Introducing the O/D CO2 Matrix

Using Connected Vehicle Data from Millions of Vehicles to Reduce Greenhouse Gas Emissions

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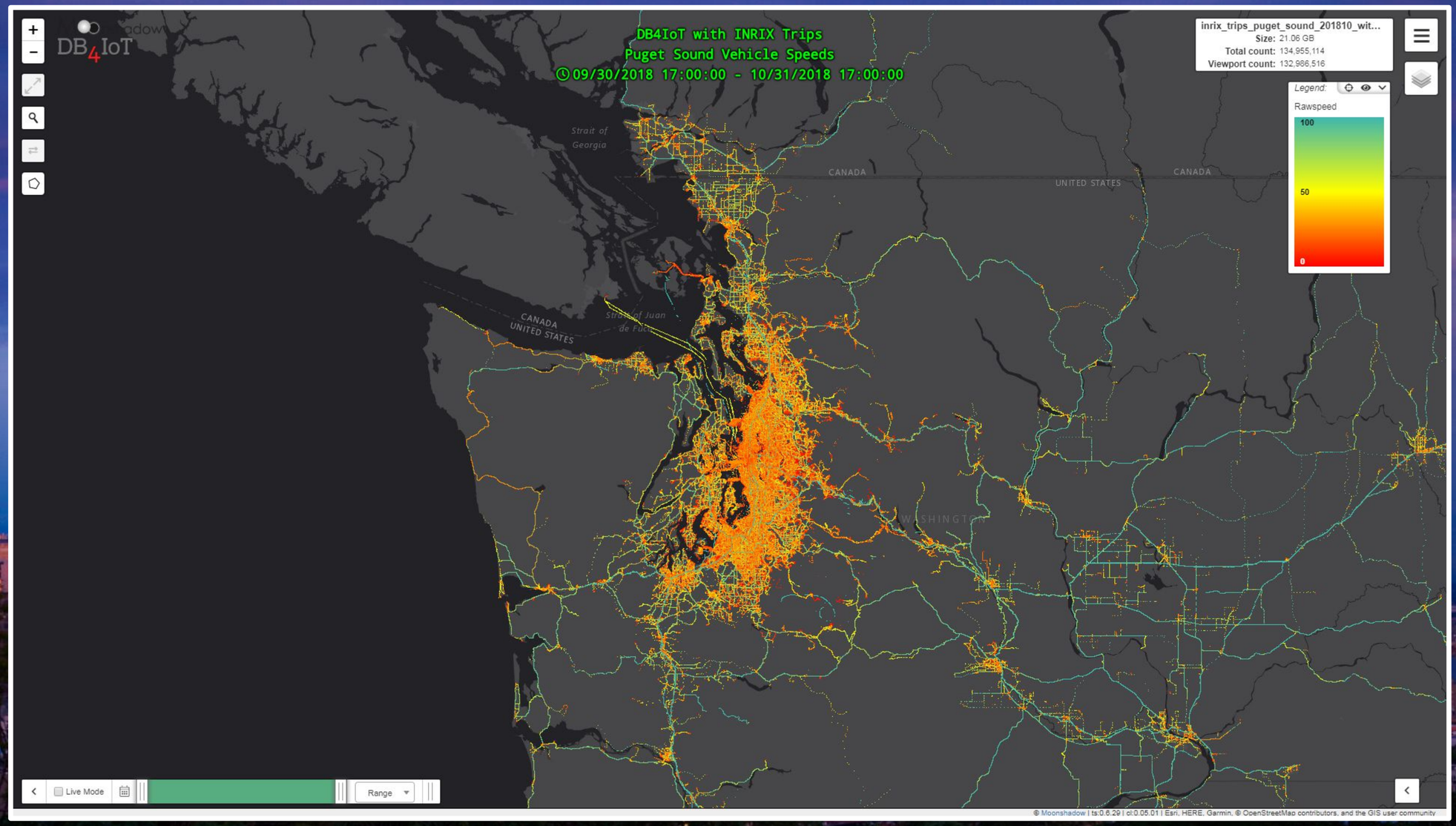
DKS

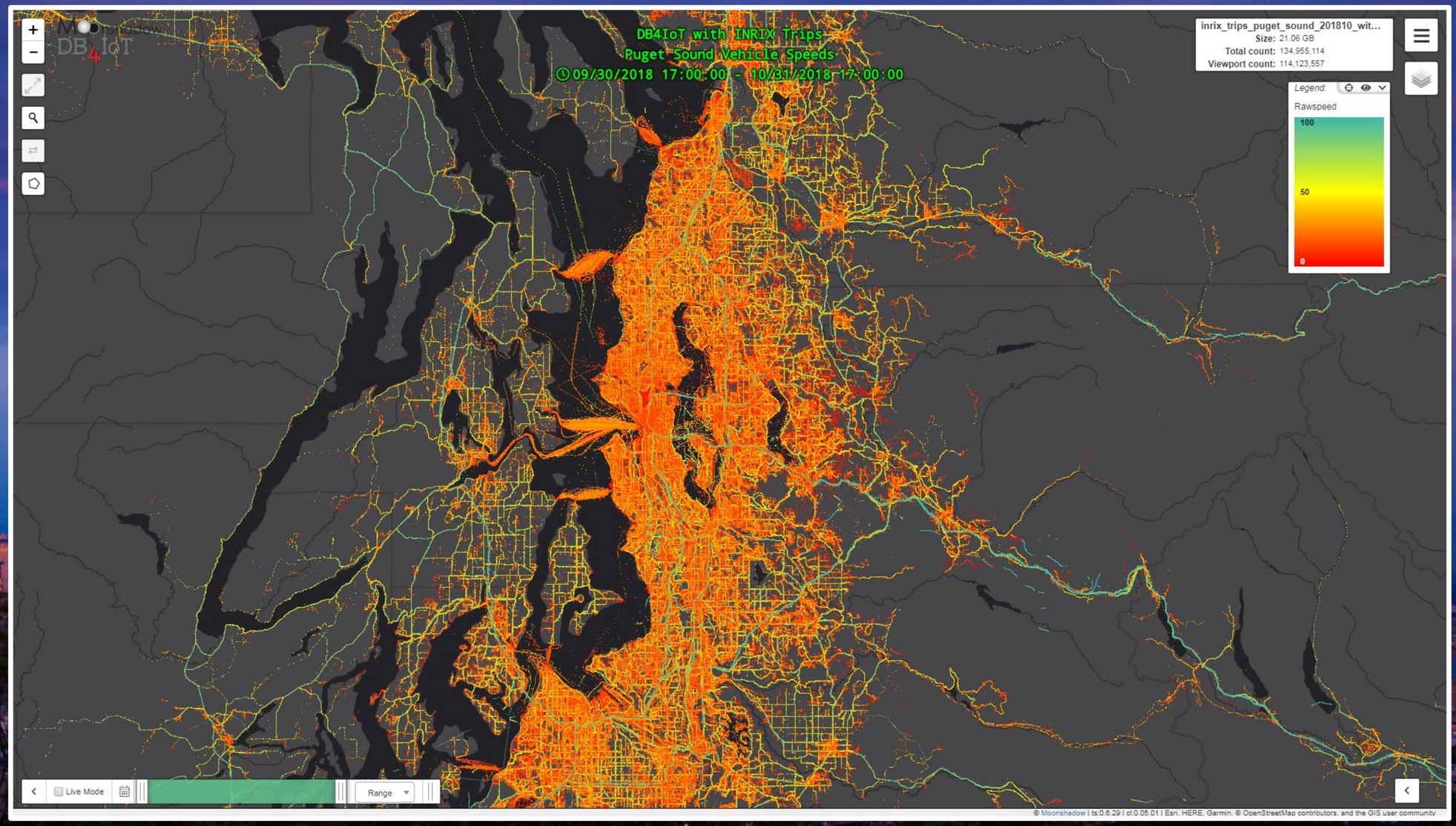
Moonshadow

We started with connected vehicle data



