

# Understanding the impacts of climate change on takeoff performance at airports worldwide

Thomas D. Pellegrin, PhD

Embry-Riddle Aeronautical University

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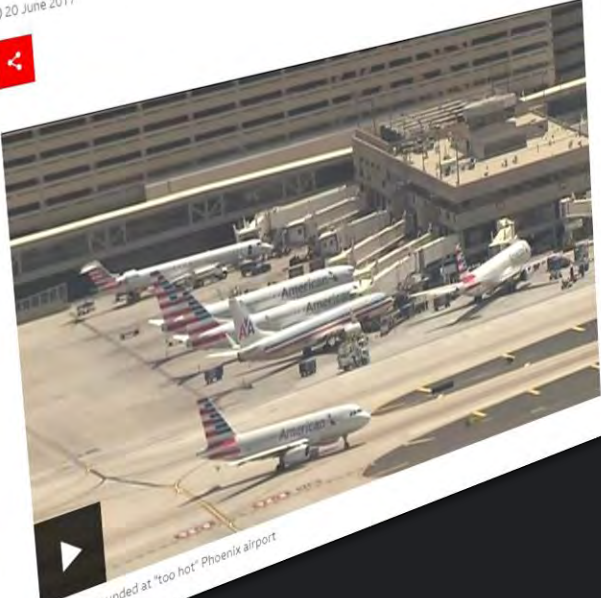
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# Phoenix flights cancelled because it's too hot for planes

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Planes grounded at "too hot" Phoenix airport

The New York Times

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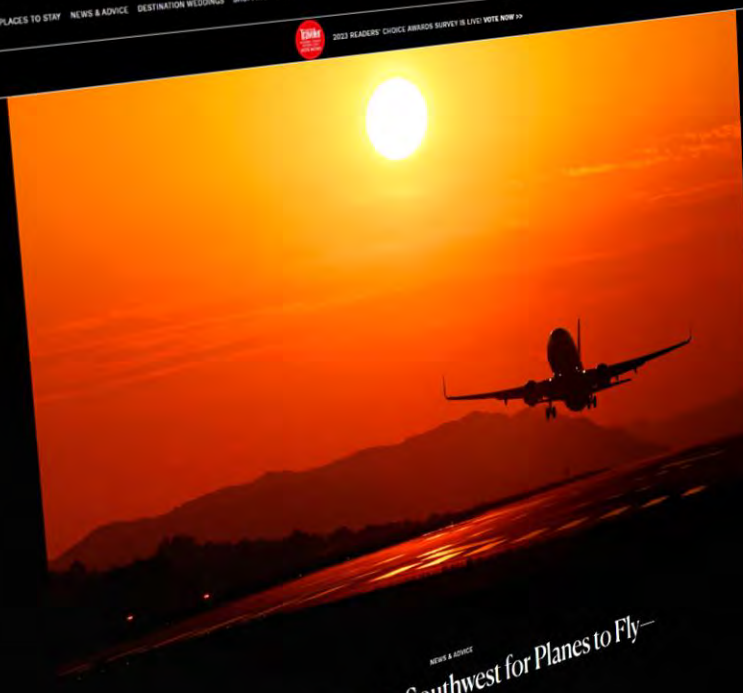
## Too Hot to Fly? Climate Change May Take a Toll on Air Travel

Excess heat in Phoenix grounded more than 40 flights in recent days, and scientists say a warming climate could also mean more turbulent rides.

