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Early Forecasting Method of Local Area's Heavy Snow Weather by Meteorological Noises

Eikichi ASARI
Department of Electronic and Information Engineering,
School of Engineering, Hokkaido Tokai University,
Minami-no-sawa, 5-Jo 1-Chome, Minami-ku,
Sapporo, Hokkaido, JAPAN

I. INTRODUCTION

In northwest districts of Japan, concentrate heavy snow often strikes coastal region facing Northern Sea of Japan. Heavy snow obstructs ground traffics, and it causes all kinds of snow damages to social activities. The persons concerned in remove snow and other activities want to reliable forecast more than 10 hours before snowfall. The cold air mass as sources of snow come to Hokkaido from northeast region of Asia across Sea of Japan about 500km of distance. Meteorological satellites cannot find a small cumulonimbus as a source of concentrate heavy snow, the other side, usual radar's observale range are no longer than about 200km, and forecast periods are within 3 hours. this facts means that radars are not fit for early forecast of snow.

There are two methods of forecasting weather that causes heavy snow. One of them is "early warning" which detects its happening and approaching, and the other is "location" which examines the detailed nature when it is approaching.

Early warning itself is necessary to protect desasters and it is also necessary to use efficiently high-cost location system on a large scale like a radar system.

Heavy snow weather emits special electro-magnetic radiation that is noise waves. Therefore, if we examine and analyze them, we are able to give early warning for the weather at the distance of several times as far as radar indication area and it takes more than 24 hours to reach.

Author was able to develop and utilize this forecasting method by radio engineering. It compensates forecasting by satellites and radars for insufficiency.

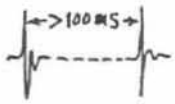
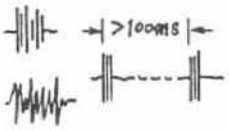
II. THE CHARACTERISTICS OF METEOROLOGICAL NOISE CAUSED BY SNOW

In a cold air mass, air currents carry water vapor from ground to high sky. Change water vapor into ice crystals, and mass of their in space called a cloud. Ice crystals grow into snowflakes with their fall down.

In this process, atmospheric electricity charges snowflakes, consequently spherics and precipitation noise produced by snowflake's collisions and breakups. Moreover, moving of cold air mass produces various kinds of noises by disturbances of atmospheric electricity. These noises called generally " meteorological noises", and they are effective information against forecastings of snow.

Table 1 shows a classification for detected noises and their conditions expressed as audio waves. According to observations in LF-HF bands, detected noises which classified as RMN (random MN) and PMN (periodic MN) make the back ground (BGN) of the whole noises which concern snowfall. Increasing of BGN tells approach of snow. According to observation at frequency of 3MHz, detection of the noises which classified as PIN (periodic IN), PINS (periodic IN short range) and MNS (MN short range) gives sure proofs of snow, and spherics (SPN) presages coming of concentrate heavy snow. Severe noises which classified as RN and CN often received with heavy snow, sometimes these noises called "precipitation noise".

Table 1 A Classification of Meteorological Noises

Noise's classification. Symbols and waveforms. (Firstly assort)	Detailed classify and notes (Secondly assort)
Generally classification: Random noise: RN (Random impulse train)	1. For random pulsate noises, preface "R-" to noise's symbols. For periodic pulsate noise, preface "P-" to noise's symbols. 2. For noises are instanteneous or short durations, suffix "s" to ends of noise's symbols. 3. For forming random impulse trains, preface "R" to noise's symbols. For forming periodic impulse trains, preface "P" to noise's symbols. 4. For forming some continuous train, suffix "C" to end of noise's symbol. For forming some discrete train, suffix "D" to end of noise's symbol. 5. For mixed noises, combine by /, more distinct one described to left side, for example as PMN/RMN.
Continuous noise: CN (Random wave or frequent impulse train)	
Impulsive noise: IN (Mono-impulse: Solitary impulses, each impulse has about one cycle) 	
Multi-impulses: MN (A block of randomized grouping impulses) 	
Periodic noise: PN (Periodic wave or periodic impulse train) PNC  PND 	
Special types: Spherics SP or SPN (Occur by kinds of thunders)	Periods of spherics are related to thunder's magnitudes and distances.
Static discharge noises: P-CN (Occur by atmospheric electric field and conductive constructions)	Periodic enveloped noises. The spectrums distribute like harmonics over HF frequency band.
Atmospheric turbulence's noises: CNS (Occur by atmospheric electric field's turbulences)	Continuous waves that energy condense to very narrow frequency interval. This noise observed in 20-30MHz of frequency band.

III. THE NORTHEAST REGION OF ASIA AND RADIO-METEOROLOGICAL WEATHER OBSERVATION

Generally, Japan's weather depends on weather conditions of the northeast region of Asia. About Hokkaido, weather contributed by conditions in Siberia, cyclones or front lines moving across the Sea of Japan to west coast of Hokkaido. There are only a few international weather observatory in Siberia, therefore we ourselves have to get weather informations. Meteorological noises are able to received at observe point over sea because the noises belong to lower region of radio frequency. According to analyze of characteristics of noises, it is

able to forecast of snow and rain before it begins more than 12 hours.

