

## **DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)**

Our knowledge of the Earth's atmosphere is derivative of discoveries in physics, chemistry, mathematics, and recently also in computer science. However, the core of each research process are observations, these linked with atmosphere are missing. It seems that number of automatic weather stations within a frame the World Meteorological Organization (WMO) or in public-private partnership of the Citizen Weather Observer Program (CWOP) are sufficient enough to fully express atmospheric state, or at least in the lower troposphere which is most turbulent environment. But it isn't. Ground observations are mostly collected over lands, but leave large data gaps in hard-to-reach regions, especially over water bodies. They also have one fundamental flaw – observations of this kind are representative only for the first few meters above the surface.

Number of space-based remote sensing techniques exist that allows to monitor a state of the troposphere in visible as well as infrared bands. Satellite images from geostationary orbits enables to evaluate moist convection that leads to thunderstorms. Observations derived from passive microwave radiometers, which measure radiation magnitude of different atmospheric layers allow to create sort of tropospheric profiles, however quality of these profiles are low.

For decades the vertical atmospheric structure could be only investigated by weather balloons. In radiosoundings instrument, a sensor is attached and carried by a balloon filled with helium or hydrogen that lifts the device up through the atmosphere when atmospheric parameters are measured with high accuracy. The first regular radiosonde launches have been initiated in the XIX century, and ever since these data were used as a core for forecasting. The radiosonde network expanded over highly industrialized countries. Still, such data can be sparse in developing countries or uninhabited areas.

A technique that brings a new perspective to profiling of vertical atmospheric structure is radio occultation. It is based on a bending of microwave signals that are transmitted by GPS satellites and received by another satellite during its setting or rising behind the Earth's limb. The magnitude of the distortion is proportional to the air density along the propagation path between transmitter and receiver. Due to high quality orbits and precise atomic clocks on-boards radio occultation and navigational satellites, the signal bending can be measured in microradians, excluding the lower troposphere part up to 5 km of altitude. From the point view of human activity, this part of the atmosphere is the most important, because it is a place of origin for the most dangerous weather phenomena. Thus, high quality retrievals are essential to avoid economic losses and improve general public safety.

The reliability of radio occultation data within the first 5 km of the troposphere requires in-depth studies and simulations as we are approaching a new era in radio occultation technique. In 2016 new series of satellites equipped with high frequency, multi-GNSS receivers will be launched to the orbit in follow-on COSMIC-II mission. Within this proposal, we will conduct propagation simulations and such signal received at radio occultation satellite will be used to determine atmospheric profile. In the long-term perspective, this will help to develop novel methods in processing of radio occultation data using new GNSS carrier phase measurements to enhance our understanding of global weather phenomena.