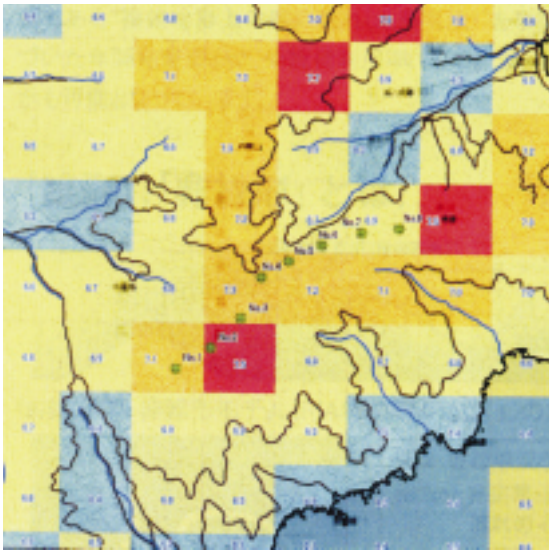
RIAM-COMPACT

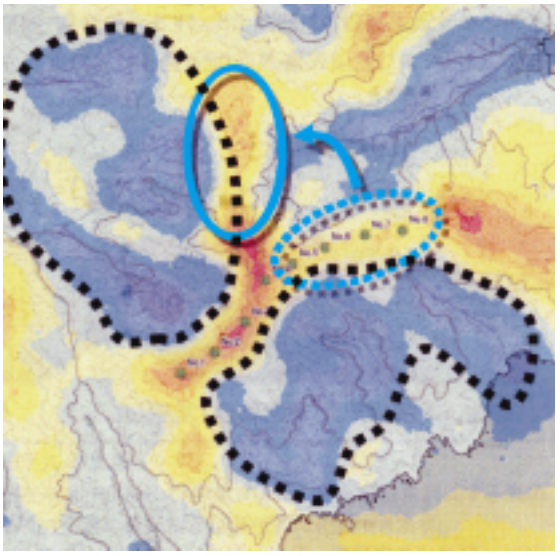
Non-stationary, Non-linear Wind Synopsis Simulator [**RIAM-COMPACT® Natural Terrain Version**]

Creating reciprocal linkages between Computational Fluid Dynamics (CFD) and Geographical Information System (GIS)

Support for wind turbine installation planning
(Distribution of wind speed at the wind turbine hub-height)



NEDO wind synopsis map



Results from RIAM-COMPACT® Natural Terrain Version

Kyushu Electric Power Co., Inc. group
West Japan Engineering Consultants, Inc.
http://www.wjec.co.jp/

Venture corporation initiated from Kyushu University, Japan
RIAM-COMPACT CO., LTD.
http://www.riam-compact.com/

Develop the new GIS field
ENGIS Environmental GIS Laboratory Co., Ltd
http://www.engisinc.com/

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Key factors are "animation display" and "rigorous project evaluation"

The effective use of wind power energy (natural energy) is now attracting attention. In Japan, the number of wind power generation facilities has been rapidly increasing to achieve the goal of 300 million kW of wind generated energy in 2010. These wind power generation facilities range from those with a few wind turbines to large wind farms with dozens of wind turbines. The generated energy output from a wind turbine is proportional to the wind speed cubed. Therefore, accurate selection of sites with favorable wind conditions, even to the pin-point level, is very important. Like many parts of the globe, the topography of Japan is mostly characterized by complex terrain with few flat areas. Therefore, topographical effects such as flow impingement, flow separation, flow reattachment, and reverse flow (Figure 1) need to be taken into consideration for selecting sites for wind turbine construction.

With this background, we have developed RIAM-COMPACT® ※1 (Research Institute for Applied Mechanics, Kyushu University, COMputational Prediction of Airflow over Complex Terrain), an innovative, non-stationary, non-linear wind synopsis simulator, with “animation display” and “rigorous project evaluation” as key factors. Wind characteristics over complex terrain (terrain-induced turbulence) are one of the major issues to be considered for the installation of wind power generation facilities. Accordingly, the simulator is equipped with an easy-to-operate capability to visualize wind characteristics in the form of animation. The simulator also facilitates the intuitive comprehension and evaluation of terrain-induced turbulence prior to the installation of wind power generation facilities. Additional features of the simulator include 1) the estimation of the annual energy generation (kWh) and the utilized capacity (%) and 2) a display of the wind rose and the vertical profile of wind speed at the construction sites of wind turbines.

Wind passing over steep topography

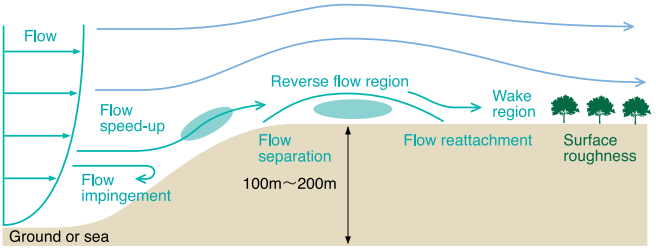


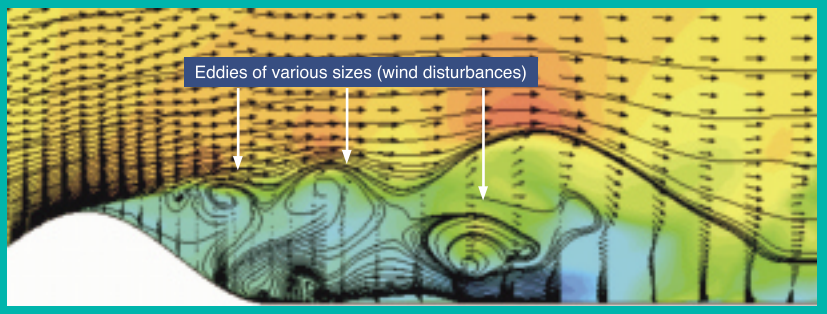
Figure 1. Topographic effect on wind

Main features of RIAM-COMPACT® Natural Terrain Version software

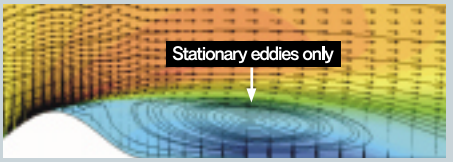
1. Non-stationary, non-linear fluid engineering CFD (Computational Fluid Dynamics) model.
2. Based on an LES (Large-Eddy Simulation) turbulence model that is considered more promising than a RANS (Reynolds-Averaged Navier-Stokes) turbulence model; "wind paths" and "wind disturbances" over complex terrain can be simulated and animated.
3. Applicable for all kinds of flat and complex terrain throughout the world with a powerful reciprocal linkage between GIS (Geographical Information System) and CFD. **(Utility Model: "Fluid analysis support system," registration number: 3128436)**

What do "non-linear" and "non-stationary" mean ?