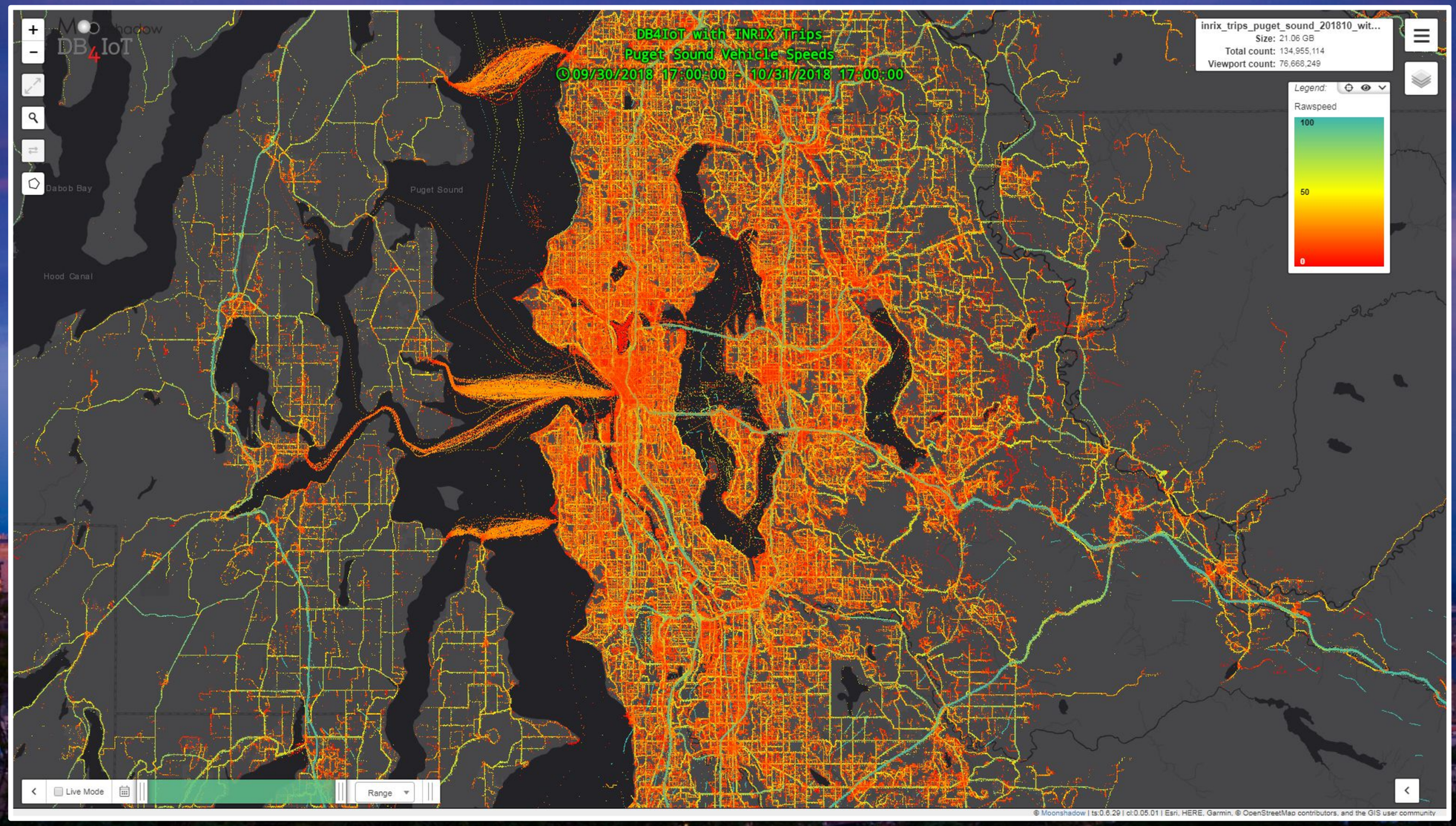
Proof of Concept:
Emissions values
not validated

Connected vehicle data from INRIX Trips in DB4IoT



