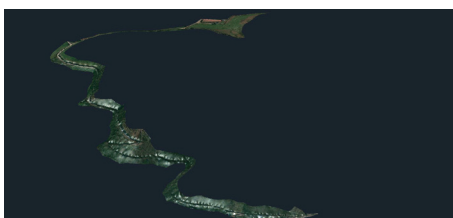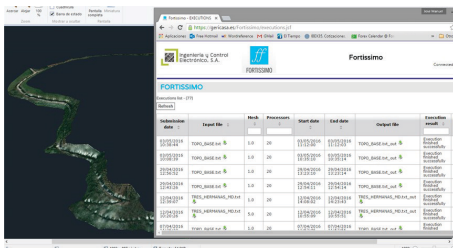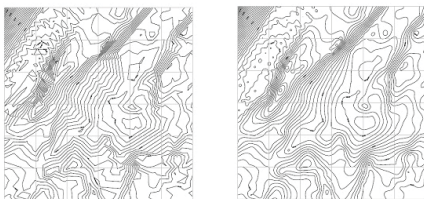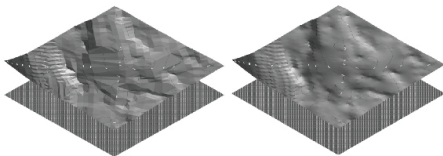# Fortissimo Success Story

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FORTISSIMO

# HPC-Cloud-based map interpolation for civil engineering

**Fortissimo Experiment Facts:**
- Segment: Renewable Energies
- Application Domain: Geographic Simulation
- Application: In-house Code



## The Company

Sisener Ingenieros, a Spanish SME, is an engineering company whose main market is in energy projects, especially in the field of renewables. Projects undertaken by Sisener need accurate topographical information not only to determine the earthworks to be performed, which depends on intrinsic information, such as levels, slopes and volumes, but also for the overall design of the installation. The work involved in obtaining topographic information from surveys and converting it into a usable format is both time-consuming and expensive. Ingeniería y Control Electrónico (Ingecon), a Spanish SME, develops and sells software for managing cartographic data.

The use of accurate maps is essential in the optimum design of substructures comprising earthworks (where the selection of appropriate materials is important), drainage (including prefabricated components, such as piping) and equipment to satisfy the relevant requirements of international standards. Globally, several tens of thousands of maps need to be analysed each year in the wind farm area alone. The objective of this experiment is to demonstrate how Cloud-based HPC can be used to convert and manage cartographic data across a range of formats and resolutions in order to improve the design process of wind farms and to reduce overall costs.

## The Challenge

Most civil engineering projects need accurate cartographic data during the tender, design and implementation phases. Such data is a significant component in the overall costs and duration of a project. In certain parts of the world this data may even not be available. All civil engineering projects require a resolution of 1 metre or even finer. This demanding resolution can be achieved through the application of Kriging interpolation to a map with coarser resolution. The original map could be an existing one or one generated at a lower cost and in shorter time whose resolution could then be increased by means of such interpolation. However, Kriging interpolation is very numerically intensive. Its use in the design of typical installations requires HPC. The challenge facing this experiment is to port Ingecon's Kriging interpolation software to run on an HPC system and to make it available on a pay-per-use SaaS platform to civil engineering companies, particularly SMEs. For the software vendor this would be a scalable way to offer a new service to customers. Civil engineering companies would save time and money because data acquisition times could be reduced and expensive data gathering could be replaced by cheaper and quicker numerical interpolation.

## The Solution

Ingecon already uses Kriging interpolation for coarse maps with a typical resolution of 80 m. The software to do this runs on a powerful PC. To obtain the required resolution of 1 m, the computational load becomes 80x80 times greater. HPC is needed because a PC is no longer able to tackle such problems. Ingecon has ported its interpolation software to run on an HPC system via a PC-based GUI which supports both data input and output. The use of HPC has reduced the processing times for wind farms to a few minutes and for other projects requiring greater resolution to a few hours. Furthermore, it has moved such calculations away from the desktop by putting them on an HPC system. This enables engineers to work on other tasks while the interpolation is taking place.

**Fortissimo Experiment Partners:**
- Sisener Ingenieros S.L. (End-user)
- Ingeniería y Control Electrónico S.A. (HPC Expert)
- CESGA (HPC Provider)

**More Information:**
www.fortissimo-project.eu
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## The Benefits

Ingecon sees this as a major opportunity to provide a new service not only in the design of wind farms, but also in other application areas where cartographic data is used. For a company like Sisener, the costs of a yearly software licence and a powerful enough computer to perform the necessary computations are prohibitive. However, a pay-per-use service where computing costs and software licensing are available, would be a very attractive proposition for all parties.

The major benefit for Sisener is a reduction in the cost of map data. Through the use of interpolation, as opposed to buying raw data, the cost of a typical design can be reduced from €4k to €2k taking staff effort and computing costs into account. A company like Sisener will be involved in around 25 such projects per year, so annual savings amount to €50k.

Ingecon already has two further companies testing this solution and expects to engage 10 companies by the end of 2016. Based on data from Eurostat, there are over 350,000 potential customers across the EU for the proposed service from Ingecon of which 40,000 are based in Spain. Ingecon estimates a yearly income from this service at €200 per customer with 200 customers by 2018 and a 1% share of the European market (3,500 customers and a revenue of €700,000) by 2020.

## The Fortissimo Project

Fortissimo is a collaborative project that enables European SMEs to be more competitive globally through the use of simulation services running on a High Performance Computing cloud infrastructure. The project is coordinated by the University of Edinburgh and involves 123 partners including Manufacturing Companies, Application Developers, Domain Experts, IT Solution Providers and HPC Cloud Service Providers from 14 countries. These partners are engaged in 53 experiments (case studies) where business relevant simulations of industrial processes are implemented and evaluated. The project is funded by the European Commission within the 7th Framework Programme and is part of the I4MS Initiative.