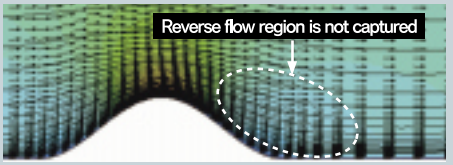
Result of the non-stationary, non-linear model, RIAM-COMPACT®



Non-stationary, non-linear models such as RIAM-COMPACT® simulate the wind flow that matches the wind that we experience every day. The wind disturbances can be understood intuitively. Non-linear models are applicable for both flat terrain and steep complex terrain.



Result of a stationary, non-linear model
Stationary, non-linear models simulate the same results but are averaged in time.



Result of a linear model
Linear models are designed for flat terrain. When applied to steep topography, flow separations (reverse flow regions) cannot be predicted.

Figure 2. Comparisons of various models for predicting wind conditions

※1: RIAM-COMPACT® Natural Terrain Version software development is mainly performed by RIAM-COMPACT Co., Ltd. with cooperative efforts from Environmental GIS Laboratory Co., Ltd., West Japan Engineering Consultants, Inc., and FS Consulting Co., Ltd. The technical core of the software was principally developed by Dr.Takanori Uchida of the Research Institute for Applied Mechanics, Kyushu University, Japan. An exclusive license of the pertinent components has been granted to RIAM-COMPACT Co., Ltd. by Kyushu TLO Co., Ltd.

A summary of services utilizing RIAM-COMPACT® Natural Terrain Version software

※2 : SRTM (Shuttle Radar Topography Mission) was an effort to create a detailed 3D topography database of the Earth by a radar system loaded on the space shuttle. Two topography datasets have been released to the public: SRTM-1 and SRTM-3. The resolution of the SRTM-1 data is 1minute, i.e. approximately 30m, and the data are available only for the U.S.A. The resolution of SRTM-3 data is 3 minutes, i.e. approximately 90m. Please refer to http://srtm.usgs.gov/index.html for details of the SRTM datasets.

※3 : ALOS (Advanced Land Observing Satellite) is one of the largest earth observing satellites in orbit. ALOS is based on improvements of the technologies that were acquired in the course of the development and operation of the Earth-observing satellites JERS-1 and ADEOS. We construct elevation data using the PRISM (Panchromatic Remote-sensing Instrument for Stereo Mapping) topography data. The details of the PRISM data are available at http://www.jaxa.jp/index_e.html.

Flow of contract-based analysis service (comprehensive consulting)

Flow for installation of wind power generation facilities

Planning phase

Siting study

1) Selection of a potential area
2) Collection of wind data in the vicinity
3) Survey of natural conditions
4) Survey of social conditions
   Identification of possible construction areas, power transmission and distribution lines, transportation route, and a summary of environmental influences
5) Conception of the scale of the wind power generation system to be installed

Scrutiny of wind conditions

1) Decision on the observational method
2) Decision on the observational location (refer to the figure below)
3) Processing and analysis of observational data
4) Evaluation
5) Wind simulation

Designing phase

Baseline design

1) Decision on the wind turbine deployment locations
2) Decision of scale of wind turbine power output
3) Selection of wind turbine model
4) Evaluation of annual energy generation
5) Evaluation of environmental influences (details)
6) Location survey and soil survey
7) Examination of economic potential

Execution design

1) Facility design
2) Construction design
3) Construction planning

Construction phase

Construction operations

1) Contract
2) Civil engineering work
3) Construction for wind turbine installation
4) Electrical construction
5) Test operation, inspection

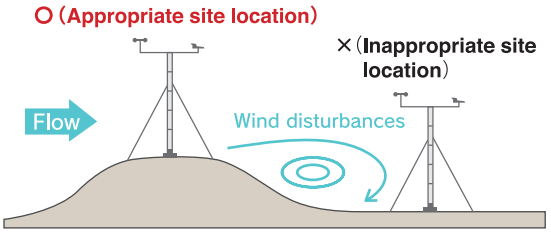


Figure 4. As with wind turbines, observational poles need to be set up in areas with few wind disturbances. Wind simulation enables the search for such areas.

Consulting service offerings

Planning phase support

Macro-siting

- Selection of potential areas with the use of NEDO wind maps (500m grids)
- Survey and evaluation of the potential areas for wind power generation facilities. The survey and evaluation are made with the use of GIS (Geographical Information System); wind condition, roads, laws and regulations, and the locations of private houses are taken into consideration※4

Support for selecting pole deployment locations for field observations

- Search for optimum locations for observation poles with wind simulations

Designing phase support

Micro-siting (Overall evaluation)

Phase 1

- Support for selecting areas for wind power generation facilities. The support is provided based on qualitative evaluations of wind characteristics including wind paths and wind disturbances.
- Survey and evaluation of the potential areas for wind power generation facilities. The survey and evaluation are made with the use of GIS (Geographical Information System). Wind conditions, roads, slope angles, laws and regulations, and private houses are taken into consideration※4

- ◆ Computational domain: approx. 20km x 20km
- ◆ Elevation data : 50m elevation data of the Geographical Survey Institute of Japan
- ◆ Spatial resolution: approx. 100~200m
- ◆ Grid size: approx. 100,000 points
- ◆ Output includes animation

Micro-siting (Detailed evaluation)

Phase 2

- Estimates of the annual energy generation (kWh) and the utilized capacity (%) based on the detailed assessment of wind characteristics. Support for selecting wind turbine deployment locations.
- Survey and evaluation of the deployment plan for wind power generation facilities. The survey and evaluation are made with the use of GIS (Geographical Information System). Wind conditions, roads, slope angles, laws and regulations, and private houses are taken into consideration※4
- Creation of post-construction bird's-eye views and animations of the wind turbine site (option)

- ◆ Computational domain: approx. 2km x 2km
- ◆ Elevation data: 2~5m high-resolution elevation data that are based on paper maps
- ◆ Spatial resolution: approx. 10~20m
- ◆ Grid size: approx. 200,000 points
- ◆ Output: customized for the clients

※4 : Information, such as laws and regulations, which is organized by GIS in a developmental phase of designing the wind power generation facilities, can be extracted in other developmental phases.

