

Power Curve Working Group 5th Meeting

Validation Framework and Dataset 1 Overview

Peter Stuart
Senior Technical Manager

Wednesday 4th December 2013



Agenda

The background of the slide is an abstract composition of vibrant orange and yellow light streaks. These streaks, which vary in thickness and brightness, radiate from the bottom right corner towards the top left, creating a sense of dynamic movement and energy. The overall color palette is warm, with the bright yellow streaks contrasting against the deeper orange background.

PCWG Progress Overview

- The 1st meeting gave a clear statement of the **problem**.
- The 2nd meeting examined possible **solutions**.
- The 3rd meeting put some of those solutions into **practice**.
- The 4th meeting **consolidated** the learning by examining new datasets.
- The 5th meeting will focus on **validating** the candidate correction methods against real data.

There will be an in depth retrospective of the progress to date in the afternoon.

Power Curve Working Group Roadmap

Definition	Solution / Evolution					Conclusion
Meeting 1	Meeting 2	Round Robin 1	Meeting 3	Round Robin 2	Meetings 4 and 5	Final Meeting
Define what's the problem we are trying to solve.	Identify possible solutions	Trial solutions	Feedback on solutions. Compare experiences & lessons learnt. Identify refined and/or alternative solutions	Trial refined solutions	Feedback on refined solutions. Is problem is solved? Should problem be redefined? Iterate solutions as required...	Finalise conclusions Publication of journal paper by working group. Publication of guideline document.
Publically disseminate presentations and minutes						
Dec 2012	Mar 2013	Apr - May 2013	May 2013	Jun – Sep 2013	Dec 2013	Jun 2014

Current Status

Review of Actions from Last Meeting

- ✓ Final collation of Round Robin 2 Results (see minutes)
- ✓ Rotor Equivalent Wind Speed Consensus Analysis (Final)
- ✓ Turbulence Renormalisation Consensus Analysis (Draft)
- ✓ 1st Validation dataset published (based on dataset 1 from Round Robin)
- ✓ Draft Inner-Outer Range Proposal (circulated within group)

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10.00 – 10.05 “Welcome” Daniel Stevens (SSE)

Analysis of Validation Dataset 1

- 10.05 – 10.15 “Validation Framework and Dataset 1 Overview” Peter Stuart (RES)
- 10.15 – 10.30 “Dataset 1 Colour Map Analysis” Tomas Blodau (REPower)
- 10.30 – 10.45 “Rotor Equivalent Wind Speed: One Power Curve or Two?” Axel Albers (WindGuard)

Additional Validation Analysis

- 10.45 – 11.00 “GL DNV Validation Analysis” Richard Whiting (DNV GL)
- 11.00 – 11.15 “RES Validation Analysis” Alex Clerc (RES)
- 11.15 – 11.30 “EDF Validation Analysis” Jared Kassebaum (EDF)

Additional Open Datasets (11.30 – 12.00)

- Proposed SSE/Sgurr Dataset Dan Stevens (SEE) & Ralph Torr (Sgurr)
- Proposed RES Dataset
- Discussion: potential for other datasets?

12.00 – 12.15 “Rotor Equivalent Wind Speed and Turbulence Renormalisation Implementation in OpenWind” Nick Robinson (AWS TruePower)

12.15 – 13.00 Morning Discussion Session (Moderated by Peter Stuart)

- Rotor Equivalent Wind Speed Consensus Analysis
- Addition of Veer to REWS Consensus Analysis
- Turbulence Renormalisation Consensus Analysis
- Possible public distribution of Consensus Analysis.
- Inner /Outer Range Statement Document Discussion

13.00 – 14.00 Lunch

Afternoon Discussion Session Part 1: 14:00 – 15:30

- 14:00 – 14:15 “One year on, A review of Working Group progress to date” (Andrew Tindal DNV GL)
- Open Discussion
 - Discussion of issues raised in presentations
 - Round robin of views of Manufacturers present – verbal or brief slides

