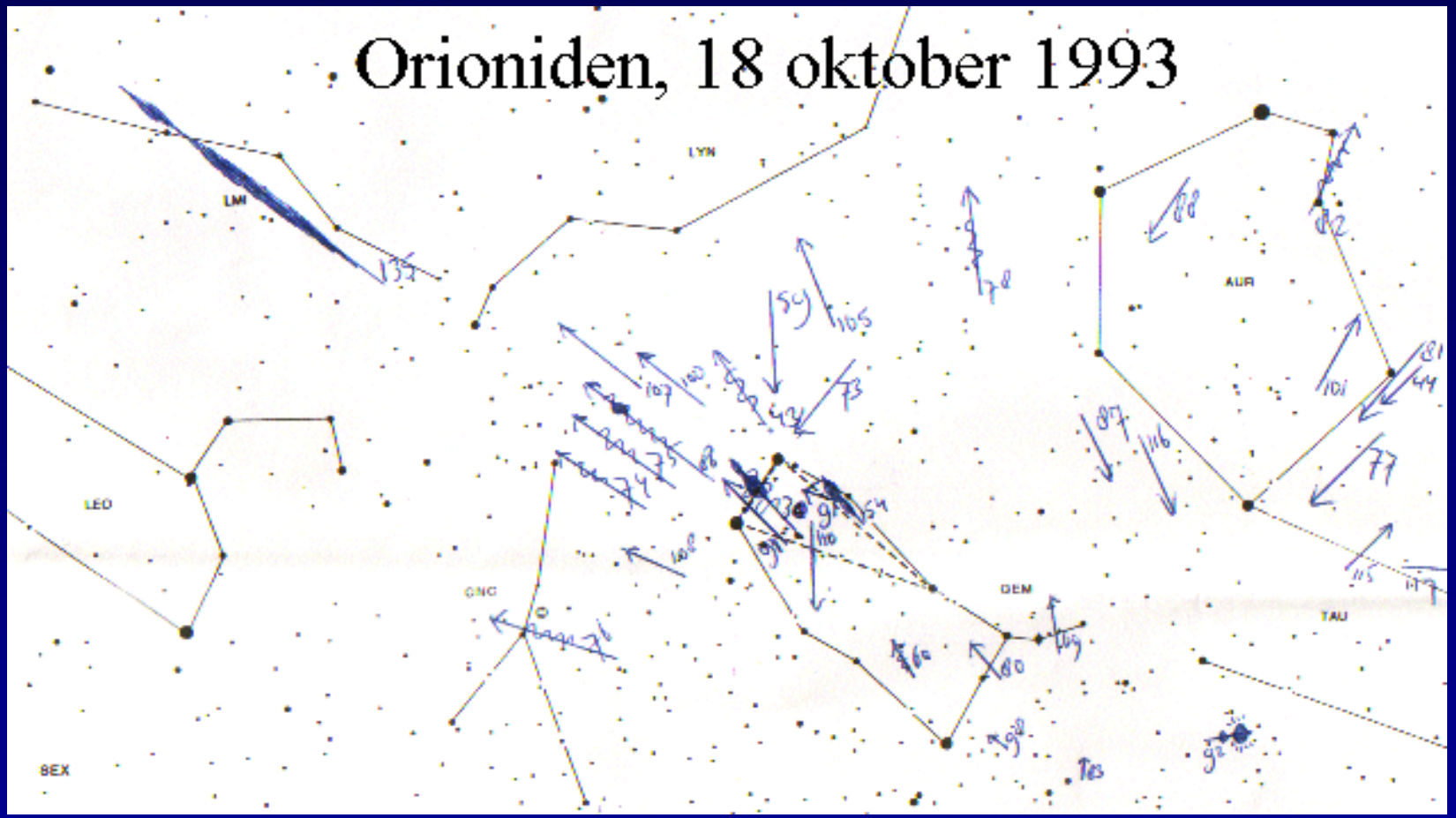
Visual Observations: forms

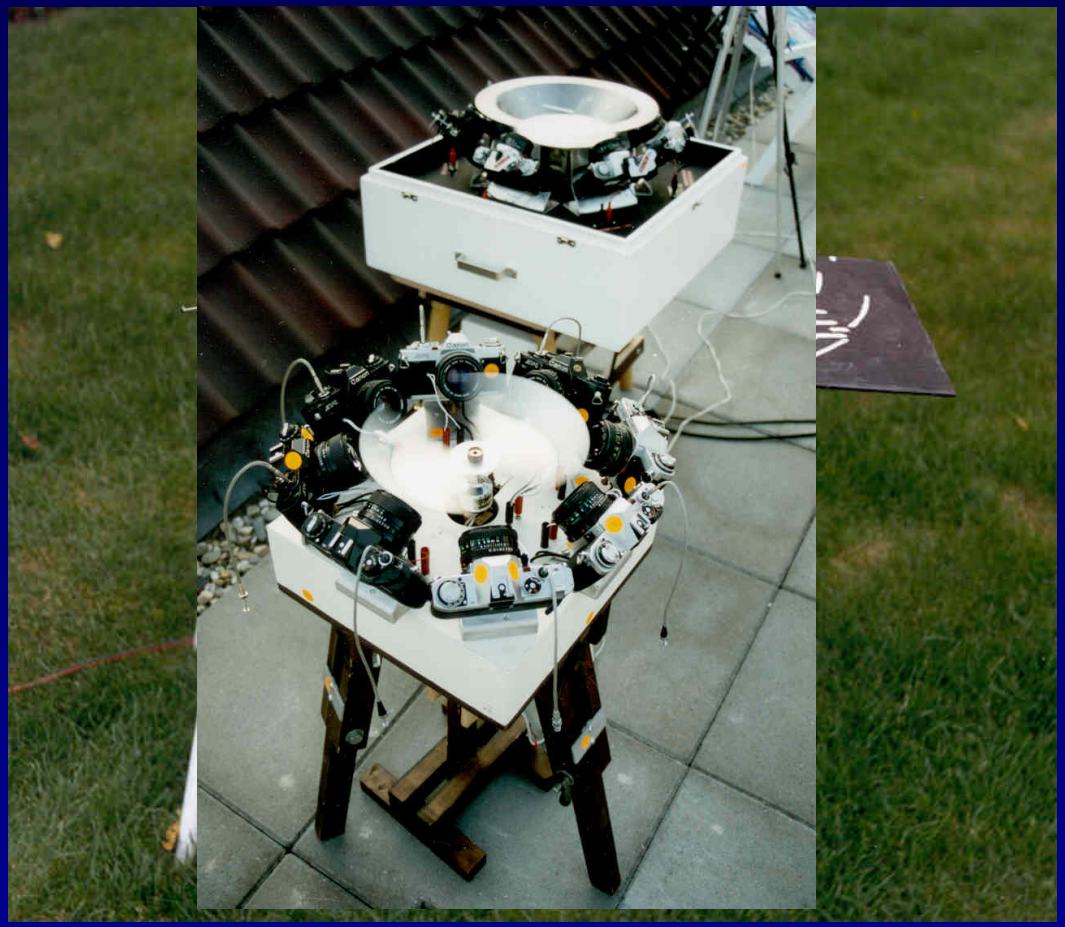


Koen Miskotte, Ermelo

Koen Miskotte, Ermelo

The hunt after Meteorstorms

Camera-array's from the past to present



Peter Jenniskens, Meterik

Koen Miskotte, Biddinghuizen
Casper ter Kuile, VS-Lattrop

The hunt after Meteorstorms

Leonids 1998 - 2001: the "Hazen" array

Robert Haas, Alphen a/d Rijn

Robert Haas, Alphen a/d Rijn

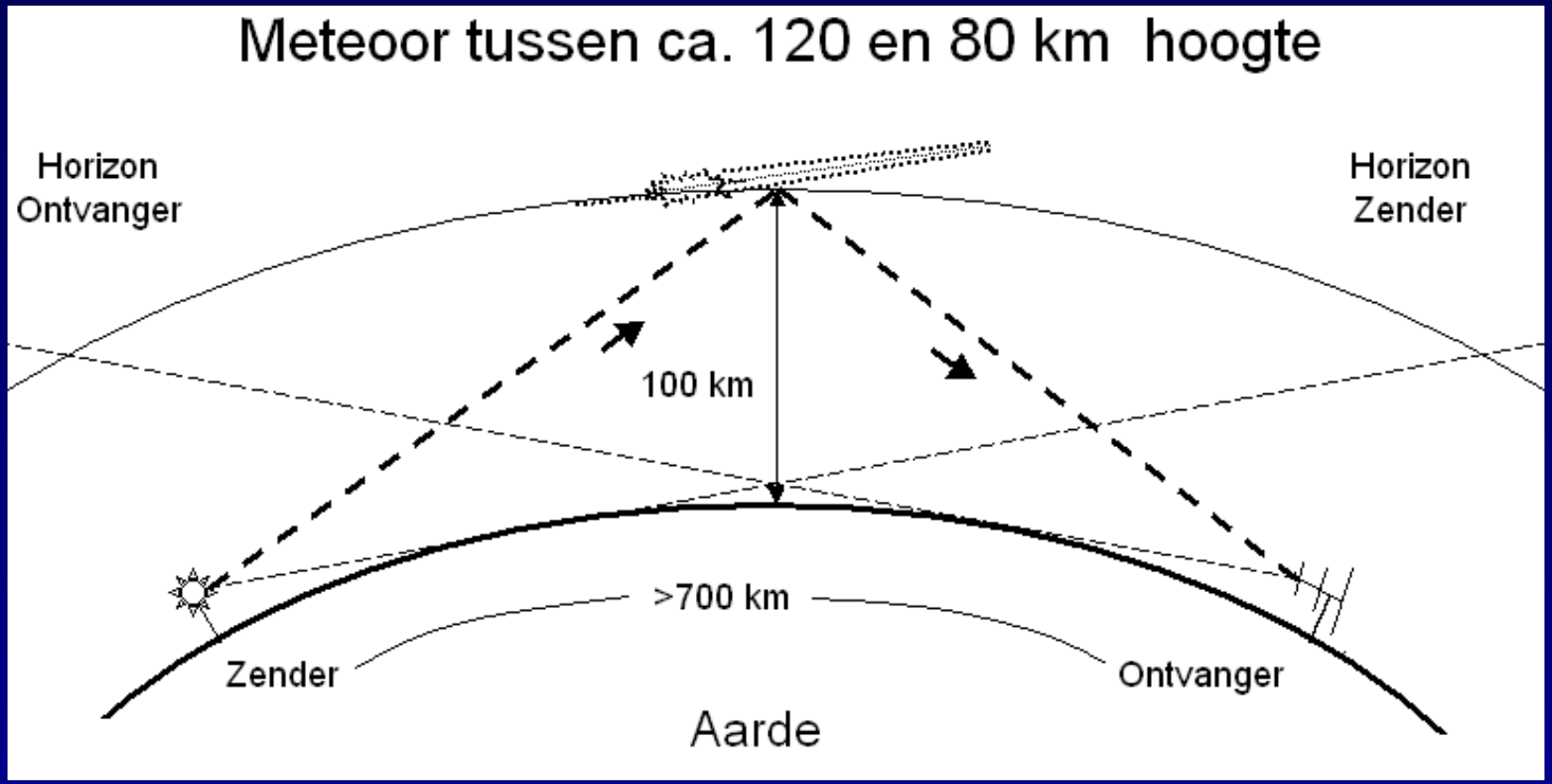
The hunt after Meteorstorms

Photography: camera's, sector, film

Photography at station Xaló - Spain							
Exposuretime 50 mm camera's: 9m58s ; 85 mm camera's: 7m58s							
Exposuredata on November 17/18, 1999 (all times in UT)							
Camera array	**Elevation**	**No. of Cam.**	**No. of Exp.**	**No. of Neg.**	**Start [hh:mm]**	**Stop [hh:mm]**	**Total exp. time [hh:mm]**
High	75°	4	35	140	23:46:00	05:36:00	5h50m
Middel	50°	7	35	245	23:46:00	05:36:00	5h50m
Low	25°	9	35	315	23:47:00	05:37:00	5h50m
85 mm	55°	6	36	216	00:07:00	04:55:00	4h48m

The hunt after Meteorstorms

Forward scatter: theory

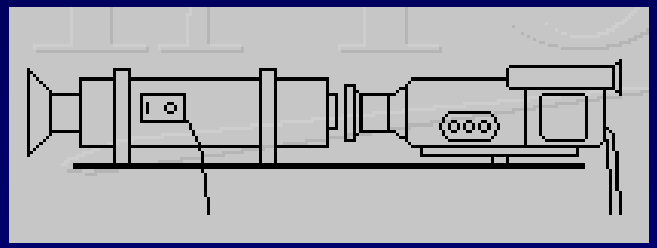


Peter Bus, Groningen

Ton Schoenmaker, Roden

The hunt after Meteorstorms

Video: technical



- Lens
- Image intensifier
- Camcorder

Carl Johannink & Casper ter Kuile

The hunt after Meteorstorms

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The hunt after Meteorstorms

Observingcampaign in Western Europe

Before

- Astronomy
- Climate

During

- The amateur weatherman
