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On the use of infrasound sensors for low frequency atmospheric studies

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Most of infrasonic stations from International Monitoring System (IMS) of the Comprehensive Nuclear Test Organization (CTBTO) use absolute infrasound sensors associated with acquisition units dedicated to geophysics. These sensors measure ambient atmospheric pressure over a frequency bandwidth from DC to tens of Hz, including the entire infrasound frequency range. The reference cavity vacuum gives them an intrinsic thermal sensitivity much lower than that of differential infrasound sensors such as microphones. Experience shows that this is especially interesting when low frequency pressure measurements are needed.

Direct digitizing of such signals requires a dynamic range better than 145 dB over the frequency bandwidth of interest. Microbarometers were equipped with an additional output attenuating the very low frequencies with a simple first order high pass filter with a cutoff frequency of 0.01 Hz and a gain over its bandwidth of 20. This output has a dynamic range of about 108 dB easier to digitize. It is made from electronic components selected for their accuracy, their stability and insensitivity to environment. This is the "filtered output" which is generally used on the IMS.

More and more scientific studies for civilian applications focus on low frequency signals affected by this filtering. This presentation discusses how the use of this filtered output affects data quality in this frequency range and how it is possible to exploit them.

Microbarometer output stage has been modeled to estimate the noise induced by filtering and its influence on the infrasonic signals of interest. This presentation discusses how it is possible to compensate filter's influence to recover the "true" signals of interest. It explains how the operating principle of these sensors can minimize errors.

Three stations consisting in four sensors were set up in Mongolia in order to record pressure variations produced by the total solar eclipse of the 1 August 2008. For each sensor, the filtered and unfiltered outputs were recorded. This paper presents an analysis for each record. The temperature inside each sensor was also recorded. The influence of temperature on these measurements has been deducted.

The conclusion outlines the potential use of IMS infrasound measurements below the bandwidth of the sensor.