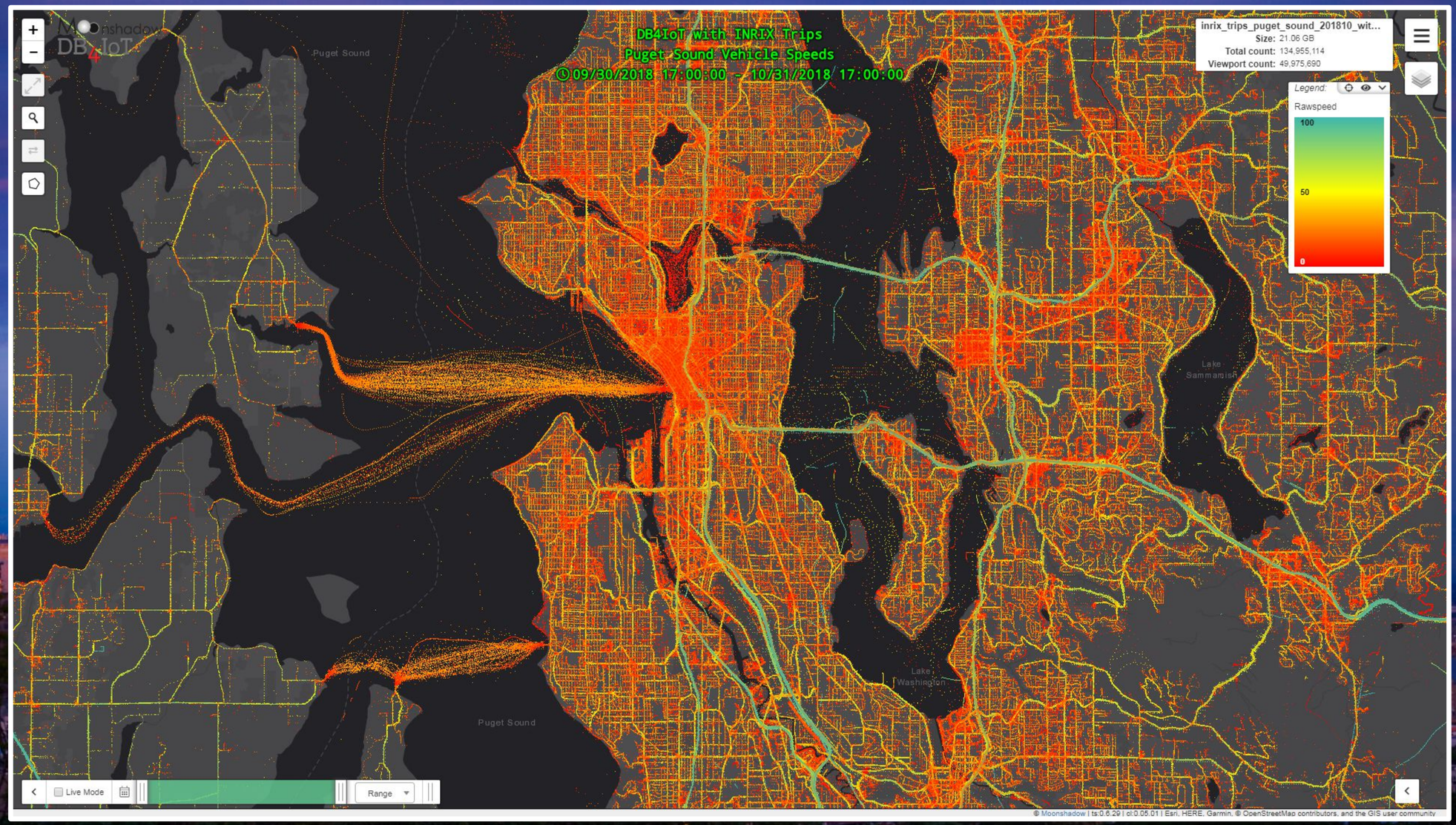
Proof of Concept:
Emissions values
not validated

One month of trip data = 135 million records



Proof of Concept:
Emissions values