- The meteorologist

The hunt after Meteorstorms

Astronomy: Sun, Moon and Radiant

Leonids 2000, 17/18 november, 03:45 UT

RADIANT

ZON						
Begin schemering	**Hoogte**	**Utrecht**	**Toulon**	**Brest**	**Valencia**	**Faro**
		52 / +5	43 / +6	48 / -4	39 / 0	37 / -8
Astromisch	-18	5h05m	4h53m	5h40m	5h15m	5h43m
Nautisch	-12	5h45m	5h27m	6h17m	5h47m	6h14m
Burgerlijk	-6	6h27m	6h02m	6h55m	6h20m	6h45m
Zonsopkomst	-0.8	7h05m	6h33m	7h30m	6h49m	7h13m

6	1	60

The hunt after Meteorstorms

Climate of Western Europe (november)

Source: WKI (The Interactive Wheatherquide)
Harry Geurts & J acob Kuiper

ZON-UREN IN WEST-EUROPA						
NR	PLAATS	LAND	ZON [UREN]	ZON [%]	GEO-NB	GEO-WL/OL
1	Ostende	Belgie	65		51° 12'	2° 52'
2	St. Hubert	Belgie	57		50° 02'	5° 24'
3	Karup	Denemarken	41	16	56° 17'	9° 08'
4	Hannover	Duitsland	58		52° 28'	9° 42'
5	Berlin	Duitsland	52		52° 28'	13° 24'
17	Toulon	Frankrijk	157	55	43° 06'	5° 56'
18	Perpignan	Frankrijk	148	53	42° 44'	2° 52'
19	Valencia	Spanje	159	49	39° 30'	-0° 28'
20	Madrid	Spanje	147	52	40° 28'	-3° 34'
21	Almeria	Spanje	185	58	36° 51'	-2° 23'
22	Faro	Portugal	182	59	37° 01'	-7° 55'

Source: WKI (The Interactive Wheatherquide)
Harry Geurts & J acob Kuiper

The hunt after Meteorstorms

Sources of weather-information

- Teletext
- Weatherline by telephone
- Mobile phone: SMS
- Newspapers
- Radio and Television
- Internet

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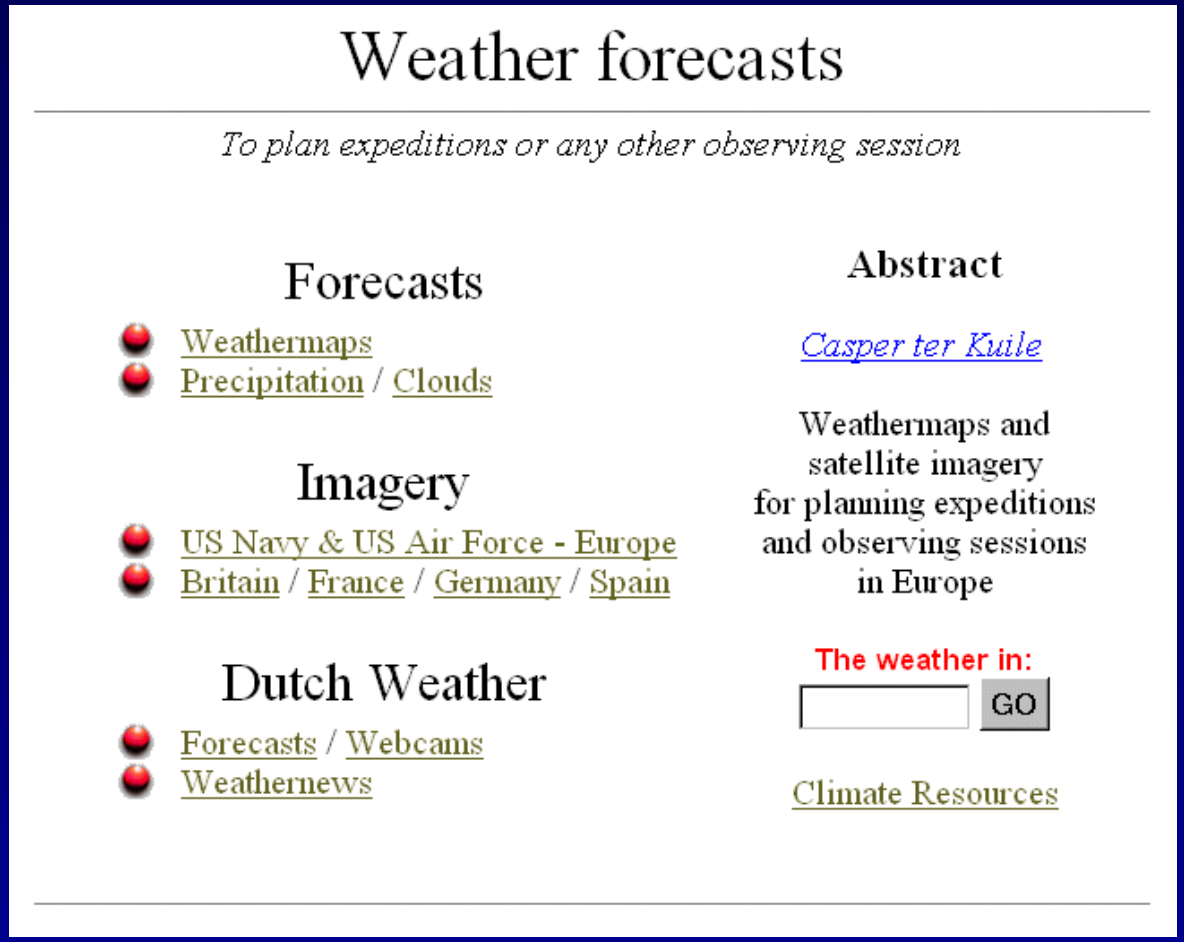
The hunt after clear skies through the Internet!