Contract-based analysis service 1

Macro-siting service based on GIS (Geographical Information System)

~ Search for potential areas for wind power generation facilities ~

Selection criteria for potential areas of wind power generation facilities

- Minimum annual mean wind speed at 70m above the ground surface: 6m/s (NEDO※5 "local wind map" 500m grid data)
- Availability of access roads with a minimum width of 5m
- Legal regulations on the influence on the environment (e.g. Natural Parks Act, Forest Act, and Agricultural Land Act)
- Other criteria (Power transmission lines, noise of wind turbines, presence of rare plants and animals, angles of topographical slopes, landscape aesthetics, and understanding by local residents)

If a potential site is found,
we will continue the micro-siting procedure

※5：New Energy and Industrial Technology Development Organization

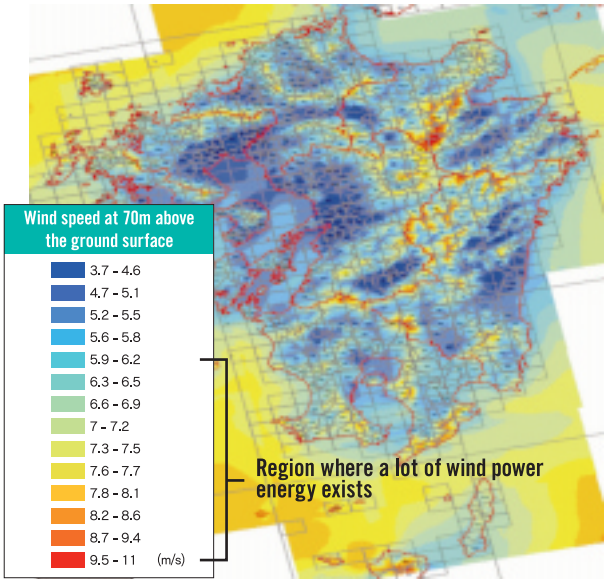
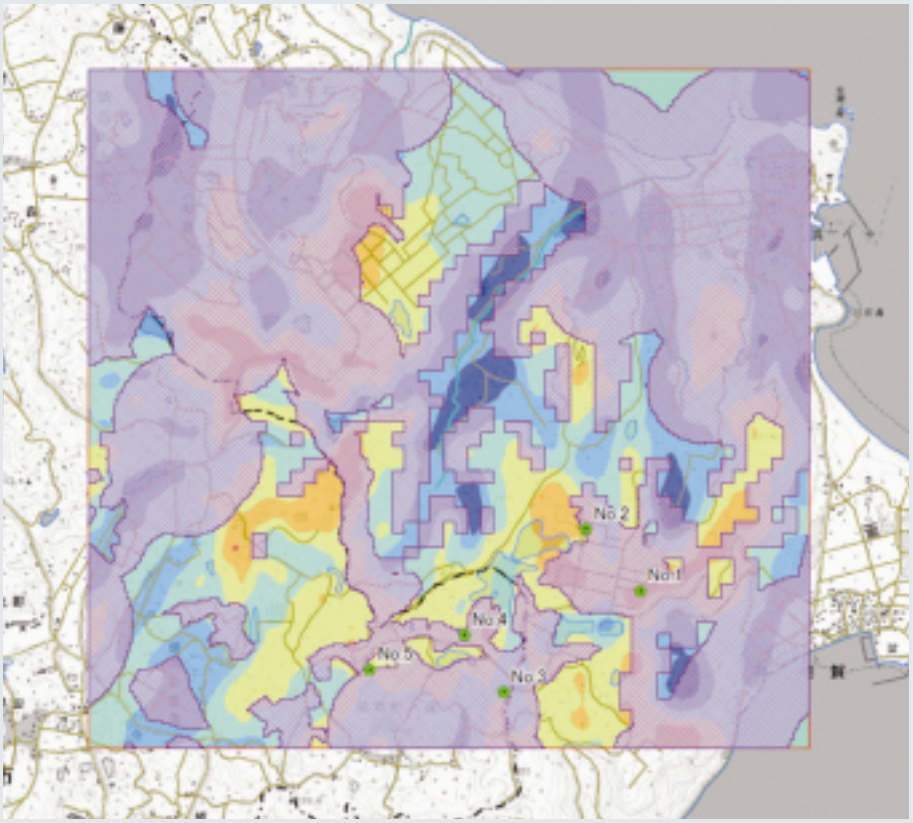


Figure 5. Wind maps of NEDO※5 can be loaded into GIS

- Publicly available data with missing data entries are converted to a seamless map.
- Sites with an annual mean wind speed of 6m/s or higher can be searched for easily and efficiently (Applicable for all districts across Japan).



Integrated judgment of appropriate site location

Construction candidate site location

Composite wind maps

- 5.5 - 10 Weak wind
- 10.1 - 15
- 15.1 - 20
- 20.1 - 25
- 25.1 - 30
- 30.1 - 35 Strong wind
- Development difficulty region

N

0 250 500 750 1,000m

Figure 6. An example of the selection of a potential area for wind turbine installations after a search with the use of wind synopsis maps and various GIS data

Contract-based analysis service 2

Micro-siting service with RIAM-COMPACT® Natural Terrain Version

~ Detailed evaluation of the potential area for wind power generation facilities ~

Phase 1 Understanding of qualitative wind characteristics at the candidate site

With the results of the micro-siting, "wind paths" and "wind disturbances" at the candidate site for a wind power generation facility are animated for visualization, and qualitative wind characteristics are evaluated. Various GIS data can be superimposed with a linkage to GIS.

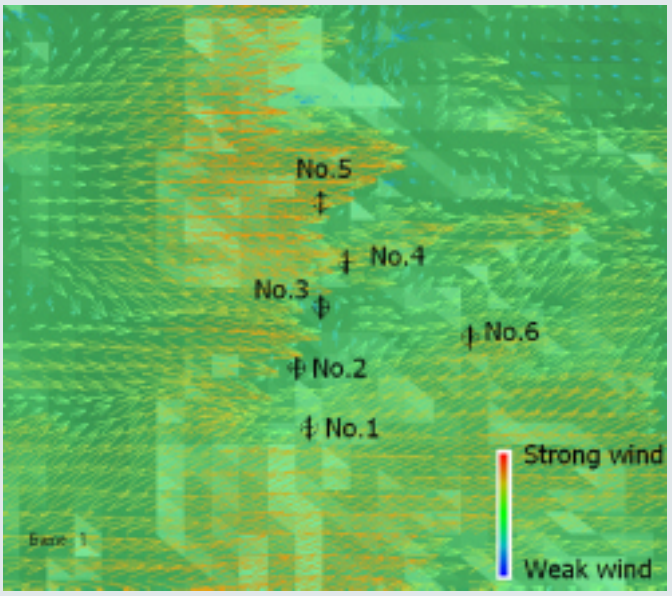


Figure 7. Wind velocity vectors at the wind turbine hub-height

Phase 2 Detailed evaluation of annual energy generation and of wind turbine deployment

High-resolution wind simulations are performed with elevation data that are constructed with a spatial resolution of 10m or less. By taking the observational data from the candidate site into consideration, we estimate the annual energy generation (kWh), assess wind disturbances (terrain-induced turbulence) and propose a plan for appropriate wind turbine deployment.

