Optimising the analysis of road cycling sprint power data

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The importance of sprint training for road cycling performance

- Most races are won in a bunch- or breakaway sprint

- Races contain lots of attacks and severe accelerations

- High volume of training and racing leads to decrease in sprint capacity
  - Shift of type II to type I muscle fibres

- Important for all types of rider

How sprint training is performed

- Different sprint series or random sprints during training session

- Sprint durations last between 5 and 15 sec

- Sprints on the flat and sprints uphill

- Different speeds at start of sprint

- Aproximately the same cadence for each sprint condition

- Always after 1 or 2 easy days

- Throughout the season

How are sprint sessions analysed

- SRM powermeter and software

- Velobook website developed for the Cofidis Team

- Maximum Mean Power (MMP) values for 5'', 10'' and 15''

Several tendencies noted

- Influence of topographic condition

- Influence of start speed condition

- Influence of period of season

- Influence of « motivational conditions »

- Difference between training and race values

Important to understand any influences & differences

- To know if a sprint value is a good one

- To compare inter- and intra- session sprint performance

The research questions:

- How does topography and start speed influence sprint power in professional cyclists

- How does sprint performance vary during a season and over several seasons in professional cyclists

- How does « motivational condition » influence sprint performance in professional cyclists
  - Sprint vs. another rider in a Training Camp

- What is the difference between best training and race sprint performance in professional cyclists

Method

- 24 riders (all type of riders)

- 641 sprint sessions (5-20 sprints/session (M=10), 11-68 sessions/rider (M=27))

- 6268 sprints (110-750 sprints/rider (M=261))

- Excluded sprints at:
  - \> 1200 m altitude
  - too high/low gear

Method

- 5'' MMP values of each sprint were obtained with Velobook
- Sprint conditions were determined manually in each SRM file
- Slope and zero offset of each file was verified
- 9 sprint conditions :

| Flat med (I2)	Flat fast (I3)	Flat slow	False F med (I2)	False F fast (I3)	False F slow	Uphill med (I2)	Uphill fast (I3)	Up slow

- Season was divided in 3 parts :
-         - November -> January (pre race season)
-         - February -> June (early race season)
-         - July -> October (late race season)

Statistical analysis

- Multilevel mixed effect modelling
  - Research questions (1-3) were treated as fixed effects
  - Reserach question 4 analysed separately
  - Riders regarded as random effects (intercept only)
- Dependent variable: 5-sec mean maximum power output

- **Plain English translation:**
  We built a statistical model to predict riders' sprint performance.
  We examined the effects of:
  1) topograpy, 2) season, and 3) training camp.
  Each rider had a different sprint power, (not the average).