Weather forecasts

To plan expeditions or any other observing session

Forecasts

- Weathermaps
- Precipitation / Clouds

Imagery

- US Navy & US Air Force - Europe
- Britain / France / Germany / Spain

Dutch Weather

- Forecasts / Webcams
- Weathernews

Abstract

Casper ter Kuile

Weathermaps and satellite imagery for planning expeditions and observing sessions in Europe

The weather in:

GO

Climate Resources

http://www.dmsweb.org

http://www.dmsweb.org

The hunt after Meteorstorms

The expedition starts in 240 hours…

http://www.dmsweb.org

http://www.dmsweb.org

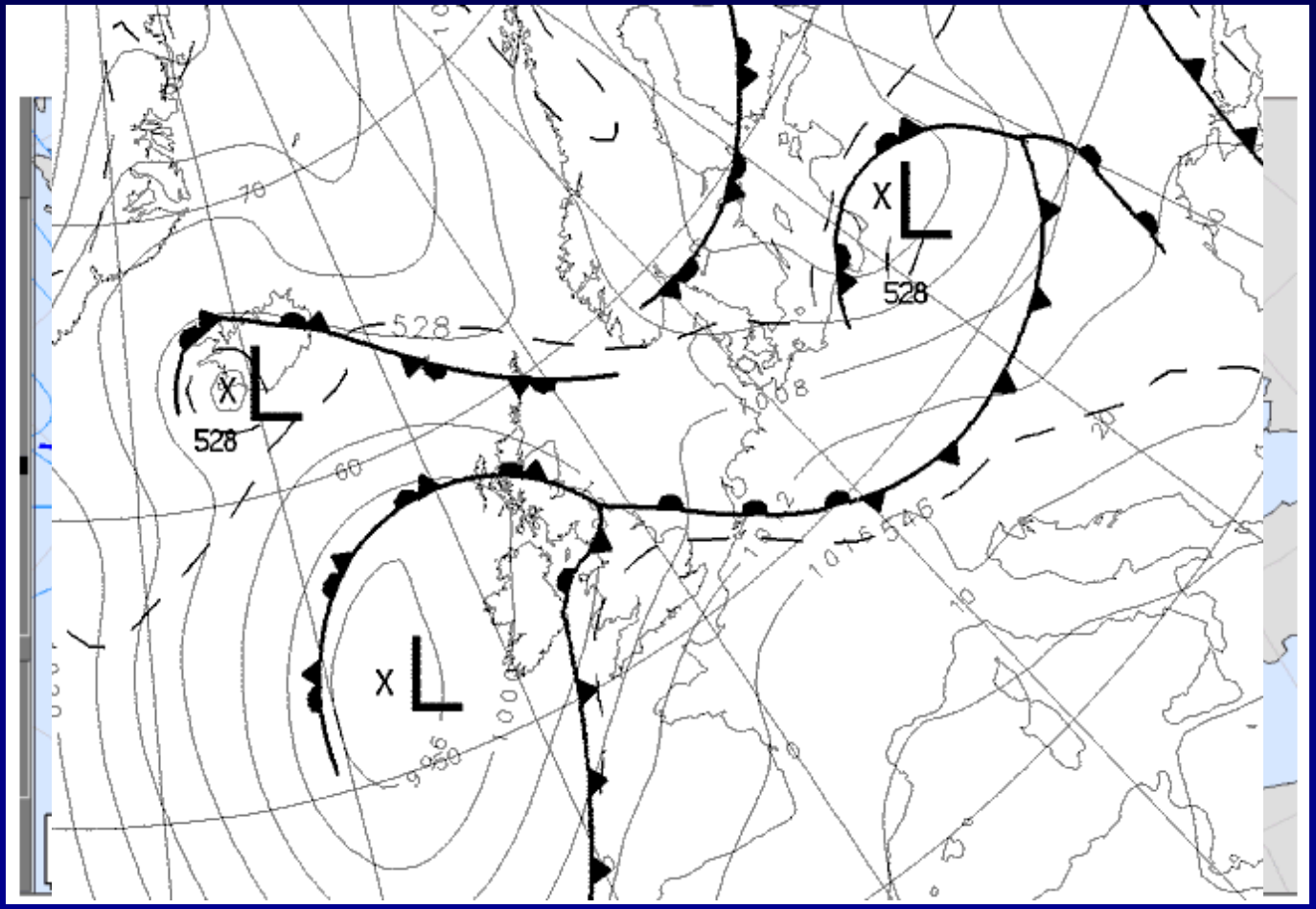
Weathermaps

To plan expeditions or any other observing session

Name	1 - 10 day predictions [hours] Surface level pressure [hPa]
MRF	+24 +48 +72 +96 +120 +144 +168 +192 +216 +240
Bracknell	+24 +36 +48 +60 +72 +96 +120
ECMWF	+72 +96 +120 +144
HIRLAM	+00 +06 +12 +24 +36

The hunt after Meteorstorms

Models: interesting but not always usefull



MRF, Bracknell

ECMWF, HIRLAM

The hunt after Meteorstorms

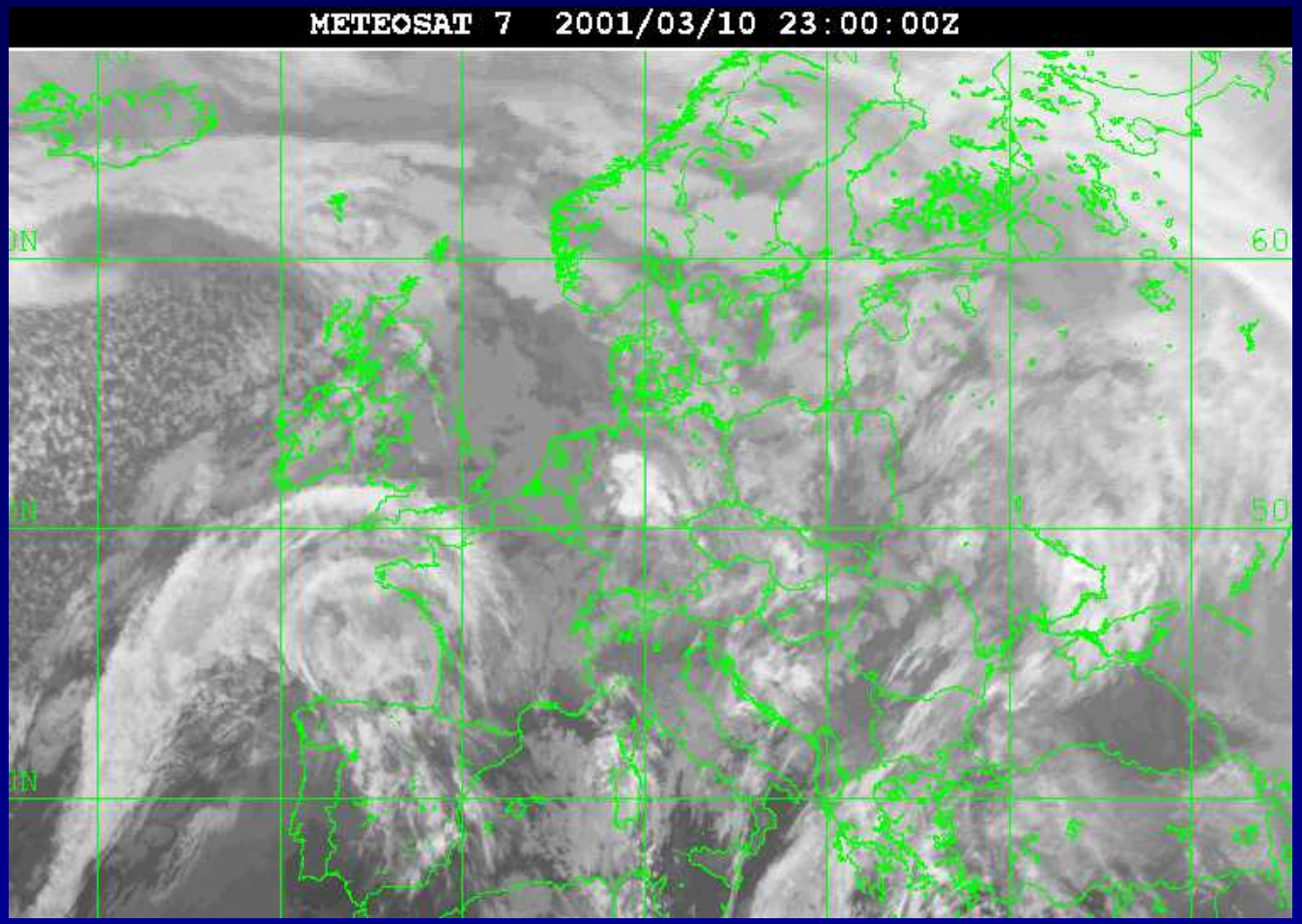
NOAA: very detailed but not up-to-date

NOAA - 1999/11/18 - 05:26 UT

NOAA - 1999/11/18 - 05:26 UT

The hunt after Meteorstorms

Meteosat: up-to-date but not very detailed



METEOSAT - US-Navy

METEOSAT - US-Navy

The hunt after Meteorstorms

Help by professional weatherman

- Exchange of knowledge during the entire observingcampaign between meteorologist and meteorobserver
- Flexibel and highly mobile teams
- The importance of communications between groups + arrangements for timely updates of weatherpredictions
- Breaking down psychological ‘bottlenecks’ of observers