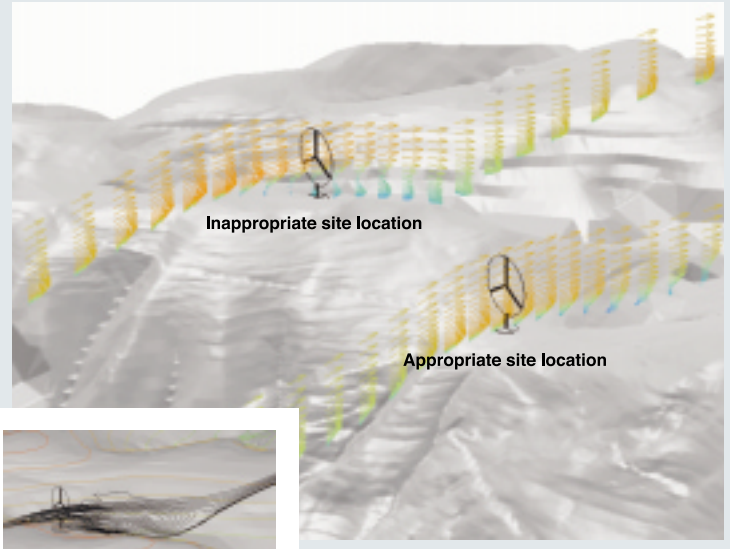
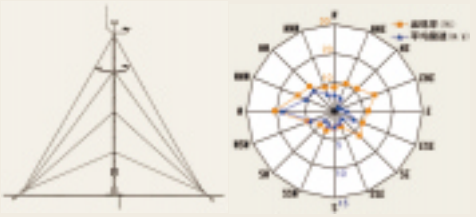
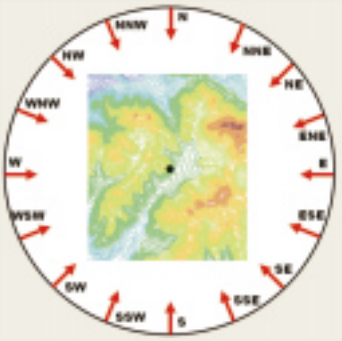


Figure 8. Assessment of wind disturbances caused by terrain irregularities (terrain-induced turbulence)

Evaluation flow for annual energy generation (kWh)



Field observation based evaluation of wind characteristics in the vicinity of a potential site

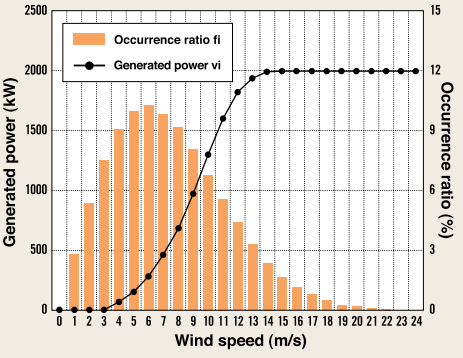


16 wind direction dependent wind simulation by RIAM-COMPACT® Natural Terrain Version

Data assimilation

Direct calculation of airflow conditions at the wind turbine hub-height at a desired location. The influence of terrain is taken into consideration.

Power curve of a wind turbine



[Estimation of annual energy generation]

Annual energy generation(kWh)
$= \Sigma(vi \times fi \times 8{,}760h)$

vi: Generated power(kW) at the wind speed class i in the wind turbine power curve

fi: Occurrence ratio(%) of the wind speed class i in the distribution of wind speed occurrence ratios

Various losses such as wake loss are taken into account

Prediction of annual energy generation from the entire wind farm

Contract-based computation service with RIAM-COMPACT® Natural Terrain Version

We provide a simulation service for the wind condition at a proposed site for wind power generation facilities. The simulation is performed with the use of the 50m elevation data from the Geographical Survey Institute of Japan. "Wind paths" and "wind disturbances" of the target area are visualized in the form of animation, and qualitative wind characteristics are evaluated. In addition, we convert the time series data of wind speed at the wind turbine hub-height into graphs. We also provide quantitative evaluations such as the vertical profiles of wind speed and turbulence intensity for the proposed locations of wind turbine installation. The computation service comes with an option for high-resolution wind simulation which uses elevation data with a spatial resolution of less than 10m. As additional options, we can also estimate the annual wind energy generation (kWh) and utilized capacity (%) by taking into consideration the correlation between the simulation and field observation data.

List of data to be offered

- Map of the area targeted for computation
- Computational parameters (e.g. details of inflow wind conditions such as wind speed and wind profile)
- Animation of wind velocity vectors at the wind turbine hub-height (see Figure 9)
- Animation of wind disturbances at the wind turbine hub-height
- Time series graphs of wind speed data from the wind turbine hub-height
- Vertical profiles of mean wind speed at the proposed locations of wind turbine installation (see Figure 10)
- Vertical profiles of turbulence intensity at the proposed locations of wind turbine installation

We provide the above data summarized in PowerPoint.

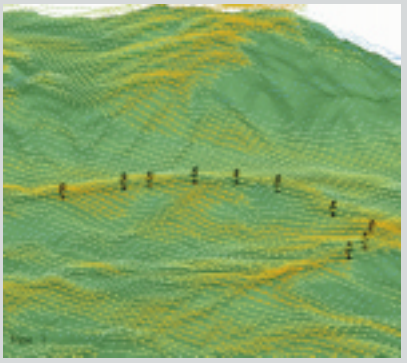


Figure 9. Wind speed vectors at the wind turbine hub-height

Time required

- Approximately 10 days for one wind direction (general guideline)

Options

- High-resolution simulation by including elevation data with resolution finer than the 50m elevation data of the Geographical Survey Institute of Japan. Elevation data with resolutions of 10m or less are constructed from topography maps of 1:2500 or from CAD data in DXF format.
- Estimates of the annual energy generation (kWh) and utilized capacity (%) (see Figure 11). These estimates are made using the results from the wind simulations individually performed for 16 wind directions. (Please note: the estimate of the annual energy generation requires field data (bi-hourly time series data) observed in at least one location for a year.)

Fee for contract-based computation

- Please contact us for estimates (e.g. 200,000 yen and up for contract-based computation using 50m elevation data from the Geographical Survey Institute of Japan).

