|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Principal Measurements | Meaning | | | Formula | Explanation | |
| Background Noise (Bn) | The sound pressure level (SPL) of a certain time window in a frequency range in the recording. | | | Root mean square (RMS) of the amplitude of the selected signal |  | |
| Signal-to-Noise-Ratio (SNR) | This ratio evaluates how much of the energy from the source signal stand out from the energy of the background noise. | | | SNR = 10log((Ey -Bn)/Bn | Bn is the background Noise, and Ey is the ratio of the energy of the test sound. | |
| Tail-to-Signal-Ratio (TSR) | The amount of energy in the reverberations after the time frame of the source signal. | | | TSR = 10 log((Et − Bn)/(Ey − Bn)) | Bn is the background Noise, and Ey is the ratio of the energy of the test sound, Et is the ratio of the energy of the tail echoes. | |
| Blur-Ratio (BR) | The distortion in the time dimension between the model and the observation sound, without taking into account the attenuation. | | | Bn: BR = Ex/(Ey – Bn) | Both variables are the amplitude envelopes of the experimental signal (Ex) and the model signal (Ey) normalized to 1, Bn is the background Noise. | |
| Attenuation(A) | The ratio in dB of the differences in SPL of the model and observed sound, reported as the observation divided by the model sound | | | A= Sm/Se | Sm is the model signal and Se is the experimental signal. | |
| Excess attenuation (EA) | The extra amount of attenuation from the predicted loss of amplitude by distance as a result of spherical spreading and atmospheric absorption. | | | EA = -20log(Kaf) -A | Kaf is a constant product of the mean difference between amplitude envelopes of the model and observation signal and A increases by 6 dB each time the distance between the microphone and speaker is doubled. | |
| Other Measurements |  |  |  | | |
| Signal-to-Signal-Ratio | The distortion rate between different samples of sound in the same distance. | | | SSR = S2/ S1 | S2 is the second type of signal, S1 is the first type of signal | |
| Signal Consistency | The attenuation variation of a signal by changes in the propagation in equal time segments. | | | SC = Sx-Csd | Sx is the segment tested, Csd is the standard deviation from the maximum cross-correlation coefficient of amplitude envelopes from the observation and model signals in all segments. | |
| Spectogram Distortion | The acoustic degradation over distance in time and frequency. | | |  | Calculates the values of the cross-correlation of the spectrograms from the observation and model signal. | |
| Mean/Max Amplitud Difference | The difference between amplitudes of the model and observation signals. | | | MAD = Ay – Axe – Bn | Ay is the mean or max amplitude of the model signal, and Axe is the amplitude of the model signal. | |
| Changes in Modulation | The percentage of the loss of frequencies (modulation) by the transmission. | | | CM = (Obw/Mbw)\*100 | The result of dividing the bandwidth of the observation signal (Obw) by the bandwidth of the model signal (Mbw) and multiplied by 100. | |
| Change in Spectral Continuity | The changes in frequency contours across time windows, in which the key difference is that Weiner entropy measures variation in Y axis, and the spectral continuity is on X axis. | | |  | T is the selected threshold for the analysis, in which each frequency (fi) in each time window (ti) has their contours values of duration and frequency range calculated and their difference from the other close time window, WE is wiener entropy  MF is the mean frequency. | |