The hunt after Meteorstorms

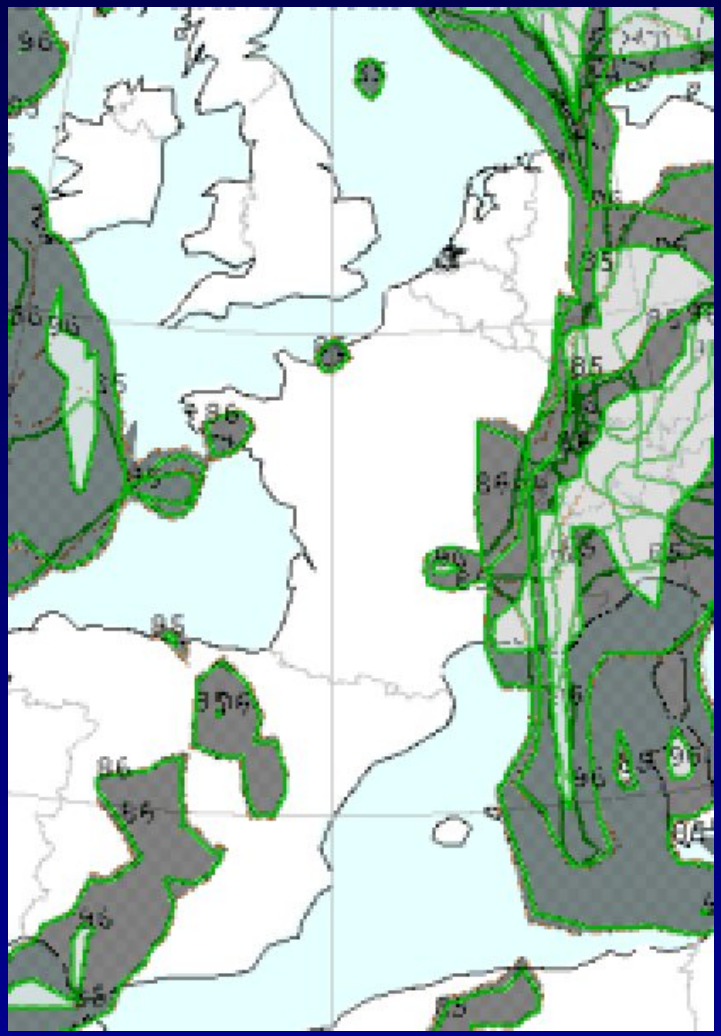
Example

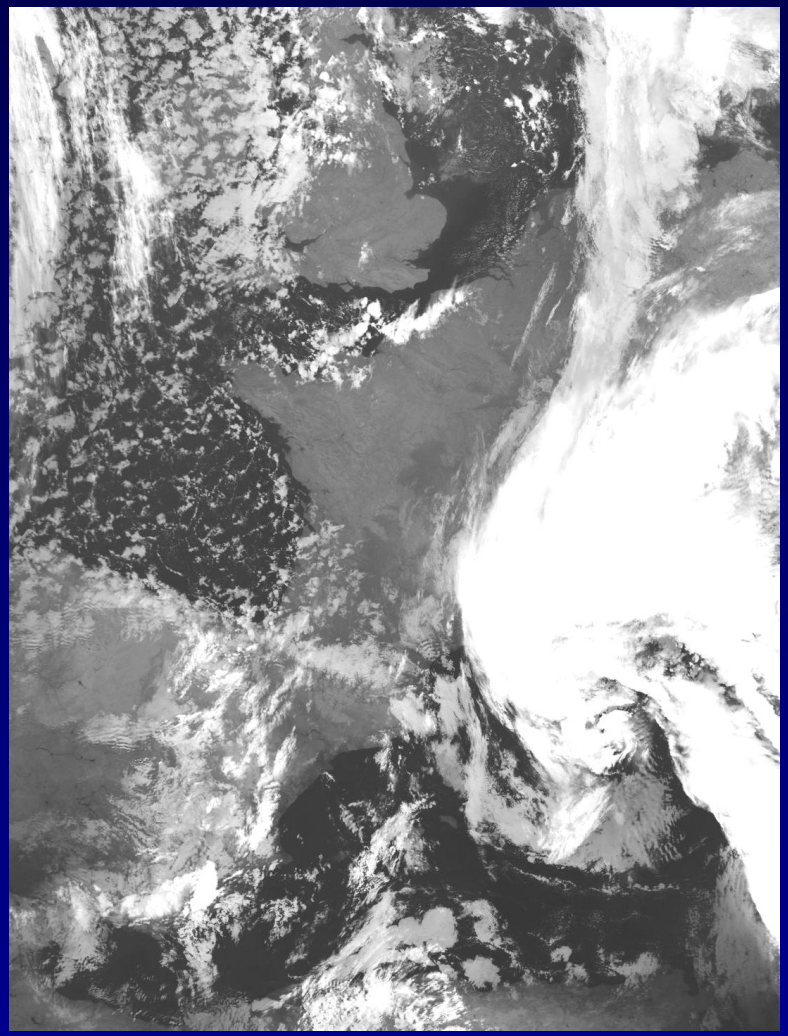
Leonid observingcampaign 2000

16 / 17 november 2000

The hunt after Meteorstorms

HIRLAM cloudprediction +60 our

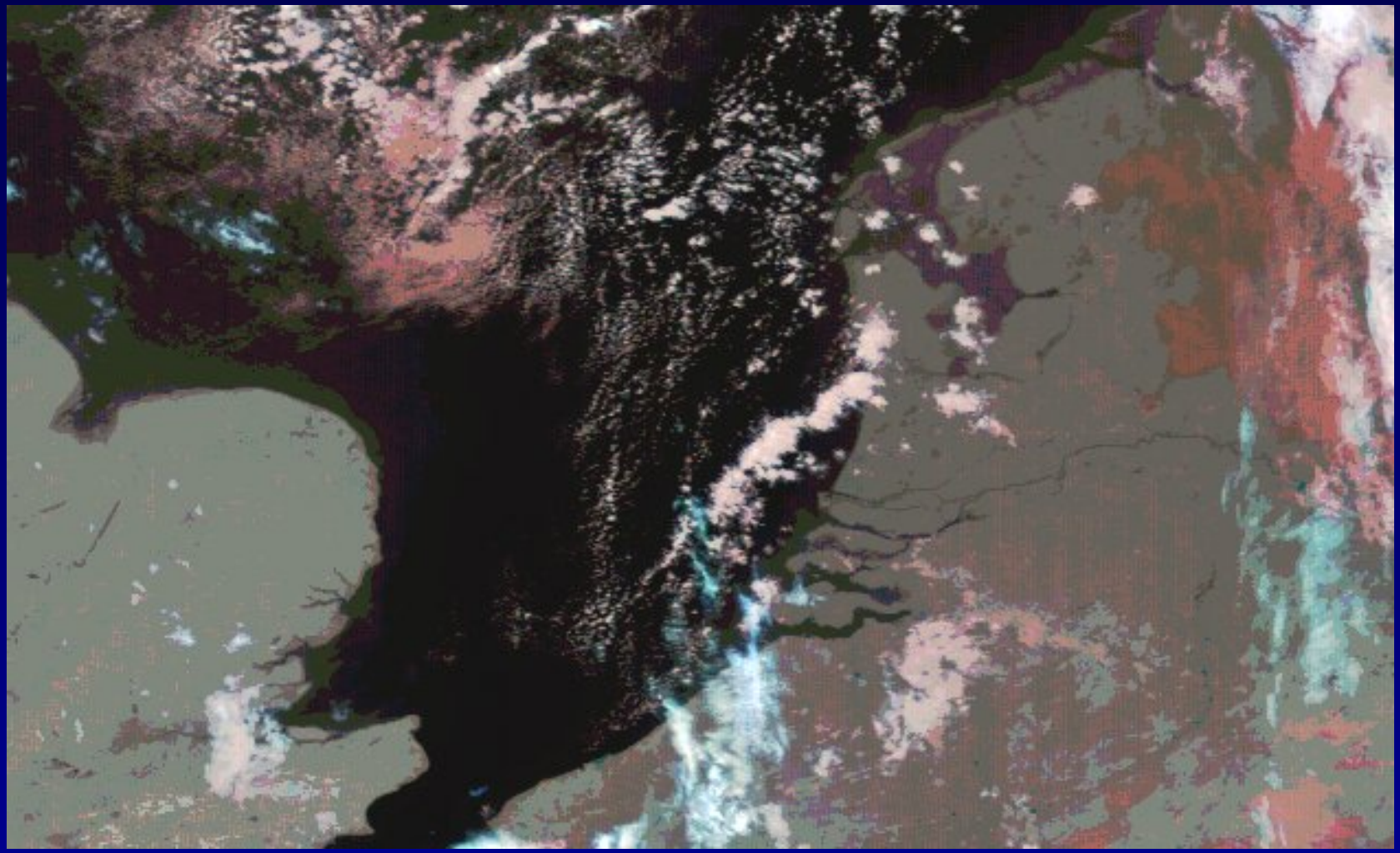




NOAA IR4 17 november 2000

The hunt after Meteorstorms

NOAA IR on 16/17 november 2000



NOAA IR on 16/17 november 2000

The hunt after Meteorstorms

Contents of the Presentation

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- Preview Leonids 2001
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The hunt after Meteorstorms

Why Expeditions?