Results
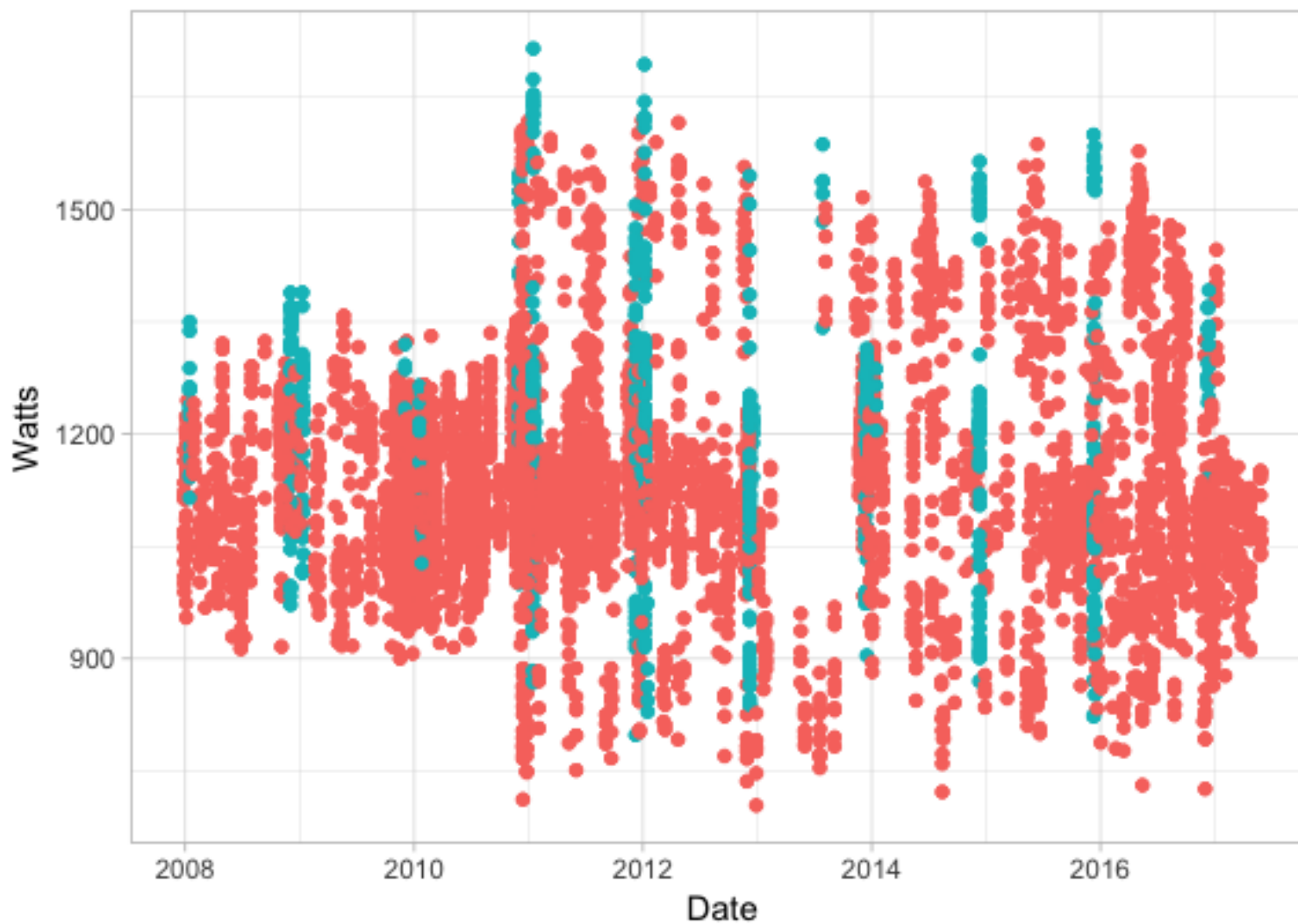
Effect of speed and gradient
