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The typhoon created due to the eclipse at Sakhalin region.

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Introduction

- The Moon's influence on the climate is well known. Many peoples take into account the Moon's phases if they are planning the agriculture activity on the West coast of Pacific.
- It is not a prejudice, it is a real fact. The long term observation of meteorological parameters show that the spectral maxima on periods of Moon's nodes regression (18.6 years), the spectral maxima on the combination of frequencies of Moon's and Sun's rotation around the Earth are observed on the spectra of the variation of air pressure and air temperature as a first so the second harmonics.

The periodicity affected by Moon

- period of the Moon rotation around the Earth
- 27.33 (0.73 years) days
- Period of the Moon to the Earth distance oscillation
- 27.55 (0.73 years) days
- Period of second harmonics 13.7 days
- period of the Moon Phases 29.55 (2.73 years) days
- period of second harmonics 14.76 days
- period of nodal line rotation 18.66 years
- Period of Combination of nodal line and Earth's rotations around the Sun 0.948 and 1.052 years
- In brackets are written the periods , observed on the monthly data.

Illustration

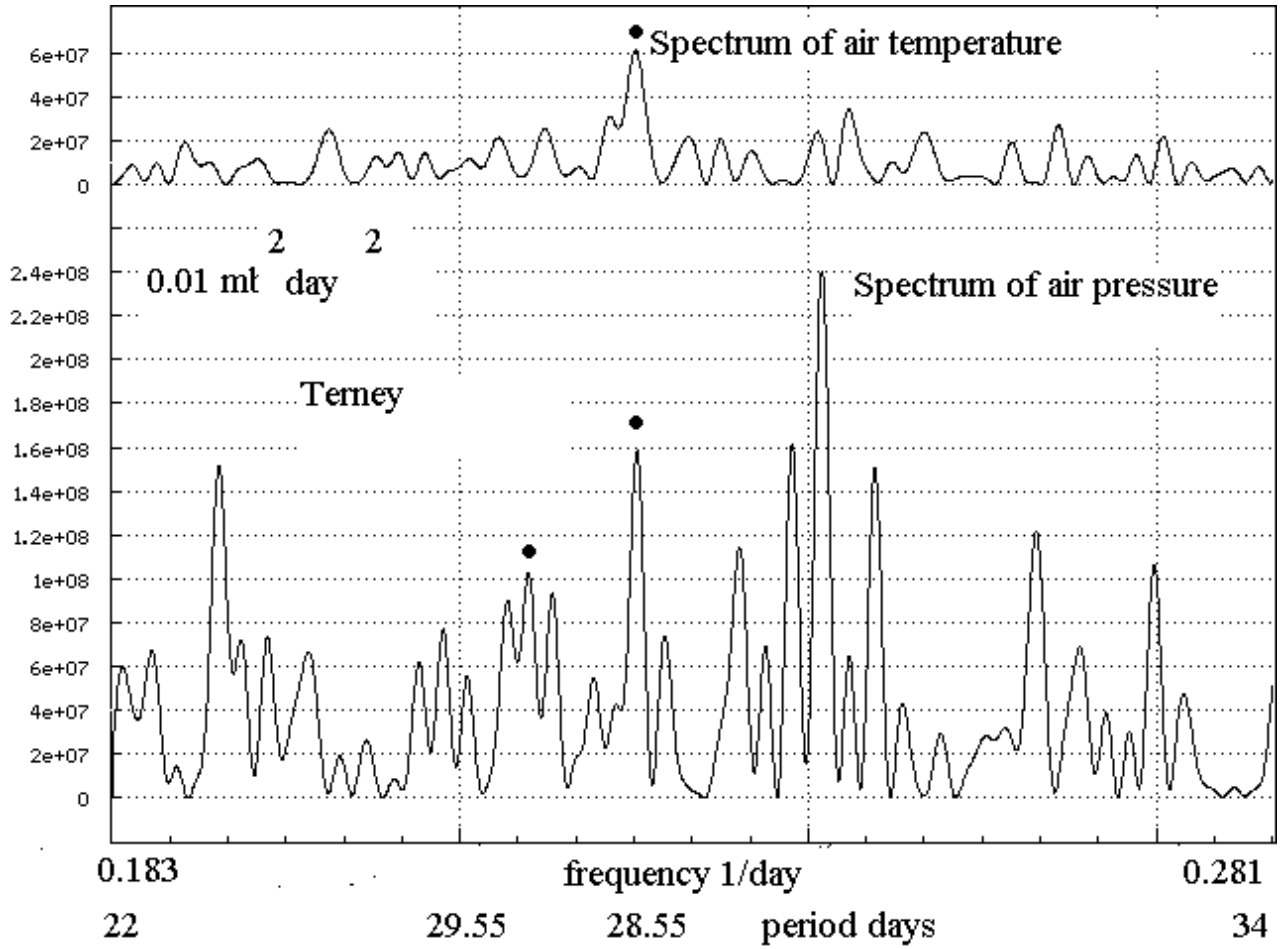


Illustration 2

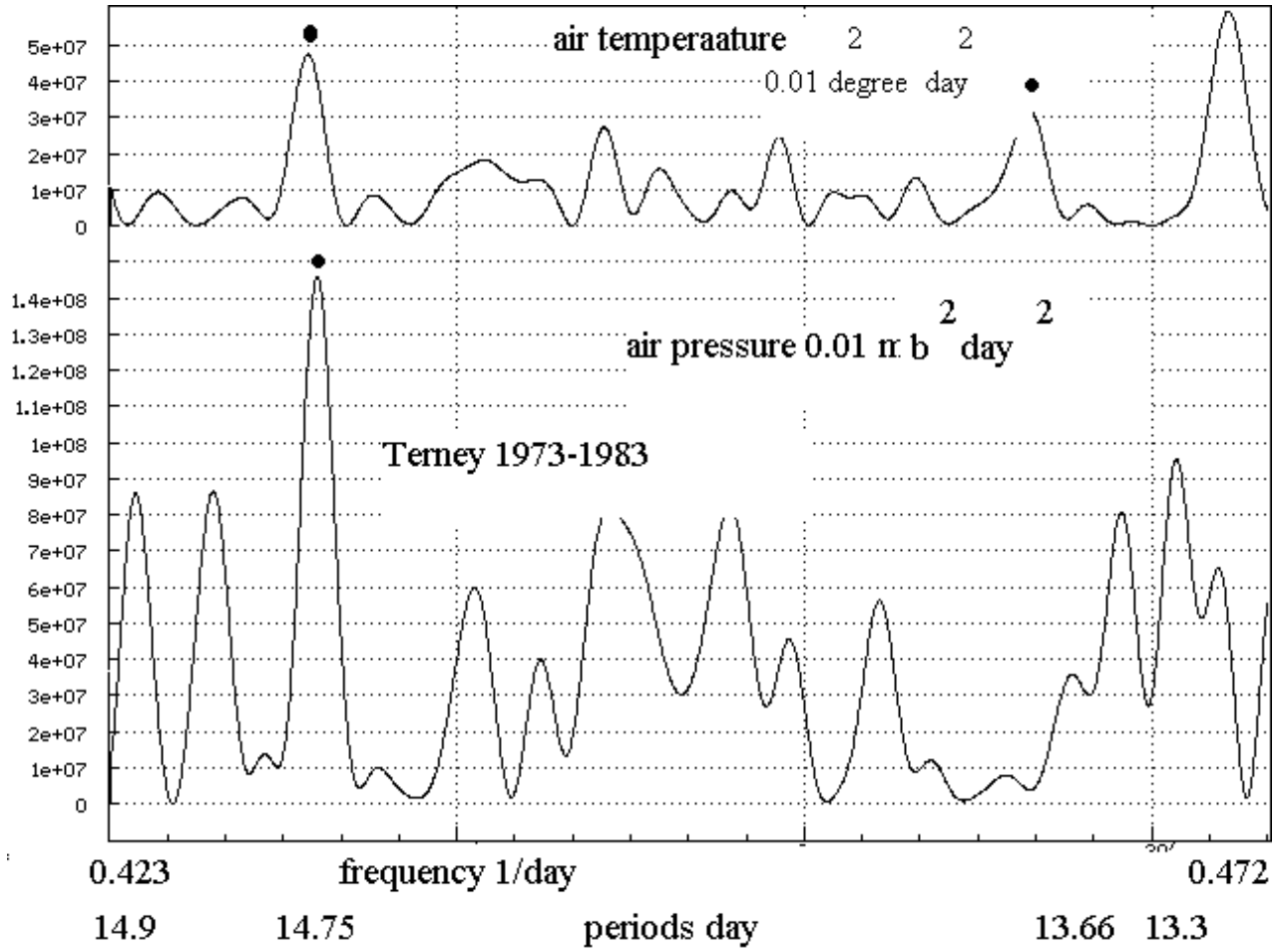


Illustration 3

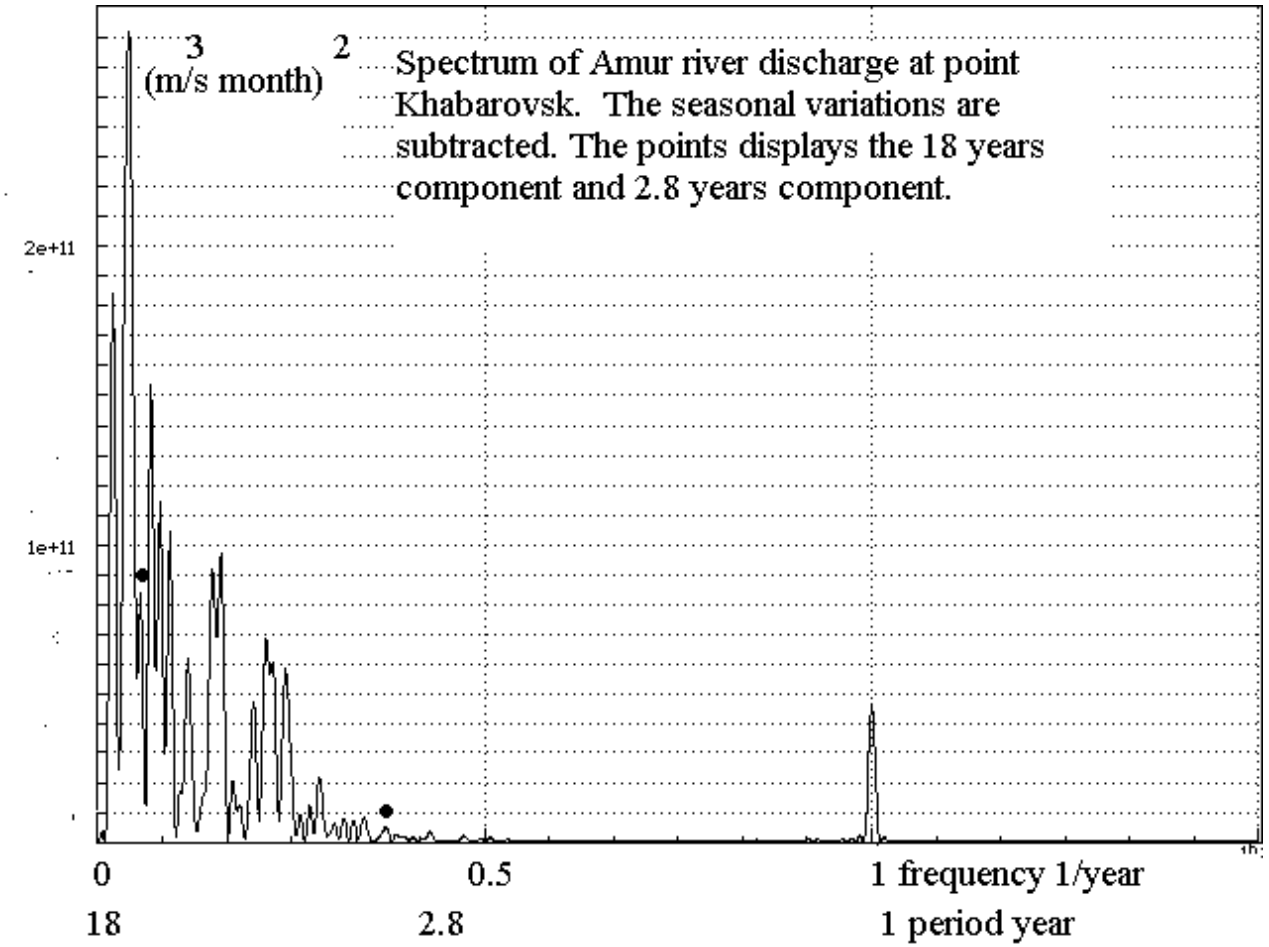
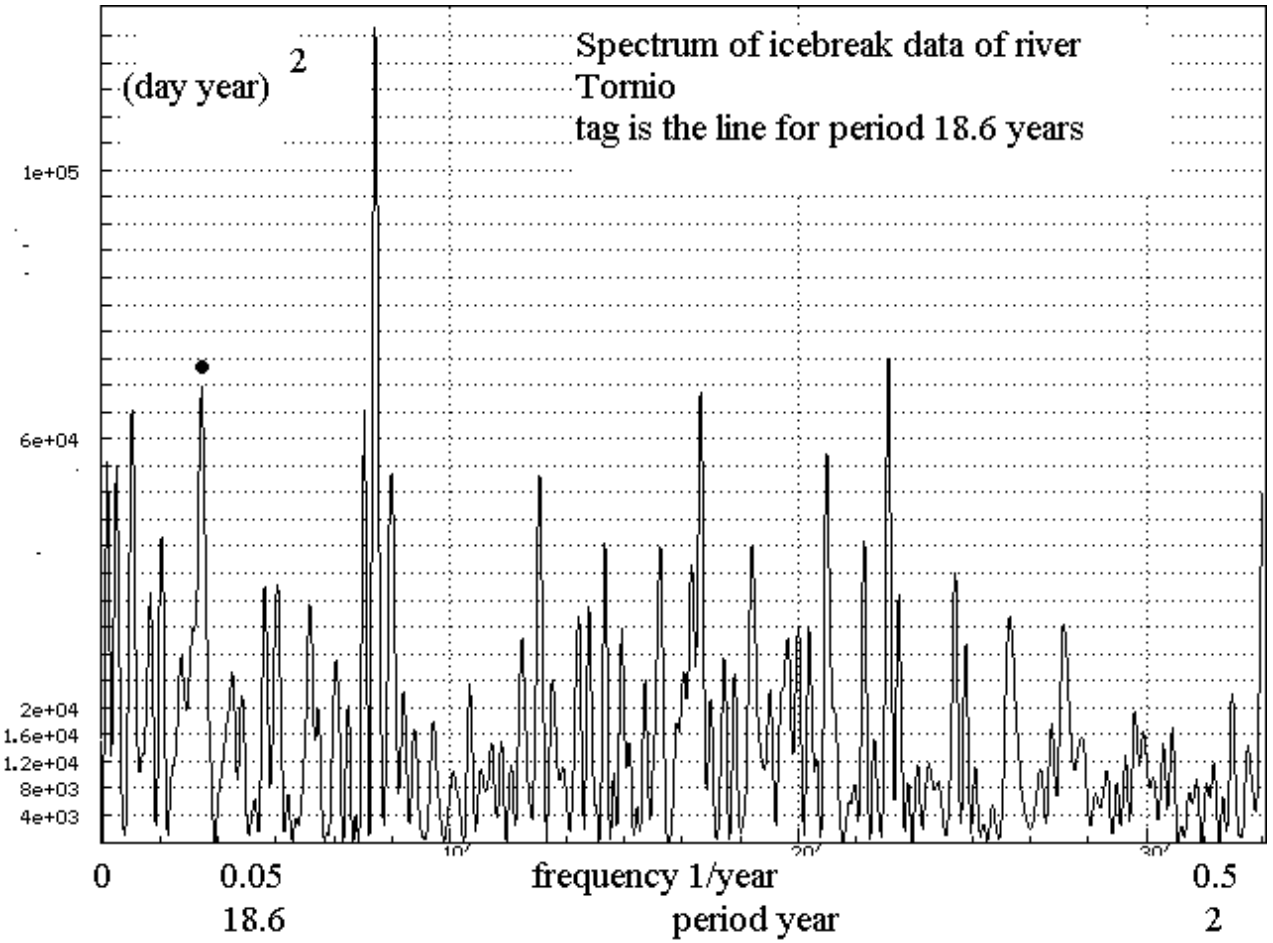