15.30 – 15.45 Tea/Coffee Break

Afternoon Discussion Part 2: 15.45 – 17.30

Next steps for working group

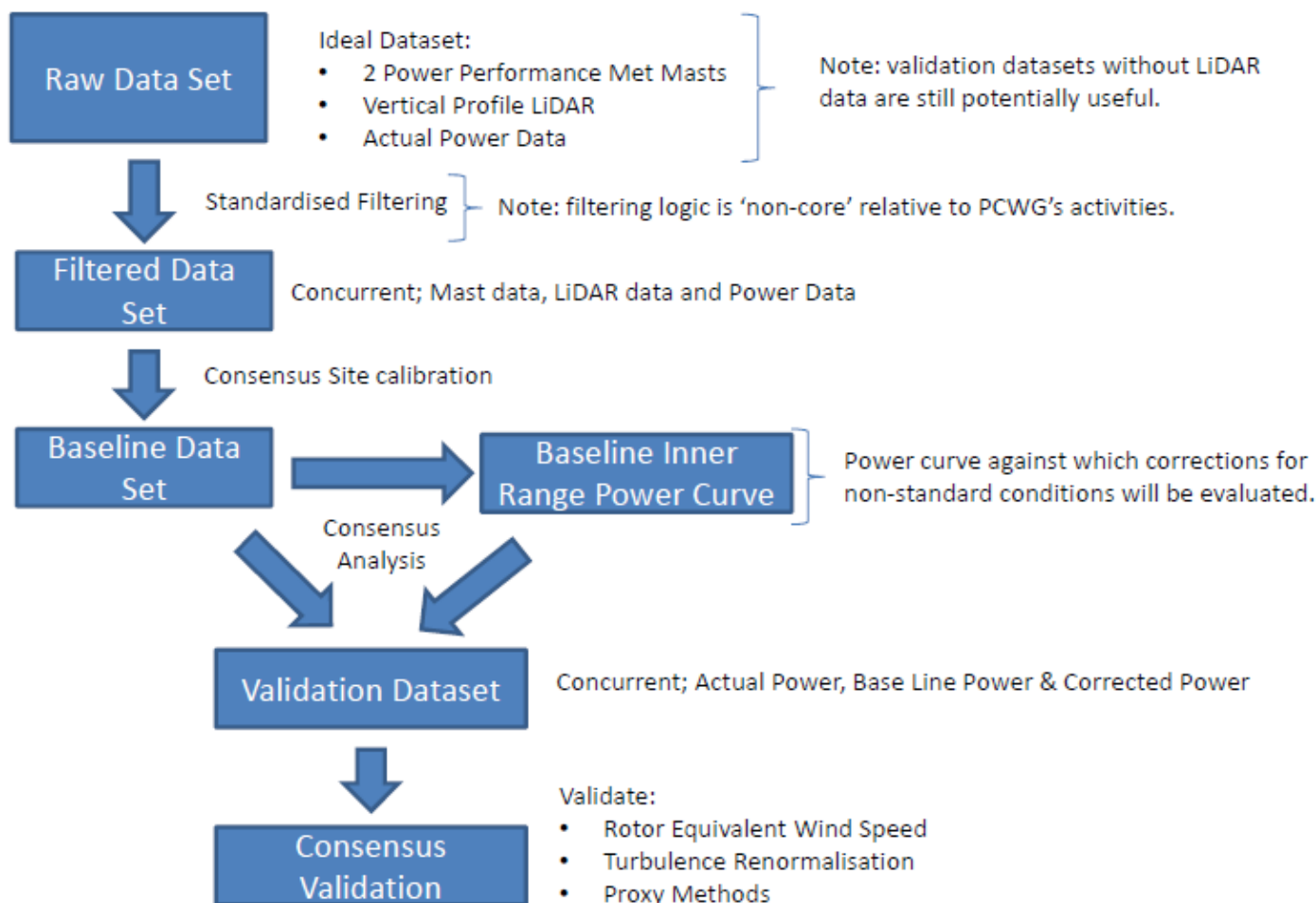
- Wrap Up, Conclusions (20 minutes)
- Continued Public Distribution of Minutes and Presentations (5 minutes)
- Venue for next meeting (5 minutes)

Validation Framework Overview

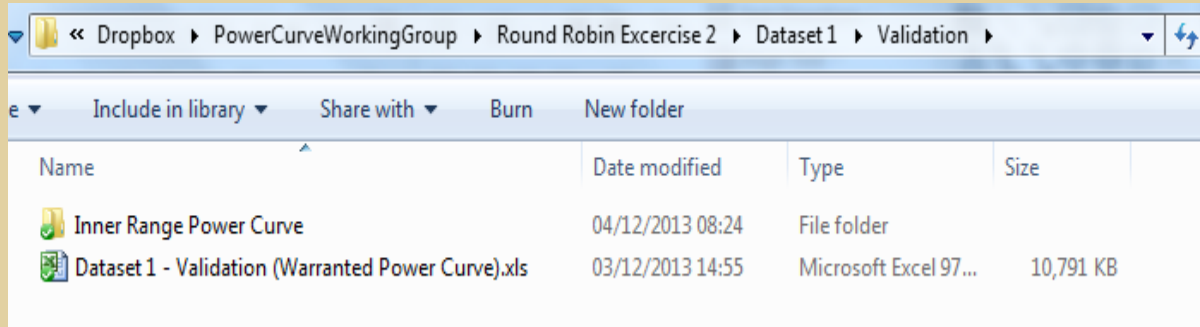
