

natural power 

ForeSite™

forecasting for wind farms

in partnership with :

meteoblue®
weather ☼ close to you

clever with energy™

don't rely on hindsight

let Natural Power give you ForeSite™

UTILITY COMPANIES & INDEPENDENT POWER PRODUCERS DEMAND ACCURATE WIND FORECASTS. WIND FARM OWNERS NOW HAVE THE ABILITY TO ADDRESS TRADING / DISPATCH RISKS AND TO OPTIMISE DOWNTIME SCHEDULING. FORESITE IS A FORECASTING SERVICE FOR WIND FARMS, PROVIDING A SITE SPECIFIC ENERGY FORECAST FOR ANY WIND FARM WORLDWIDE ON A DAILY OR HOURLY BASIS.

We deliver forecasting services in exclusive partnership with **meteoblue®**, one of the world's leading independent forecasters who operate their own global weather model which has proven to consistently deliver top quality forecasts for any location across five continents. The resolution of the meteorological model over regions of interest is often comparable to that of the local meteorological service, but with a much longer prediction horizon, thereby providing the most powerful forecasts available in the region. This best-of-breed meteorological forecasting is merged with Natural Power's industry-leading practical wind farm consulting and management services, bringing knowledge from the ground up to improve the accuracy and relevance of forecasts for individual wind farm sites.

ForeSite forecasts can be offered on a daily or hourly basis. Hourly forecasts give the expected instantaneous production of the wind farm from 6 hours up to 7 days ahead as required. Daily forecasts give the total expected energy production of the wind farm for the complete day following the day in which the forecast is made, up to 7 days ahead, as required.

ForeSite provides forecasts in BASIC, STANDARD or ADVANCED.



what the wind will do in the next hour, for the rest of the day, tomorrow and the next 7 days

the difference is CLEAR

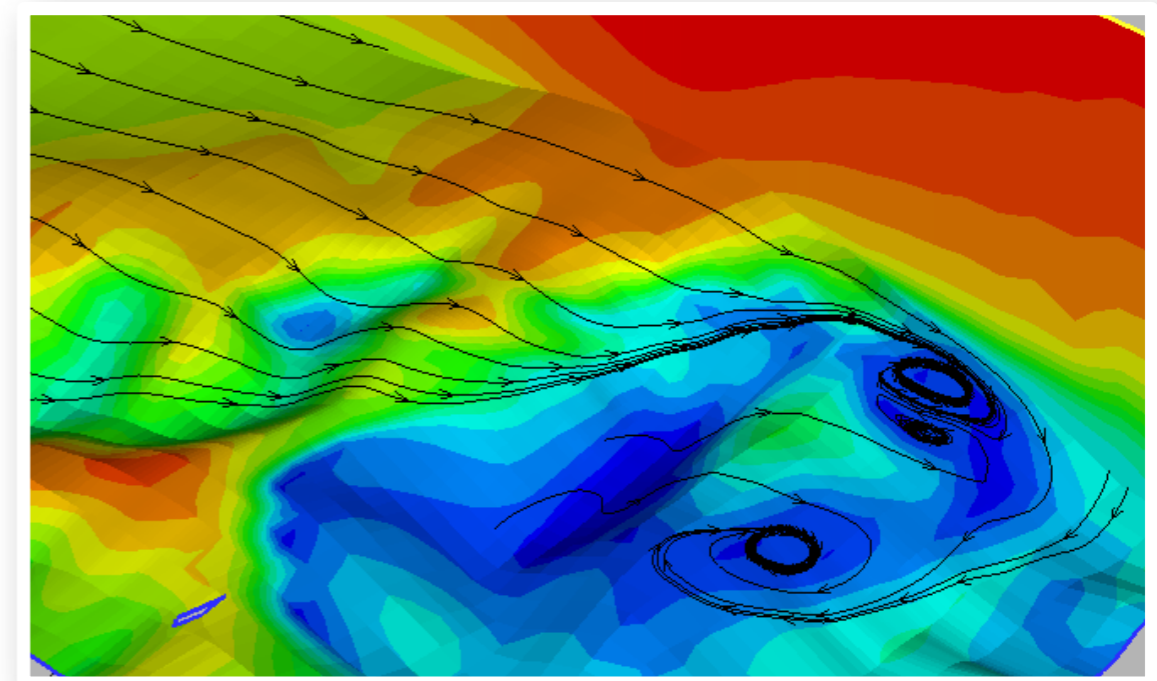
WIND FORECASTING IS PROVIDED BY MANY ORGANISATIONS ACROSS THE INDUSTRY. WITH **ForeSite** THE DIFFERENCE IS CLEAR. OUR MODELS ARE BASED ON NMM TECHNOLOGY ON WHICH WE APPLY REAL-TIME DOWNSCALING BASED ON TOPOGRAPHY AND ROUGHNESS TO REDUCE LEARNING TIME AND FURTHER REFINE ACCURACY. IN ADDITION WE COMBINE OUR FORECASTS WITH **Melogale**® WHICH INTEGRATES ON-THE-GROUND OPERATIONAL INFORMATION, SUCH AS PLANNED DOWNTIME, IN TO THE POWER FORECASTS.

