Developing soiling forecasts for optimizing operation and maintenance procedures in CSP plants

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Introduction

- CSP plants are being implemented in dusty environments such as Middle East and North Africa where solar radiation is high.
- The minimization of soiling-induced losses together with the reduction of cleaning costs is a challenge for operators and project planners.
- H2020SOLWATT project targets a significant reduction in the water used by CSP plants (by 35% for wet cooled & by 90% for dry cooled). In this way more of 0.5 M€/year of operational cost for a 50 MW CSP plant will be saved in the future.

SOLWATT

Project objectives

The project focuses on the efficiency of innovations on solar field cleaning, power-block cooling, water recycling system, and plant operation strategy. The social acceptance of CSP will be increased by detailed analysis of case studies and education of local population to the benefits of solar energy.

Project structure

WP2 includes the development of an unique soiling forecast product that will be included in the O&M optimizer. This additional input information will assure that innovative water-saving technologies are used in the best way.

Soiling forecast model will be developed coupling the outputs of an atmospheric composition model with a soiling model.

Regional-GLOBAL operational dust forecast

Barcelona Supercomputing Center (BSC, www.bsc.es/ess) maintains daily operational dust forecast based on the in-house atmospheric composition model NMMB-MONARCH at global (MONARCH-GLOB) and regional scales at 33km (MONARCH-REG-033) and 10km (MONARCH-REG-010). The NMMB-MONARCH dust regional daily forecasts contribute to the Regional Center of the WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) dust forecast model intercomparison (https://sds-was.aemet.es) and it is the reference model of the operational WMO Barcelona Dust Forecast Center (https://dust.aemet.es/).

Model evaluation results

- The DLR Institute of Solar Research (SF) is the largest research entity in Germany investigating and developing concentrating solar technologies to provide heat, electricity and fuel.
- DLR has developed a soiling model that has been validated for two sites during WASCOP – Water Saving for Concentrated Solar Power (H2020 project).

Soiling model

- The DLR Institute of Solar Research (SF) is the largest research entity in Germany investigating and developing concentrating solar technologies to provide heat, electricity and fuel.
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Goal: The Soiling forecasts products Merge of BSC-Dust/ DLR model

- We will couple the dust regional-global NMMB-MONARCH model developed and maintained by BSC and the WASCOF soiling model developed by DLR.
- Both models will exchange several parameters like particle number concentration by size, and other measured weather parameters.
- The resulting soiling forecast rates will be evaluated for the various forecasting horizons over the two CSP operational sites considered in SOLWATT.
- As a result, within SOLWATT we will provide:
  - Operational soiling forecasts: up to 5-days soiling forecasts based on the daily operational dust MONARCH system.
  - A soiling rate map: based on a dust NMMB-MONARCH reanalysis for Northern Africa, Middle East and Europe.

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