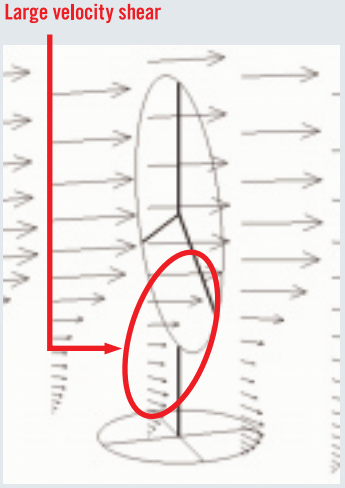


Figure 10. Velocity vectors in the vicinity of a wind turbine (the blow up and blow down angles with respect to the wind turbine can be estimated.)

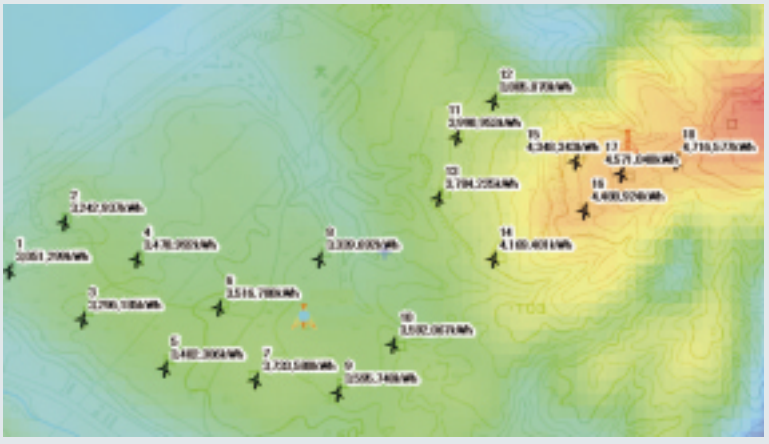


Figure 11. An example of a constructed wind synopsis map with an estimate of the annual energy generation (kWh)

Design wind speed estimation service

With the use of the 50m elevation data of the Geographical Survey Institute of Japan, we estimate the design wind speed for the installation location of the wind turbines. The estimates are based on methods compliant with "Guidelines and descriptions for the structural design of wind power generation facilities and supporting objects: 2007" (Japan Society of Civil Engineers) and "Guidelines and descriptions for architectural loads (2004)" (Architectural Institute of Japan).

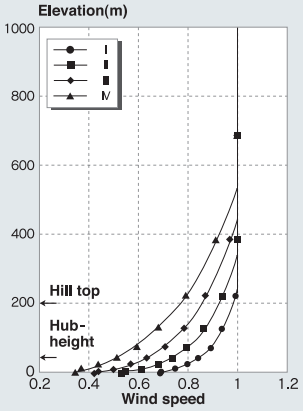


Figure 12. Inflow profiles

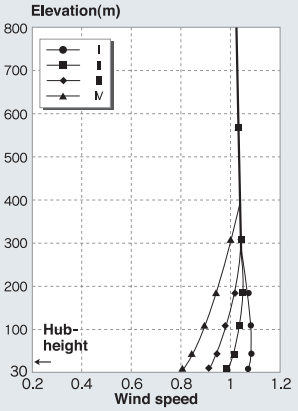


Figure 13. Profiles at the top of the terrain

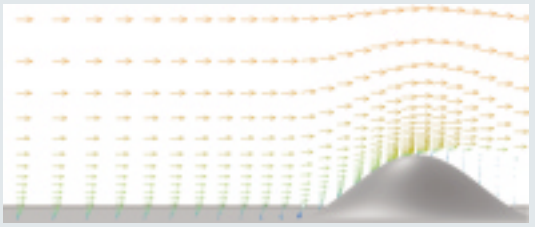


Figure 14. Time-averaged velocity. Roughness classification IV.

	Roughness classification			
	I	II	III	IV
Wind speed ratio	1.28	1.35	1.44	1.60

Table 1. Wind speed ratio for a wind turbine hub-height of 45m. Wind speed ratio = (wind speed at 45 m in Figure 2) / (wind speed at 45 m in Figure 1)

Options

- The design wind speed can be estimated from high-resolution wind simulations which utilize elevation data with spatial resolutions of less than 10m.
- Further accuracy of the estimation of the design wind speed can be achieved by combining RIAM-COMPACT® Natural Terrain Version with a meso-scale meteorological model such as the WRF (Weather Research and Forecast) or MM5 (PSU/NCAR Mesoscale Model) models.

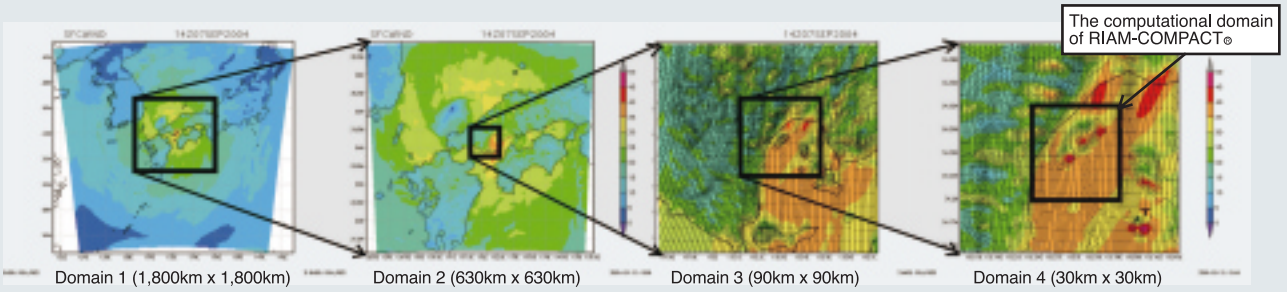


Figure 15. Estimation of design wind speed. A typhoon simulation was used in these estimations.

Horizontal domain	Extent of domain	Grid points	Side [km]
Domain 1	1,800km x 1,800km	201×201	9
Domain 2	630km x 630km	211×211	3
Domain 3	90km x 90km	91×91	1
Domain 4	30km x 30km	91×91	1／3

Table 2. Four levels of nesting

- The atmospheric layer between the ground surface and 50hPa (20,778m) is vertically divided into 34 layers.
- The grid intervals are 16m and 4,301m for the lowest and highest layers, respectively.

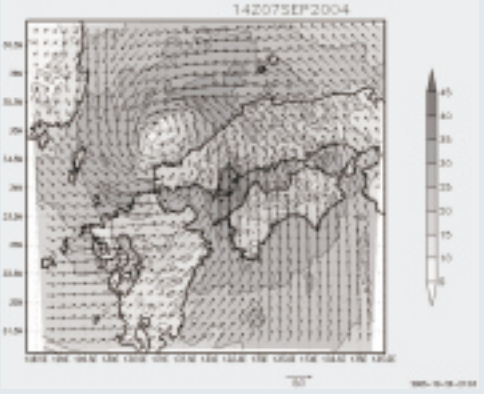


Figure 16. Distribution of horizontal wind velocity at the 10m height above the ground surface at 14:00 on September 7, 2004. Typhoon 0418. Computational result of MM5 for Domain 2.