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Validation Analysis Overview

PCWG Validation Framework

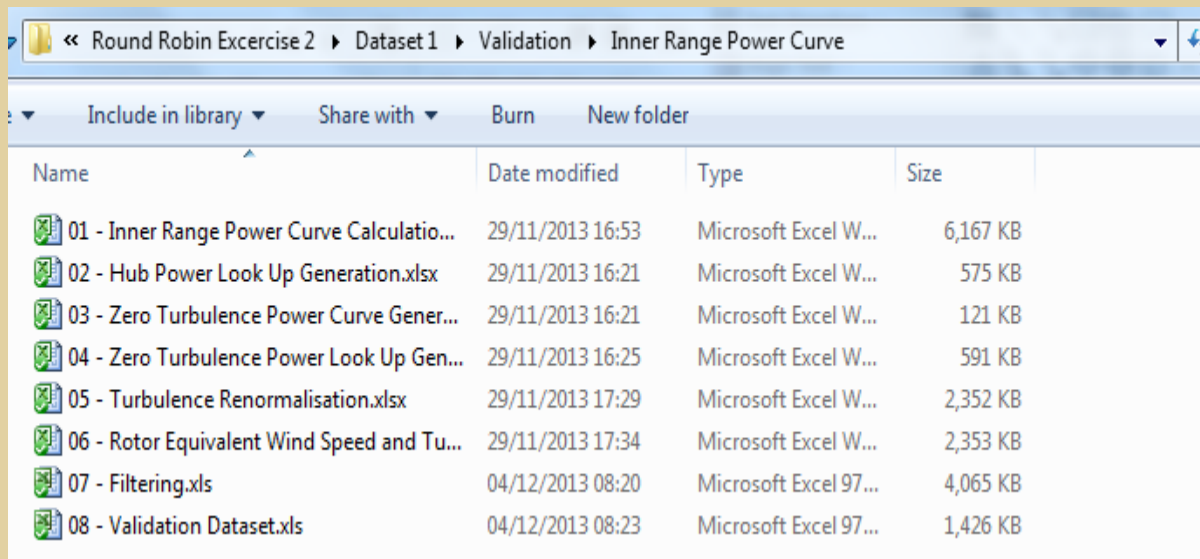


Validation Dataset Flavours



Name	Date modified	Type	Size
Inner Range Power Curve	04/12/2013 08:24	File folder	
Dataset 1 - Validation (Warranted Power Curve).xls	03/12/2013 14:55	Microsoft Excel 97...	10,791 KB

