Spotting Suitable Onshore Wind Farm Sites from Space

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Abstract

There has been much study, research, and investment in the field of measuring and modelling onshore wind as “the critical resource”; and rather less attention on automating the assessment of the many geographical, environmental, logistical etc. “non-wind resources” required when screening for suitable onshore wind farm locations.

This poster highlights the work of the innovative SEWISS (Space Enabled Wind Installation Site Screening) project which is co-funded by the European Space Agency within the program Integrated Application Promotion (IAP).

SEWISS has made recent user validated progress in the use of multi-spectral satellite imagery, combined with other relevant data sets to automate the global remote screening of these “non-wind resources”, with a view to reducing both the cost and duration of the site screening and selection phase.

Methods

The starting point: Satellite imagery such as the below 50 cm resolution Pleiades image of the Waltersholt site here in Hamburg contain layers of geo-referenced data across multiple spectral bandwidths which must be processed.

The layers: The initial image is combined with other relevant data layers and analysed via a user defined rule set.

The automated analyses: Each analysis is validated during SEWISS demonstration project against physical site surveys and crowd sourced data such as google and Instagram photos.

Objectives

Technical and commercial viability of the SEWISS concept has been validated via a successful feasibility study, and a demonstration project was recently launched (1st Sept 2016), to develop, trial and validate SEWISS on 24 global areas of interest chosen by involved onshore wind developers.

What are the main challenges for SEWISS?

- Validation of our image analysis algorithms such that users can automatically generate a land cover map for any location in the world with M100 μ≤ 1 hectare.
- 10-classification indexes including low/high trees and buildings with feasibility grade accuracy.
- Validation of our image analysis algorithms such that users can automatically recognize buildings and generate a building vector layer with feasibility grade accuracy.
- Wrap SEWISS up into a web-based service to allow users to search, purchase, and analyse data, plus go on to manipulate, save and export analysis results.

What are the key drivers behind user interest and involvement in SEWISS?

- Desire for recent up to date data, and increased automation to drive down the cost and duration of site screening and site selection.
- Interest in a solution that can remotely provide site screening and site selection data in countries where a user may not have local resources, where access and existing data (maps, cadastral, etc.) are poor or when due diligence for site purchase is required.
- Expandable growth in satellites means that solutions using satellite data provide global coverage, frequent revisit cycles and have no permit or deployment issues.

Results

Initial feasibility study cost benefit analysis indicates that SEWISS has the potential to reduce the duration of the site screening and selection phase by 30%, and the cost by 10-15%.

Object Based Image Analysis algorithms trained on 3 global sites during feasibility study indicate that SEWISS automated land cover and building recognition analyses can globally achieve >70% accuracy with 90% confidence.

Conclusions

- By using SEWISS technology, developers would no longer need to visit actual locations for initial site screening.
- SEWISS technology increases the probability that the initial site selection work identifies the site which actually has the best success criteria.
- SEWISS technology dramatically reduces the probability that the initial site selection work identifies sites which ultimately prove not to meet success criteria after further wasted investment by developers.
- The use of SEWISS technology makes it possible for all developers, large and small to have access to best practices in the areas of site selection and data layering.
- SEWISS’s rule sets can be configured to include valuable local data such as legislative rules etc.
- SEWISS outputs have value as inputs to existing packages such as windPRO and AutoCAD for wind resource and noise modeling.

References

1. SEWISS Space Enabled Wind Installation Site Screening Feasibility Study, European Space Agency, 10 April 2016, Report Number: SEWISS/SEF/4/001
2. The SEWISS demonstration project kicked off on 1st April 2016 and the team would like to thank Greenwich Marine Consultants Ltd, ENGI, and all our involved energy providers, onshore wind developers and renewable energy consultants for their input and continued support.
3. Background satellite image provided by European Space Agency © CNES 2015/16 distribution AirbusDS