not validated

Trip waypoints are colored by speed



Proof of Concept:
Emissions values
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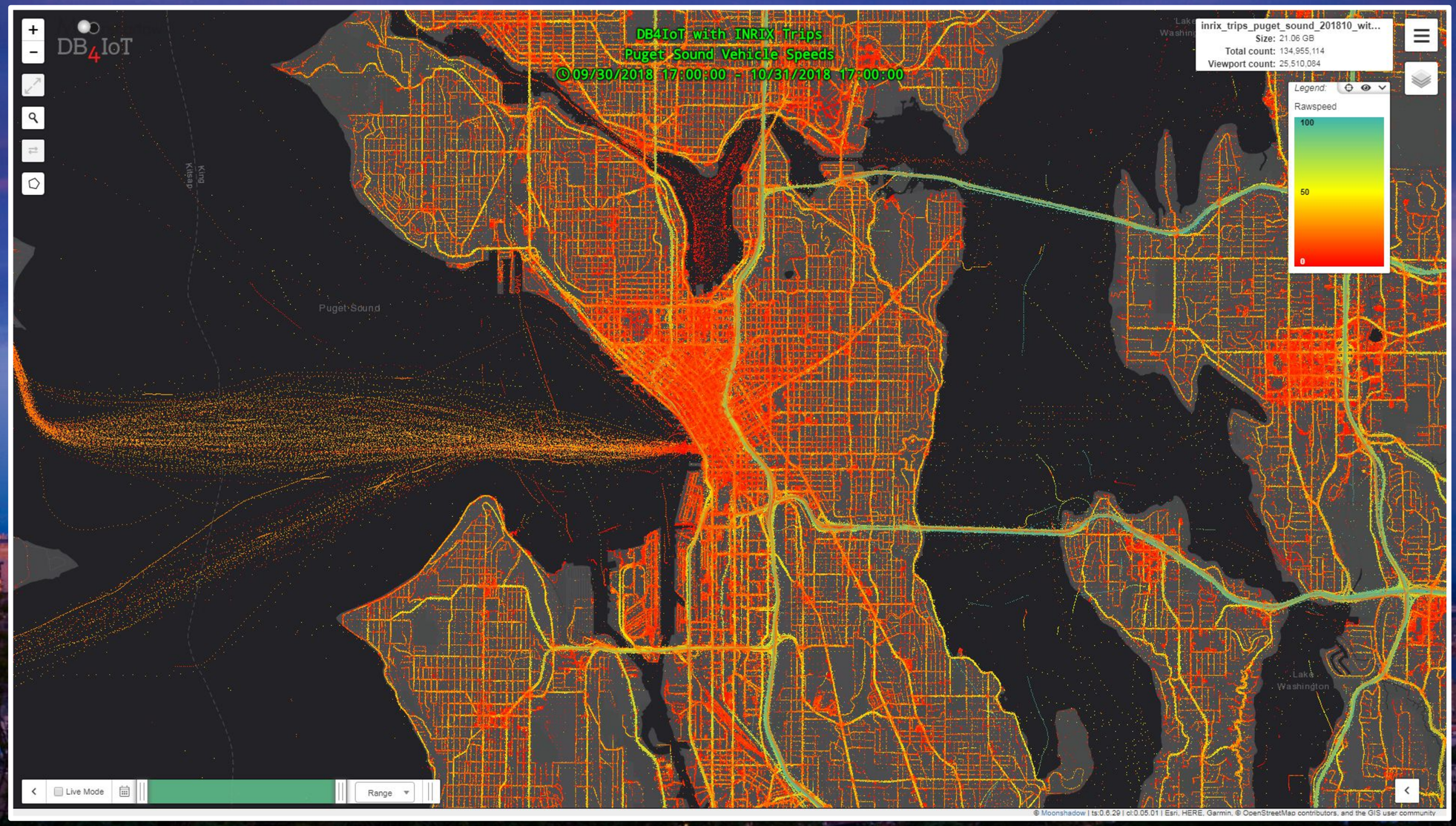
Some vehicles in the Puget Sound are on ferries



Proof of Concept:
Emissions values
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