Fee for design wind speed estimation service

- Please contact us for estimates.

Intended mainly for sites within Japan

Detailed 3D topography data creation service for use in RIAM-COMPACT® Natural Terrain Version

Creation of topography from paper maps of approx. 1:2500 and CAD data in DXF format

At low cost and with a short delivery time, we will create detailed 3D elevation data from sources such as paper maps of approximately 1:2500 and CAD data in DXF format. The detailed 3D elevation data can be used for the high-resolution wind simulations with RIAM-COMPACT ®Natural Terrain Version, landscape CG (Computer Graphics), civil design, and other applications for which the use of the 50m elevation data of the Geographical Survey Institute of Japan limits the accuracy of the results. RIAM-COMPACT ®Natural Terrain Version supports elevation data (GIS elevation data) of any spatial resolution, thus computations can be performed right away at any resolution required by the user.

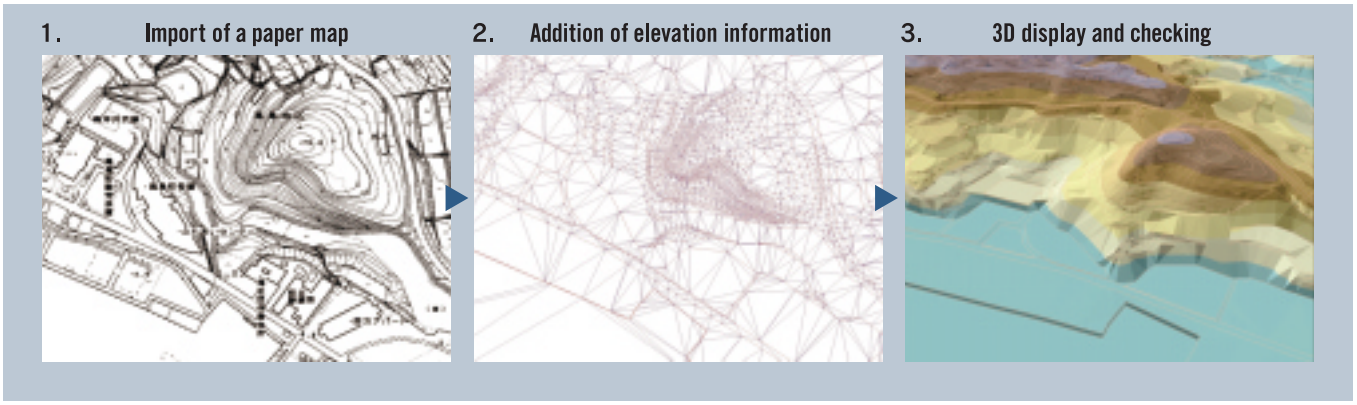


Figure 17. Flow of data creation

1 Acceptable source maps

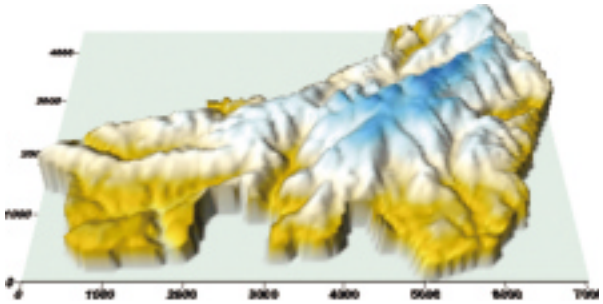
- We ask the client to obtain a paper map of approximately 1:2500 from local government or other sources.
- The map will serve as the source data.
- Maps with other scale ratios such as 1:500 and 1:5000 are also acceptable for the 3D elevation data creation as long as elevations are labeled clearly on the maps.

Acceptable maps

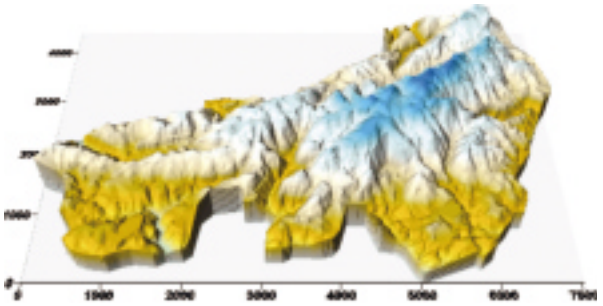
- Printed contour maps, photocopied contour maps (maps with clearly drawn lines)
- Maps with geodetic coordinates at the four corners

Unacceptable maps

- Diazo maps, colored drawings, maps with creases, and maps with unclear printing



(a) 50m elevation data of the Geographical Survey Institute of Japan



(b) 5m data created from a paper map

Figure 18. Comparison of spatial resolutions

2 Data precision and accuracy

- The precision and accuracy of the 3D elevation data to be created is dependant on the source map.

3 Time required

- Approximately 1 week per map (general guideline)

4 Fee for the 3D terrain data creation

- Please contact us for estimates.
- The fee for a typical case is approximately 100,000 yen.

Figure 19. Composite of a 3D topography model and an aerial photo

Intended mainly for sites outside Japan

Detailed 3D topography data creation service for use in RIAM-COMPACT® Natural Terrain Version

Creation of topography from terrain data from the Shuttle Radar Topography Mission (SRTM) and the Earth observation satellite DAICHI (ALOS)

Creation of high-resolution elevation data has been highly limited for wind simulation for sites outside Japan. With the use of the topography data from the Shuttle Radar Topography Mission (SRTM) or the Earth observation satellite DAICHI (ALOS), we create 3D elevation data (latitude-longitude ASCII elevation data) for use in RIAM-COMOPACT® Natural Terrain Version at a low cost and with a short delivery time. We can also nest ALOS data within SRTM data to create more efficient elevation data. The created data allow wind simulations of high accuracy for sites outside Japan. In addition, these elevation data can also be created for sites within Japan.

For SRTM data (spatial resolution: approx. 90m)

1 Area specification for elevation data creation

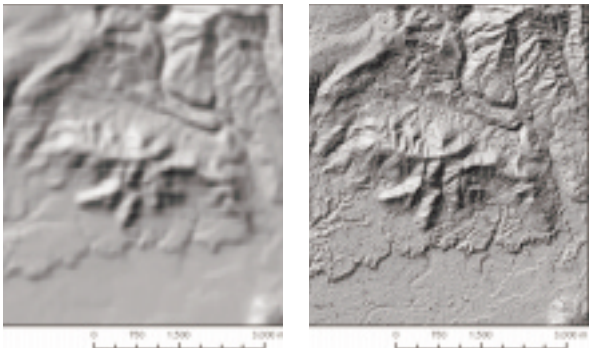
- The client chooses the central latitude and longitude.
- We create elevation data for an approximately10km x 10km area.