Modelling science

ForeSite models are based on the NMM (Numerical Meso-Scale Modelling) technology, which enables the inclusion of detailed topography (meso-scale = 20-1 km; micro-scale = < 1 km), surface cover and the initial data conditions (measured at the start of the calculation) into the modelling process.

Computational Fluid Dynamics (CFD)

In addition to the fundamental model described above we are able to deploy VENTOS® - the industry leading CFD model - on ForeSite projects to provide real-time downscaling to further improve accuracy and reduce learning time. The downscaling process consists of correcting a large scale local meteorological model forecast to take into account the local conditions of a site, including topography and surface cover. This method is particularly powerful in complex flow environments which greatly affect the wind flow behaviour. Proven experience in complex flow studies leads Natural Power to apply the latest statistical and physical modelling methods, resulting in significant gains in the accuracy of wind speed predictions.



Real-world experience

We are a leading independent consultancy with expertise of the entire wind farm development and operations cycle spanning from site prospecting and resource assessment, through to construction and asset management. We have managed the construction of over 500 MW of wind farm projects, provide asset management services for over 300 MW, and our Due Diligence and resource assessment services have been applied to over 15 GW of projects in 14 countries worldwide. Our quality of work is demonstrated by our 100% successful consenting record on more than 2000 MW of client projects and we are recognised by major banks and financial institutions as a robust and thorough due diligence provider.

CHOOSE YOUR LEVEL OF SERVICE

ForeSite | basic

This level of forecast includes :

- Forecast given for complete wind farm site
- Basic downscaling model without topographic and wakes correction
- Typical accuracy NMAE*: 17%
- Typical learning time*: 20 days

(NMAE - Normalised Mean Absolute Error. This applies to power and corresponds to the average error divided by the nominal power.)

ForeSite | standard

This level of forecast includes :

- Forecast given for complete wind farm site
- Advanced downscaling model where site topography and roughness is modelled using VENTOS® micro-scale CFD model to further improve accuracy and reduce learning time
- Typical NMAE*: 14%
- Typical learning time*: 10 days

ForeSite | advanced

This level of forecast includes :

- Forecast given for complete wind farm site, and individual turbines (if required)
- Anticipated turbine availability is integrated into forecast**
- Historical availability-corrected data is used to refine accuracy**
- Advanced downscaling model whereby site topography, roughness is modelled using VENTOS micro-scale CFD model to further improve accuracy and reduce learning time
- Tree cover (where relevant) is included in CFD model
- Turbines wakes are modelled
- Typical NMAE* < 12%
- Typical learning time*: 10 days
- Monthly report is provided giving statistics on forecast accuracy
- Guaranteed accuracy: daily energy forecasts with an NMAE > 17% are not invoiced**

ForeSite | special projects

Natural Power and **meteoblue** are able to offer a range of forecasting services on any projects outside of the above remit. Please do get in touch for more information.

*Typical NMAE and learning times are based on tests carried out on several operational wind farms and on tall masts. The actual forecast accuracy achieved on a particular site depends on many factors and therefore these numbers are given as an indication only and no warranty is given as to whether these can be achieved.