VI. DETECTION AND ANALYZING SYSTEM OF METEOROLOGICAL NOISES

Author detected and analyzed to noises at frequencies of LF-HF by special equipments system , and the measured quantities as follows;

mean value of noses, peak value of noises, spectrum of noises, wave form, characteristics of filtered noises, transition's records of noise intensity, number of impulses, periods of impulses, and other.

Fig.1 shows noise analyzing system that expressed as a block diagram, and this is a expression which is constructed by form of hardware in electronics.

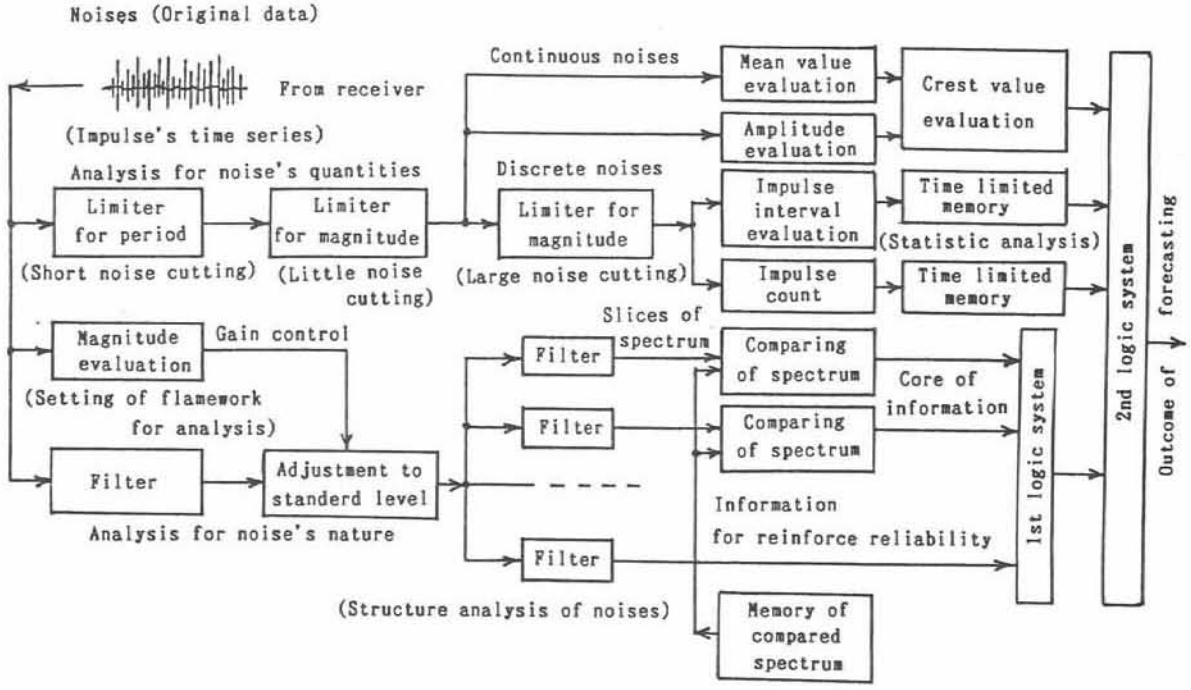


Fig.1 The Weather Forecast System by Meteorological Noises

If we can make all blocks by electronic circuits, the system functions a real artificial interigence apparatus for weather forecasting.

In the system, original noises correspond to raw materials the informations, therefore the system refines the informations for reinforcement of their usefullness. Two currents of information processings included in the system, one of them is analysis for noise's quantities, another is analysis for noise's nature. By the former current, we get crest value of continuous noises, number of impulses and each impulse's intervals. These quantities directly contributes to forecast of snow. The latter current means analyzing and processing system for noise's spectrum. The the system keeps important part of noise's spectrum produced by snow to the memory. In weather forcast, received noises compared with memorized noise's characteristics as shown in Fig.1, the 1st logic system discriminates coming weather by search the noise conformable to which type of memorized noise's spectrum.

Then, two currents of information combined and processed by 2nd logic system, as a result, we can make accurate forecasts not only concentrate heavy snow but also ordinary snofall.

Fig.2 shows examples of normalized spectrums of detected noise waves which produced by snow and non-snow weather. Two spectrums well contrasted each other with a point of contact at 800Hz. Fig.3 shows examples of noise's transitions.