Illustration 4



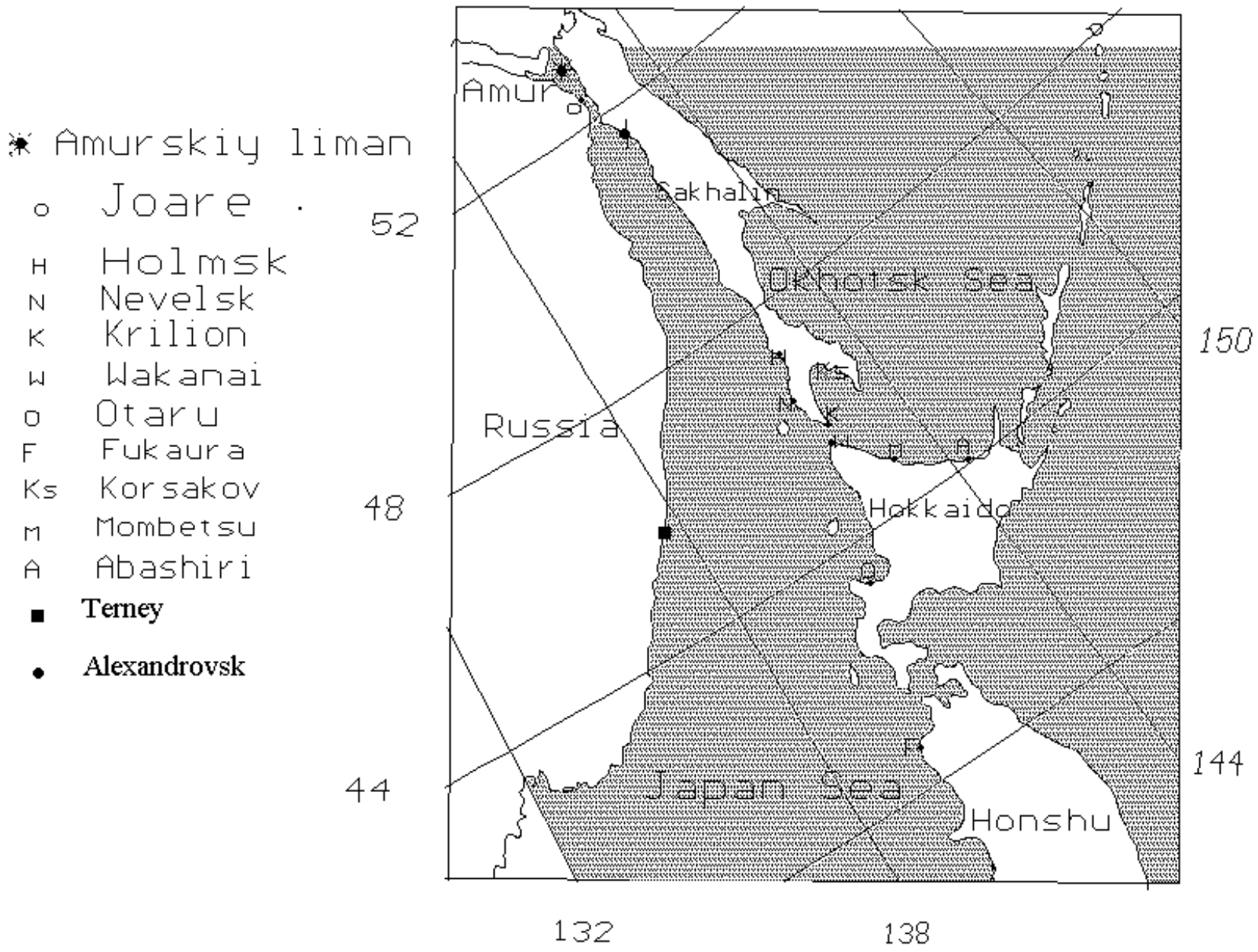
The observed oscillations.

- *Air temperature*
- *Point Terney* (Russia, 45N, 135 E) Data obtained from 1973 to 1983/ interval 12 hours
- Period 27.56 days, amplitude 0.26 degree interpretation – distance oscillation
- Period 14.76 days ,amplitude 0.38 degree interpretation – second harmonics of Moon's phases
- *Point Alexandrovsk* (Russia, 50 N, 142 E) Data obtained from 1891 to 2001 , digital interval 1 month
- Period 19.22 years, amplitude 0.19 degree, interpretation Nodal line rotation.
- Period 2.794 years, amplitude 0.13 degree, interpretation Moon's phases oscillation
- Period 0.74 years, amplitude o.22 degree, interpretation Rotation Moon around Earth
- Period 1.054 years, amplitude 0.68 degree, interpretation
- Combinations of Nodal line rotation and Earth rotation around the Sun,.

The observed oscillations.

- *Air pressure*
- *Point Terney* (Russia, 45N, 135 E) Data from 1973 to 1983/ interval 12 hours
- Period 27.56 days, amplitude 0.68 mb interpretation – distance oscillation
- Period 14.76 days ,amplitude 0.72 mb degree interpretation – second harmonics of Moon's phases
- Period 29.56 days, amplitude 0.43 mb interpretation – phases of Moon
- Precipitation
- *Point Alexandrovsk* (Russia, 50 N, 142 E) Data from 1891 to 2001 , digital interval 1 month
- Period 18.44 years, amplitude 0.27 cm, interpretation Nodal line rotation.
- Period 2.794 years , amplitude 0.74 cm, interpretation Moon's phase oscillation
- Period 0.74 years , amplitude o.43 degree , interpretation Rotation Moon around Earth

The map of the Sakhalin Island



The eclipse and climate

The Sun eclipse by Moon is the one of the mechanism of Moon's action on the climate. The air and soil temperatures decreases in the area of Moon's shadow.