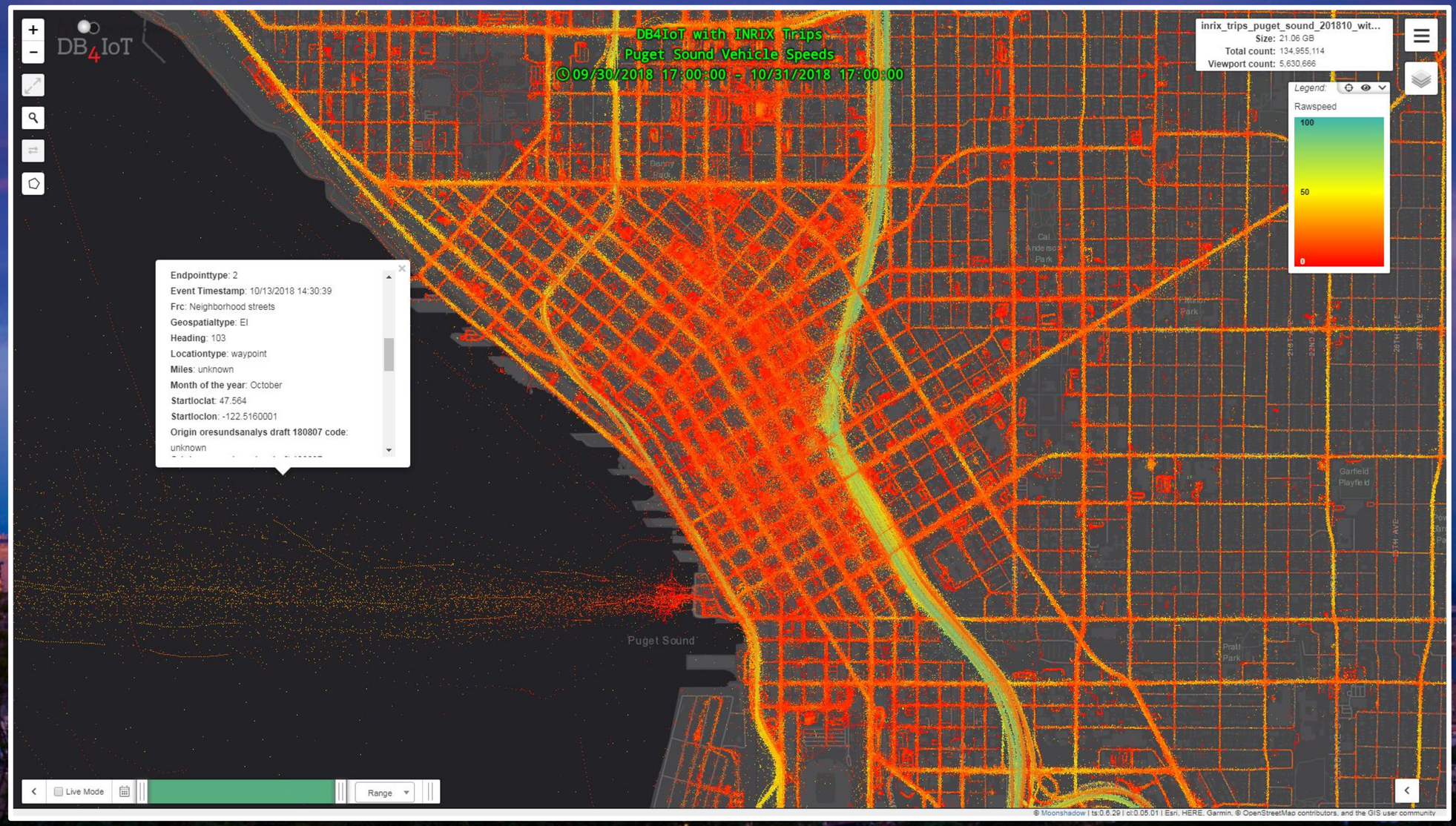
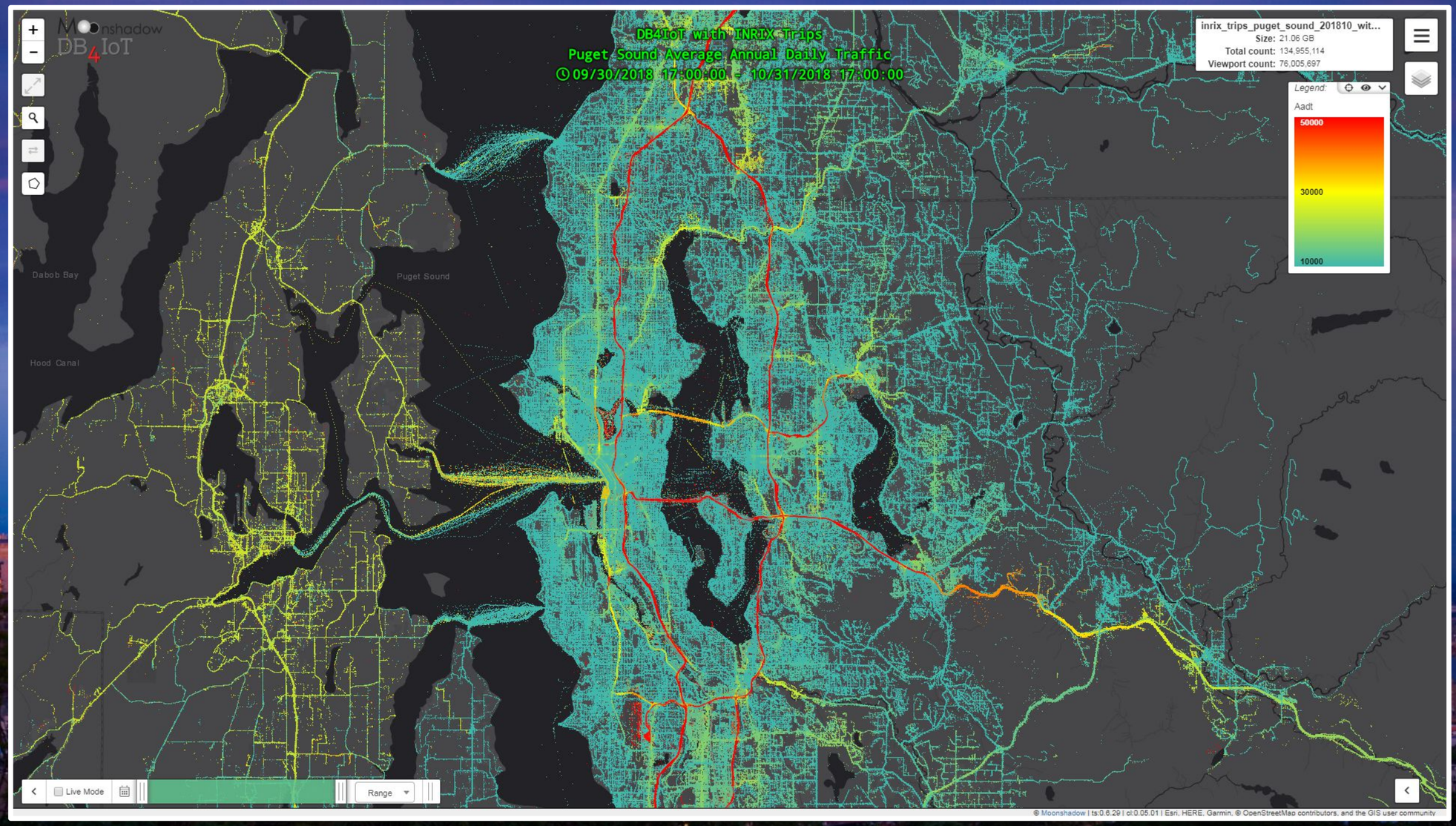
Every dot is a vehicle reporting its position at a point in time