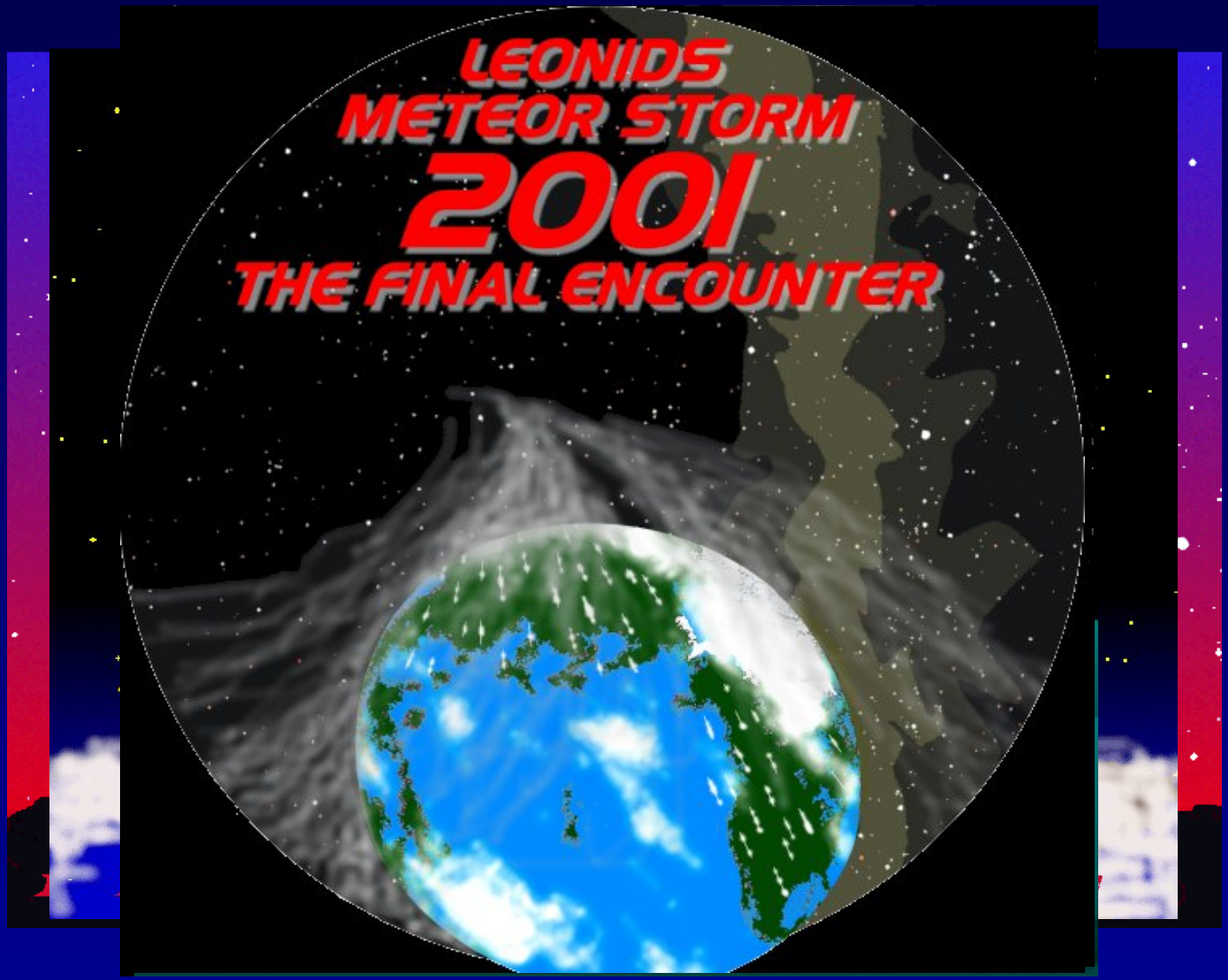
Meteor-observing…

Science…

Experience the world…

The hunt after Meteorstorms

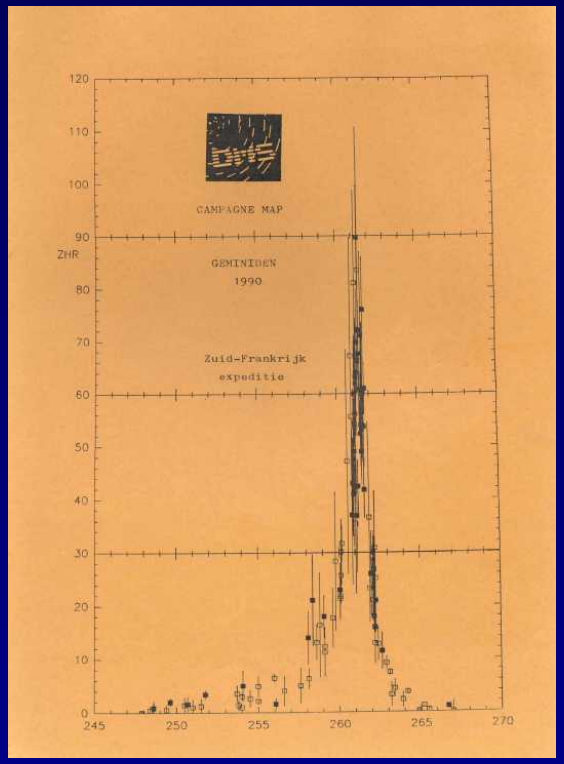
Logo design and production:
Robert Haas, Alphen a/d Rijn



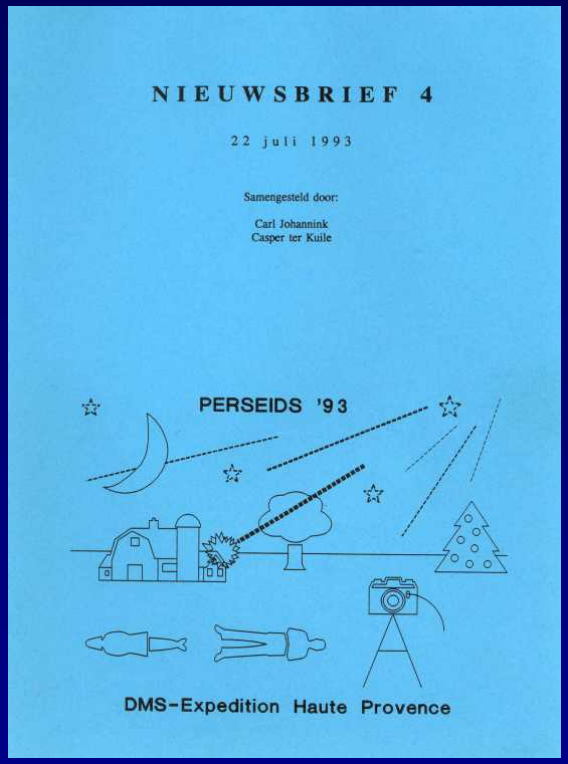
Logo design and production:
Robert Haas, Alphen a/d Rijn

The hunt after Meteorstorms

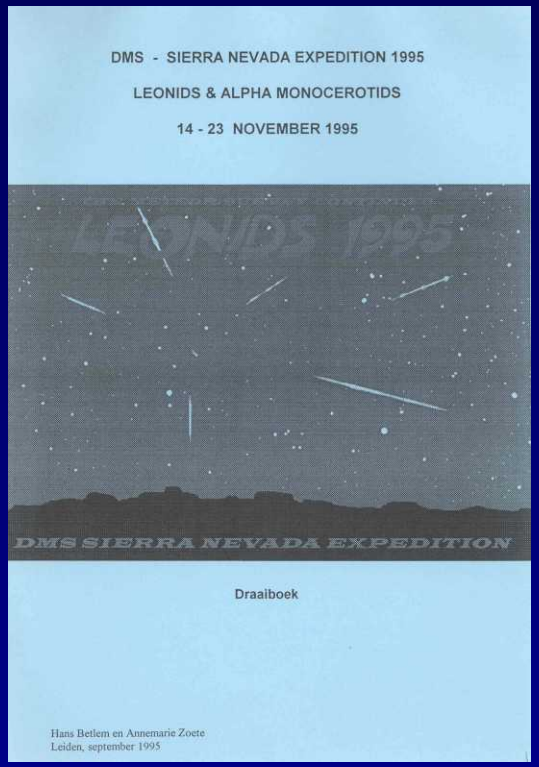
Expedition Handbooks



Geminids 1990



Perseids 1993



Leonids 1995

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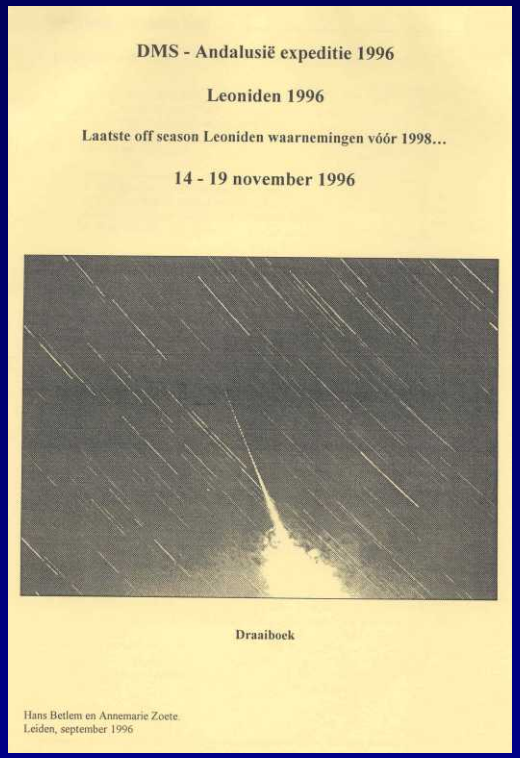
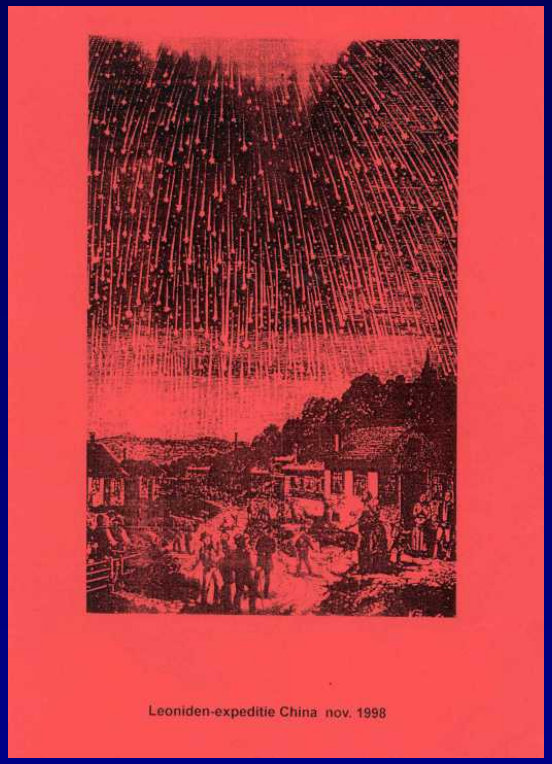
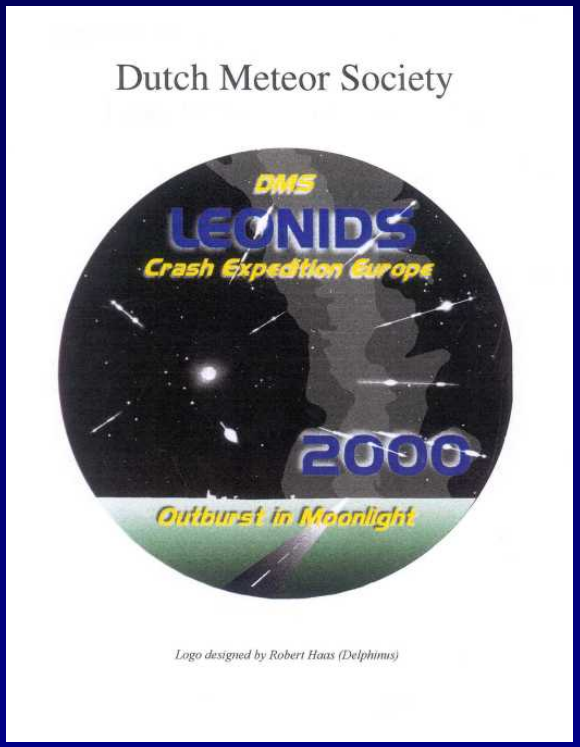
Expedition Handbooks



Leonids 1996



Leonids 1998



Leonids 2000

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Expedition Handbooks

Sino-Dutch Leonid Expedition 2001

Study of comet P/Temple-Tuttle through observation of the 2001 Leonid meteor storm

Een voorstel voor een vervolg op de in 1998 aangegane samenwerking tussen het Chinese Purple Mountain Observatory en het Beijing Astronomical Observatory en de Dutch Meteor Society.