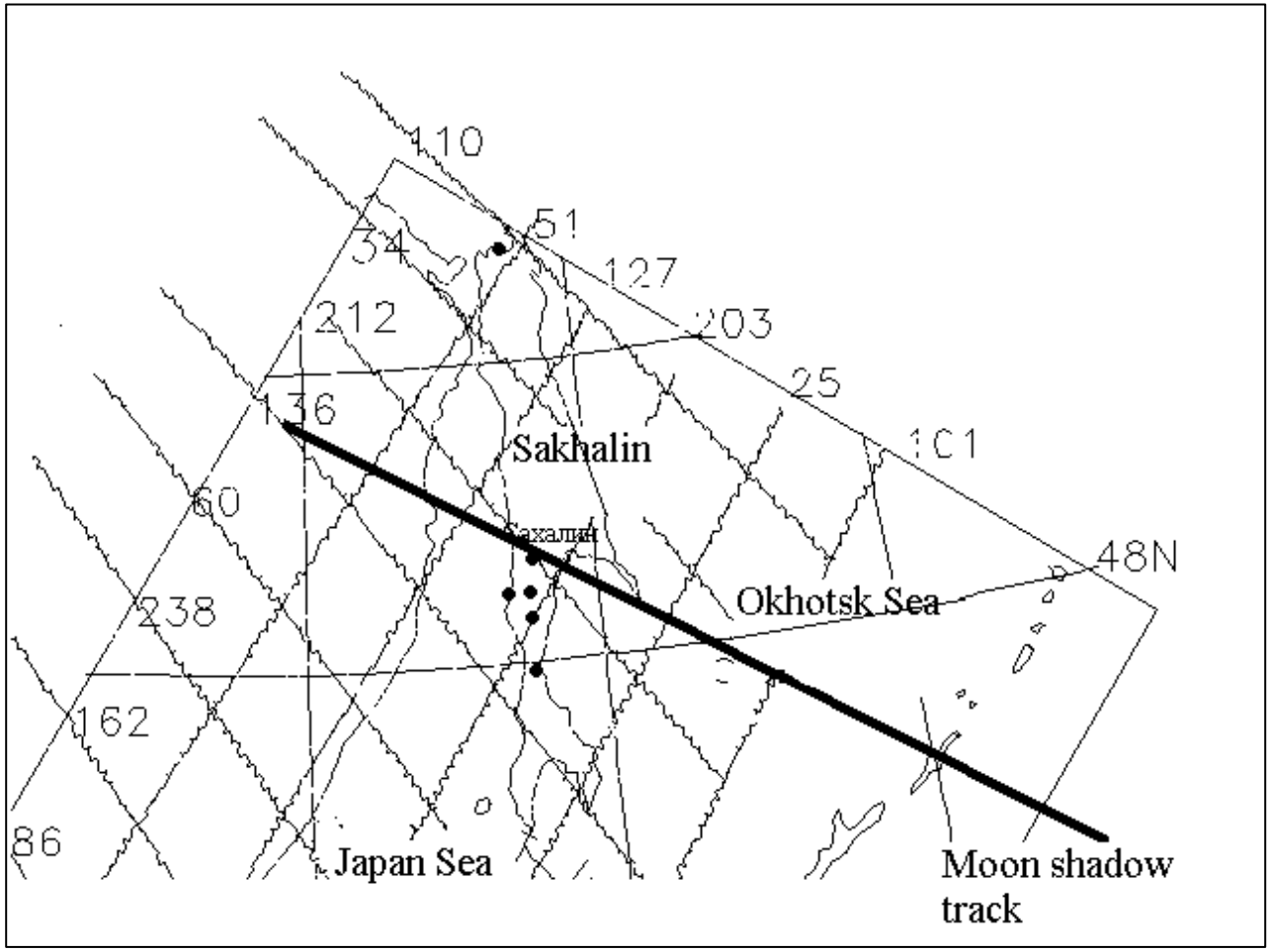
The direct effect have been investigated by prof. Berngardt during the full eclipse at July 31, 1980 at different points of Island, located in the zone of full shadow.

The meteorological effect in the shadow of Moon at Sakhalin Island

The temperature decreasing (Δt °C) of the air and surface of soil during the eclipses and condition of observations

Stations	Δt °C		Conditions of observation
	Air	Soil	
Москальво	1,5		The North west coast of Sakhalin Island To north direction fromstripe of full eclipse. Layer cloudness
Виахту	1,6		West coast of Sakhalin Island, Inside the stripe of fulleclipse. Slight cloudness.
Александровск	1,8	16,9	
Пильво	2,5		
Ныш	3,9		Central Part of island, inside the stripe of full eclipse. Thunderstorm, Rain
Адо-Тымово	4,6		
Тымовское	2,7	18,2	
Зональное	2,7		
Комрво	2,7		East coast of Sakhalin Island inside the astripe of full eclipse Thunderstorm,rain
Онор	2,1		The central part of island, to South direction from the stripe of full eclipse. Thunderstorm, rain
Первомайское	3,3		
Победино	3,2		
Ноглики	4,9		East coast of Sakhalin, North direction from stripe of full eclipse. Thunderstorm, rain
Вал	2,3		
Оха	3,5		
Сиземан	4,3	23,0	East coast of Sakhalin, inside the stripe of full eclipse. Thunderstorm, rain.

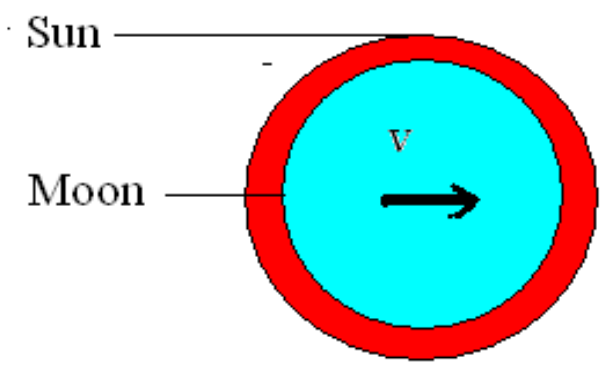
The map of the points of observations. o



CONCLUSIONS

- The data of table show that the air temperature decreased on 1,5 - 2,5 degree in stripe of full shadow.
- The maximal effect is observed in the stripe of full shadow in the soil (the temperature variations was 4,50 C).
- This essential variation occurs in result of serious soil cooling and formation of clouds. The position of minimal value is coincided with maximal phase of eclipse.

Explanation



Angle radia 0.0046 (ϕ)

Angle radius 0.0044

$$V = \frac{2pi}{T_p}$$

$T_p = 29.6 \bullet 24$ hours

Eclipse duration $\phi/2pi \quad T_p = 1.1$ h

Daily variation (temperature) Tm 10°

Eclipse variation (temperature) $T_E \quad T_m \; T'_p \; 6_{\text{hours}} = 1.6°$

Parameters of theory

- Rs Earth's orbit radius
- The Moon orbit plane crosses the plane xy by axis y. Equation of plane is $z \cos EM = x \sin EM$,
- EM - angle between the equatorial plane and Moon orbit plane.
- D – Moon's orbit radius
- $\omega 1$ is the frequency of the Moon rotation around the Earth (period 27.32 days)
- $\omega 2$ is the frequency of the Earth rotation around the Sun (period is 365.25 days)
- $\omega 4$ is the frequency of the Moon nodal line rotation (period 6585.3 days = 18.65 years)
- Δ is the angle between directions from the point to the Moon and to the pole of the Earth.

Peculiarity

The peculiarity is that
effect (temperature decreasing area of Moon's shadow) is observed not only in the shadow area, but everywhere on the North West Pacific coast, if the Shadow trace is coming through the North part of Pacific.

To show this peculiarity we separate the eclipse effect from the air temperature records at the point Alexandrovsk (Sakhalin, 50N, 140 E) from 1880 to 2000

To separate the eclipse effect we use the important feature of eclipse ,discovered by astronomical theory

This feature is the periodical dependence of the effect with periods of the Moon rotation, the Sun rotation and The nodal line rotations.

