Antennas in the mountains

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Those radio amateurs who are going on a high-mountain radio expedition must know about the following thing. Clouds and snow do harmful effect to antennas in the mountains. During my previous mountain trips I ran into this effect.

However, the harmful effect very obviously arose on Ai - Petri plateau during the UR- QRP-C radio expedition. This effect essentially corrected the schedule of our radio expedition. All members of the radio expedition observed the effect and they could confirm the truth of my observation.

Clouds against antennas

So, it happened in May, 2001, during the radio expedition of the UR-QRP-C on Ai - Petri plateau. We used a special call sign EM5QRP. For work on short waves we installed two antennas. One antenna was a usual long wire in length of 55 meters. The second antenna was a GPA-30 vertical multirange antenna, made by the Fritzel corporation. More detailed information concerning our antennas, ways of their installation and accommodation of the expedition in Ai-Petri shelter can be found in reference **[1]** (in Russian).

Though the main part of Ai-Petri plateau is only 1200 meters above sea level, clouds would often cover the plateau. They constantly fall down to Ai-Petri plateau from the sky. Then the wind slowly moves the cloud over the plateau in various sides. It occurs that the weather changes dramatically within five minutes. The Sun shines, then a cloud falls down to the plateau, it rains, the wind blows away the cloud, and the Sun shines again.

The cloud does not choose a side where it moves on the plateau. The wind controls the cloud. If the cloud moves over the plateau aside our antennas, it does not influence the work of our radio expedition. But, if the cloud "sits" directly on our antennas, the work of our radio station becomes impossible. We named this harmful effect as “Ai-Petri effect “.

How it was opened

At first I thought that the reason for periodic deterioration of reception and transmission on the radio station of our radio expedition was due to bad contacts in antenna’s terminal of ATU (an Antenna Tuning Unit). The wires of the antenna and grounding were repeatedly and carefully cleaned and plugs were tightly twisted. It felt as if we observed the "imaginary effect" caused by these actions.

It was like you turned off contacts, cleaned wires, stretched twirled contacts, and the work of our radio station again renewed. But in spite of periodical cleaning of the contacts, reception and transmission on our radio station vanished away and appeared again. Obviously, the true reason for periodic deterioration of work at our radio station was not in bad contacts …

Clouds down

Dielectric cloud around the antenna

Dielectric permeability of a cloud differs from that one of the air, which is equal to 1. Therefore, if a cloud sits on the antenna, antenna’s electric length changes. It results in a change of resonant frequency of the antenna. Input resistance of the antenna also changes.

Usually, a cloud is sitting on an antenna for a rather short time, for one - three minutes. Within the minutes the current in the antenna varies in a few times. ATU’s RF ammeter shows these current varies. Certainly, it is impossible to provide constant tuning of the ATU within the minutes!

Screening of the antenna

It turned out that a cloud does another even more harmful effect to antennas than the change of the resonant frequency of antennas in the cloud. The effect is the screening of the antenna by the cloud. The cloud consists of billions of tiny droplets, and each one can bear a small negative (concerning the surface of the ground) charge. Also each of the tiny droplets is not an insulator due to thunderbolt, each droplet has a small conductivity to electricity

Hence, the cloud has a small conductivity to electricity and a negative charge concerning the ground. And this substance covers our antennas. It is like when a metal sheet covers our antennas. Still some minutes ago there might be a magnificent reception. Within a couple of minutes the cloud covered our antennas and the reception is completely stopped. ***This effect was observed mainly in the afternoon when the white clouds covered the antennas.***

A black cloud is not dangerous

It was noticed by us, if a black cloud covered our antennas, the reception was present, though it was weak. It remains a riddle for me. The black cloud is usually much denser than the white one. When a black cloud covered me, I was under the impression that I was in fine douche. A lot of microscopic droplets of water gathered round me. The droplets fell on my clothes and hair, got in my nose and ears. It is darkly, that such a black cloud influences the reception much less that a white one.

A night is better than a day

At night a full stopping of the radio reception due to clouds was not observed. Usually only the effect of detuning of the antennas appeared when a cloud sat on antennas or passed through them. At this time reception became unsatisfactory, antenna current varied at transmitting mode. It was necessary to stop work on our radio station temporarily and wait until the wind blew away the cloud from our antennas.