Warranted Power Curve Based – Consistent with Round Robin (Original)



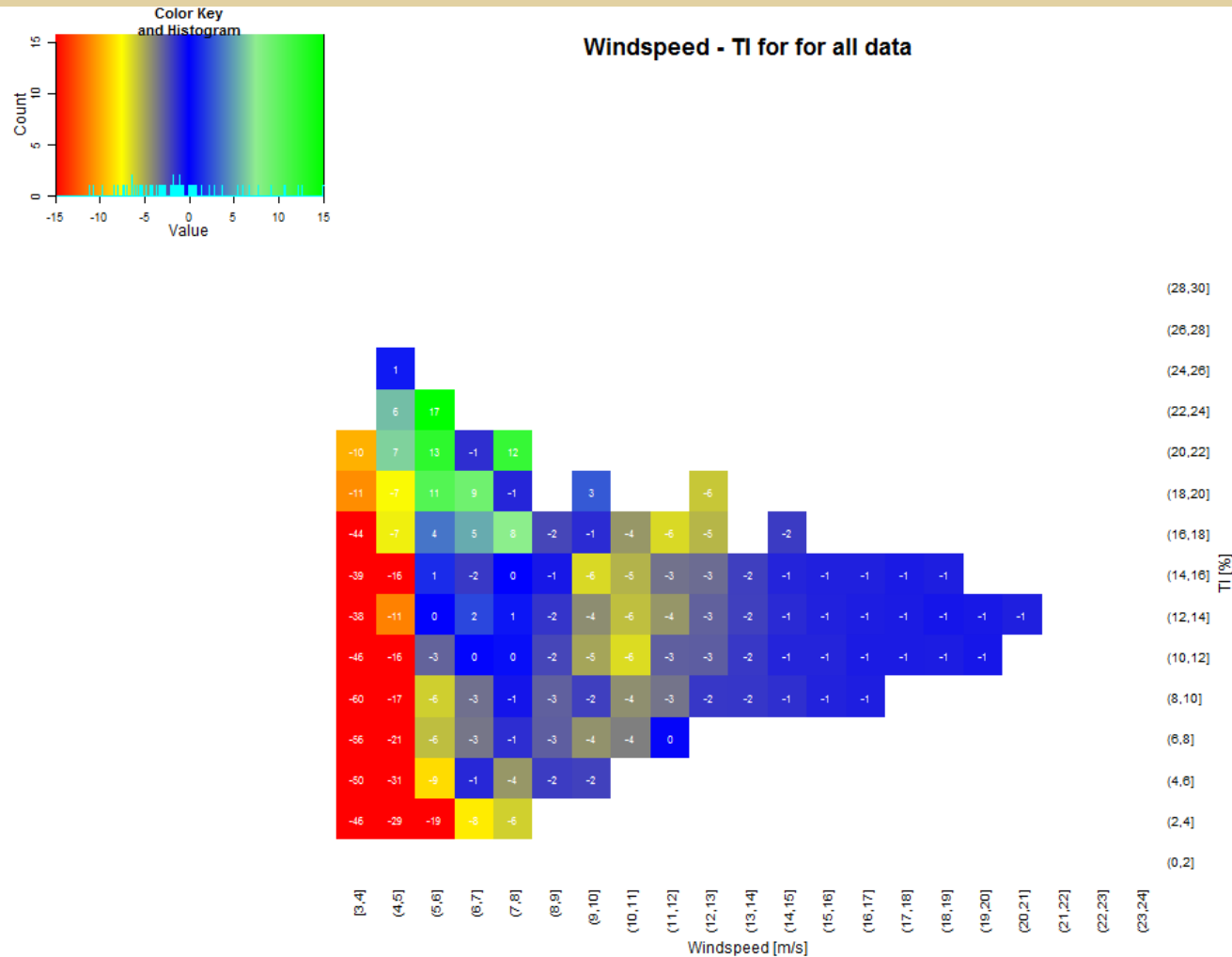
Name	Date modified	Type	Size
01 - Inner Range Power Curve Calculation...	29/11/2013 16:53	Microsoft Excel W...	6,167 KB
02 - Hub Power Look Up Generation.xlsx	29/11/2013 16:21	Microsoft Excel W...	575 KB
03 - Zero Turbulence Power Curve Gener...	29/11/2013 16:21	Microsoft Excel W...	121 KB
04 - Zero Turbulence Power Look Up Gen...	29/11/2013 16:25	Microsoft Excel W...	591 KB
05 - Turbulence Renormalisation.xlsx	29/11/2013 17:29	Microsoft Excel W...	2,352 KB
06 - Rotor Equivalent Wind Speed and Tu...	29/11/2013 17:34	Microsoft Excel W...	2,353 KB
07 - Filtering.xls	04/12/2013 08:20	Microsoft Excel 97...	4,065 KB
08 - Validation Dataset.xls	04/12/2013 08:23	Microsoft Excel 97...	1,426 KB

Inner Range Power Curve Based – Consistent with validation framework (just released)

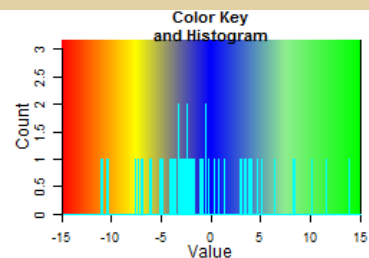
The background of the slide is an abstract composition of vibrant orange and yellow streaks, resembling flames or energy waves, set against a darker orange backdrop. In the upper-left corner, there is a solid orange rectangular box containing white text.