Traveler

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It's Too Hot in the Southwest for Planes to Fly—Here's Why

*A heat wave in Arizona and California has grounded some planes.*

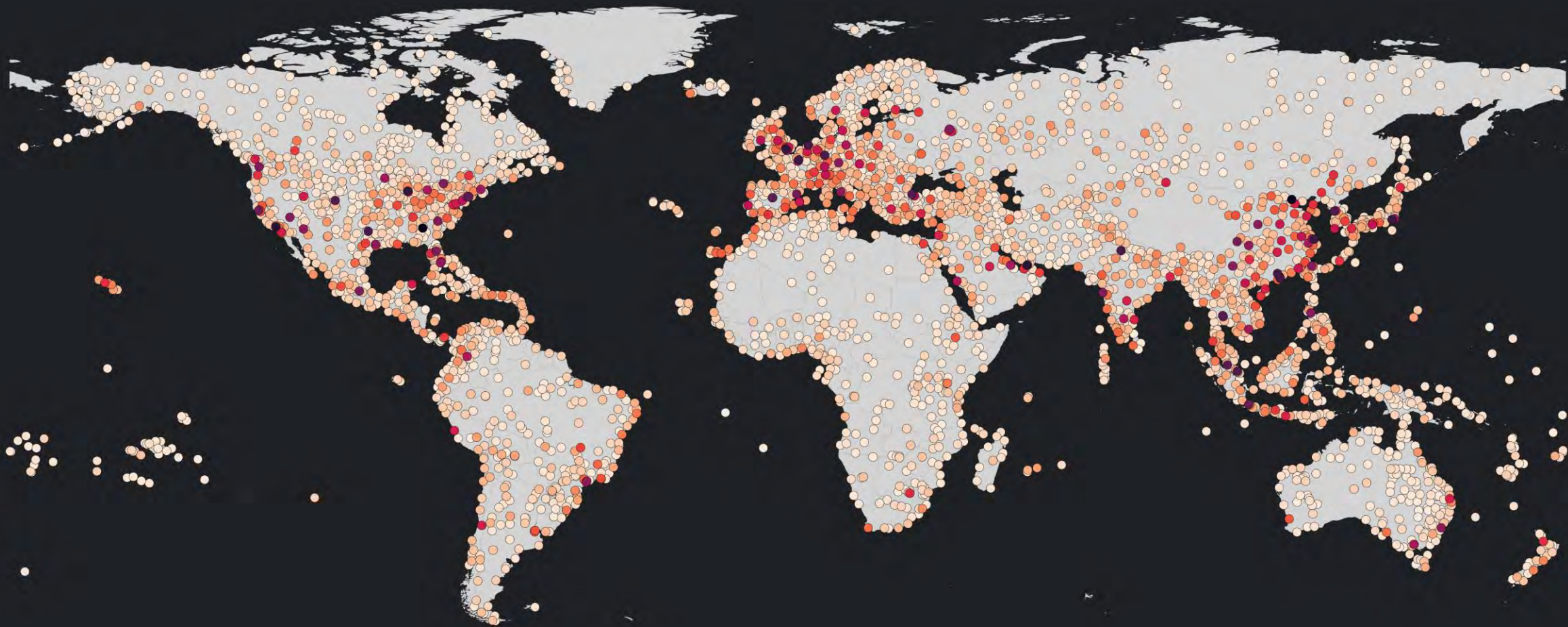
BY ALLEIGH HOPKINS  
June 30, 2017



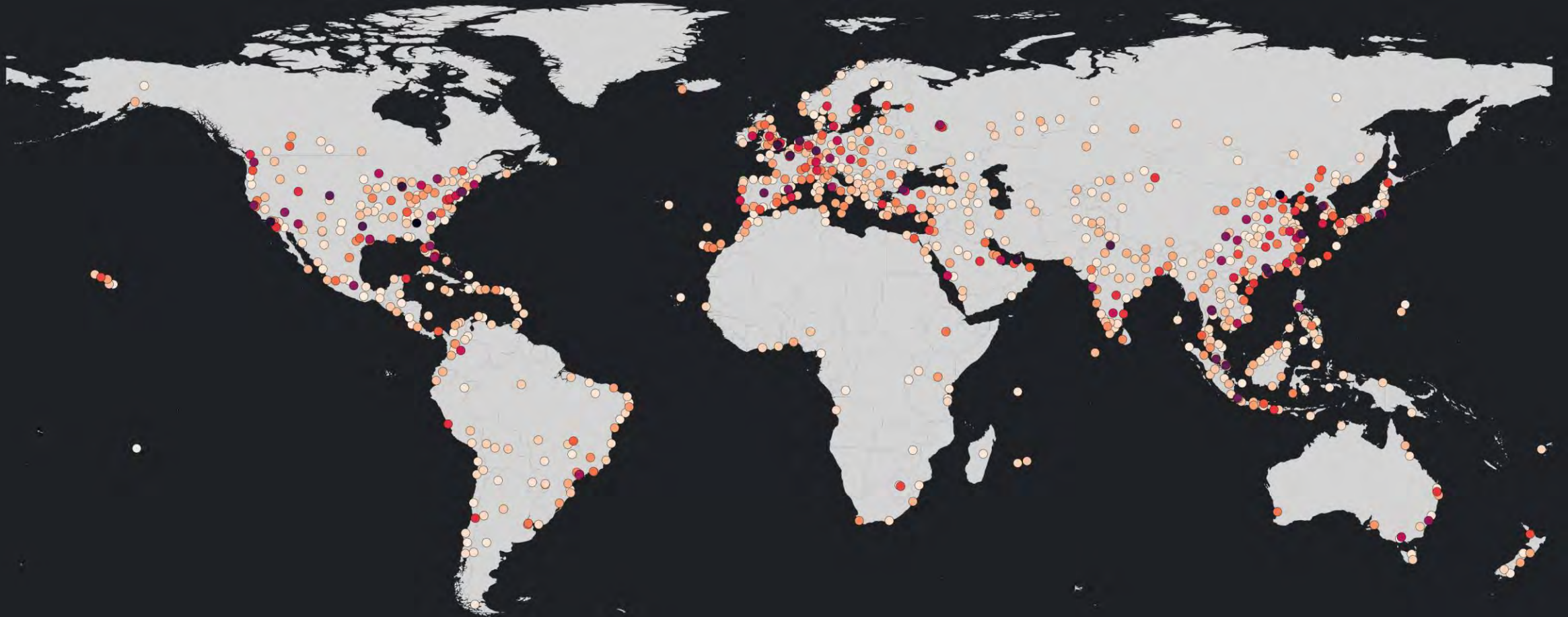