Een aanvraag bij de Koninklijke Nederlandse Academie van Wetenschappen voor ondersteuning bij de wetenschappelijke samenwerking tussen de Dutch Meteor Society en de National Astronomical Observatories van de Chinese Academy of Sciences.

Met aanbevelingen door:

- Dr. J. Lub, Onderzoeksinstituut Sterrewacht Leiden, Faculteit Wiskunde & Natuurwetenschappen van de Universiteit Leiden.
- Dr. Vladimír Porubčan, President of Commission 22 of the International Astronomical Union (IAU) *Meteors, Meteorites and Interplanetary Dust.*
- Dr. Zdenek Ceplecha, Interplanetary Matter Department, Astronomical Institute, Academy of Sciences, Ondřejov Observatory, Czech Republic.

Dutch Meteor Society (DMS)

Leonids 2001

The hunt after Meteorstorms

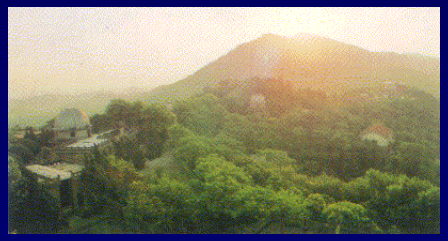
Organising Sino-Dutch Leo'98

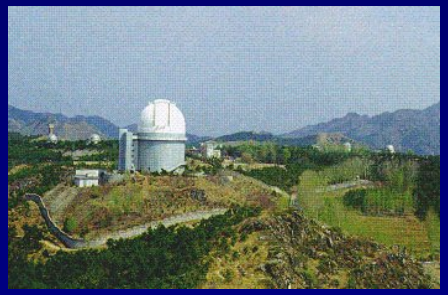
1. KNAW
2. CAS
3. BAO / PMO
4. Delingha / Xinglong
5. VNC
6. KLM
7. U-Freight

Koninklijke Nederlandse Akademie van Wetenschappen

THE CHINESE ACADEMY OF SCIENCES

VNC TRAVEL





The hunt after Meteorstorms

Logistics Sino-Dutch Leo'98

1. Powerunit
2. GPS
3. GSM
4. Laptop
5. Tools
6. EHBO-suitecase
7. Spare-materials

The hunt after Meteorstorms

Reports of Expeditions

Alcudia de Gu

Robert Haas
Casper ter Kuile
Marco Langbroek
Koen Miskotte
Jos Nijland

14 november 1995 - 23 nover...

Sino-Dutch Leonid Expedition
Van 6 t/m 22 november

Reisverslag

Jos Nijland
31 januari 1999

Leoniden Expeditie Frankrijk-Spanje
Van 13 t/m 20 november 1999

Reisverslag
Jos Nijland
3 februari 2001

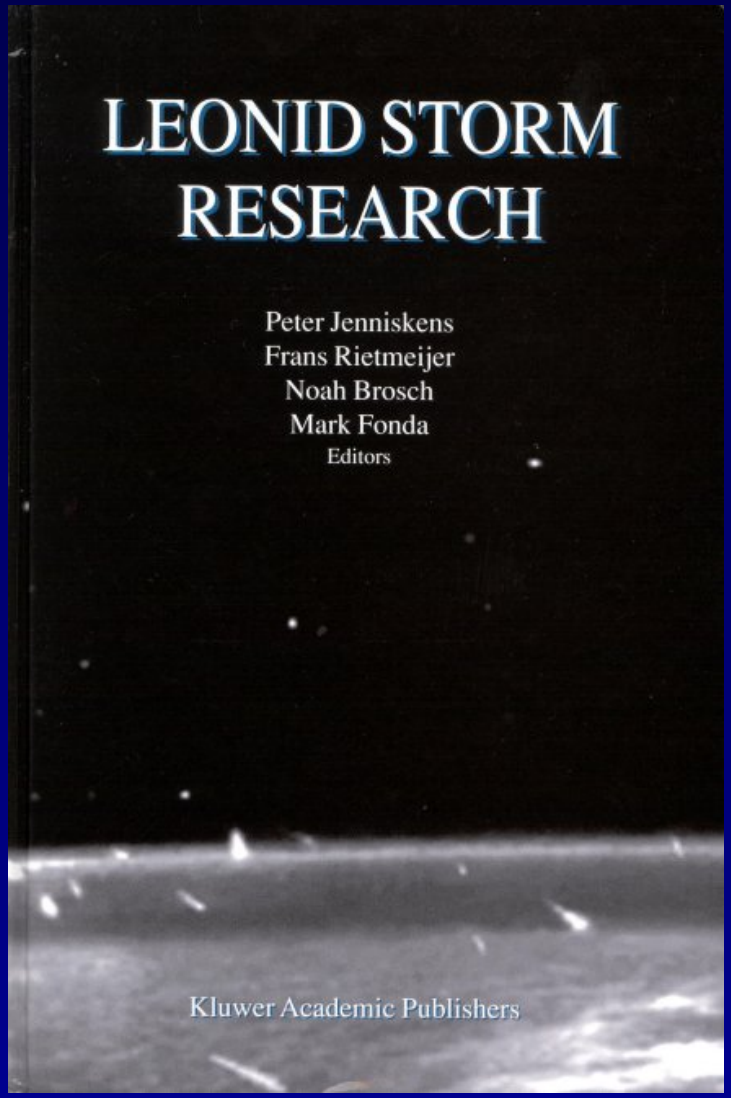
Jos Nijland, Benningbroek

Jos Nijland, Benningbroek

The hunt after Meteorstorms

Publications . . .

The hunt after Meteorstorms



The hunt after Meteorstorms

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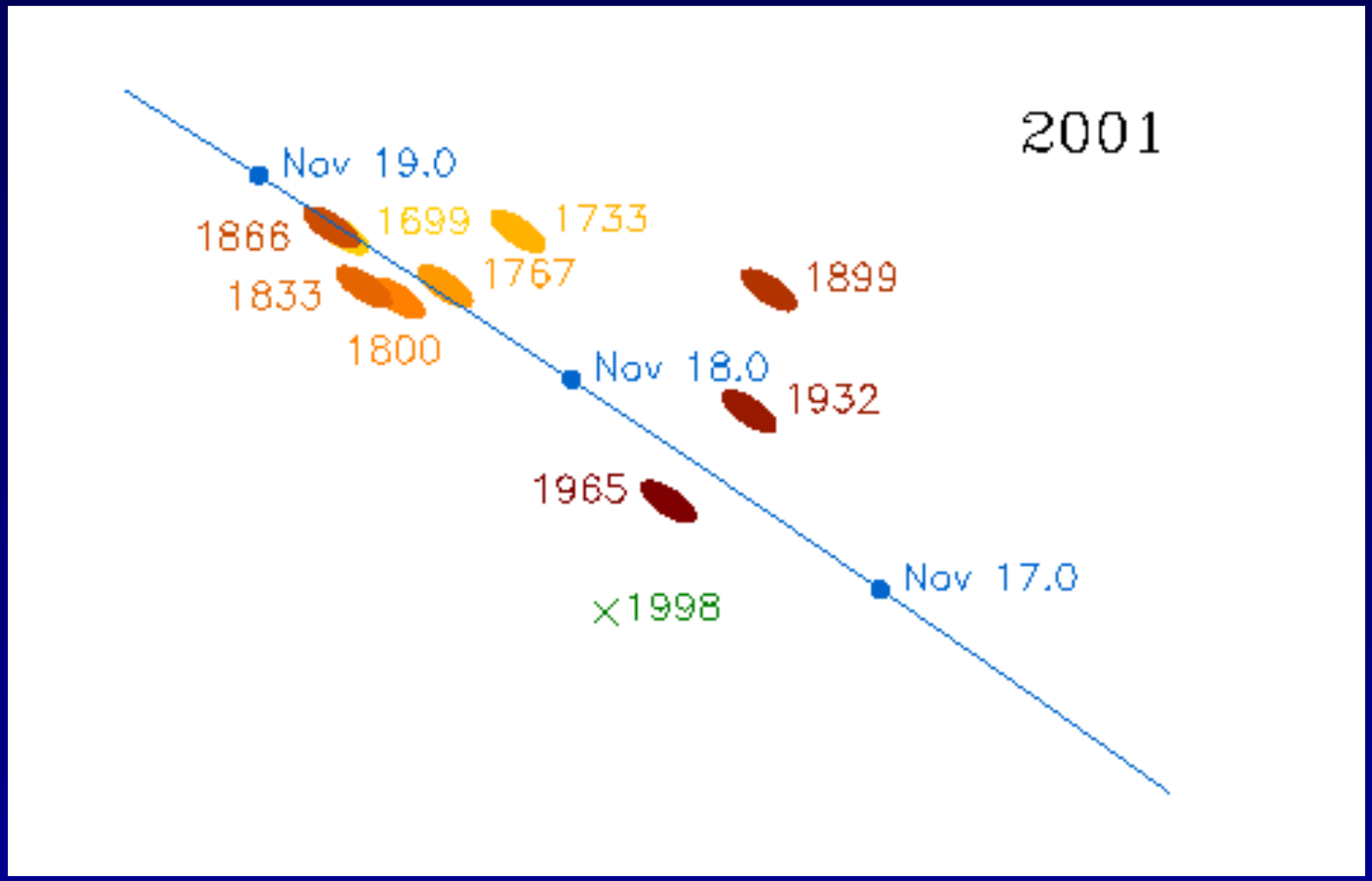
The hunt after Meteorstorms

Leonids 2001: "The big one?"