Dataset 1 Colour-map Analysis (Relative to Warranted) Prepared by REPower

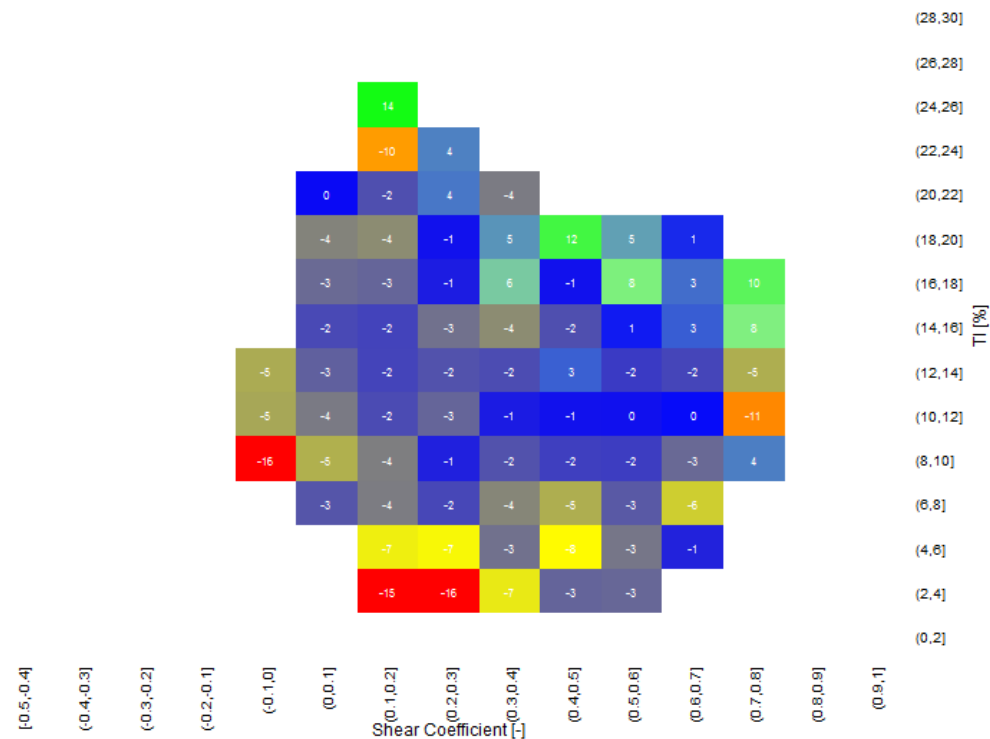
Wind speed vs. TI (All Data)



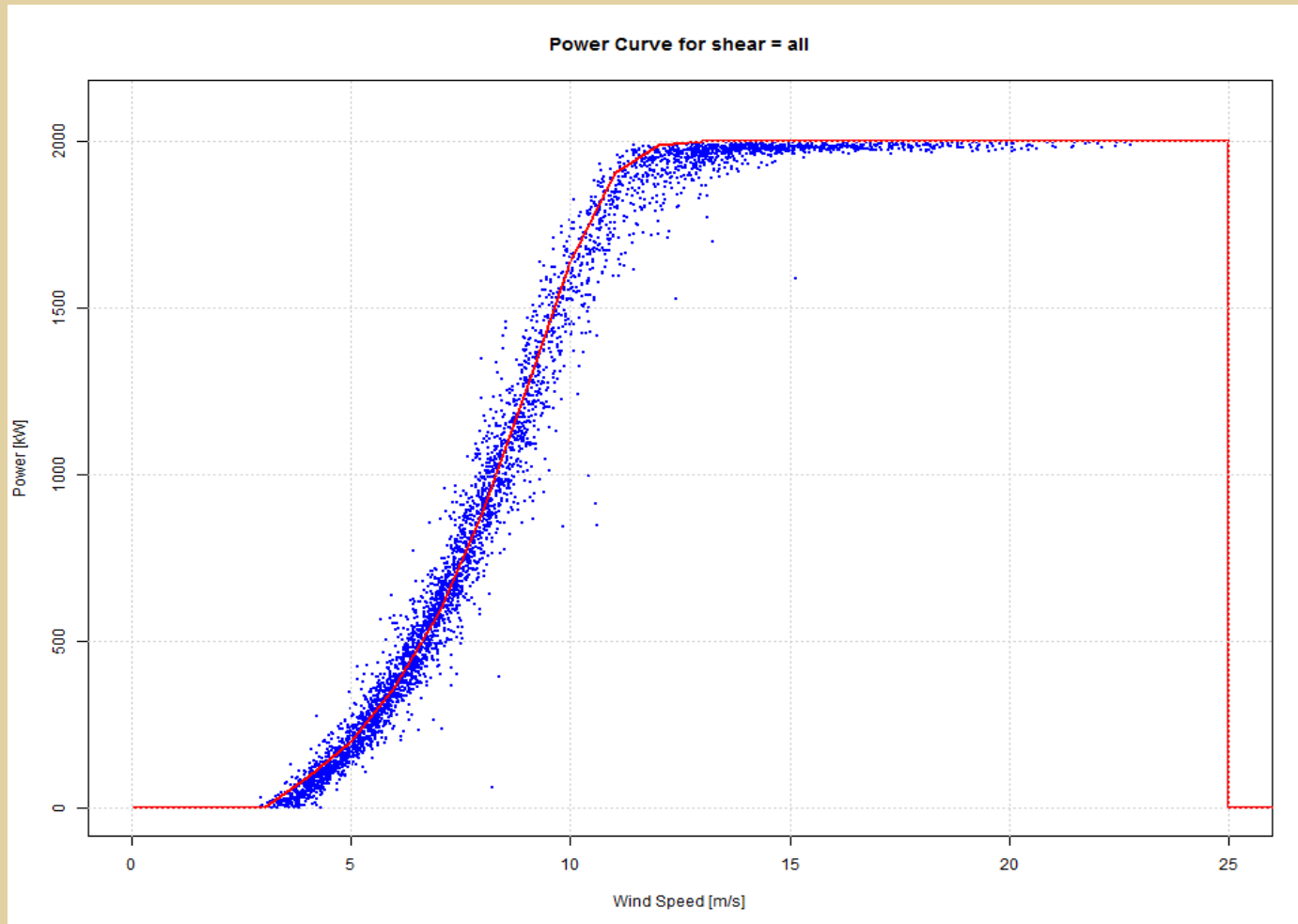
Shear vs. TI (All Data)



