VÄISÄLÄ PRIZE

Minna Palmroth

Minna Palmroth (b. 1975), professor at the Finnish Meteorological Institute and the University of Helsinki, is engaged in studying the Earth's upper atmosphere. She and her team have developed the world's first accurate weather simulator that covers the whole of the upper atmosphere and enables them to study the effects of turbulence on large-scale dynamic processes in the magnetosphere and vice versa. This simulation program run on a supercomputer is numerically highly resource-intensive, and the research has aroused considerable interest internationally. It has twice received funding from the European Research Council (ERC).

At Minna Palmroth's instigation the Meteorological Institute set up an operative Space Weather Service which functions as part of its general weather services. The system relies on the simulation model developed by Palmroth in her doctoral thesis combined with the institute's magnetic and auroral measurement data. Operative space weather services are currently concentrated in the space organizations of the major powers undertaking space research, but their importance to smaller nations and for technologies lying outside the space sector is increasing rapidly. One such field of research is positioning technology.

Finland and its Meteorological Institute are at the forefront of the development of local space weather services internationally and are very closely networked with international actors in this field, partly as a consequence of Palmroth's networks and activities.

Minna Palmroth is also an active participant in discussions of social matters and has put much effort into the popularization of science, and particularly of space research, for the benefit of the general public. She has served as both an expert advisor and an evaluator with respect to European Union programmes.

"I can't imagine a world that isn't based at some level or other on information obtained from research," she replied when asked about her own world view, and hurries to point out that alchemy was still taken seriously as a topic of research in the 17th century but that as knowledge in-

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creased people came to understand that its scientific basis was unsustainable.

Minna Palmroth is fascinated by the fact that the impossible can prove to be possible. When she first put forward the idea of a model that provided accurate simulations of events in the upper atmosphere, her Vlasiator, her research colleagues said it was impossible: the largest computers in the world would not have sufficient capacity. That was in 2007. She nevertheless began coding on the strength of her first ERC grant in spite of their negative reaction, as she reckoned that, in accordance with Moore's Law, the processing capacities of supercomputers would at least double over the three years it would take her to construct the code. And that is what happened. By the time the code was ready, processing capacities had grown so much that suitable computers were to be found even in Finland.

A 2-dimensional model is now available and a 3-dimensional one is under construction. The latter will, of course, be much more accurate, but it will also require considerably more processing power.

Space physics is a form of plasma physics, and it is the complexity of the behaviour of plasma in different situations that makes both plasma and space physics so challenging.

The resolution of the simulation model developed by Palmroth's team is extremely good, and for that reason it can reveal cause-and-effect relations that cannot be detected by means of satellites, for instance, because they only study individual points. "Our model is so accurate that it could be compared with a system of satellites placed at intervals of 300 kilometres. I really believe that we are rewriting space physics," Palmroth claims.

Väisälä Prize is awarded annually to 1–3 already distinguished scientists in the active parts of their careers.