Standardization of BMX start times using real-time weather data

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Background

- Electronically-measured start times are the most common method for monitoring training start performance and tracking progress in BMX racing.
- The accuracy of start times measurements is assumed to be subject to varying outdoor weather conditions (wind, air density).
- How strongly start times are affected by wind and air conditions is unknown.
  - Depending on effect magnitude, a correction procedure could be warranted for improving the accuracy of training start times.

Procedures

- Time frame: March – July
- Acquired data: 84 starts, 4 riders, 7 sessions
  - Start times, gate to ground [a]
  - Time-synced weather data [b]
- [a] Brower optical timing gates. [b] Skywatch Aero 6 weather station.
- Range of weather conditions:
  - Temperature: 3 – 36°
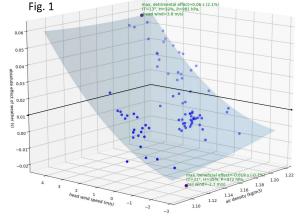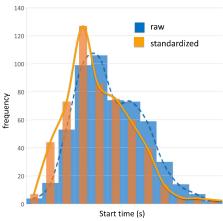 - Pressure: 955 – 983 hPa
  - Humidity: 25 – 88%
  - Air density: 1.09 – 1.22 kg/m^3
  - Wind speed: 2.7 m/s tail wind – 4.4 m/s head wind

Results

- Calculated effects of weather on start time (Fig. 1) ranged from -0.02 to +0.06 s (between -1 and +2%).
- Wind (especially head wind) was by far the largest single influencing factor.
- Effects of temperature, humidity, and air pressure were comparatively small.

Fig. 1

Conclusions & Application

- Measuring and correcting for weather conditions, especially wind, is recommended for improving start time accuracy.
- Implementation of an algorithm to standardize training start times by correcting for real-time weather data (Fig. 2) reduces the number of outliers (mostly overestimations) and is believed improve data accuracy.
- This is especially important for tracking training progress across annual periods with vastly different weather conditions.
- Effects of weather are expected to be greater on other segments of the BMX track where average speed is higher.