Other amateurs faced the phenomena

Hams who worked in mountain conditions also faced the effect of influence of the cloud on antennas. ***Andrey Blinushov/UA3SGV*** writes about his amateur radio work during his trip across Hibina Mountains in2002 **[2]**.

Andrey Blinushov

" On August 11, alpinist group with my guys left our mountain camp for a three-day ring trip, and I danced from impatience - quickly to my transceiver! But within one hour a dense cloud, bearing fine rain suspension, descended the mountain ridge Chasnochorra to the place, where I stayed, and covered our mountain camp. And for all the day - only 14 QSOs! I heard about the radio expedition of EM5QRP on Ai- Petri. When such a cloud sat on their antennas, the radio

communication broke. It was a surprise for me at that time. Now I have faced such a phenomenon myself…"

Cloud cancels directional antennas

We had to refuse the installation of directional wire antennas, which I had taken with me because of the cloud effect. Really, a greater part of time Ai- Petri plateau is covered with clouds. So, our antennas are also covered with clouds… It was not wise to install directional antennas, which will not function a greater part of the time. Inside a cloud the elements of directional antennas, for example such as YAGI, will not have those resonant frequencies which are necessary for their proper work. Hence, these antennas will have no proper diagram directivity.

Antennas with phased feeding would not help us. Clouds have variable dielectric permeability through their volume, and moreover, these clouds are constantly moving through our antennas. So, the electric distance between elements of the phased feeding of the antenna will be constantly changing. Hence, the diagram directivity of such a phased antenna will change according to unknown law. That is why we could use only simple single-element antennas for work during the radio expedition on Ai-Petri plateau.

Antenna current from clouds to the ground

We noted one more very interesting effect at covering our antennas by a cloud. My ATU, which we used during our radio expedition on Ai- Petri (circuit of the ATU is given in reference **[3]**), had an RF ammeter in antenna circuit. The meter indicated a hundred milliamperes whenever a dense white cloud quickly passed through our antennas. It was completely useless to hope for any reception in these conditions. Only a steady crash and roar was in our headphones.

If only this useless current, flowing between a cloud and the ground, one could direct for useful needs. For example, it could charge accumulators. This idea sounds fantastic, but such high current is quite capable not only to interfere with reception but also to do some good things, for example, to charge accumulators.

Electrically grounding is mandatory for antennas

It shows that electrical grounding is an important thing for any antenna in the mountains. The antenna terminal at my self-made ATU was electrically connected to ATU's case (I used a resistor by resistance of 100k Ohm / 2 watts), and the case was grounded to the real earth. Cloud current flowed from a cloud to the earth, and did not do us any harm

The antenna terminal of the R-143 radio, which we used for work in our expedition, was not electrically connected to the case of this one. As a result of it, if clouds covered our antennas, this radio station could not work in the ether without ATU. Without ATU, a neon bulb, placed near the antenna terminal of the R-143 radio, shone. Sparks jumped from the antenna terminal to the case of the R-143 radio. It might damage this radio station if the antenna accumulated too big static potential.

The Ai- Petry effect in winter

In December 2001, the UR-QRP-C organized expedition to Ai – Petri plateau. This expedition was

length. The dipole was fed through a thick coaxial cable with characteristic impedance of 75 Ohm. The coaxial cable was 8 meters in length. This CB- dipole worked well on ranges of 10-20 meters. Each antenna was connected by its own separate ATU to our transmitting equipment. In winter we also encountered the influence of weather mountain conditions on our antennas. In winter this effect was caused by snow.

Snow has effected the antennas

Almost constantly there was snowfall on Ai- Petri plateau. It was very beautiful when large white

snowflakes slowly fell onto the ground. Alas, each snowflake carried a small negative charge. It caused a weak click in earphones if such a charged snowflake discharged our antenna. The click was much stronger if10, 20, or 100 snowflakes simultaneously discharged

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dedicated to the centenary of the first wireless contact of G. Marconi across the Atlantic Ocean.

There were used two antennas for short waves. One of them was an antenna of a Long Wire type. It was 55 meters in length, the top end of which was fixed to the mast of rescuers. The second antenna was a CB-dipole. Each wing of this dipole was 2,7 meters in

Ai- Petry Meteo

the antenna, or rather there was a constant crash from weak to a loud one in the earphones. During a strong blizzard, when the snow enveloped our antennas, it was almost impossible to work in the ether because of a loud crash in the earphones.

