INEEL/01/14/14829/I001/P

Inventory of datasets of atmospheric flow simulations and observations

Ricardo Saldaña Flores, Ramón Lira Arguello and Ubaldo Miranda Miranda (INEEL)

Gerencia de Energías Renovables,
Instituto Nacional de Electricidad y Energías Limpias,
Cuernavaca, Morelos, México

July 2019

Authors: Ricardo Saldaña Flores, Ramón Lira Arguello and Ubaldo Miranda Miranda (INEEL)
Title: Inventory of datasets of atmospheric flow simulations and observations
Department: Gerencia de Energías Renovables

INEEL/01/14/14829/I001/P
July 12, 2019

ISBN:
In process

Abstract

Regarding the activity of identification of wind data both observational and simulated, as well as the availability of orographic information and land use used in studies on the wind to meso and microscale in the project "Multi-scale and model-chain Evaluation of Wind Atlases (MEWA)", various institutions were consulted by sending a survey.
As a result of this survey, measured data was obtained for several sites, as well as data monitored with LIDAR systems and data modeled with the WRF model.
The largest amount of measured data correspond to the Automatic Meteorological Stations (EMA) from Servicio Meteorológico Nacional (SMN) and the airports.
As for modeled data, 10 years of simulations were obtained from DTU for the whole the country; from UV, five years of simulations for three regions of the state of Tamaulipas and one in the state of Oaxaca; and from Instituto Nacional de Electricidad y Energías Limpias (INEEL), three years of simulations for the whole country and one year for the state of Hidalgo.
Regarding to microscale modeling only is known that some institutions such as INEEL, Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), UV, Universidad Autónoma de la Chontalpa and Universidad del Istmo (UNISTMO), have done some efforts by using programs like WAsP and Windsim.
About the models used in Mexico to simulate the wind, it was found that WRF model is the most used for the mesoscale and the WAsP for the microscale. The topography used in wind modeling usually taken from Instituto Nacional de Estadística y Geografía (INEGI), but also from the Shuttle Radar Topography Mission (SRTM) database. The land use is taken, in most cases, from the same source of the WRF for the mesoscale, and in a few cases from INEGI variants. For the microscale, the land use is taken from INEGI and SRTM.
There are other sources of information that could provide wind data, such as the National Renewable Energy Laboratory (NREL), Asociación Mexicana de Energía Eólica (AMDEE) and Instituto de Energias Renovables of the UNAM.

Contract no:

Project no:
DFC No. 17-M01-DTU

Sponsorship:
Ministry of Foreign Affairs of Denmark

Cover:-

Pages: 19
Tables: 5
Figures: 1
References: 12

Instituto Nacional de Electricidad y Energías Limpias
Reforma 113
Col. Palmira C.P. 62490
Cuernavaca, Morelos , México
Tel. +527773623811
rsf@ineel.mx
www.ineel.mx

Contents

1 Introduction

The multi-scale and model-chain evaluation of wind atlases (MEWA) project has, as main objectives, to investigate the best way to couple, meso and microscale models, for a better prediction of the wind resource, and to investigate the impact of the climate variability and the changes in the surface characteristics and ground cover in the wind resource.

One of the first activities of the project is the data identification, both observational and simulated, as well as the availability of orographic and land use information used to conduct mesoscale and microscale studies, for the evaluation of the feasibility of wind projects. This auscultation was carried out in educational, research, and governmental institutions in Mexico.

There are also other databases of global models with wind data for Mexico, these databases are generated by institutions such as the National Centers for Environmental Prediction (NCEP), the European Center for Medium-Range Weather Forecasts (ECMWF) or the Japan Meteorological Agency (JMA). These forecast and reanalysis data are available for download on the Internet from the servers of these institutions.