$T_0 = 29.53$ days

$T_3 = T_1 T_2/(T_1+T_2)$

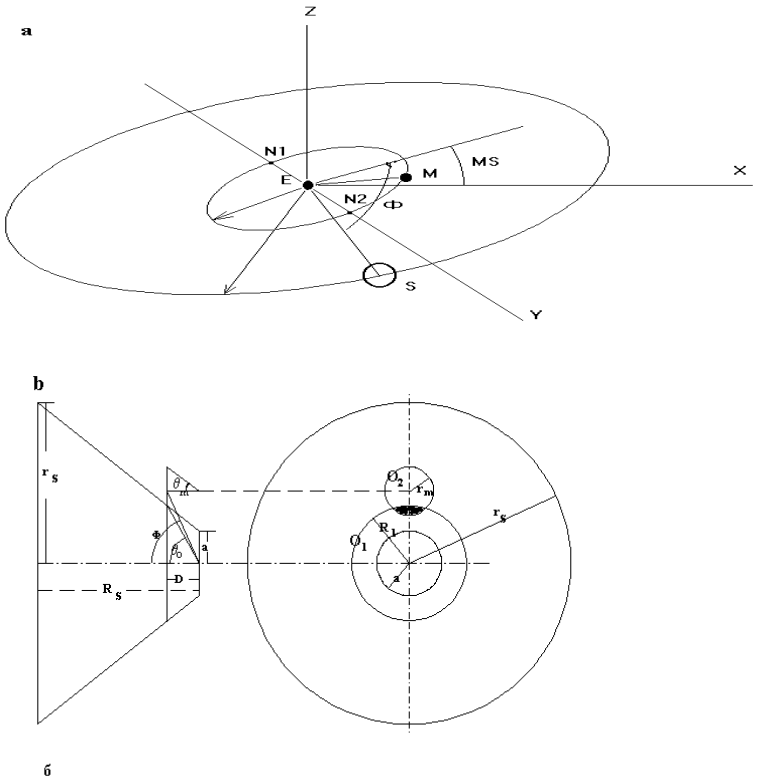
T1 = 365.25 days

T2 = 6585.32 days.

$$\omega ik = 2\pi\, i\, /T_0 \quad + 2\pi k\, /\, T_3$$

I and k are integer positive or negative

Theory illustration



Coordinates of Moon and Sun

- $Mz = D \sin MS \cos (\omega 1 + \omega 4)\, t$;
- $My = D \sin (\omega 1 + \omega 4) t$;
- $Mx = D \cos MS \cos (\omega 1 + \omega 4 \cdot) t$;
- $Sz = 0$;
- $Sy = Rs \sin (\omega 2 + \omega 4) t$;
- $Sx = Rs \cos (\omega 2 + \omega 4) t$;
- Φ – phase angle of the Moon
- $\cos \Phi = \cos MS \cdot \cos (\omega 1 + \omega 4)\, t \cdot \cos(\omega 2 + \omega 4)\, t + \sin \Delta \sin (\omega 1 + \omega 4)\, t \sin (\omega 2 + \omega 4)\, t$

- The direction to the Moon is located in the plane
- $z \cos EM = x \sin EM$.
- the angle with line $y = 0$; designate by α , time is accounted from the moment when the direction on the Moon came to the plane xz. The estimation of Δ can be made by equation
- $\cos \Delta = \sin EM \cos \omega 1 \, t$
- The angle *EM periodically changes from* 18°18’ to 28°35’ with period 18.613 years (6585 days) Maximal value was at August, 1950г, march 1969 года , November 1988 .Time variation can be estimated from equation
- $\sin EM = \sin E \cos MS + \cos E \sin MS \cos \omega 4t$

The eclipse is the shadowing of Sun radiation by the Moon. Effect is proportional to ratio two area. The first one is the area of crossing of the Sun and Moon projection on the sphere , which radius is D and center at the Earth ‘s center. The second one is the area of the Sun projection on this sphere, which has a radius RE + (RS - R-E) rm / Rs . The maximal crossing area has an angle diameter -

θ_0 = (RE + (RS - R-E) rm / rs)/ rm = 0.0211 .

The effect of shadowing depends on angle between directions to the Moon and to the Sun. It is the phase angle of Moon. It can be estimated from equation

$$\cos \Phi = \cos MS \cdot \cos (M + SAR)\, t \cdot \cos(S + SAR)\, t + \sin (M + SAR)\, t \ \sin (S + SAR)\, t$$

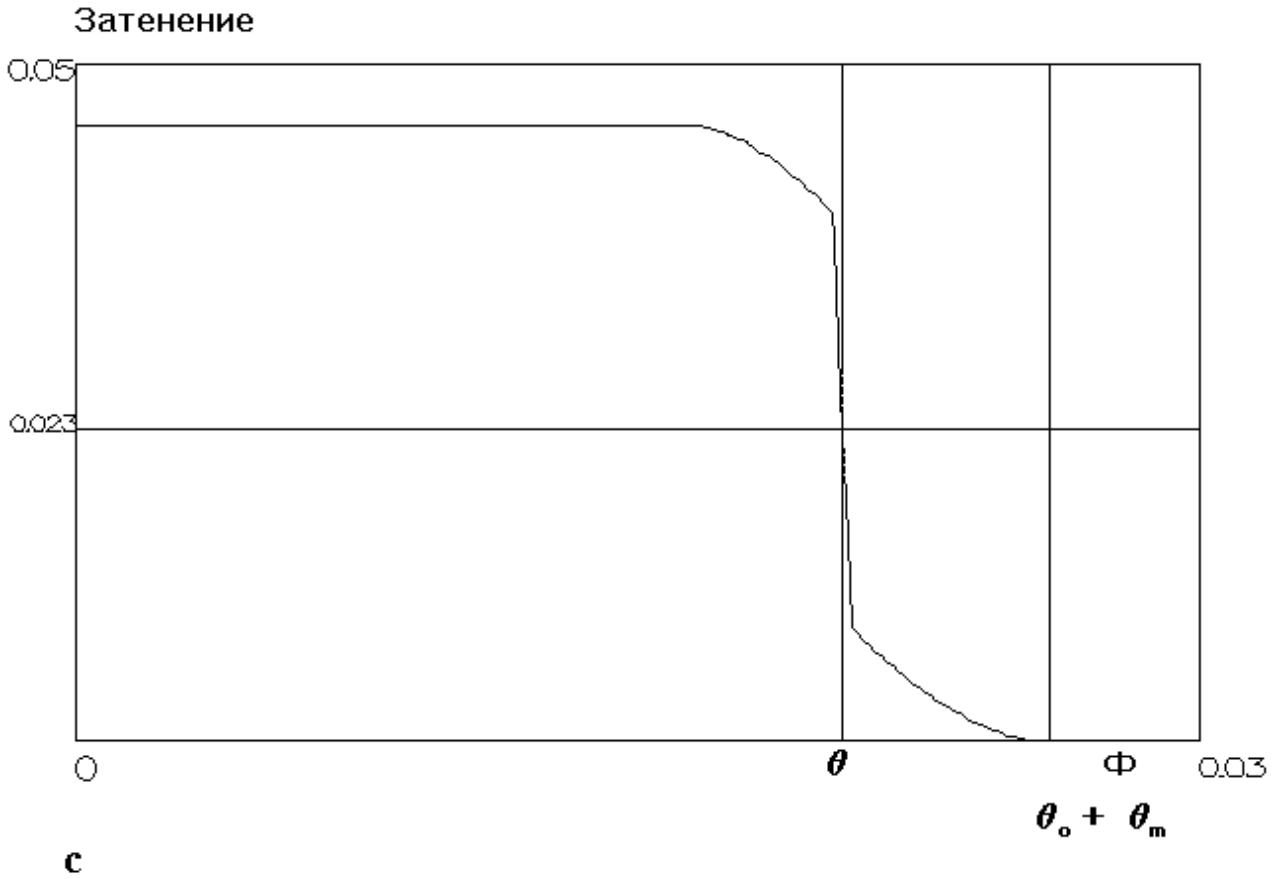
The intensity of shadowing is proportional to area of crossing the circle with radius $\theta 0$ with center on direction to the Sun and circle with radius

$\theta m = R_m / r_m = 1730 / 384000 = 0.0045$

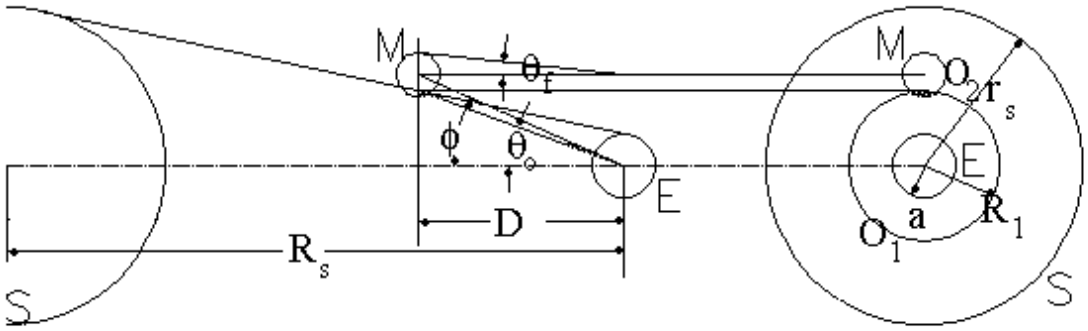
with center in direction to the Moon..

