

Forecasting hazardous geomagnetically induced currents for Spanish critical infrastructures

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In the last decades, our society has become more interdependent and complex than ever before, being highly dependent on relevant technological structures, such as communications, transport, or power distribution networks. Indeed, solar activity and their associated events, such as solar flares and coronal mass ejections, may provoke disturbances, interruptions, and even long-term damage to our modern critical infrastructures, with drastic social, economic and even political impacts. These phenomena variate the natural electromagnetic fields and can cause geomagnetically induced currents (GICs). Unfortunately, these phenomena and their effects are not yet well understood, and their forecast is still in the early stages of development.

This training project, that uses a multidisciplinary approach, aims to understand and forecast, in an unprecedented way in our country, the effects of space weather on the Earth's surface, and particularly the GICs that flow in long earthed conductors like wired communications, train lines, or power transmission networks. The ultimate goal is to provide a real-time prediction of the GICs from extreme geomagnetic storms on the Spanish critical infrastructures. To achieve this, we use real-time warnings of solar storms from the NASA's ACE space probe at the Lagrange point 1 in space, which leads to disruptions on Earth some 30-45 minutes later. The student will learn and use advanced deep-learning techniques to study how to use data from ACE to forecast geomagnetic field variations as a needed and preliminary step to provide an early warning system.