Some databases are The Global Forecast System (GFS), NCEP North American Mesoscale (NAM) 12 km Analysis, NCEP FNL Operational Model Global Tropospheric Analyzes, NCEP / NCAR Reanalysis 1, NCEP / DOE AMIP-II Reanalysis, North American Regional Reanalysis (NARR), ERA-Interim and the JRA-25 Reanalysis.

The main objective of this activity is:

- To identify, collect, document, verify quality and register existing data sets obtained from simulated and observed atmospheric flows, relevant for the analysis of wind resources and climatic impacts in Mexico.

The tasks are:

- Identification and documentation of data sets available from atmospheric flow simulations.
- Identification and documentation of observational data sets available.

In this report, we describe the progress on these activities.

2 Identification of national institutions working on wind energy

It is known that in Mexico there are few official institutions that perform measurements and research in wind energy. Generally, measurement campaigns are carried out for the purposes of climate studies or simply for educational purposes. For the first case, the network of stations of the National Meteorological Service is normally used and for the second the stations of the universities.

For purposes of the MEWA project, a list was made of institutions with which INEEL has had some contact or conducted joint researches on wind-related activities. In a first stage, 20 contacts were determined, with whom there was communication to let know them about the objectives of the project. Contacts and institutions are listed in Table 1.

No.	Contact	Institution
1	Oscar Jaramillo Salgado (ojs@ier.unam.mx)	Institute of Renewable Energies, Universidad Nacional Autónoma de México (UNAM)
2	Geovannis Galvez Hernández (geovannisg@yahoo.com)	Universidad de la Chontalpa
3	Gilles Arfeuille (gilles@ucol.mx)	Universidad de Colima
4	Francisco Bañuelos Ruedas (fbanuelosrs@hotmail.com)	Universidad Autónoma de Zacatecas
5	Orlando Lastres Danguillecourt (orlando.lastres@unicach.mx)	Universidad de Ciencias y Artes de Chiapas
6	Jorge Zavala Hidalgo (jzavala@atmosfera.unam.mx)	Center of Atmospheric Science, Universidad Nacional Autónoma de México (UNAM)
7	José Noel Carbajal Pérez (noelc@ipicyt.edu.mx)	Instituto Potosino de Investigación Científica y Tecnológica (IPICYT)
8	Rafael Cabanillas López (rcabani@iq.uson.mx), Gabriel Cuevas Figueroa (gabriel.cuevas@unison.mx)	Universidad de Sonora
9	Gustavo Márquez Vázquez (gustavo.marquez02@cfe.gob.mx)	Selection of Sites Department, Comisión Federal de Electricidad (CFE)
10	Luis Carmona (luis.carmona@cfe.gob.mx), Juan Santiago Andrés (juan.santiago02@cfe.gob.mx)	Department of Civil Engineering and Earth Sciences, Comisión Federal de Electricidad (CFE)
11	Juan Matías Méndez Pérez (matias.mendezp@gmail.com)	Faculty of Electronic Instrumentation, Universidad Veracruzana
12	Estela Cerezo Acevedo (ecerezo@ucaribe.edu.mx)	Universidad del Caribe
13	Roberto Acosta Olea (rao@ier.unam.mx)	Universidad de Quintana Roo
14	Oliver Matthias Probst Oleszewski (oprobst@itesm.mx)	Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), Campus Monterrey
15	Serafín López Pineda (serafin.lopez01@cfe.gob.mx)	Comisión Federal de Electricidad, Morelia
16	María Tereza Cavazos Pérez (tcavazos@cicese.mx)	Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE)
17	Michel Alejandro Rivero Corona (mariveroco@conacyt.mx)	Instituto Tecnológico de la Laguna
18	Rafael Dorrego Portela (r.dorrego.63@hotmail.com)	Universidad del Istmo
19	Victor Manuel García Saldívar (vmgarcia@intranet.uaz.edu.mx), Juan Manuel García González (jmgarcia@uaz.edu.mx)	Academic Unit of Chemical Sciences, Universidad Autónoma de Zacatecas
20	Quetzalcoatl Cruz Hernández Escobedo (qhernandez@uv.mx)	Faculty of Engineering, Universidad Veracruzana, Coatzacoalcos Campus

Table 1: List of institutions and contact persons with activities related to wind energy in Mexico

3 Survey

For the compilation of the basic information of measurements and simulations that the institutions have carried out or are carrying out, a survey was prepared and it contains three sections: background, data of the institution (see Table 2), modeling activities, wind measurements and databases available (see Table 3).