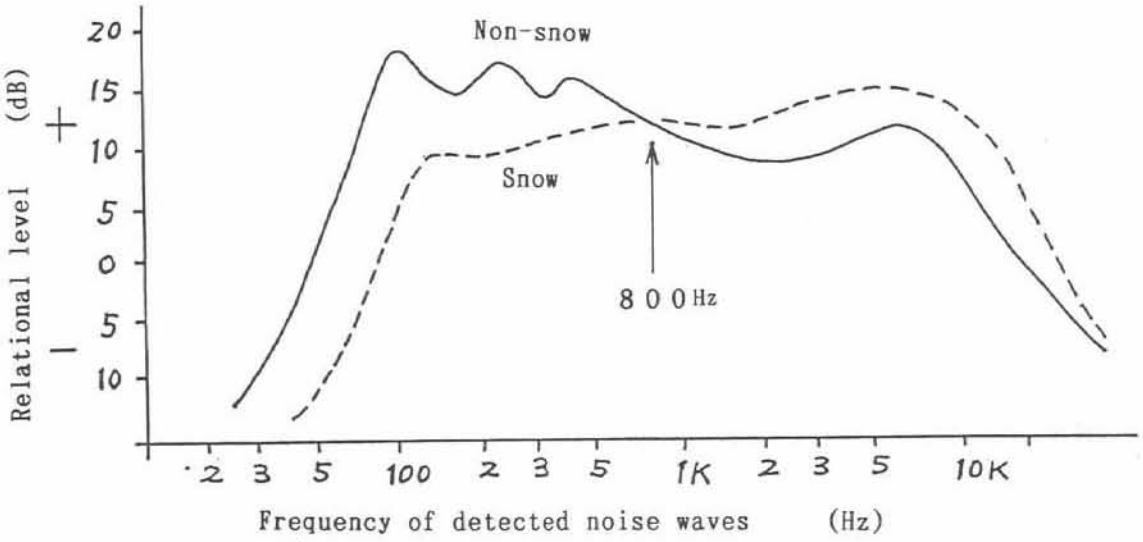


Fig.2 The Spectrums of Detected Noise Waves

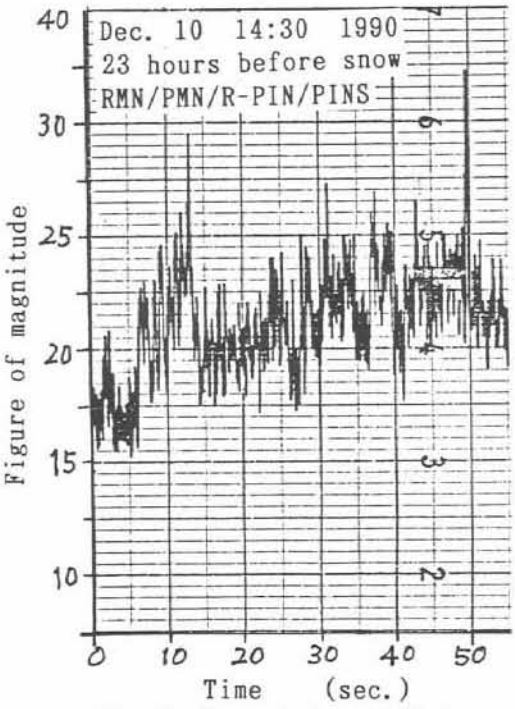


Fig.3a Transition of Noises

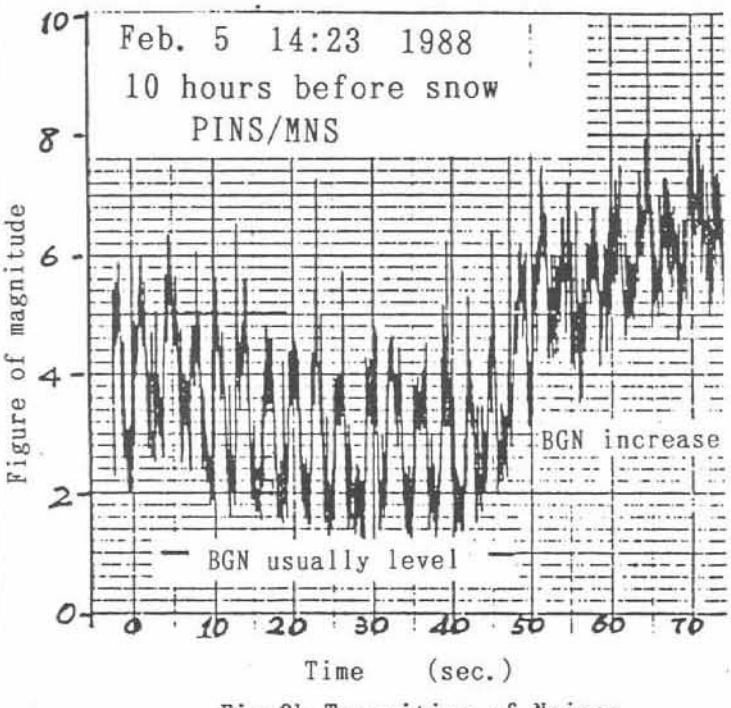


Fig.3b Transition of Noises

V. CONCLUSION

According to experiments in personal weather forecasting since 1975, weather forecasting method by observation of meteorological noises is very useful to early warning of local area's heavy snow and rain. This method is able to have a result of warning instanteneously at any time and it is complementary and supportable to other weather forecasting methods, so that when we combine them, it has the characteristic to raise overall reliability rapidly. The present time, author applying this method to agricultural weather forecasting for rain.