Ionik network based on a low cost scintillation monitor for continuous monitoring of ionosphere

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The Global Navigation Satellite System (GNSS) signal is an important tool for monitoring the ionosphere. The ionosphere under low latitudes has a particular dynamics with generation of plasma irregularities bubbles. This phenomenon affects the communication near the geomagnetic equator region. The Brazilian territory is the major one in South America, located in the eastern part bordering the Atlantic Ocean; it occupies almost 50% of this region of the continent. This expansive territory is mainly belonging to the low latitude and equatorial regions and therefore is directly affected by the ionospheric irregularities. This large territorial size is a challenge for monitoring and mapping the ionospheric characteristics and consequently its effects for GNSS users, more specifically for aviation and precision agriculture. In the past two decades the advances in semiconductor technology resulted in microelectronics systems more integrated, which also resulted in a low-power consummation, substantial dimension and weight reductions, with increasing of reliability and processing capability. In this work it is presented the development of a low cost scintillation monitor developed under requirements of low complexity and simple interface. This monitor does not need computer interface for operation and the acquired data is transmitted by internet to a remote server that will process and store the data. Based on the measurements of this monitor, a series of scintillation parameters like, scintillation index S_4, decorrelation time τ_0, fading coefficients α and μ, besides positioning. The first station was deployed at São José dos Campos (23.21^o S, 45.95^o W, -17.5^o dip latitude, declination 21.4^o W), São Paulo state, on November 2016 and the results were validated against commercial scintillation monitors that are available in the market. The validation results showed a good agreement between the prototype developed and the commercial monitor, including for strong scintillation regime. That was the first phase of the project where the concept of a low cost scintillation monitor has been successfully proven. The second phase of the project is the network test. After, the next stage involves the installation of initial nineteen stations distributed over the Brazilian territory with planning of expansion for more thirty units. These monitor stations are also expected to integrate the CIGALA/CALIBRA network and the corresponding database. Finally, in the last stage it is planned to have a system for real time monitoring, imaging and warning concerning bubble structures that may affect GNSS applications.