Code		
DI-1	Name of the institution	
DI-2	Names of the people who consign the information	
DI-3	Address of the institution	
DI-4	Contact phones	
DI-5	Email and WEB page	
DI-6	Type of institution (academic, private company, government, etc.)	

Table 2: Information about the institutions

Code		
AM-1	Details of models and versions (if possible) used for wind modeling	
AM-2	Spatial and temporal resolution used in modeling	
AM-3	Origin and resolution of the topography used in the modeling	
AM-4	Could you share them with the MEWA project group for research purposes? What would be the procedure for obtaining it?	
AV-1	Details of wind measurements: location, anemometry used (types, heights and periods), temporal resolution and measured periods	
AV-2	Do you have a descriptive technical sheet of the places where you have carried out wind measurements? Could you share this information?	
AV-3	Were the measurements made following some standards? If so, mention them	
AV-4	Can be the data obtained from the measurement campaigns shared with the MEWA project group for research purposes? What would be the procedure for obtaining it?	

Table 3: Information about the modeling activities, wind measurements and databases available

4 Results

Table 4 shows the information obtained from 20 surveys sent and Fig. 1 the location of the institutions to which the survey was sent, and the responses obtained.

Table 4: Results of the survey. The row identifier corresponds to the contact in table 1.

	Sent date	**Answer date**	**Measured (M) or simulated (S) data?**	**Models used**	**Topography**	**Land use**	**Acquisition conditions**	**Number of sites**	**Period of available data**	**Period of data delivered**
1	16/06/2018 16/08/2018									None
2	18/06/2018	21/06/2018	S	Acquired from AWS True Power-WAsP			None	**3**	Typical year of each site	Typical year of each site
3	18/06/2018 29/08/2018									None
4	18/06/2018	18/06/2018 The survey was not filled								None
5	18/06/2018	It does not have data. He transferred the survey to Rafael Dorrego from UNISTMO.								None

6	18/06/2018 28/08/2018	28/08/2018	M, S	WRF	INEGI	INEGI	Land use, with agreement Wind, with request	Various	Various	None
7	18/06/2018 28/08/2018									None
8	18/06/2018	19/06/2018	S	WRF			With request			None
8	18/06/2018	11/07/2018	M, S	WRF	INEGI		No, they have a cost	20 sites1 region		None
10	23/05/2018 18/06/2018 17/07/2018	17/07/2018 The survey was not filled								None
11	18/06/2018 28/08/2018		S	WRF			Not available	4		None
12	18/06/2018 28/08/2018									None
13	25/06/2018	30/07/2018	M				With request	Various in Chetu-mal Q. Roo.		None
14	26/06/2018 28/08/2018									None
15	4/07/2018 28/08/2018									None

16	15/05/2018	25/05/2018	Other researchers will fill out the survey.							None
17	25/06/2018	02/07/2018								None
18	18/06/2018 Vía Orlando Lastres	22/08/2018	M				With request	4		None
19	30/07/2018 28/08/2018	30/07/2018 The survey was not filled. VMGS is no longer active in the UAZ, it was forwarded to another researcher						3		None
20	1/06/2018	16/06/2018	S	RAMS WRF	SRTM	INEGI	With request	1 region		None

