**Mid-point evaluation report of the PWING Project**

This 5-year project aims at a study of dynamical variation of particles and waves in the inner magnetosphere using ground-based network observations. It represents an important element in the investigation of the dynamics of our nearest space environment: Earth's ionosphere, magnetosphere and Van Allen radiation belts. The research subject of the PWING project also has practical aspects linked to the safety of an increasing number of assets placed on the Earth's orbit. Telecommunication, navigation and Earth observation spacecraft but also human crews of astronauts can be put in danger by the varying levels of hard radiation in space, represented mainly by variable fluxes of energetic particles.

The PWING project proposes and effective strategy of continuous monitoring of physical phenomena which are linked to the variations of space radiation. These phenomena have been carefully selected in terms of their importance but also in terms of their observability on the ground. This selection lead the project team to setting up measurements by fast auroral cameras, induction magnetometers, riometers, and magnetic loop antennas. The success of the project therefore relies on deployment of an appropriate number of these different scientific instruments at different longitudes in the high latitude sector. Here the energetic particles from the Earth's magnetosphere penetrate to the ionosphere and atmosphere where their effects can be observed from the ground. Similarly, electromagnetic waves which influence radiation levels in space via wave-particle interactions can also penetrate through the ionosphere into the Earth-ionosphere waveguide at high latitudes. Good longitudinal coverage of these ground based measurements is an important positive factor. The data collected in the frame of the PWING project can be then coordinated and combined with other remote ground-based measurements by the SuperDARN radar and by GNSS receivers, but also with in situ spacecraft observations.

The project started in 2016 and my assessment is that it runs extremely successfully. The phase of deployment of the instrumentation to 9 different high-latitude stations is finished and all instruments are in full operation, with an exception of the Nain station in Canada where the instruments are deployed but the operations are delayed, waiting for installation of a power line. These instrumentation activities resulted in an unprecedented set of operational equipment all around the globe. The project leadership succeeded in all aspects of complex logistical problems linked to this phase of the project. Some previously installed instruments have been included in the project but a major part of the instrumentation is new. The data are now routinely collected and placed on different websites to allow their scientific exploitation through the IUGONET project or through the ERG Science center.

The scientific output of the project in its midterm is very impressive. It is reflected by more than sixty peer reviewed papers which have been published during the term of the project from

2016, mostly in 2017 and 2018. All these results were published in reputed international scientific journals (Nature; Science; Geophys. Res Lett.; J. Geophys. Res.; Earth, Planets and Space; Radio Sci.; J. Atmos.Solar- Terr.Phys.; J. Disaster Res.). This impressive list of publications clearly demonstrates the highest quality of the project and also the quality of obtained measurements which were used in these papers.

In conclusion, my impression from the results of the PWING project during 2016-2018 is extremely positive. I highly appreciate the longitudinal coverage of the measurements and quality of the data, which is reflected by an unusual number of high-impact publications in the best journals of our field. I therefore strongly recommend further continuation and full funding of this promising project.

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