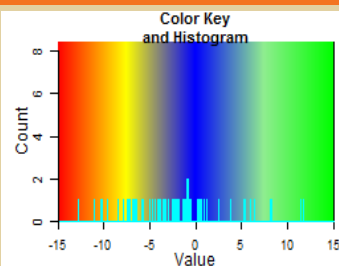
Shear - TI for all data



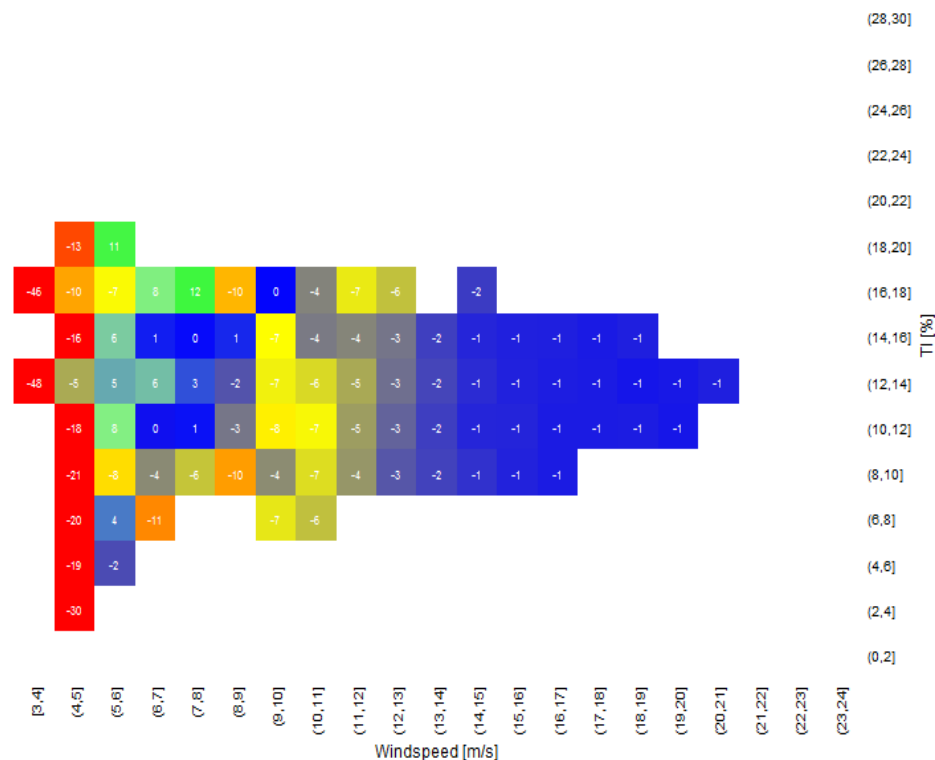
Power Curve for All Shear



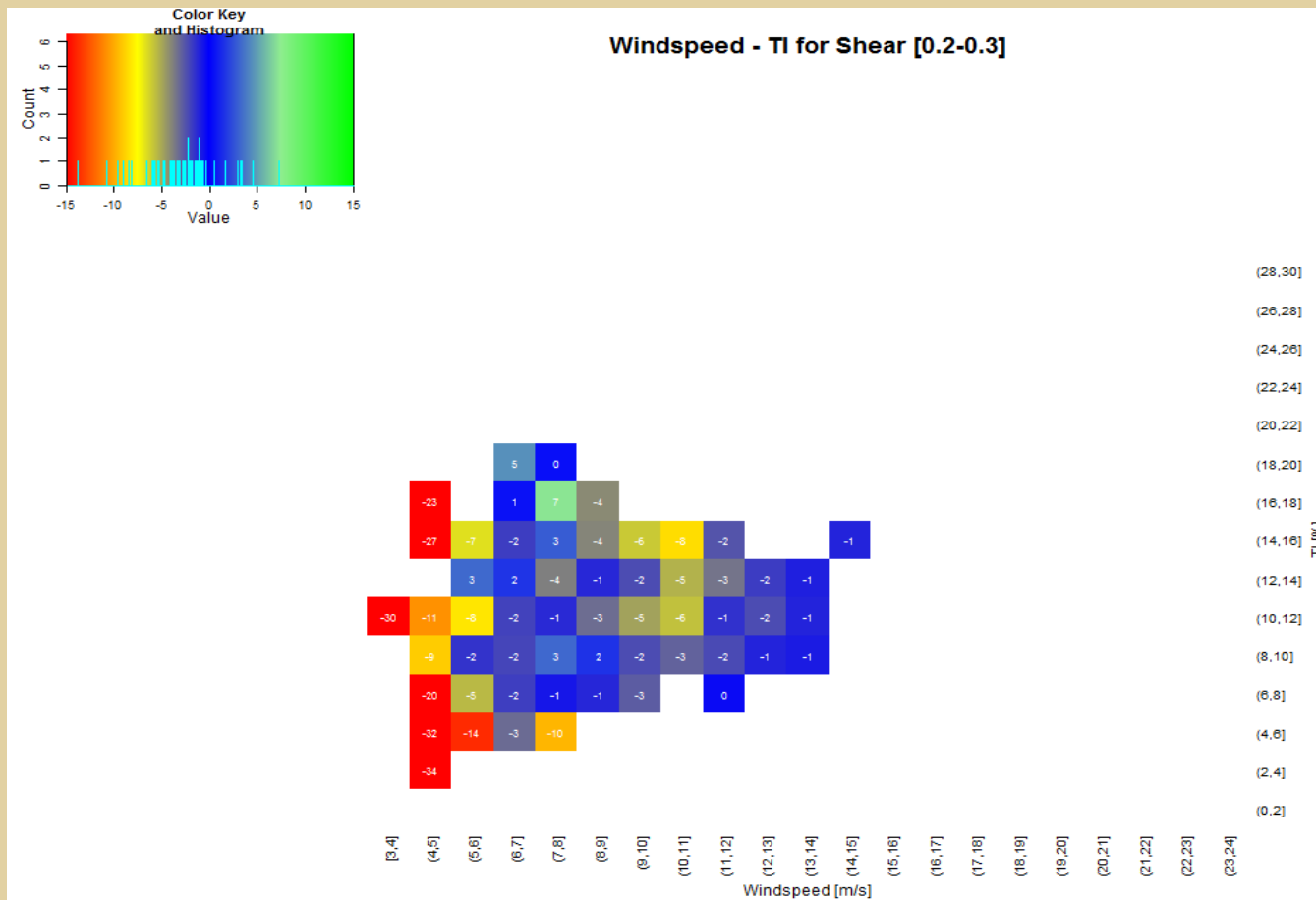
Wind Speed vs. TI (Shear < 0.2)