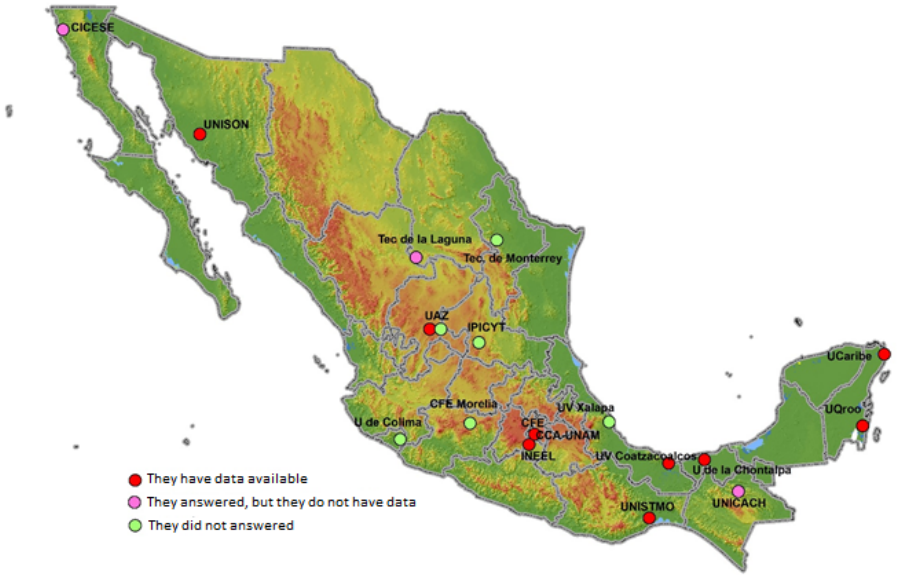

Figure 1: The location of the institutions to which the survey was sent, and the response obtained

The response obtained in this first stage of auscultation was as follows:

- 20 surveys sent
- 7 did not respond
- 8 responded, but do not have data
- 4 have measured data (3 are available and 1 can be purchased)
- 1 has data from three virtual towers
- 5 have available simulated data

Regarding the models used, topography and land use in the different institutions, the situation is as follows:

- 4 use WRF
- 1 uses WRF and RAMS
- 3 use INEGI topography
- 1 uses SRTM topography
- 2 use the land use of INEGI
- 2 did not report any source of land use

Regarding the databases, the situation as of November 23, 2018 is as follows:

- 1 institution delivered a typical year of virtual towers of three sites.
- 1 institution provided data on the vertical wind profile of a site.
- 1 institution delivered modeled data from 4 zones (this information can not be shared).

5 Other wind monitoring and modeling activities

5.1 Technical University of Denmark (DTU)

- Analysis of wind information obtained from the meteorological stations of INEEL (Hahmann et al., 2016).
- Simulations of wind and other parameters for Mexico at 25, 50, 80, 100 and 150 m height, at a resolution of 5 km×5 km in hourly form for the period from October 2005 to September 2015 using the WRF model (Hahmann et al., 2016).