2 Time required

- Approximately 1 week for each site (general guideline)

3 Fee for 3D terrain data creation from SRTM data

- Please contact us for estimates.
- The fee for a standard case is approximately 100,000 yen.



(a) 90m SRTM data (b) 10m ALOS data

Figure 20. Comparison of spatial resolutions

For ALOS data (spatial resolution: approx. 10m)

1 Area specification for elevation data creation

- We ask our clients to check the image of the site for which elevation data are to be created by contacting the sale agent, RESTEC (http://www.restec.or.jp/).
- In case missing values exist in the ALOS dataset due to sporadically occurring clouds, the elevation data will be missing for the corresponding locations.
- After clients have checked the image, they are asked to specify the central longitude and latitude.
- We create elevation data for an approximately 10km x 10km area.

2 Time required

- Approximately 3 weeks for each site (general guideline)
- Approximately 2 weeks are required for the delivery of the source data from RESTEC.

3 Fee for 3D terrain data creation from ALOS data

- Please contact us for estimates.
- Our estimates will include the price of the source data from RESTEC: 315,000 yen (sales tax included).

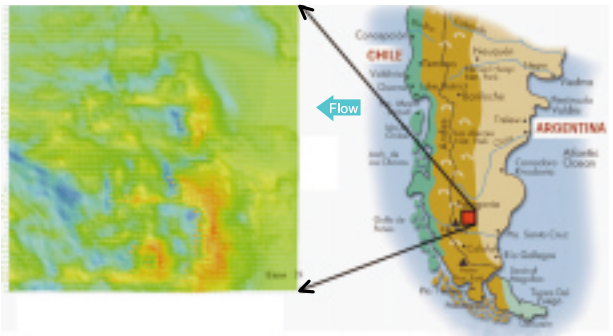
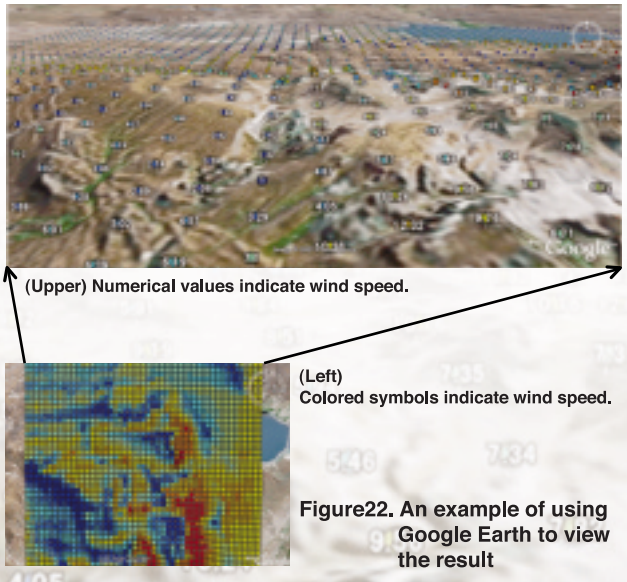


Figure 21. An example of analysis with RIAM-COMPACT® Natural Terrain Version together with ALOS data.



(Upper) Numerical values indicate wind speed.

(Left) Colored symbols indicate wind speed.

Figure22. An example of using Google Earth to view the result

MAP file creation service for use in the linear wind simulation software WAsP

We create MAP files (contour data in the UTM coordinate system) for the linear wind simulation software WAsP developed by the RISO National Laboratory of Denmark. The source data of the MAP files are the high-resolution elevation data (DEM data in the latitude-longitude coordinate system) that are created by our corporations. The MAP file can be created with any desired intervals. This allows comparisons of the outputs by RIAM-COMPACT® Natural Terrain Version (a non-stationary, non-linear CFD software) and those by WAsP (a linear wind simulation software) with the same spatial resolution of elevation data. The MAP file can be prepared from the Shuttle Radar Topography Mission (SRTM) topography data or the Earth observation satellite DAICHI (ALOS) topography data. In this case, the created MAP file is more versatile and can be applied for sites outside Japan. The service described here is also offered for sites within Japan.

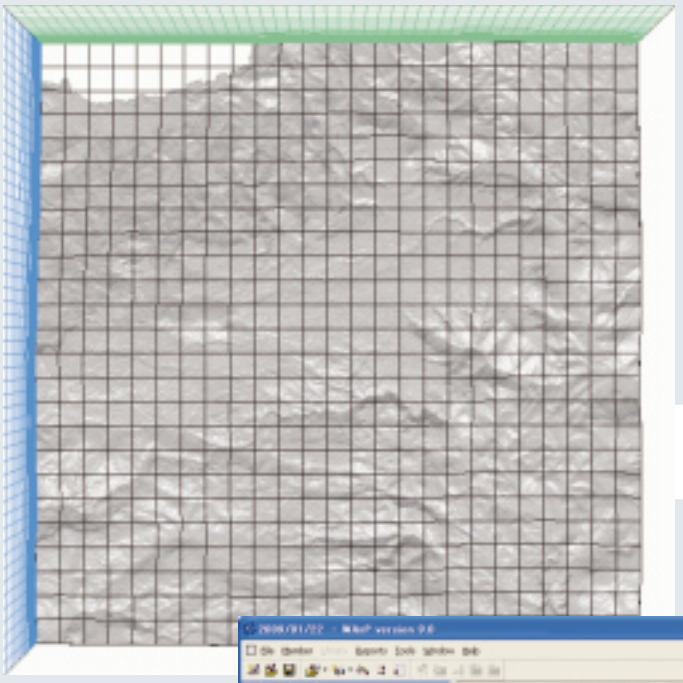
Time required

- Approximately two weeks for each site (general guideline)