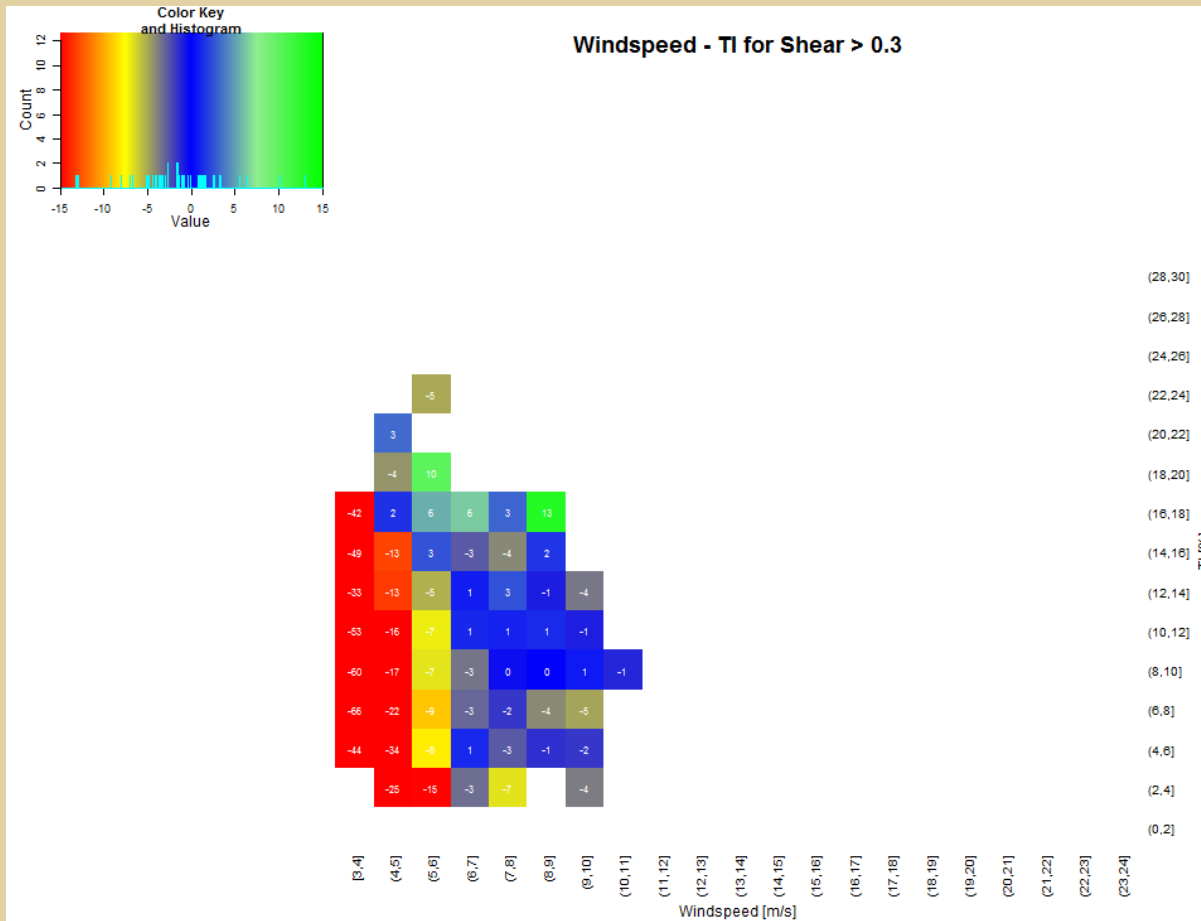
Windspeed - TI for Shear < 0.2



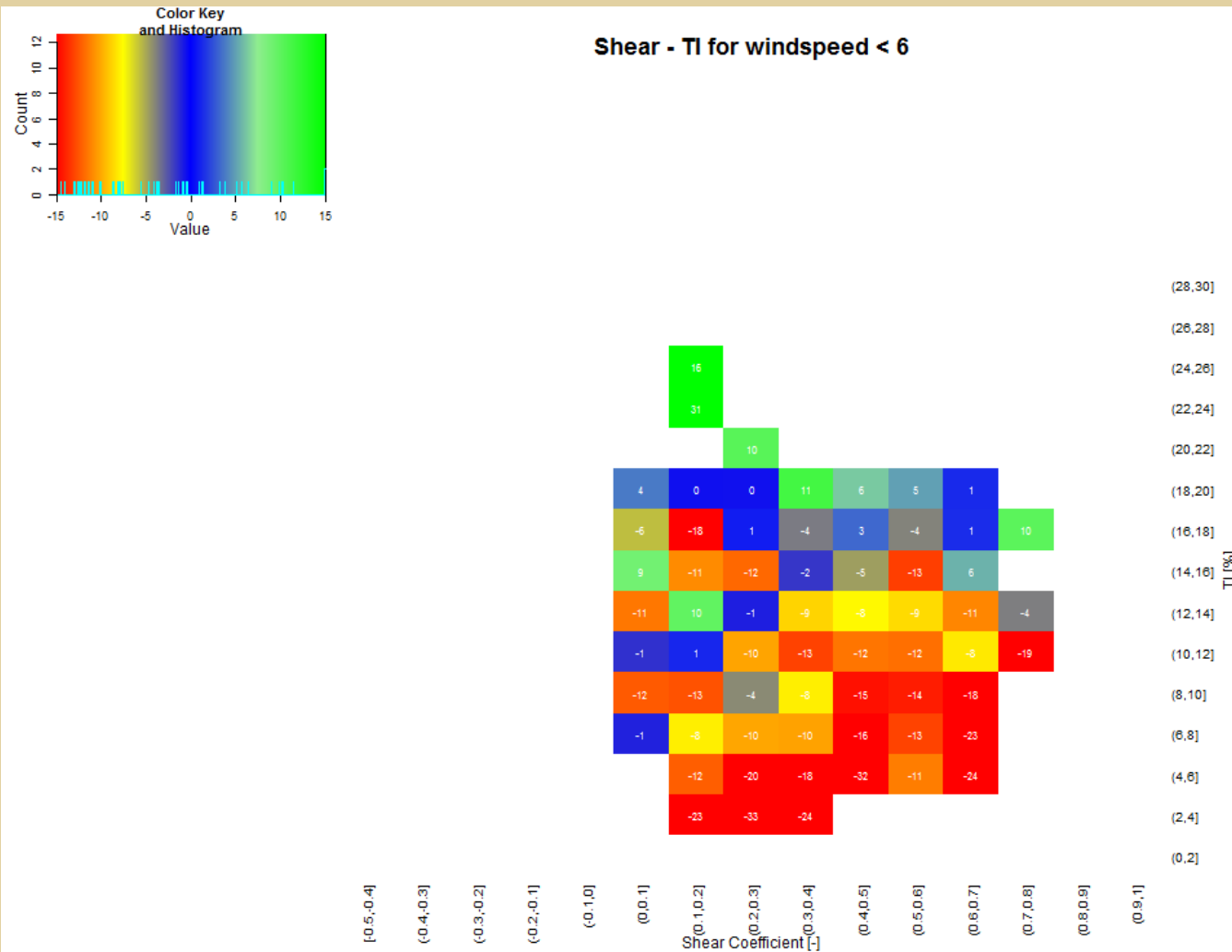
Wind Speed vs. TI (0.2 < Shear < 0.3)