- Predictions (4x)
- Astronomy
- Climate
- Choice of location

The hunt after Meteorstorms

Leonids 2001: Dust trail theory



David Asher, Ierland

Rob McNaught, Australie

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Leonids 2001: Predictions

Datum	Tijd	Trail	Revolutions	ZHR	Lokatie
2001-nov-18	09:58	1766	7-rev	2000	North & Central America
2001-nov-18	12:00	1799	6-rev	110	Western USA
2001-nov-18	14:10	1833	5-rev	60	Eastern Pacific
2001-nov-18	17:19	1666	10-rev	600	East & South-Eastern Asia
2001-nov-18	17:22	1633	11-rev	260	East & South-Eastern Asia
2001-nov-18	17:33	1699	9-rev	1750	East & South-Eastern Asia
2001-nov-18	18:22	1866	4-rev	6100	East & South-Eastern Asia

Esko Lyytinen and Tom Van Flandern

Meta Research

http://www.metaresearch.org/solar%20system/leonid/leonid2000_predictions.asp#Predictions for November 2001

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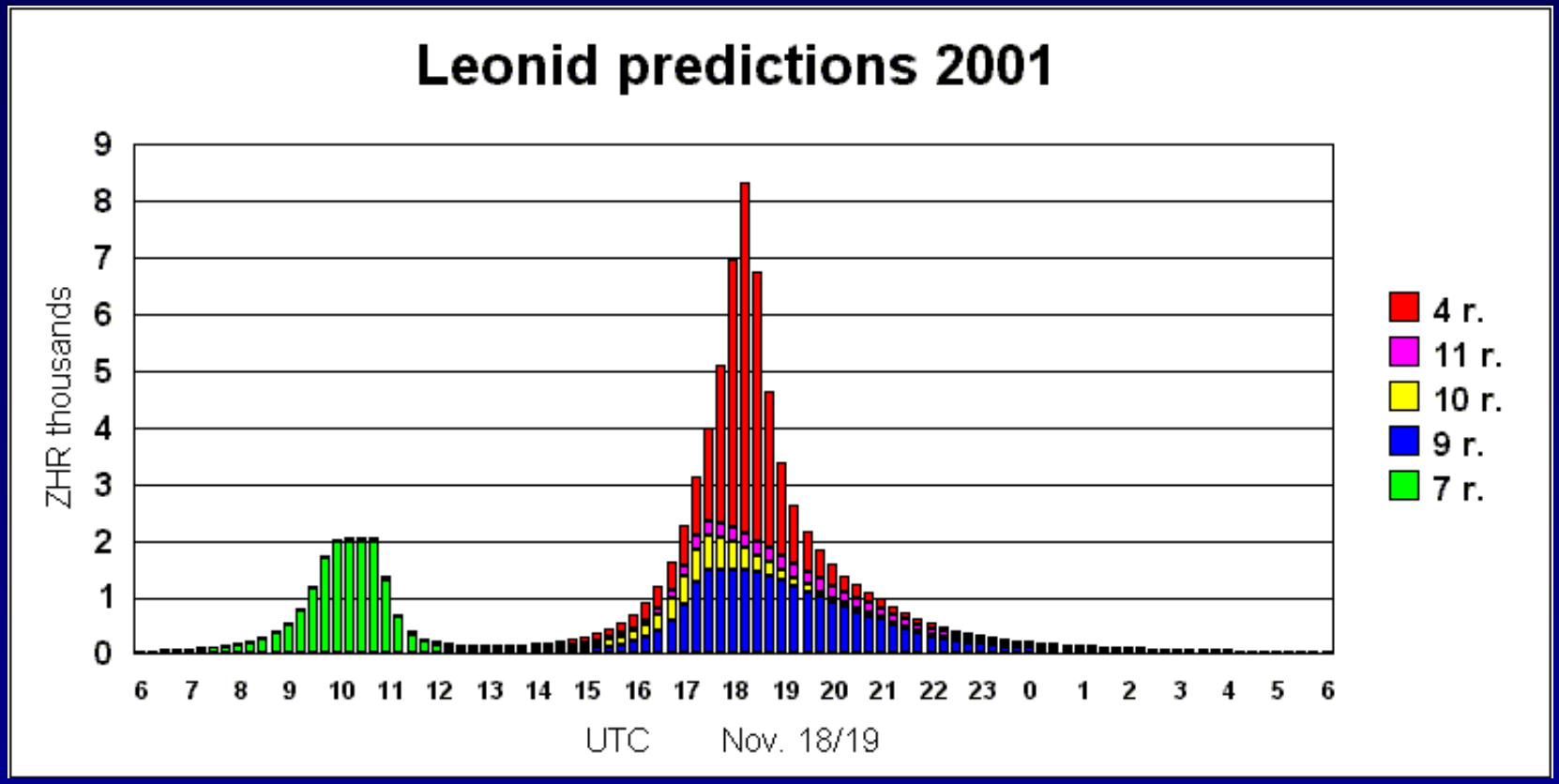
Leonids 2001: ZHR predictions



Esko Lyytinen, Finland

Esko Lyytinen, Finland

The hunt after Meteorstorms

Leonids 2001: ZHR prediction

Peter J enniskens, NASA-AMES

Peter J enniskens, NASA-AMES

- Dust trails shifted by gravitation
- ZHR [USA] : 4200
- ZHR [Eastern Asia] : 3700
- Slightly brighter as in 1999
- Latest predictions???

The hunt after Meteorstorms

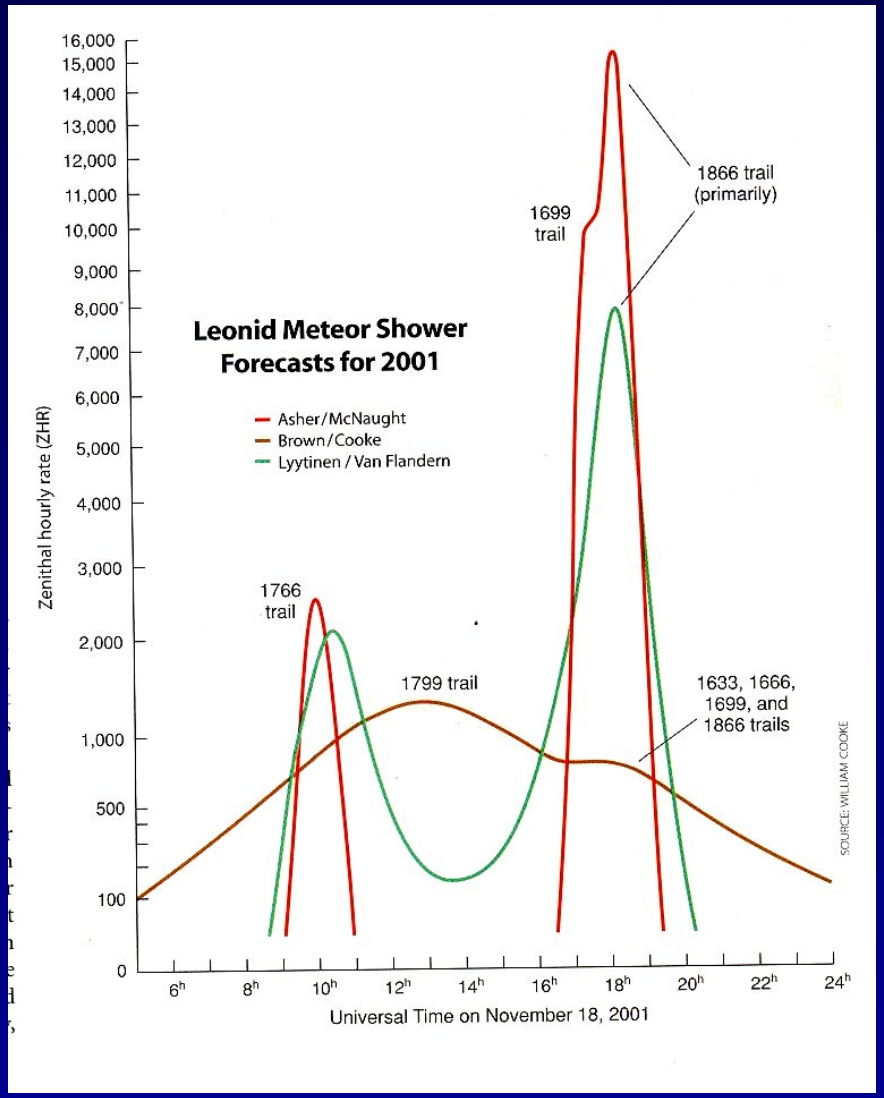
Leonids 2001: ZHR predictions

- ZHR [pacific] : 1300 (13 UT)
- ZHR [USA] : 850
- ZHR [Eastern Asia] : 800
- Broad structure, no peaks
- Latest predictions???