3,400 population airports



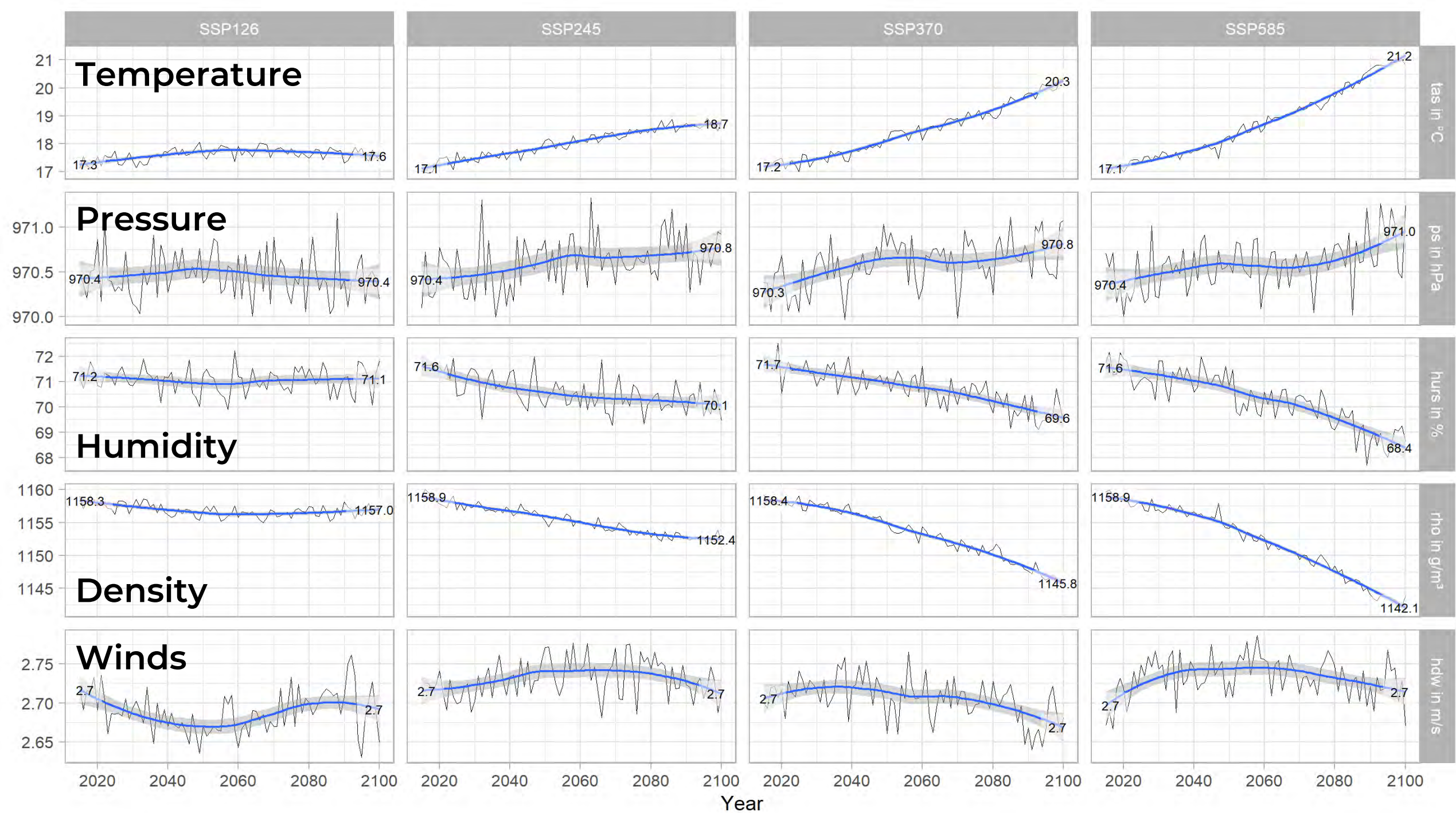
881 sample airports



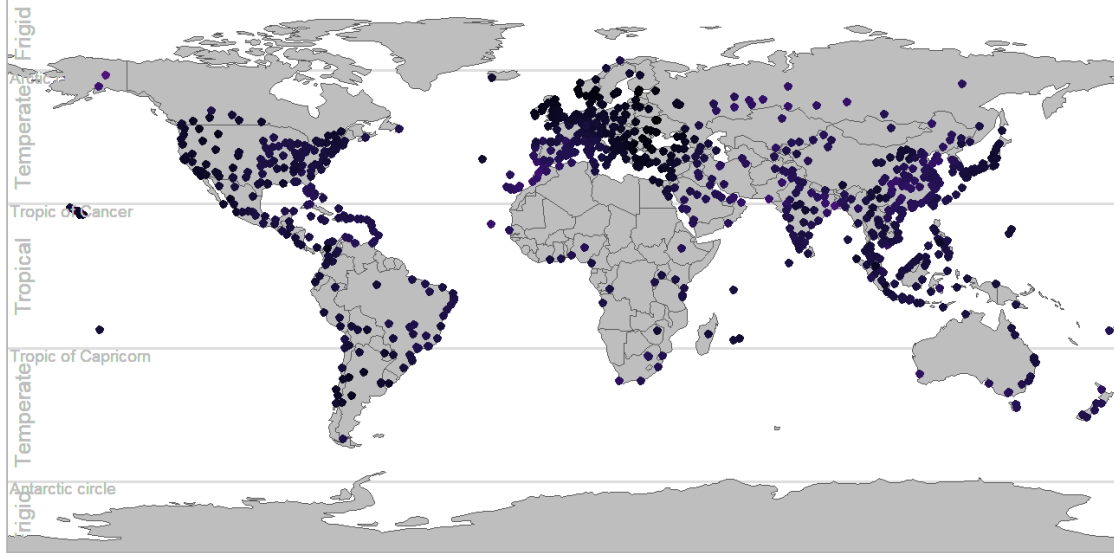


100 km

