New opportunities for ionospheric research and applications made possible by modern ionosondes

Since the era of the discovery of the ionosphere, ionosondes have been the primary instrument for its study. To this day, a worldwide network of ionosonde stations is in operation for both the scientific investigation of the ionosphere and as the basis for various operational applications. Despite this long history, the ionosonde technologies keeps evolving and new capabilities are always being added to the newest digital ionosondes. In this presentation, we will discuss various ways in which these improvements to the instrumentation open up new possibilities for research and way to investigate and monitor phenomena that could previously not be studied.

One significant improvement is that the implementation of new wave-forms for the transmitted pulses, together with the interferometric field of receiver antennas, allows to produce high quality ionograms in a shorter period. Shortening the ionogram sounding time is very important because it allows to either use the freed time for other measurements, or to increase the cadence of ionograms. Increasing the cadence of ionogram soundings unveils a variety of phenomena on shorter time-scales that would otherwise not be detectable.

Another area of new opportunities comes from the precise synchronisation of multiple ionosondes. This not only allows to produce oblique ionogram traces, effectively adding a virtual observatory in between two ionosondes, but also allows for specific sounding operation not possible with individually operating sounders. We will discus how these improvements to the soundings methodologies allow the study of transient events like TIDs and sporadic layers.