5.2 Instituto Nacional de Electricidad y Energías Limpias (INEEL)

- Estimation of the wind energy potential using the WAsP program for various areas of Mexico, with areas of 50 km×50 km at a resolution of 200 m at 50 m height.
- Estimation of the wind energy potential in five areas of the lower basin of the Usumacinta River in Tabasco, from hourly wind speed modeled at 50 m height with the MM5 model for the year 2005, using the WAsP program, in areas of 10 km×10 km, with a resolution of 100 m. These estimations were carried out by INEEL for Universidad del Istmo, through a contract. This information served to identify 10 possible sites for the installation of 80 m high anemometric towers.
- Evaluation of wind energy potential in 10 zones of the Istmo de Tehuantepec from hourly wind information modeled at 50 m height with model MM5 for the year 2005, using the WAsP program, in areas of 20 km×20 km, at 20, 30 and 40 m height. These estimates were carried out by INEEL for Centro del Cambio Global y la Sustentabilidad en el Sureste, through a contract (Saldaña et al., 2013).
- Modeling of the wind for three months (January 2005, February and December 2012) with the MM5 and RAMS models. The results of the modeling were compared with data of the INEEL stations network in order to analyze different parameterizations of the RAMS model and study the sensitivity of the parameterizations related to turbulence and topography. The modeling was carried out for an area of the Isthmus of Tehuantepec of 34 km×34 km, in hourly form, with spatial resolution of 833 m and 32 levels in the vertical. The variables generated were wind speed, wind direction, temperature, atmospheric pressure and relative humidity (Dolores et al., 2014).
- Preparation of wind speed databases and other parameters from measurements made during complete years in 34 stations, distributed throughout the national territory, property of INEEL.
- Modeling of the first 5 days of each month for the period from October 2015 to September 2016 using the WRF and RAMS models in order to perform a comparative analysis of the results of both models in the forecast of wind speed. The experiment was conducted for an area of 32 km×42 km in the Isthmus of Tehuantepec with a spatial resolution of 1 km at a height of 80 m and was compared with wind data obtained from a meteorological station at the same height (Lira-Arguello et al., 2016).
- Obtaining wind information in seven sites of interest in Mexico as part of the Wind Atlas for Mexico (WAM) project. This information consists of:
  - Wind speed at 20, 40, 60 and 80 m.
  - Wind direction at 58 and 78 m.

- Temperature at 40 and 80 m.
- Relative humidity at 15 m.
- Atmospheric pressure at 15 m.
- Solar radiation at 80 m.
- Density of the air at 15 m.

The data are measured every second and averaged every 10 min. The measurement periods and the location of the meteorological stations are shown in Table 5.

Station	Period of data	Location
M1	2017-12-02 - up to now	32°28'50.47" N 116°6'46.66" W 1343 m (above sea level)
M2	2017-10-05 - up to now	21°8'14.92" N 89°47'7.36" W 4 m (above sea level)
M3	2017-11-28 - up to now	29°1'14.07" N 106°57'7.92" W 2128 m (above sea level)
M4	2017-11-23 - up to now	16°32'49.27" N 94°57'20.83" W 31 m (above sea level)
M5	2018-01-07 - up to now	21°39'24.08" N 101°42'55.32" W 2420 m (above sea level)
M6	2017-10-09 - up to now	25°1'19.85" N 98°5'14.58" W 33 m (above sea level)
M7	2017-10-07 - up to now	18°35'41.91" N 97°56'13.39" W 1636 m (above sea level)

Table 5: Information about the stations of the WAM project

5.3 Instituto Potosino de Investigación Científica y Tecnológica (IPICYT)

- Modeling of the wind for the State of Hidalgo at the heights of 10 and 50 m, with a resolution of 3 km×3 km, every 3 hours, for the year 2004, using the MM5 model. This activity was carried out by IPICYT for INEEL through a contract.

5.4 Instituto Politécnico Nacional (IPN)

- The area of Dynamics and Stability of Atmospheric Flows, Department of Geophysics, of the Instituto Politécnico Nacional carries out wind forecasts using the WRF model with a resolution of 12 km×12 km. Likewise, it carries out modeling for the CFE with resolution of 4 km×4 km, with which makes the estimation of the wind power density.

5.5 Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM)

- Mesoscale modelling of one year of wind using the WRF model and downscaling of such information using the WindSim microscale model at a resolution of 200 m for a complex coastal site (Puerto Penasco, Son.), located in a northern area of Mexico (Chávez-Arroyo et al., 2012),

5.6 National Renewable Energy Laboratory (NREL)

- Preparation of database of wind and other parameters at different heights, for the period 2009-2013, with a resolution of 2 km×2 km with outputs every 5 min NREL (2018). This information will be public, so it could be used within the MEWA project.