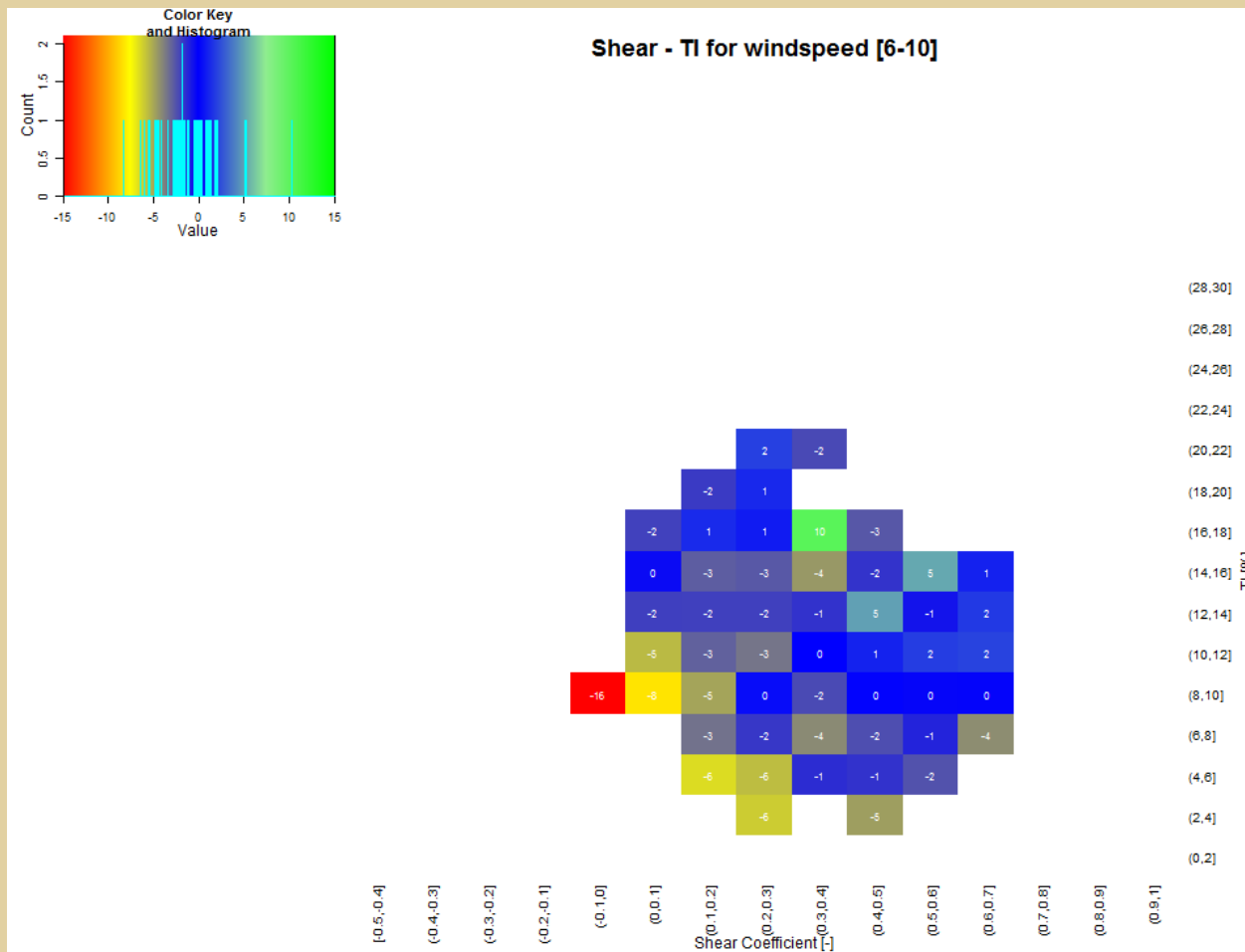
Wind Speed vs. TI for Shear > 0.3



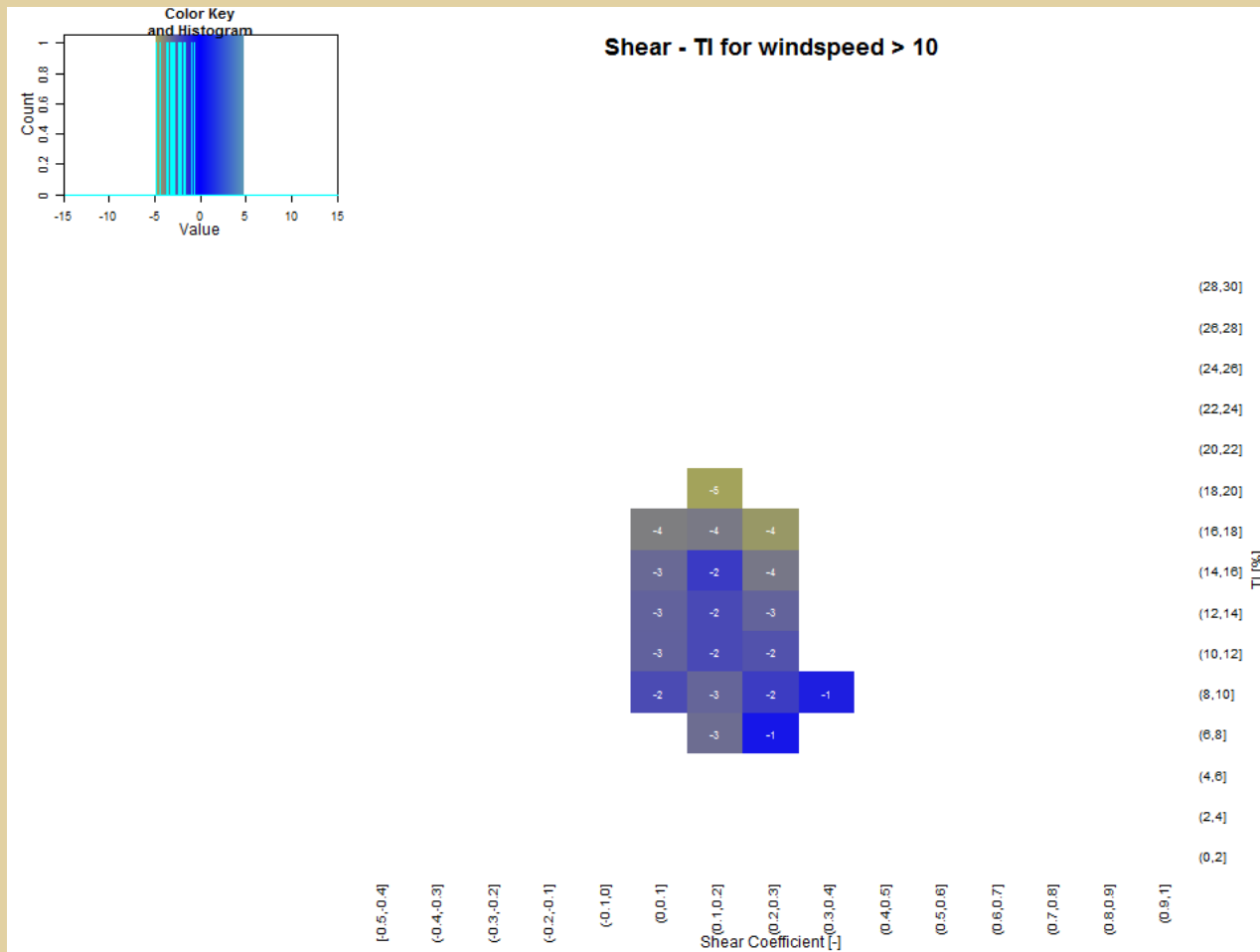
Shear vs. TI for Wind Speed < 6



Shear vs. TI for $6 < \text{Wind Speed} < 10$



Shear vs. TI for Wind Speed > 10





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power for good