Climate Change, Event Geography and Regional Impacts: Evidence from Professional Cycling

Professional road cycling is uniquely dependent on the territories it traverses. Unlike stadium-based sports, its routes, host cities, and regional visibility are inseparable from the physical environment. As climate change accelerates, rising temperatures and more frequent extreme weather events raise questions about the long-term viability and spatial organization of major cycling competitions. This study investigates whether climate dynamics have begun to influence the geography of professional cycling events in France, focusing on the four most prominent races: the Tour de France, Paris–Nice, Paris–Roubaix, and the Critérium du Dauphiné.

The analysis relies on a newly constructed spatial–temporal dataset covering the period 2000–2025. For each host city, the dataset includes the number of stages that start and finish, the annual average, minimum, and maximum temperatures, and the number of years in which the maximum temperature exceeded 40°C. These climatic indicators are combined with qualitative descriptors such as administrative region and climate type. The objective is twofold: first, to determine whether long-term climatic conditions explain why certain cities are more central to the cycling calendar; second, to assess whether short-term climatic variations influence the annual probability of hosting a stage.

Descriptive statistics reveal substantial heterogeneity across cities. Some, such as Paris, Nice, Roubaix, Pau, and Bordeaux, appear repeatedly as major hubs, accumulating dozens of departures or arrivals over the period. Others host only a handful of stages. Climatic conditions also vary widely: Mediterranean cities exhibit higher average and maximum temperatures, while mountain and continental cities experience colder winters and more pronounced minima. Over time, the data shows a clear upward trend in average and maximum temperatures, as well as a marked increase in the frequency and intensity of heatwaves. Minimum temperatures, by contrast, display a weaker trend, with extreme cold events becoming less frequent after 2012.

To evaluate whether these climatic patterns influence the geography of cycling events, the study employs two complementary econometric strategies. First, cross-sectional regressions examine whether long-term climatic averages explain the total number of departures or arrivals hosted by each city. Second, Poisson models estimate the effect of annual temperature variations on the number of stages hosted in a given year, controlling for unobserved city-specific characteristics and common temporal shocks.

The cross-sectional results show that long-term climate variables do not explain the spatial distribution of stage starts and finishes. Average, minimum, and maximum temperatures, as well as the number of years exceeding 40°C, have no significant effect on the total number of stages hosted. The explanatory power of these models is extremely low, and none of the coefficients are statistically significant. These findings indicate that the geography of professional cycling remains primarily shaped by structural factors, including historical tradition, infrastructure, media visibility, and logistical capacity. Cities like Paris, Nice, or Roubaix occupy central positions not because of their climate, but because of their symbolic importance, long-standing relationships with organizers, and ability to accommodate large-scale events.

The Poisson regressions confirm this conclusion. When analyzing annual variations, the models show that year-to-year changes in average, minimum, or maximum temperatures do not significantly affect the probability of hosting a stage. Even extreme heat events, measured by the

number of years exceeding 40°C, do not exhibit a robust effect. The coefficients are small, statistically insignificant, and the overall explanatory power of the models remains limited. These results suggest that, despite the intensification of heatwaves and rising temperatures, organizers have not yet altered the spatial configuration of major races in response to climatic pressures.

However, the absence of a current effect does not imply that climate change is irrelevant for the future of professional cycling. On the contrary, the descriptive trends highlight growing environmental constraints that could increasingly challenge the organization of events. Rising maximum temperatures and more frequent heatwaves pose risks for athlete safety, spectator comfort, and logistical operations. Heat stress can impair performance, increase the likelihood of medical incidents, and force organizers to modify stage schedules, shorten routes, or implement emergency protocols. Several recent editions of major races have already been disrupted by extreme heat, suggesting that climate-related adaptations may become more common.

These findings carry important implications for local authorities. While climate does not currently determine whether a city is selected as a stage host, the capacity to manage extreme temperatures may become a differentiating factor in the future. Cities that invest in heat-resilient infrastructure—such as shaded spectator areas, cooling systems, improved water distribution, and heat-resistant road surfaces—may be better positioned to maintain or enhance their attractiveness to organizers. Conversely, cities facing recurrent heatwaves without adequate adaptation measures may encounter growing challenges in hosting stages safely and efficiently.

For organizers, the results underscore the need to integrate climate considerations into long-term planning. Although historical and symbolic factors continue to dominate route design, rising temperatures will likely require greater flexibility in scheduling, route selection, and risk management. Organizers may need to develop alternative routes, adjust start times to avoid peak heat, or implement stricter medical protocols. The increasing unpredictability of climatic conditions also calls for closer collaboration with local authorities to ensure that safety and logistical requirements can be met under extreme weather scenarios.

Stakeholders of tourism and regional development are also affected. Hosting a stage of a major cycling race generates substantial visibility and economic benefits. If climate change reshapes the geography of events, some territories may lose opportunities while others gain prominence. Regions with more moderate summer temperatures could become relatively more attractive, while those exposed to recurrent heatwaves may face higher organizational costs and reputational risks. Anticipating these shifts will be essential for maintaining competitiveness in the tourism sector.

In summary, this study shows that climate change has not yet reshaped the geography of professional cycling events in France, but the intensification of extreme temperatures signals emerging challenges. While long-term climatic conditions do not currently influence the selection of host cities, the growing frequency of heatwaves may require significant adaptations from organizers and local authorities. The findings highlight the importance of integrating climate resilience into event planning, territorial strategies, and infrastructure investment to ensure the sustainability of professional cycling in a warming world.