5.7 Universidad Nacional Autónoma de México (UNAM)

- The Center of Atmospheric Sciences of UNAM carried out the modeling of the wind for the period 2005–2007 using the model MM5, obtaining hourly values of wind speed, temperature and pressure at 50 and 80 m with a resolution of 4.5 km×4.5 km. With these data,

velocity and power density maps were prepared within the project 'Preparation of Medium Resolution Maps of Solar and Wind Resources, as part of the National Inventory of Renewable Energy Resources' (Saldaña et al., 2012). This activity was contracted by INEEL.

- The Institute of Engineering of UNAM jointly with the Academic Unit of Electrical Engineering of Universidad Autónoma de Zacatecas carried out the work 'The wind resource in the state of Zacatecas: Wind characteristics in 34 localities'. For this work, wind speed information of the network of stations of Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP) was used. The wind data were measured at 3 m height. The WAsP program was used to estimate the wind power at the analyzed localities (Ángeles-Camacho et al., 2011).
- The Institute of Geography of UNAM transferred to INEEL hourly wind information of at least 400 observation points on surface for the period 2000 to 2018, this information comes from the following sources:
  1. METARES. The METAR is the international standard for the format of the code used to issue reports of meteorological observations at aerodromes. It includes information of the day of the month, hour and minutes in UTC with information of various meteorological elements including wind. The available METAR reporting sites correspond essentially to airports in Mexico, and the history of the data depends on the date of inauguration of the airport. There are about 65 sites in Mexico with reports of METARES.
  2. Network of Automatic Meteorological Stations (EMA) of the National Meteorological Service. Each station is made up of a group of sensors that automatically record and transmit meteorological information from the places where they are strategically placed. Its main function is the collection and monitoring of some meteorological variables to generate files of the 10-min average of each variable. This information is sent via satellite at 1- or 3-hour intervals. It is estimated that the representative area of the stations is approximately 5 km radius, on flat terrain, but in mountainous terrain, the spatial representativeness of a station is much smaller. The sensors that make up the station measure:
     - Wind speed
     - Wind direction
     - Pressure
     - Temperature and relative humidity
     - Solar radiation
     - Rain

     In Mexico, there are more than 700 EMA, although not all of them have complete or continuous information.

5.8 Universidad Veracruzana (UV)

- The Faculty of Electrical Mechanical Engineering carried out the estimation of the wind potential in the North and center of the state of Veracruz using the WAsP program (no more information is available) (Ibarra, 2012).
- The Faculty of Electrical Mechanical Engineering carried out the estimation of the wind resource from two years of anemometric measurements (2001 and 2002) in Alvarado, Veracruz, using the WAsP program. The results obtained were maps at 10, 50 and 80 m height of average speed and power density (Cruz, 2012).
- The Engineering Faculty (Coatzacoalcos campus) carried out wind modeling in an area of 122 km$\times$122 km in the region of Coatzacoalcos, Veracruz, using the RAMS model with a spatial resolution of 1 km$\times$1 km at a height of 50 m, hourly, for 2008, in order to estimate the wind potential in the area (Hernández, 2018).

- The Faculty of Electronic Instrumentation carried out wind modeling in 3 areas of interest of the state of Tamaulipas using the WRF model, in order to estimate its energy potential. The zone 1 has an area of 55 km×40 km, the zone 2, 45 km×70 km and the zone 3, 40 km×45 km. The modeling was carried out with a resolution of 1 km×1 km for the period from January 2006 to December 2010. The variables generated were the two horizontal components of the wind, speed, wind direction, pressure and atmospheric temperature, and from these variables, the air density and power density of the wind, every 10 min at 80 and 120 m height.
- The Faculty of Electronic Instrumentation carried out the modeling of the wind of an area of 90 km×65 km in the Isthmus of Tehuantepec area, with a resolution of 1 km×1 km for the period of January 2011 to December 2015 in order to estimate the power density. The modeling was done using the WRF model. The variables generated were the two horizontal wind components, speed and wind direction, pressure, temperature, air density and wind power density with outputs every 10 min at 80 and 120 m. This activity was carried out as part of a project contracted by CFE.
- The Engineering Faculty (Coatzacoalcos campus) carried out the wind modeling in zones of interest of the states of Tamaulipas, Veracruz, Tabasco and Campeche using the WAsP program in order to install wind power plants (Gallegos, 2018).