Here, R_E - = 6370 km is the Earth's radius, R_S = 695600 km is the Sun's radius, R_m = 1730 km is the Moon's radius, r-s = 1496 105 км is the distance to the Sun, r_m = 384000 км is the distance to the Moon.

The dependence of shadowing from the angle between directions to the Sun and to the Moon



The theory of the eclipse influence on temperature show that the effect can be more than 1 degree and be observed on periodical perturbation of the air temperature.



b

In the case $\Phi > \theta_0 + \theta_m$ the effect is absent ,
In the case $\Phi < \theta_0 - \theta_m$,the effect is
$Sh = (\theta_m / \theta_0)^2 = 0.0455$.
In intermediate cases the effect is calculated by system of equations

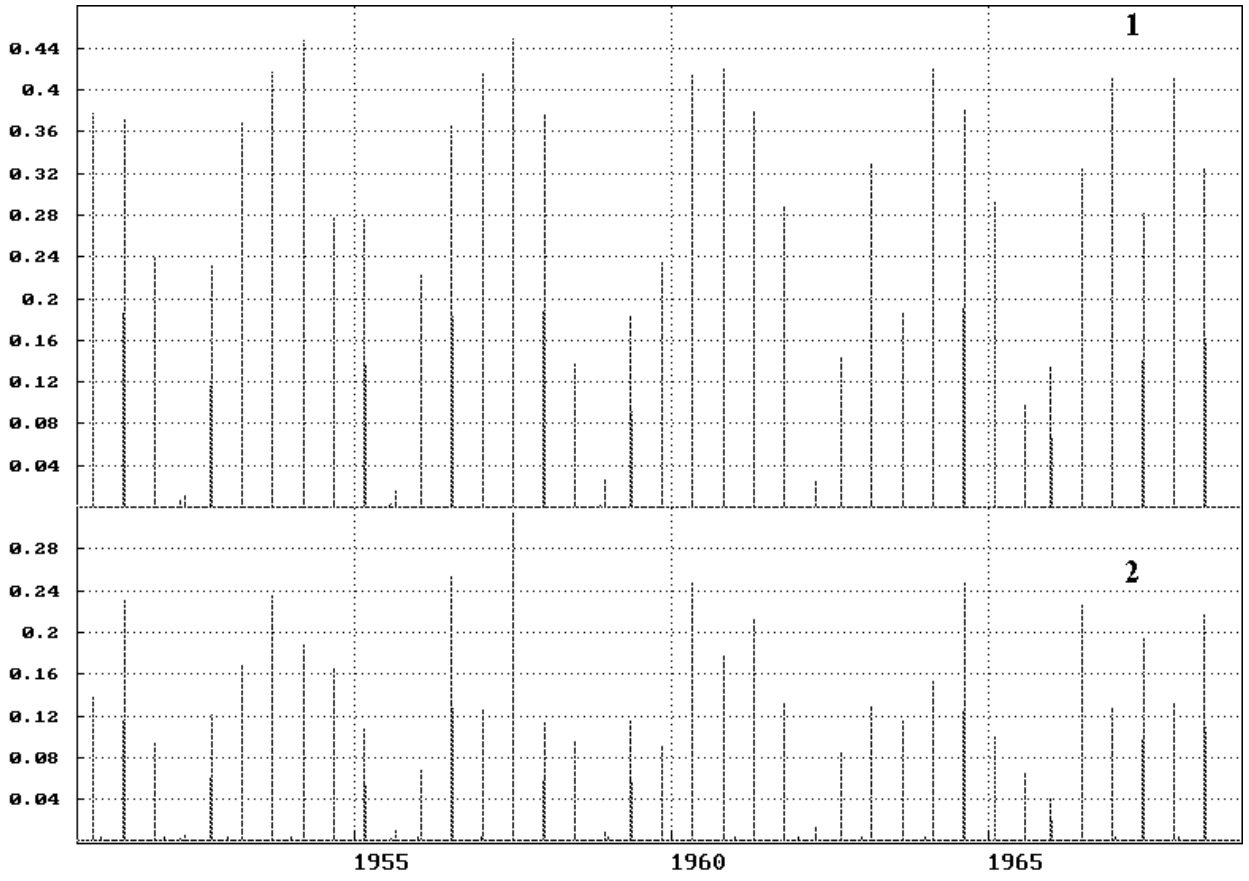
$$\theta_0 \sin \varphi_1 = \theta_m \sin \varphi_2;$$

$$\theta_m (1 - \cos \varphi_1) + \theta_0 (1 - \cos \varphi_2) = \Phi;$$

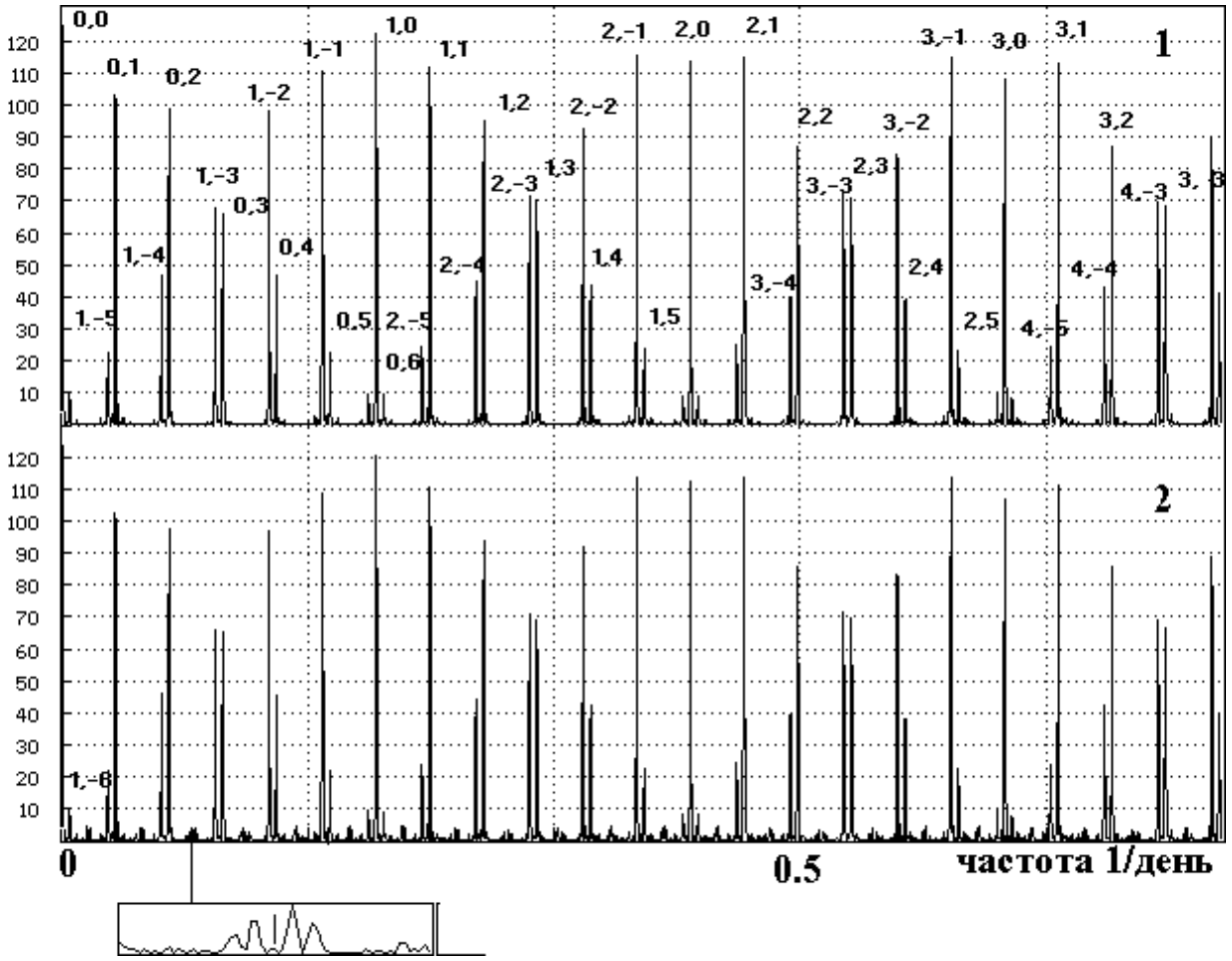
$$Sh = 1/\pi (\theta_0 \cdot (\varphi_1 - \sin \varphi_1) + \theta_m (\varphi_2 - \sin \varphi_2));$$

This system has been decided by computer and result are shown on the figure.