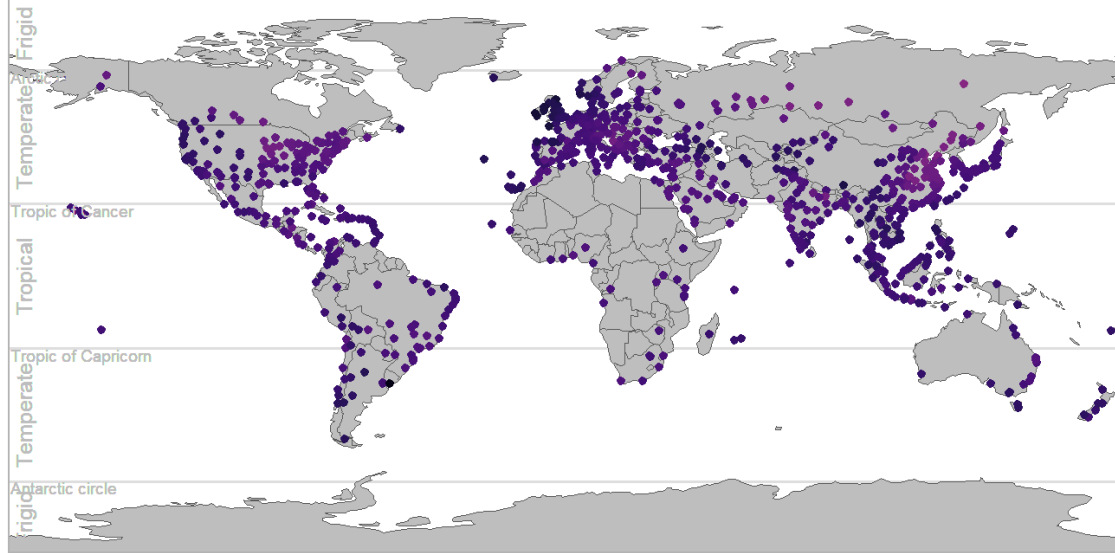




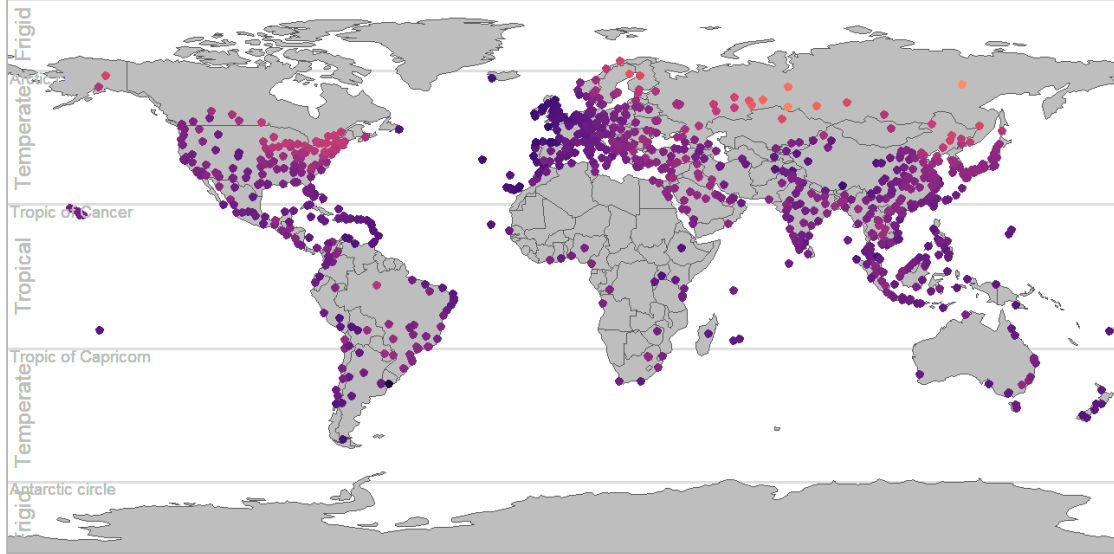
SSP126



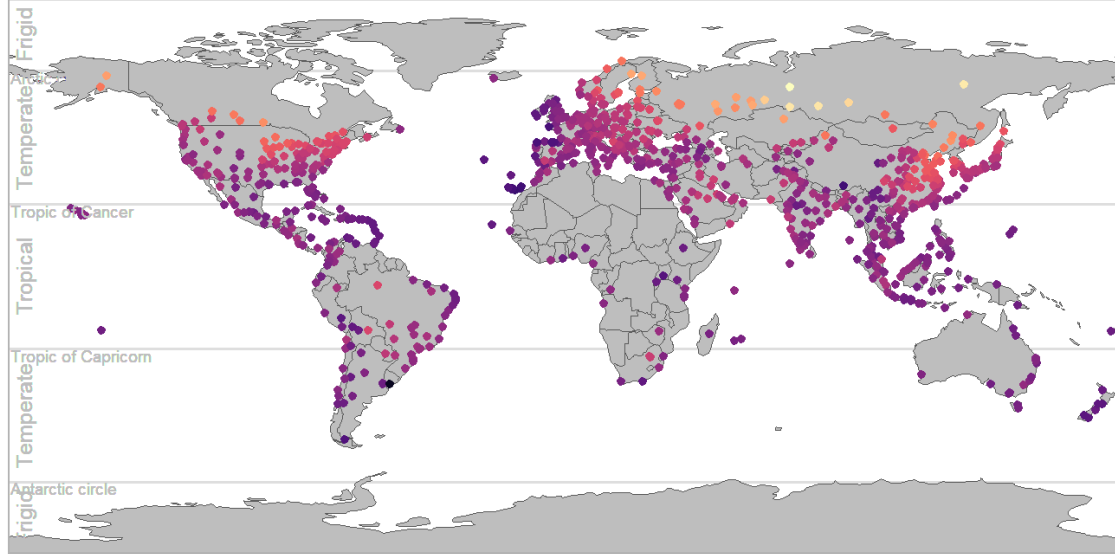
SSP245



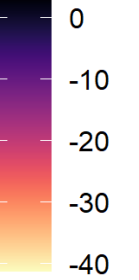
SSP370



SSP585



in  $\text{g}/\text{m}^3$



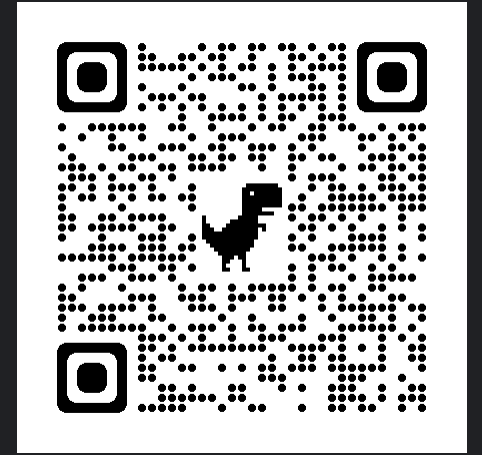
Calculate liftoff speed  
based on air density