** Requires Natural Power Melogale asset management service

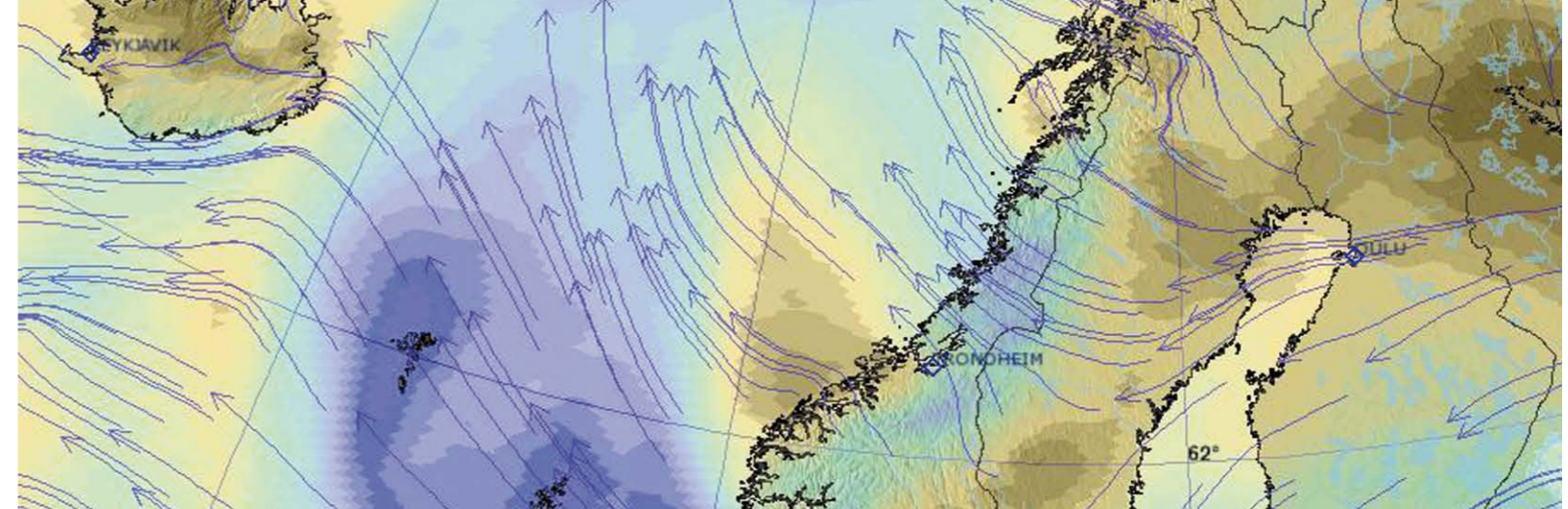
meteoblue®

weather ☀ close to you

meteoblue DELIVERS LOCAL WEATHER FORECASTS OF HIGH QUALITY, EASY-TO-ACCESS AND WITHOUT ANY ADVERTISING. PREMIUM CONTENT, PRODUCTS, AND SERVICES ARE DESIGNED FOR BUSINESSES THAT DEPEND ON THE WEATHER AND FOR INDIVIDUALS WITH A SPECIAL INTEREST IN METEOROLOGY, AND ARE AVAILABLE AT COMPETITIVE PRICES. FOR THE GENERAL PUBLIC meteoblue OFFER A FREE HIGH-RESOLUTION WEATHER FORECAST SECOND TO NONE.

Initially hosted at Basel University, **meteoblue** forecasts became quickly popular with scientists and the public with a specific interest in meteorology, including mountaineers, (hobby) pilots, and astronomers. The company was founded in 2006, to ensure reliable operational forecasts and better serve the industry, and an independent commercial computing infrastructure and product development was established. Since early 2007 the **meteoblue** computes it's own high resolution forecasts for Europe, Africa, South America and Southeast Asia, and North America, and uses further proprietary downscaling methods to localise forecasts in other areas. **meteoblue** offers detailed diagrams, maps and movies of these models worldwide, as well as downscaling and postprocessing services such as wind forecasts at several levels, atmosphere profiles and archive analysis.

Starting in May 2008, **meteoblue point™** offers local forecasts for more than 5 million places worldwide, using proprietary modelling to generate locally adapted forecast for surface and atmosphere. Through the introduction of SPOT™ technology, **meteoblue** became the first supplier worldwide capable of showing local weather probabilities in graphical overview for every forecast location.

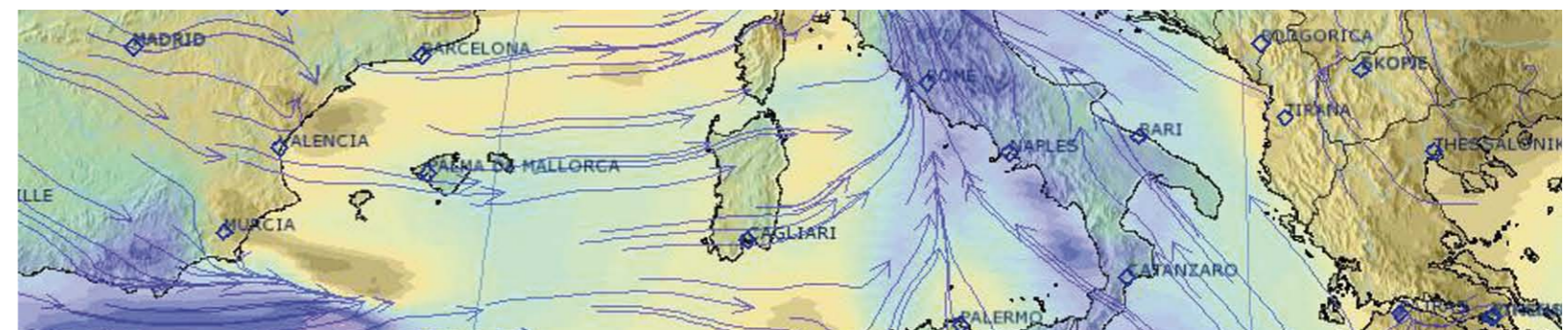


Core technology

The **meteoblue** weather forecasting system is fully automatic. It is based on the NMM (Numerical Meso-Scale Modelling) technology, which calculates forecasts for complete “domains” (areas) within a detailed spatial resolution (meso-scale = 20-1 km; micro-scale = < 1 km) for a total of 55 atmosphere layers simultaneously. **meteoblue** models produce approximately 400,000 forecast areas places in Europe, and another 500,000 places each in South America, North America, Southeast Asia and southern Africa. The initialisation and the forecast in other regions are 0.5° resolution. For local forecasts, proprietary downscaling methods are used, which take into account factors such as the atmospheric layers, fluid dynamics, and exposition.