The theoretical dependence of air temperature variation due to eclipse



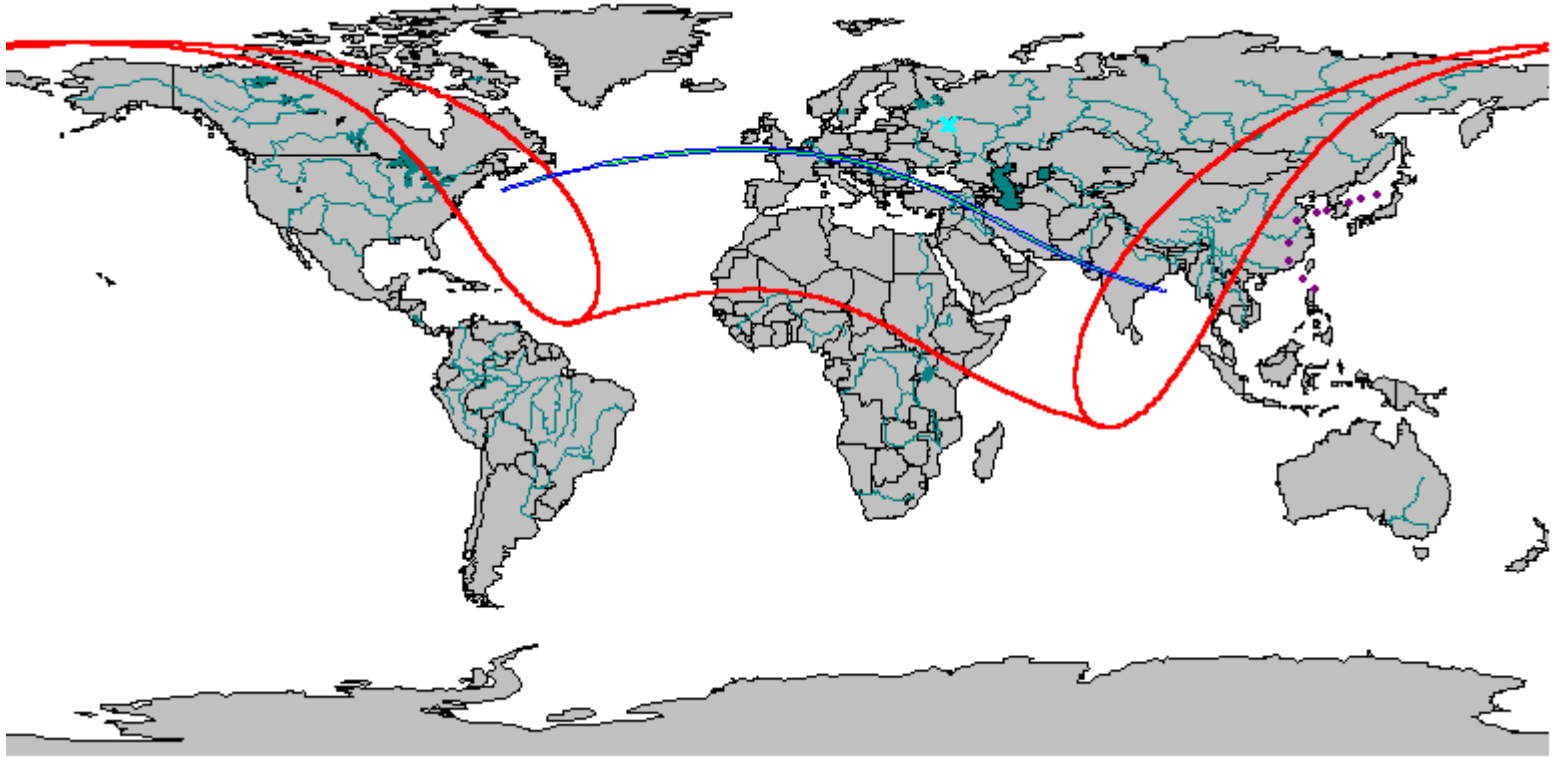
The spectrum of theoretical dependence



The spectrum of the air temperature perturbation due to the eclipse

- The eclipse is strictly periodical process,
- which is determined by periods of phase T0 = 29.53 days; Earth's rotation around the Sun T1 = 365.25 days;
- nodal line regression T2 = 6585.32 дня. The spectrum of perturbation of Sun flow due to eclipse is the linear
- spectrum with maxima on frequencies
- $\omega ik = 2\pi\, i /T0 + 2\pi k / T3 = 2\pi\, i\, \omega_0 + 2\pi k\, \omega 3$ (6)
- values i and k are the positive and negative integer numbers, $\omega 3 = 4\pi\, (T1+T2)/ T1T2$
- The spectrum is shown on the figure (left, ,down).
- The spectrum contains many pairs of lines separated by interval $2\pi/\Delta$, Δ = 1228.87 days or 3.364 years. It is the visible period of eclipses arrival .
- $\omega_0 = 2\pi /T0$

The shadow trace on the Earth
Eclipse 17.08.99



The separation of eclipse signal from real observation

The periodical features of eclipse signal permits to separate it. The spectral amplitude of periodical component of the signal increased as a square of values of the record duration. The spectral amplitude of random component of the signal increased proportional to the duration. So, if the duration is big enough, the spectral amplitude of periodical signal will be greater than an amplitude of a random component [1].

Code of calculation

- If we would like to separate the effect of the eclipse $\delta(x)$,then we can estimate it by calculations of amplitudes aik and phases φik of the signal on the
- frequencies ωik, corresponded to theoretical values and
- the effect calculate by formula
- $\delta(x) = \sum aik \cos(\omega ik\, t - \varphi ik)$.

