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IEA SHC TASK 36: SOLAR RESOURCE KNOWLEDGE MANAGEMENT

GLOBAL RADIATION SHORT TERM FORE-CAST AND TRENDS / AEROSOL CLIMATOLOGY

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Abstract

In the framework of IEA Solar Heating and Cooling (SHC) task 36 Meteotest investigates the possibilities and quality of global radiation forecast, the trend of recent global radiation data and distribution of atmospheric aerosols.

In the fifth year 2010 of task 36 – the project had been prolonged by one year – the work within the tasks has been finished and the final report has been started to write. Additionally the definition of the follow on task 46 – the task has been approved in November 2010 – has been made in two meetings. The new task will start mid 2011.

METEOTEST wrote two chapters in the final report, which will be published in 2011. One is dealing about aerosol climatologies and one about long term trends of global radiation. *METEOTEST* presented the advances of the solar radiation forecast based on regional weather forecast models of the last few years at the PVSEC 2010 in Valencia, as well as the long term trends of global radiation at the Bad Staffelstein PV meeting and Eurosun 2010. It could be showed, that the uncertainty of the weather forecast models used at *METEOTEST* has been lowered significantly during the last years.

Introduction

In the framework of IEA Solar Heating and Cooling (SHC) task 36 “Solar Resource Knowledge Management” [1] Meteotest investigates mainly the possibilities and quality of global radiation forecast. The task 36 is divided into 3 main subtasks:

A) Standard qualification for solar resource products (includes benchmarking of different radiation estimation models based on satellite measurements).

B) Common structure for archiving and accessing solar resource products (includes prototype of online tool for accessing data).

C) Improved techniques for solar resource characterization and forecast; improve satellite retrieval methods for solar radiation products; conduct climatological analysis of solar resources.

The aim in the radiation forecast subtask is to define the quality of the existing models and to enhance the quality. Main partners in this subtask are listed in Table 1.

Additionally this year work has been done within part c). on estimation of trends of recent global radiation data and on a new aerosol climatology.

Work done and results

The year 2010 was used to finalize the task and report about the work done. No additional work parts have been started.

Here the state of all three subtasks:

Subtask A: This subtask has been completed. Final subtask deliverables as well as inputs for the Handbook on Solar Radiation are in preparation.

Subtask B: This task has been completed. Final subtask deliverables as well as input for the Handbook on Solar Radiation are in preparation.

Subtask C: This subtask is nearing completion. Further analysis of long-term climate trends, and additional solar resource forecasting studies, including benchmarking with PV system outputs as well as high quality ground solar measurements, will continue, as well as preparation of materials for the Handbook on Solar Radiation.

Final report

METEOTEST wrote two chapters of the final reports, which will be published in 2011. One is dealing with aerosol climatologies and another with long term trends of global radiation (see BFE Jahresbericht 2009 of IEA SHC Task 36).

Presentation of the work

METEOTEST presented the recent advances of the solar radiation forecast based on regional weather forecast models at the PVSEC 2010 in Valencia [2] as well as the long term trends of global radiation at the PV Symposium at Bad Staffelstein [3] and at Eurosun 2010 [4]. Additionally the whole task 36 was presented at Eurosun 2010 [5].

In the presentation for the PVSEC we could show, that with relatively low effort the uncertainty of hourly global radiation forecasts could be lowered (Tab. 1 and Fig. 1).

Table 1: Validation results of different setups for forecast day 1 (1 – 24 h). PP is the post processing scheme where DMO means direct model output. PP = post processing (making changes to the direct model output).

Setup	Model	Resolution	Output	Bias	rmse
1	MM5	90 km	Direct model output	0.2%	55.0%
2	MM5	30 km	Direct model output	2.2%	48.6%
3	WRF	5 km	Direct model output	1.6%	51.2%
3 + PP 1	WRF	5 km	smoothing of 10x10 model pixels	1.3%	44.2%
3 + PP 1 & 2	WRF	5 km	smoothing of 10x10 model pixels, fixed bias correction	-0.9%	41.3%

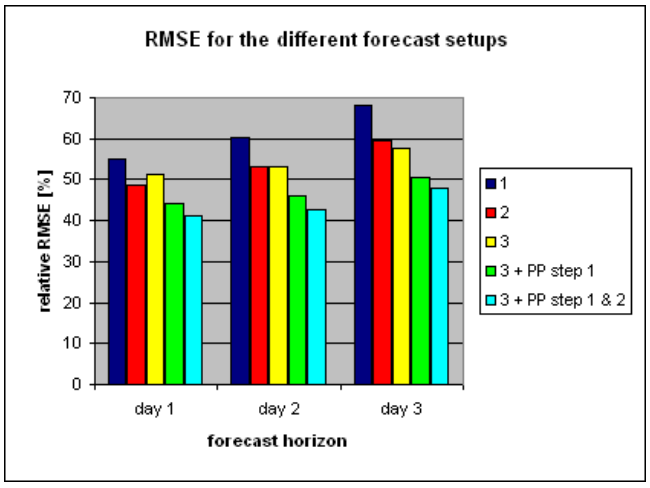

Figure 1: Error development over the three forecasting days.

The accuracy of the direct model output (DMO) for Switzerland lies in the order of 50% in the rmse on hourly values and in the mean it is quite bias less. A statistical post-processing and a more sophisticated model setup lowered the rmse by an absolute value of 14%. In relative units the improvement since the first tries is 25%. The uncertainty of 40% is in the range of other solar radiation forecast models for Switzerland [6].

New task

The new task (Nr. 46) has been defined in two task meetings. It will include the following subtasks:

Subtask A: Solar Resource Applications for High Penetration of Solar Technologies

- Solar variability and specifically ramp rates for particular systems
- Spatial and temporal characterization of intermittency
- Integration of solar with other RE technologies

Subtask B: Standardization and Integration Procedures for Data Bankability

- Measurement best practices
- Integration of data sources
- Evaluation of the use of TMY data
- Data uncertainties over various time frames
- Gap-filling, QC, and Flagging

Subtask C: Solar Irradiance Forecasting

- Short-term forecasting
- Integration of solar forecasts into operations
- Long-term variability and impact of climate change of solar resources

National / international cooperation

The work was done in the framework of IEA Solar Heating and Cooling task 36. From Switzerland there is also University of Geneva part of the task team.

Outlook

The task will be finished next year. The follow on task 46 has been approved in November 2010. The new task will start in July 2011 and end in June 2014.

References

[1] Homepage of IEA Solar Heating and Cooling task 36: http://re.jrc.cec.eu.int/iea-shc-task36/index.htm

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[6] Lorenz et al. 2009, Benchmarking of different approaches to forecast solar irradiance, 24th European Photovoltaic Solar Energy Conference (EUPVSEC), Hamburg, Germany, Sep. 21st to 25th 2009.