The model accuracy is superior to the classical station-based forecast and to other models. **meteoblue** models can therefore be used in areas where the economical use of weather forecasts was so far not possible, e.g. surface water discharge forecasts, weather route planning, solar energy prognosis as well as for local wind or precipitation forecast in mountainous and remote areas.

meteoblue calculates it's own meteorological forecast models several times a day, and has created an comprehensive archive these forecast, which is available for site prospection, ground truthing and model tuning. ForeSite accesses **meteoblue** forecasts for every place in the world, and uses several parameters including surface and atmospheric layers for forecast improvement.

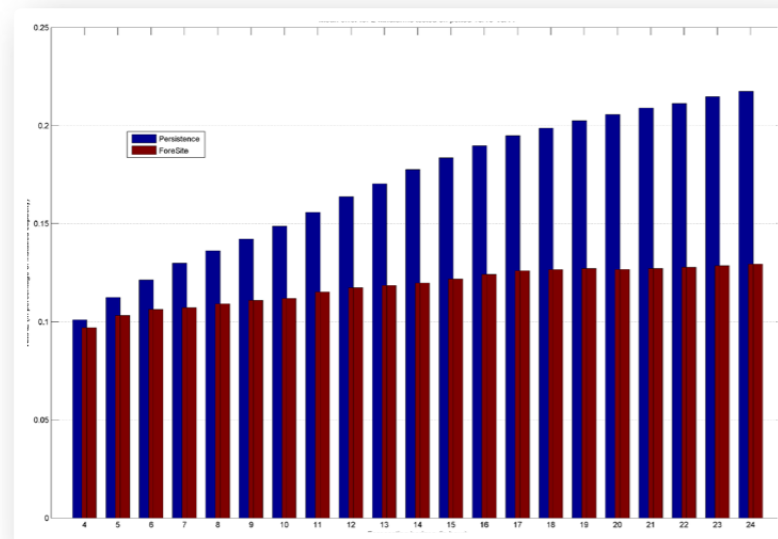


QUALITY OF DATA

ForeSite HAS BEEN DEVELOPED WITH QUALITY OF DATA AND RESULTS AT THE FOREFRONT OF ITS DESIGN.

ForeSite delivers power predictions with a mean error (on hourly basis) below 15%, and often below 10% of actual for the following day. A sample dataset comparing ForeSite forecasts to actual power production over a period of 2 weeks in 2009 on three wind farms in Europe showed mean error in forecast to be less than 6% for the next one hour period. Forecasts between 10 and 24 hours ahead have less than 13% error. These ratios have been confirmed over more than 12 months of testing.

ForeSite is superior to Persistence, the baseline method of wind forecasting which relies upon current conditions to forecast future weather (see graph below). Persistence achieves comparable results for the first 3 hours of the forecast; from then 4th hour, the mean error of persistence rapidly increases to above 20% within 20 hours, whilst ForeSite forecast the power generation with 12% error or less up to 24 hours ahead. With Foresite, power forecast error can therefore be reduced by half within 24 hours, compared to persistence.



YOUR NEXT STEPS

TO PROGRESS YOUR **ForeSite** FORECASTING PROJECT WE WILL NEED THE FOLLOWING INFORMATION. DATA FEEDS REQUIRED CAN BE PROVIDED BY EMAIL, FTP OR HTTP.

ForeSite | basic

We will require the following information :

- Ongoing data feed of 10-minute or hourly production data for the complete wind farm, corrected for turbine and grid availability
- Coordinates of wind turbines

ForeSite | standard

We will require the following information :

- As per BASIC plus :
- Good-quality scanned 1:25000 background map, colour, 300 dpi minimum, covering the site (including reference mast locations) and surrounding 8 km.
- Topographic height data for an area covering the site, reference mast locations and surrounding 8 km. This should be either in ascii XYZ format, WAsP *.MAP, or other recognised format.

ForeSite | advanced

We will require the following information :

- As per STANDARD plus :
- Turbine positions and turbine types of adjacent projects, if any
- Turbine type and variant, including hub heights and surveyed positions
- The application of Natural Power's Melogale wind farm analysis tool

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