Calculate airspeed and ground  
speed for each takeoff interval

Calculate propulsive force  
for each takeoff interval

Calculate acceleration  
for each takeoff interval

Calculate total  
takeoff distance required



<https://github.com/TheAviationDoctor/PhD>

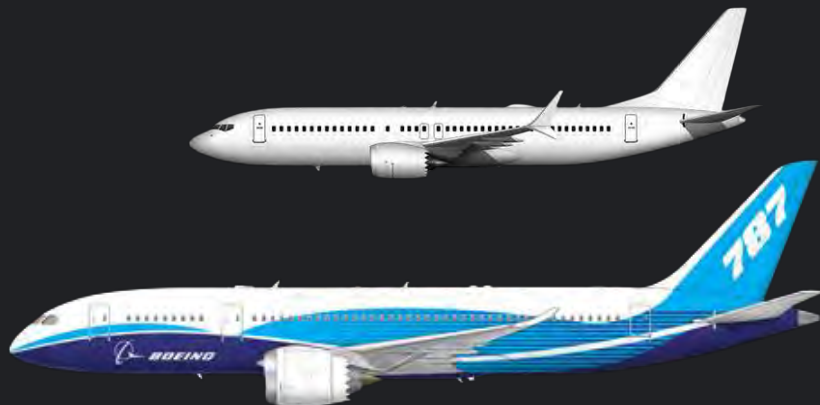
4 simulations per day  
X 365 days per year  
X 86 years (2015–2100)  
X 4 climate scenarios (SSPs)  
X 4 aircraft (2 NB, 2 WB)  
X 881 airports



= 1.8B unique takeoff conditions

X ~32 iterations per takeoff

= 57B simulated takeoffs



## Key findings

1. Moderate increase in takeoff distances

2. Modest increase in takeoff thrust

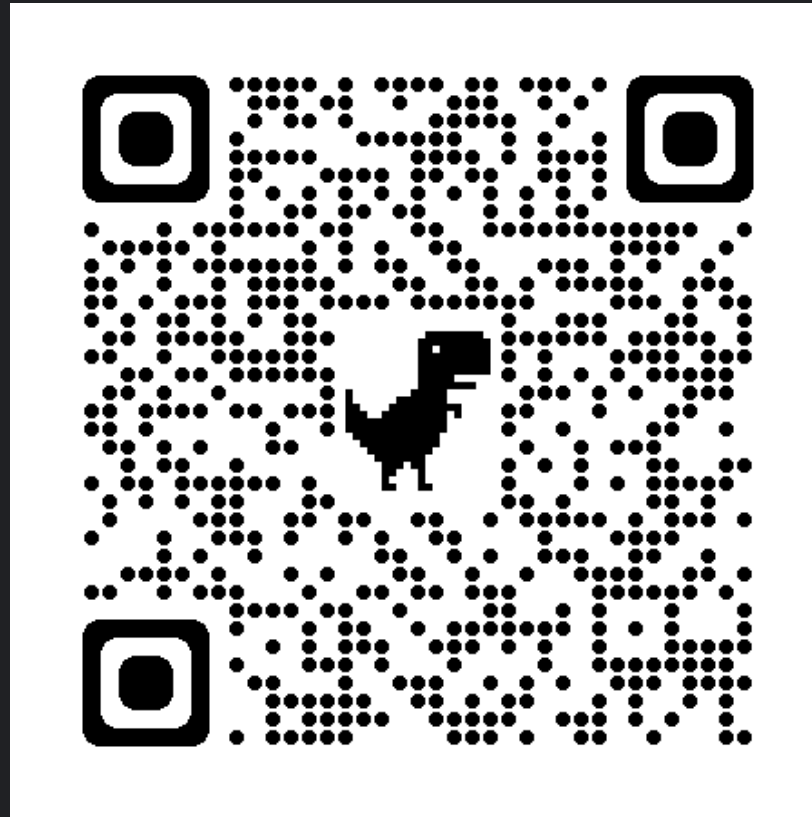
3. Modest increase in unsuccessful takeoffs

4. Small decrease in payload

**But...** conclusions highly sensitive to climate scenarios

Per-airport analysis **strongly advised**

Thank you for your attention!



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