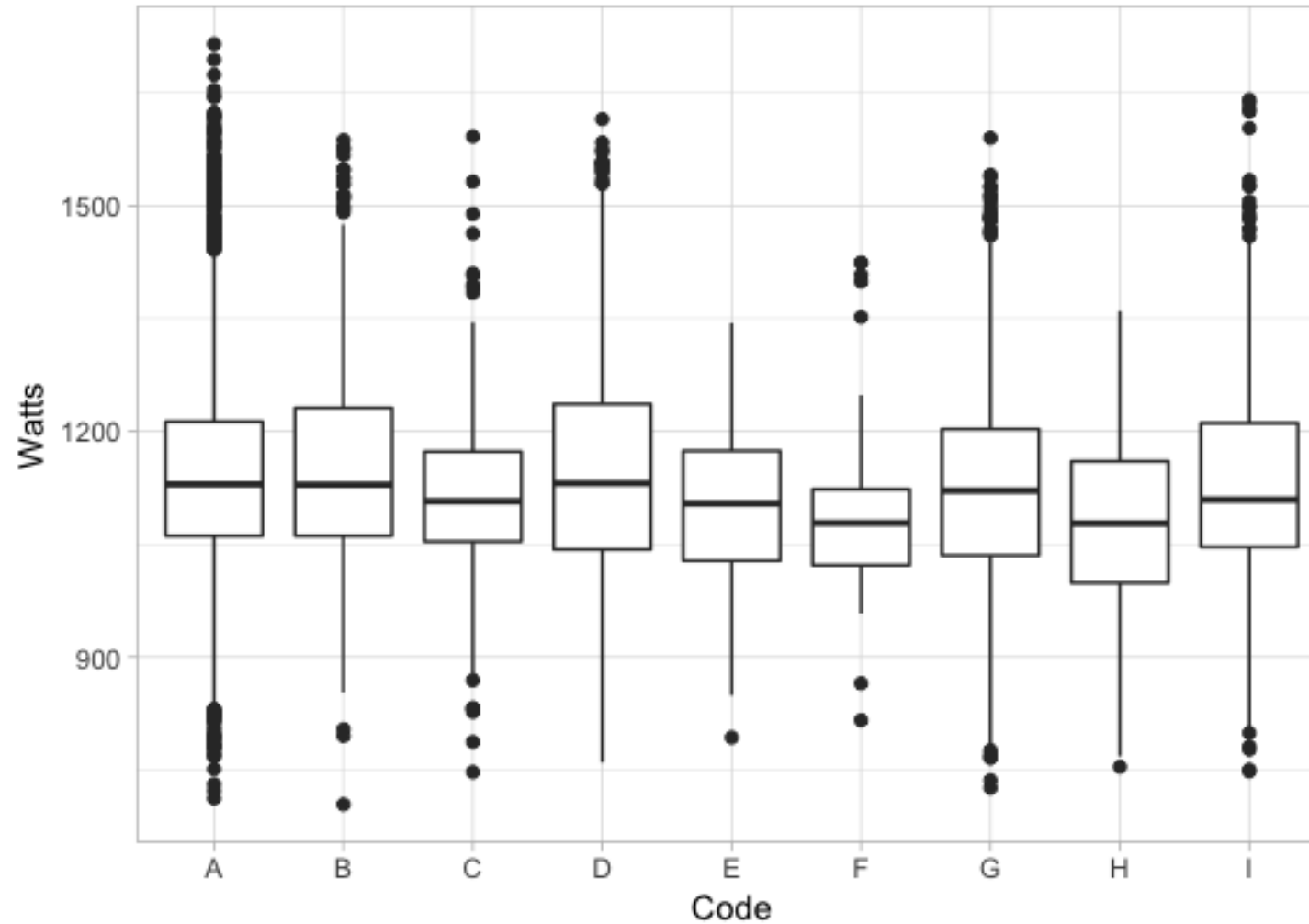
Effects of speed and gradient on sprint performance