Snow produced an antenna current

When the blizzard was very strong, there was an atmospheric current between the antenna and the ground. The RF ammeter located on our ATU confidently registered this current. But the current was not so strong as in the spring 2001, when white clouds passed through our antennas. Snow caused a current near 10 milliamperes (reportedly to the RF ammeter of the ATU).

During snowfalls we did not observe a full stopping of radio reception as it was in the spring when a white cloud sat on our antennas. Certainly, it was difficult to work in the ether with strong crashes in the earphones. But a couple of days later we adapted to the crashes in our earphones. Dry snow did not strongly affected our work in the ether. Only damp snow hindered our work.

Damp snow attacks our antennas

Damp snowflakes seldom carried a negative charge. At contact with our antenna such snowflakes did not cause clicks in the earphones. When the snow was damp, there was a silence in earphones, however it was a deceptive silence. Damp snowflakes stuck to our antennas. Gradually the antennas became thicker and thicker in their forms, they looked like thick white exotic snakes.

So, damp snowfall dressed our antennas in a thick "snow sleeve" or a thick dielectric sleeve. Dielectric permeability of snow and especially damp snow is much higher than 1. Hence, this snow sleeve changed the electric length and input impedance of our antennas.

During damp snowfall the antenna parameters constantly changed while snow was sticking to antenna wires because the electric length and input impedance of the antennas depended on thickness of this snow covering. Almost constantly it was necessary to tune the ATU connected to each antenna.

Snow dancing and Antenna shaking

After some time of the damp snowfall the ATU could not tune the antennas. The antenna current "floated" at transmission mode, the reception was very bad.

Then one of us dressed warmly, took a long stick and went out to shake off the snow from antennas. After that the antennas were operable for some time again, up to the next sticking snow. As a rule, it was necessary to shake off snow from our antennas several times a day. But during strong snowfalls it was necessary to shake them almost each hour.

Snow Cloud is going

Near a Snow Cloud

Snake Antennas

There was a lot of snow on Ai- Petri plateau! It was necessary to "float" through that snow to our antennas standing up to belt in snow and in some place up to breast to beat the antennas with a long stick.

Soon snow was in pockets of overcoats, in footwear, in sleeves. At the unsuccessful strike, snow from antennas fell under the collar, in the nose and ears, in the mouth, covered the glasses. The man came back stuck round with snow like a big snowball and ran to our fireplace to warm himself.

Half an hour later our traces near antennas were snowed in. To shake off the snow from antennas it was necessary to make a new path again… again to go through snow up to belt.

Silent night

Certainly, we could shake off snow from our antennas only in daytime. At night our lantern gave us about several meters of good visibility in strong snowfall. It was unsafe to go at this time up to belt or up to breast in snow to any side from our shelter. Therefore, at night we did not work in the ether. Let me remind you, our radio station operated in the ether each night in the spring, 2001.

In the morning our antennas being stuck with snow bent almost to the ground or to be correct to the snow lying on the ground. Thickness of the snow, stuck to our antennas and coaxial cable of CB dipole, sometimes reached 20 centimeters in diameter. Each morning I thought with horror that our antennas would not sustain snow and break. It would be very difficult for us to restore them in conditions of constant snowfall. Metal mast, where upper end of LW antenna was tied, was covered with ice for the second day of our expedition. It was impossible to climb it.

The roof of the shelter was covered with ice and a thick layer of snow. It was impossible to climb this roof. Hence, it would be impossible to restore both the LW and the dipole antenna. When the expedition was over and we left the shelter, our antennas stayed hanging in their places…

Shaking_of_antennas

In the morning after snow

In the morning after snow in the plateau

In the morning it was impossible to tune the antennas covered with snow. Antenna current "floated", reception and transmission was unsatisfactory. Only after shaking the snow off it started to work. And the station EN100GM again was operating in the ether!

References

1. I.Grigorov.; Expedition to Crimea mountains www.mountain.ru

2. A.Blinushov. Expedition to mountains Zapoljar'ja. Hibiny - 2002. www.mountain.ru