Acknowledgments

The presented work is part of the multi-scale and model-chain evaluation of wind atlases (MEWA) project, project number 17-M01-DTU, which is financed by the Ministry of Foreign Affairs of Denmark and administered by the Danida Fellowship Center.

References

Ángeles-Camacho, C., F. Bañuelos-Rueda, and J. Badillo-Fuentes, 2011: El recurso eólico en el Estado de Zacatecas: Características del viento en 36 localidades. Tech. rep., UNAM. URL https://aplicaciones.iingen.unam.mx/ConsultasSPII/Buscarpublicacion.aspx.

Chávez-Arroyo, R., C. Meissner, and O. Probst, 2012: Evaluation of the Wind Resource for a Coastal Site in Mexico by Combining WindSim with WRF. URL http://windsim.com/documentation/papers_presentations/2012_EWEA_WindSim_ITESM%20-%20Evaluation%20of%20the%20wind%20resource%20for%20a%20coastal%20site%20in%20mexico%20by%20combining%20windsim%20with%20wrf.pdf.

Cruz, H., 2012: Evaluación Preliminar del Comportamiento Eoloenergético en el Municipio de Alvarado, Veracruz, México. Thesis, Universidad Veracruzana, Faculty of Electrical Mechanical Engineering, México.

Dolores, E., U. Miranda, R. Lira, R. I. Cariño, and J. Matías, 2014: Configuración del modelo Regional Atmospheric Modeling System (RAMS) para la generación de series de datos de viento en el Istmo de Tehuantepec. *OMMAC*.

Gallegos, R., 2018: Evaluación del Recurso Eólico en los Estados del Golfo de México. Thesis, Universidad Veracruzana, Campus Coatzacoalcos, Faculty of Engineering, México.

Hahmann, A. N., A. Peña, and J. C. Hansen, 2016: WRF Mesoscale Pre-Run for the Wind Atlas of Mexico. *DTU Wind Energy*.

Hernández, A., 2018: Determinación del potencial eólico en la región de Coatzacoalcos mediante un modelo meteorológico. Thesis, Universidad Veracruzana, Campus Coatzacoalcos, Faculty of Engineering, México.

Ibarra, S. P., 2012: Determinación del Potencial Eólico en Zona Norte y Centro del Estado de Veracruz, Aplicando el Programa WAsP. Thesis, Universidad Veracruzana, Faculty of Electrical Mechanical Engineering, México.

Lira-Arguello, R., M. A. Ruiz-Jaimes, U. Miranda-Miranda, R. Saldaña Flores, F.-P. A. Díaz-Parra, O., and Y. Toledo-Navarro, 2016: Forecast of the Wind Speed using the Regional Atmospheric Modeling System (RAMS) and Weather Research and Forecasting (WRF) models. *International Journal of Combinatorial Optimization Problems and Informatics*, **9**, 11–24.

NREL, 2018: Zonas Competitivas con Alto Potencial de Energías Renovables en México . Tech. rep., NREL. URL https://dgel.energia.gob.mx/azel/.

Saldaña, R., U. Miranda, and R. Lira, 2013: Apoyo a la Universidad del Istmo para el Estudio del Potencial Eoloenergético en el Istmo de Tehuantepec. Tech. Rep. IIE/01/14/6100/I001/F/DC, INEEL.

Saldaña, R., et al., 2012: Elaboración de Mapas de Mediana Resolución de los Recursos Solar y Eólico, como parte del Inventario Nacional de los Recursos Energéticos Renovables. Tech. Rep. IIE/01/14/13997/I001/F, INEEL.