Med to Slow start	Med to Fast start	Flat to False Flat	Flat to Uphill
-17 W -2.0%	-28 W -2.4%	-4 W -0.3%	-18 W -1.6%

Sprints compared to flat and medium speed (Intensity 2 band)							
Flat fast	Flat slow	FF med	FF fast	FF slow	Up med	Up fast	Up slow
-18 W -1.6%	0 W 0%	-10 W -0.9%	-32 W -2.8%	-27 W -2.4%	-28 W -2.4%	-27 W -2.4%	-24 W -2.1%

Changes over time in sprints

- Each year sprint performance improves by 7 W (or 0.6%)

- Pre season is higher than early season -15 W (-1.3%) and late season -3 W (or 0.3%)
  - Training camp data removed

- Training Camps increase sprint performance by 77 W (or 6.7%)

- There's no effect of repeated sprints in same session
  - e.g. sprint #1 vs. sprint #10

Race vs Training
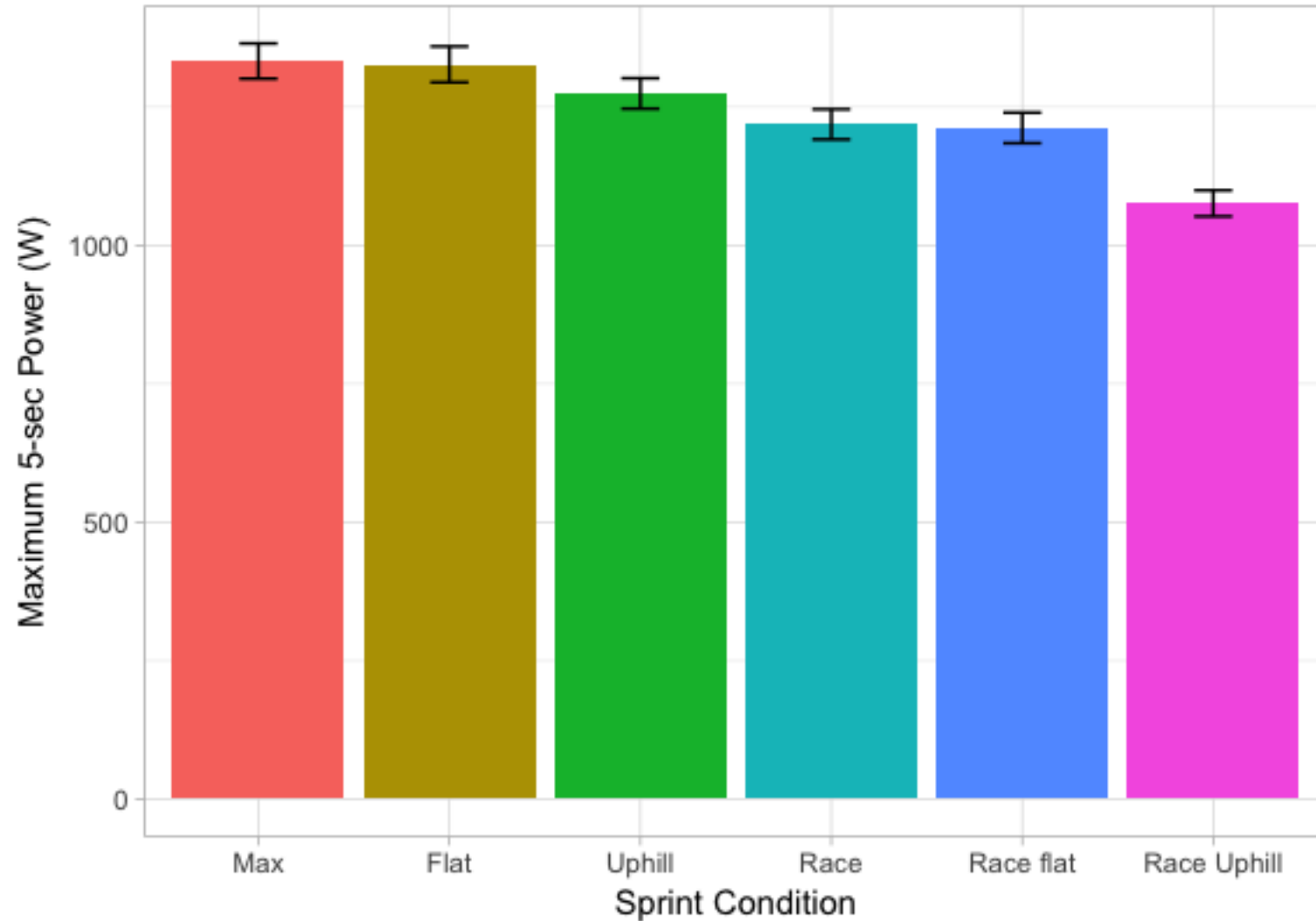
Take-home messages:

- % difference between flat and uphill
  - -1.6% Uphill
- % effect of starting speed
  - -2% at slow or fast
- % effect of season
  - -1.3% in mid-season
- % effect of sprinting with another rider
  - 6.7% improvement
- % difference for training and racing, flat and uphill
  - Train vs race -9 to -19% for race
  - Flat vs Uphill -4% to -10% for uphill