Peter Brown & William Cooke

The hunt after Meteorstorms

Predictions Leonids 2001
Joe Rao, Sky & Telescope



Predictions Leonids 2001
Joe Rao, Sky & Telescope

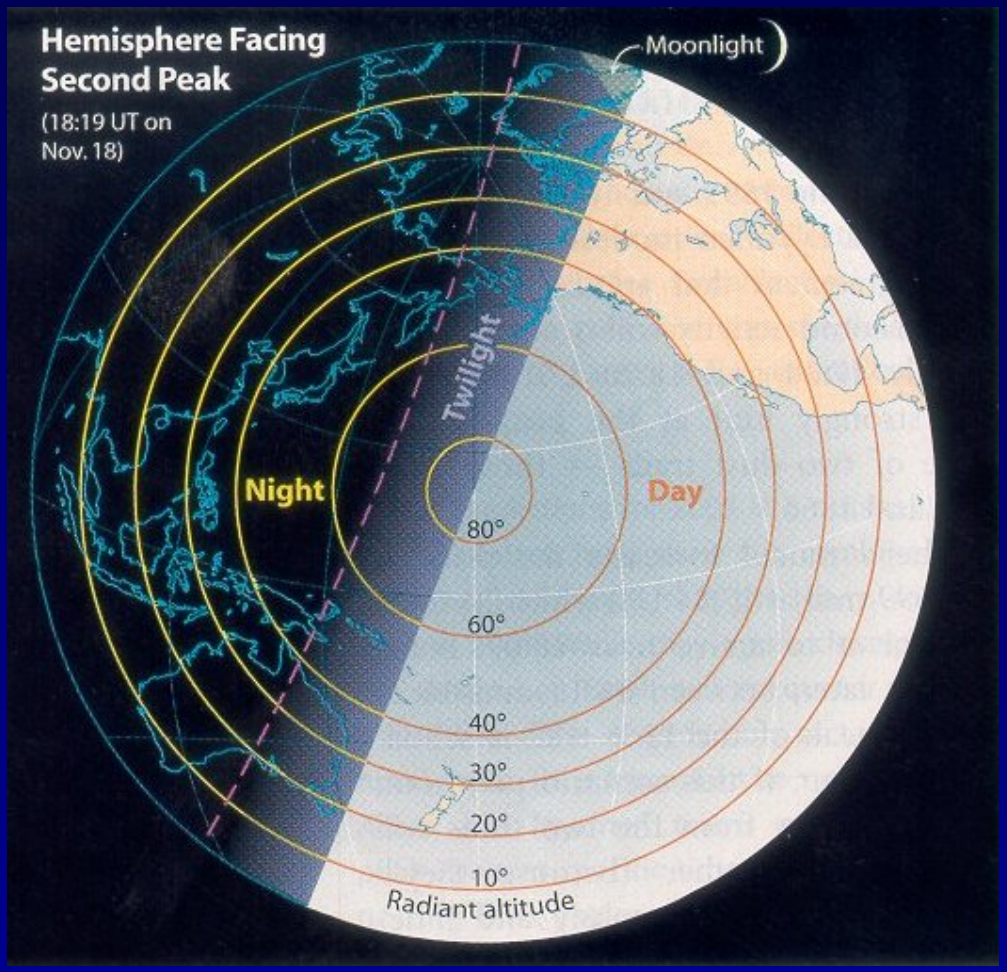
The hunt after Meteorstorms

Leonids 2001: Astronomical conditions

Japan	Nemuro	Miyako	Nagoya	Miyazaki
Geografische NB	43°20'	39°39'	35°10'	31°55'
Geografische OL	145°35'	141°58'	136°58'	131°25'
Hoogte boven zeeniveau	26	43	51	6
Radianthoogte om 18 UT	51°	49°	46°	42°
Aantal meteoren t.o.v. 8300	5832	5597	5233	4729
Zonsopkomst	21h16m	21h21m	21h31m	21h47m
Astronomische schemering	19h33m	19h44m	20h00m	20h19m
Radianthoogte 30°	16h03m	16h19m	16h41m	17h05m
Waarnemingsvenster	3h30m	3h26m	3h19m	3h14m

The hunt after Meteorstorms

Leonids 2001: Astronomical conditions



Joe Rao, Sky & Telescope

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Leonids 2001: Climatological conditions

Source: WKI (The Interactive Weatherguide)
Harry Geurts & Jacob Kuiper

Japan	Nemuro	Miyako	Nagoya	Miyazaki
Geografische NB	43°20'	39°39'	35°10'	31°55'
Geografische OL	145°35'	141°58'	136°58'	131°25'
Hoogte boven zeeniveau	26	43	51	6
Gemiddelde temperatuur	4.9	7.7	11.5	13.8
Gemiddelde minimum temperatuur	1.4	2.8	7.1	8.8
Gemiddelde maximum temperatuur	7.9	13.0	16.7	19.4
Aantal uren zonneschijn	140,5 (48%)	143,8 (48%)	157,2 (51%)	163,4 (52%)
Neerslagsom in [mm]	80.6	95.6	70.5	101.2
Aantal dagen met > 0,1 mm neerslag	8	6	7	
Relatieve vochtigheid [%]	70	65	68	76

Source: WKI (The Interactive Weatherguide)
Harry Geurts & Jacob Kuiper

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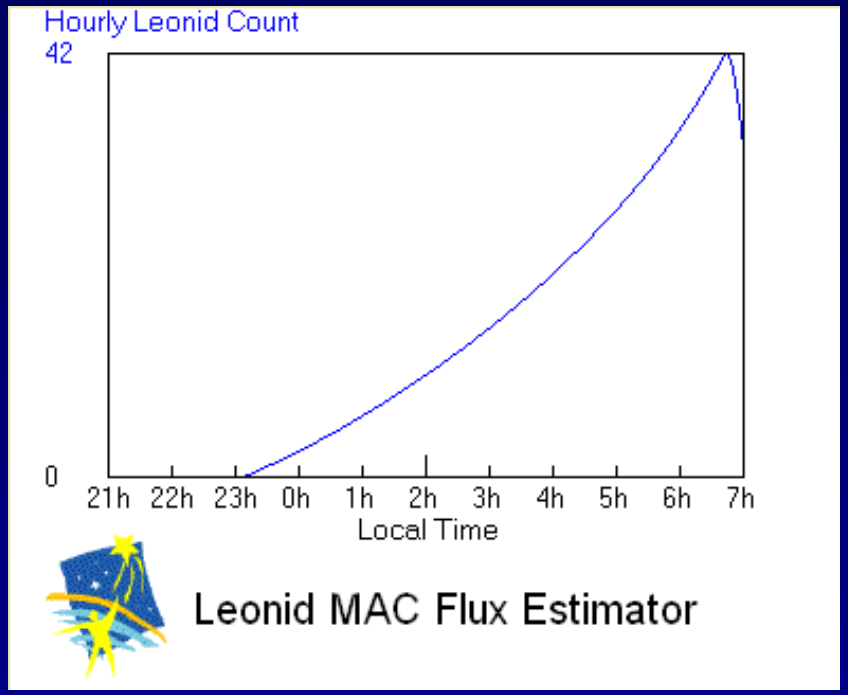
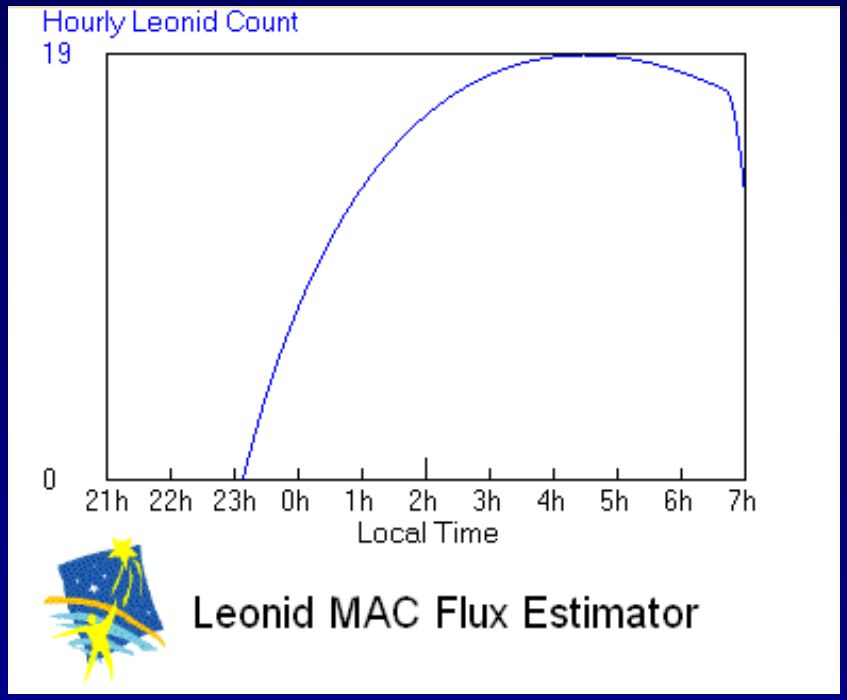
Leonids 2001: in Western-Europa (AMS)

17/18 november



18/19 november



The hunt after Meteorstorms

Contents of the Presentation

- Observing
- Meteorology for expeditions
- Expeditions
- Preview Leonids 2001
- **Video Sino-Dutch Leonid Expedition 1998**

The hunt after Meteorstorms

Things to keep in mind

- Sufficient tapes, powercell's; extra voice-recorder
- Do not observe below 50° degrees
- Many fireball's: don't "forget" the faint meteors
- Accurate notice of starttime, breaks and limiting magnitude
- Don't disturb your fellow-observers: flashlights
- Cloudy weather: take care for cloud cover
- Be honest to yourself: tired --> take your breaks

The hunt after Meteorstorms

16/17 november 1998

- Center of China, NW Qinghai, at 3200 m.
- Milkyway and stars right from the horizon
- No disturbing lightsources, but beautifull zodiacal light
- -20° Celsius and warm isolating clothes
- 5,7 hours, 972 meteors, 783 Leonids
- Magnitude≤0: 330; Magnitude≤-4: 64; Magnitude -12: 1
- Twilight: 15 fireballs!

The hunt after Meteorstorms

Results of 1998

- 100 hours of visual observations (21 hours in 6 nights)
- 7000 meteors
- 15 hours simultanious video-observations
- 180 films

The hunt after Meteorstorms

Video:

Sino Dutch Leonids Expedition 1998