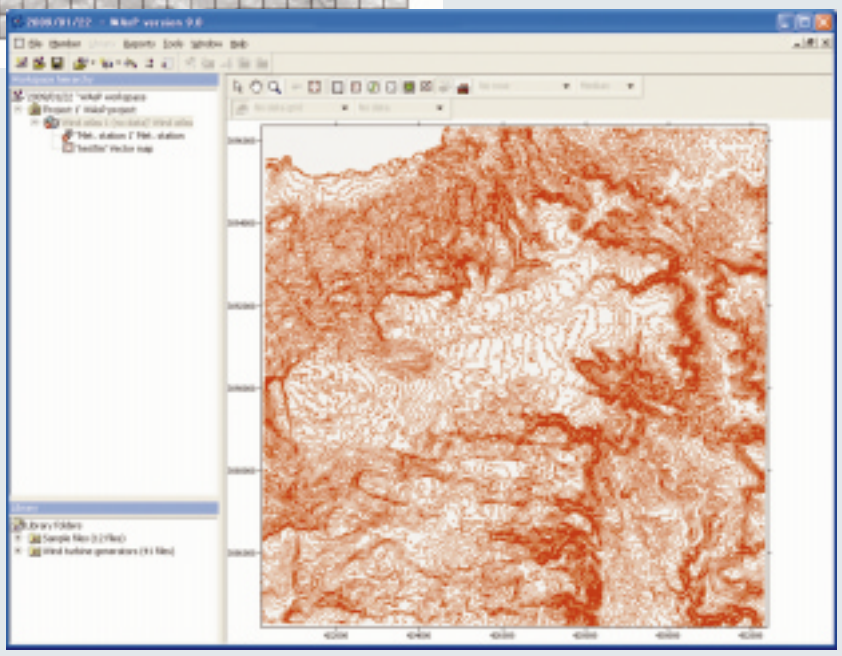
Fee for data creation

- Please contact us for estimates.
- The fee for a standard case is approximately 100,000 yen.

(a) DEM data for use in RIAM-COMPACT® Natural Terrain Version



Data conversion



(b) MAP file for the linear wind simulation software WAsP

Figure 23. An example of data created for a site outside Japan

Landscape simulation service

We create animations of the planned sites for wind power generation facilities. For these animations, we superimpose aerial photos on the 50m elevation data from the Geographical Survey Institute of Japan and insert wind turbines of the proper scale into the animations. These animations allow viewing of the proposed sites of wind power generation facilities from various angles prior to wind turbine installation. Options for the landscape simulation service include the use of 1) high-resolution elevation data (3D terrain model) created by our corporations and 2) Google Earth, a "digital globe software," which allows access to satellite and aerial photos from all over the world.

Time required

- Approximately two weeks for each site (general guideline)

Fee for animation creation

- Please contact us for estimates.
- The fee for a standard case is approximately 100,000 yen.

Figure 24. An example of an animated landscape with the use of high-resolution elevation data created by our corporations.

The animation provides a visual impression of the site including the rotating blades of the wind turbine, the view of the site from aloft and at eye level, and the site's integration with surrounding houses. Such visual information allows inspection of the landscape with the installed wind turbines from various view angles.

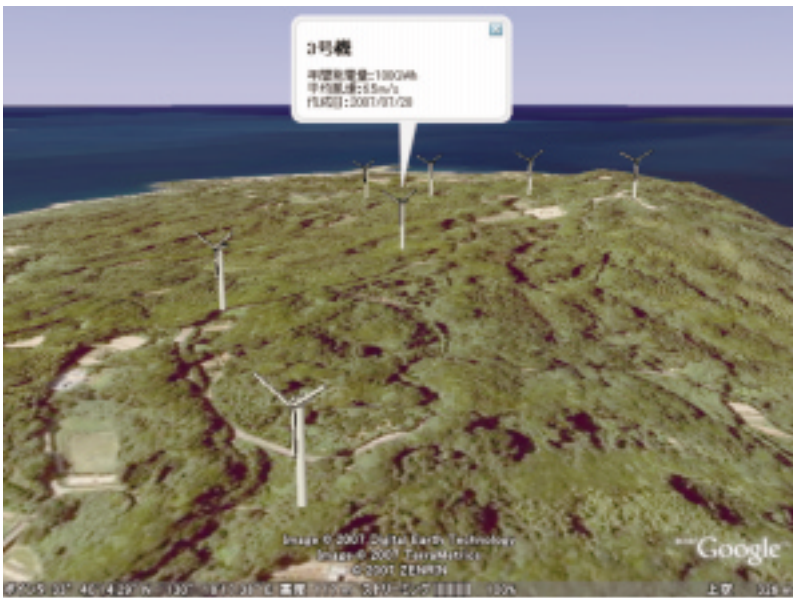


Figure 25. An example of an animated landscape viewed with Google Earth

Descriptions and references for RIAM-COMPACT® Natural Terrain Version

1. T.Uchida and Y.Ohya, Numerical simulation of atmospheric flow over complex terrain, J.Wind Eng. Ind. Aerodyn., Vol.81, pp.283-293, 1999.

2. T.Uchida and Y.Ohya, Large-eddy simulation of turbulent airflow over complex terrain, J.Wind Eng. Ind. Aerodyn., Vol.91, pp.219-229, 2003.

3. T.Uchida and Y.Ohya, Micro-siting Technique for Wind Turbine Generator by Using High Resolution Elevation Data, JSME International Journal,「Environmental Flows」, Series B, Vol.49, No.3, pp.567-575, 2006.

4. T.Uchida and Y.Ohya, Verification of the Prediction Accuracy of Annual Energy Output at Noma Wind Park by the Non-Stationary and Non-Linear Wind Synopsis Simulator, RIAM-COMPACT®, Journal of Fluid Science and Technology, Vol.3, No.3, pp.344-358, 2008.

5. T.Uchida and Y.Ohya, Micro-siting Technique for Wind Turbine Generator by Using Large-Eddy Simulation, J.Wind Eng. Ind. Aerodyn., Vol.96, pp.2121-2138, 2008.

6. T.Uchida and Y.Ohya, Micro-siting Technique for Wind Turbine Generator by Using Large-Eddy Simulation, J.Wind Eng. Ind. Aerodyn., Vol.96, pp.2121-2138, 2008.

RIAM-COMPACT® Natural Terrain Version software development consortium

1) RIAM-COMPACT CO., LTD. (http://www.riam-compact.com/)

2) West Japan Engineering Consultants, Inc. (http://www.wjec.co.jp/)

3) Environmental GIS Laboratory Co., Ltd. (http://www.engisinc.com/)

4) FS Consulting Co., Ltd. (http://www.fsconsulting.co.jp/)

Contact information

For contract-based analysis services (comprehensive consulting) and design wind speed estimation services, **please contact 2) above. Person in charge:** Yasushi Kawashima (y-kawashima@wjec.co.jp)

For other services, **please contact 1) above. Person in charge:** Dr.Takanori Uchida (RIAM, Kyushu University, takanori@riam.kyushu-u.ac.jp)

For purchasing the RIAM-COMPACT® Natural Terrain Version software, **please contact the sales agent below.**

RIAM-COMPACT


We search for the possibility of the wind power energy.

Runs on a single PC or laptop

Software that visualizes wind and supports your wind power site selection

RIAM-COMPACT

Non-stationary, Non-linear Wind Synopsis Simulator

[**RIAM-COMPACT® Natural Terrain Version**]

Sales agent