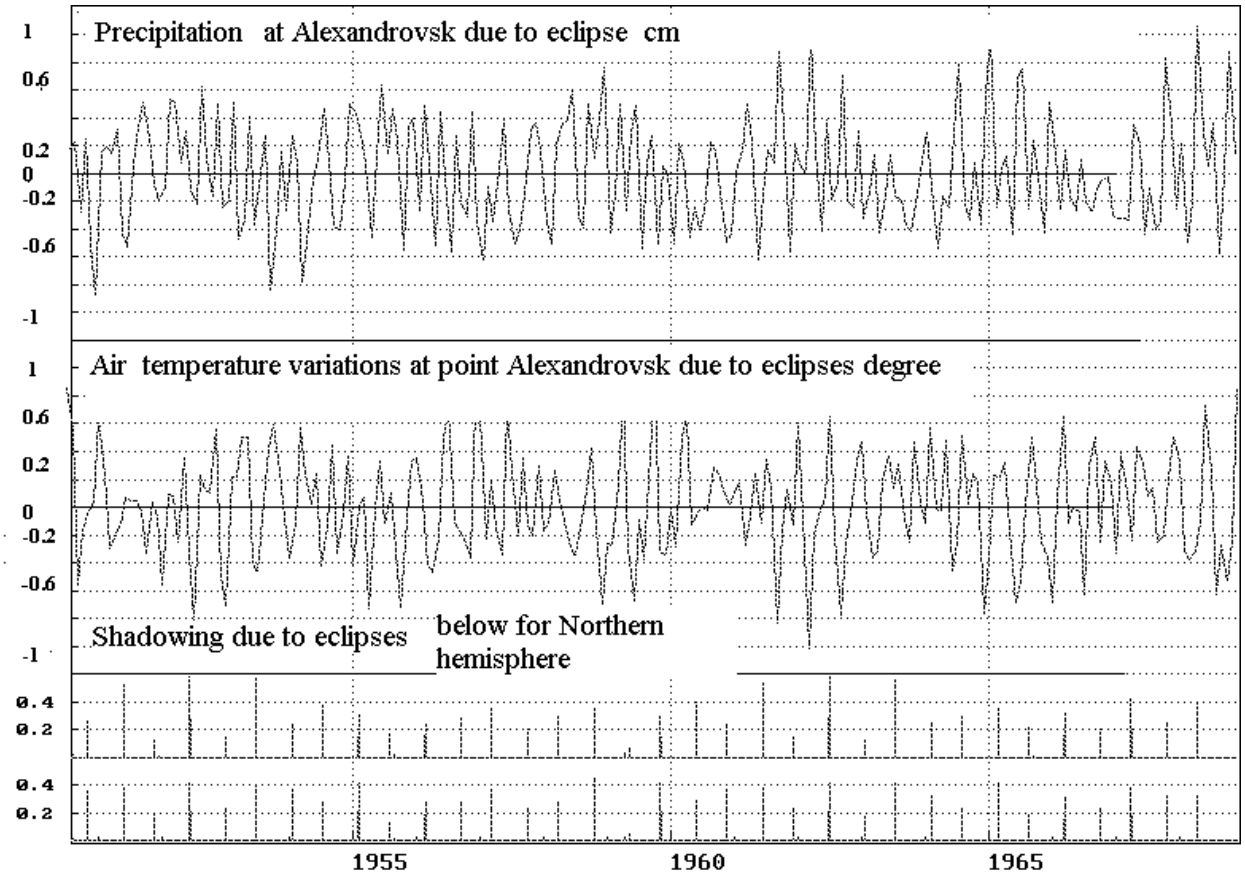
Observations

- Really we have discover only the components ω_{ik} with follow numbers I and k :
- i = -1, k = -7; i = 1, k = -5; i=0, k = 1; i = 1, k = -4; i = 0, k = 2,
- They are the periods – 3,36; 0,55; 0,47; 0,255; 0,237 years.

The lines of successive spectra of air temperature and precipitations at point Alexandrovsk

№	theory	Period years	Amplitude grad	Phase rad	Period years	Amplitude cm	Phase rad
1	3.36	3.365	-0.12	0.65	3.267	-1.82	1.47
2	0.55	0.548	-0.26	-1.26	0.554	-2.18	-0.5
3	0.475	0.480	0.215	-0.1	0.476	-2.4	-1.046
4	0.255	0.255	-0.23	0.367	0.251	-3.4	-0,511
5	0.237	0.236	-0.2	0.672	0.233	2.80	0,677

Result of calculations



Conclusion

- The eclipse decreases the air temperature and increases the precipitation every time, the temperature decreasing is near to 1 degree, the precipitation increasing $\approx$ 0.5 cm. The results are the same for different position of the Moon shadow in Northern hemisphere. It means that the effect of eclipse spreads all over the Earth's surface. And the time of spreading is less than 1 month, interval of data smoothing. We think that the eclipse creates the mobile atmospheric formation which propagates around the Earth's surface as a cyclone
-

Conclusion 2

- The point (Alexandrovsk, 50N, 140 E) is located on the way of tropical cyclones generated in the South-West part of Pacific. It means that the tropical cyclone arise every time if the moon shadow cross the Pacific.

How to check up

- We are checking up by analysis of the data of cyclones at Pacific for 1999 and 2000. The cyclones parameters are shown in the table. The two eclipses (February 16 and August 11) were observed during the 1999. The cyclone Sam can be juxtaposed with eclipse August 11 . On the figure are shown the trace of the center of Moon shadow and the trajectory of cyclone.

The table of cyclones for 1999

Table 6. The parameters of cyclones in the West Pacific(1999).

Name	Start time	Position N	Position E
STS Kate	21 April	9	126
T Leo	27 April	13.7	113
T Maggie	1 June	10.9	131.2
STS Neil	22 July	17.6	128.8
TS	23 July	17	117
TY Olga	29 July	12	134
TS Paul	3 August	19	140
STS Sam	17 August	12	129
STS Dora	18 August	17.8	180.9
TS Wenda	1 September	13	126
STS York	9 September	17	124
TS Zia	11 September	18	141
Sts Ann	14 September	25	128
T Bart	17September	20	129
TS Cam	22 September	17	126
TY Dan	2 October	17	132
Ts EVE	15 October	6	126
TS Frankie	7 November	11	134

*

- The two eclipses (February 16 and August 11) were observed during the 1999. The cyclone Sam can be juxtaposed with eclipse August 11 . On the figure are shown the trace of the center of Moon shadow and the trajectory of cyclone.

Data of typhoon Sam

Photo from sattellite

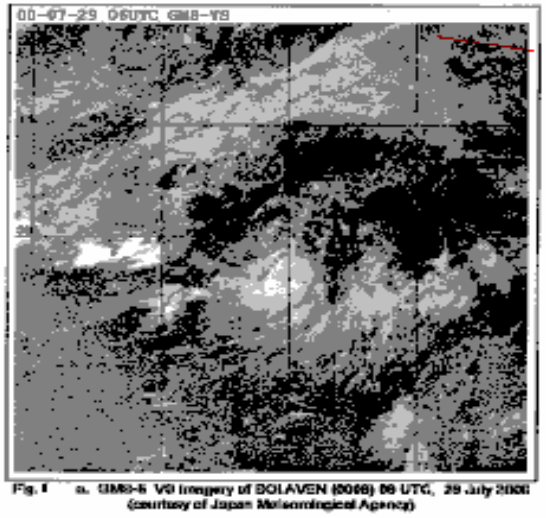


Fig. 1 a. GMS-5 VIS imagery of SOLAVEN (0006) 06 UTC, 29 July 2000 (courtesy of Japan Meteorological Agency)

red line - boundary of shadow

Trace of the Moon shadow

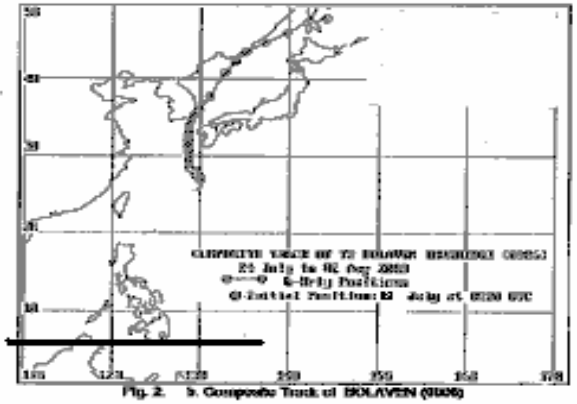


Fig. 2. b. Composite Track of SOLAVEN (0006)

Conclusion

- The Sun eclipse is the one of the mechanism of Moon's action into climate
- the eclipse generates the tropical cyclone if the shadow trace crosses the boundary between the tropical and equatorial air masses. This cyclone propagates along the Asia boundary by usual trajectory of tropical cyclones. By this way it comes to Sakhalin Island.
- So the eclipse generates the cyclone, retarded on 5-6 days ,if the Moon's shadow crosses the Pacific.
- The typhoon can be forecasted.
- The main eclipse typhoons at Sakhalin Island are
- The Filis (August 4 , 1981), November 7, 1995.