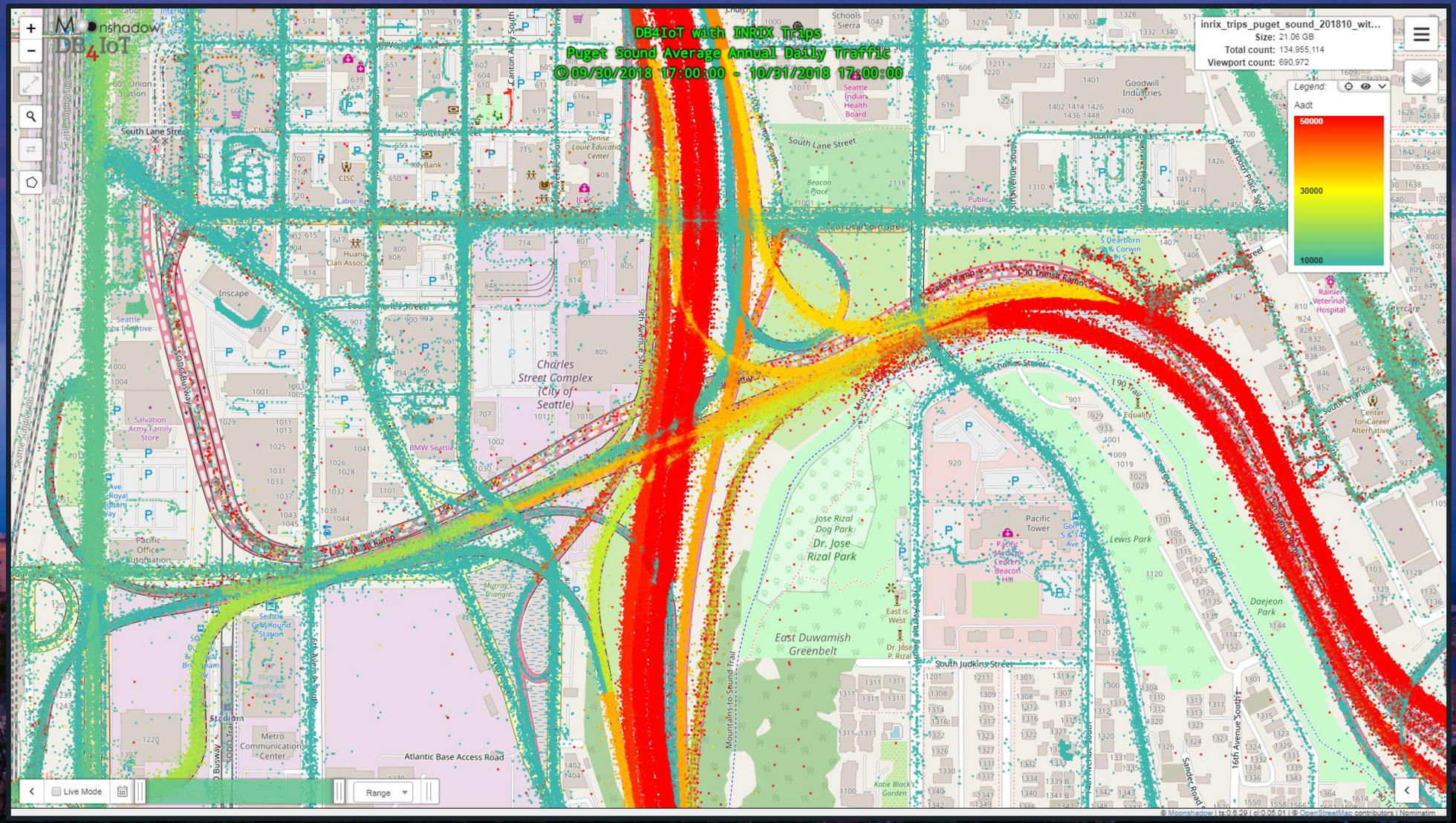
Proof of Concept:
Emissions values
not validated

Add average annual daily traffic (AADT) per road segment from INRIX



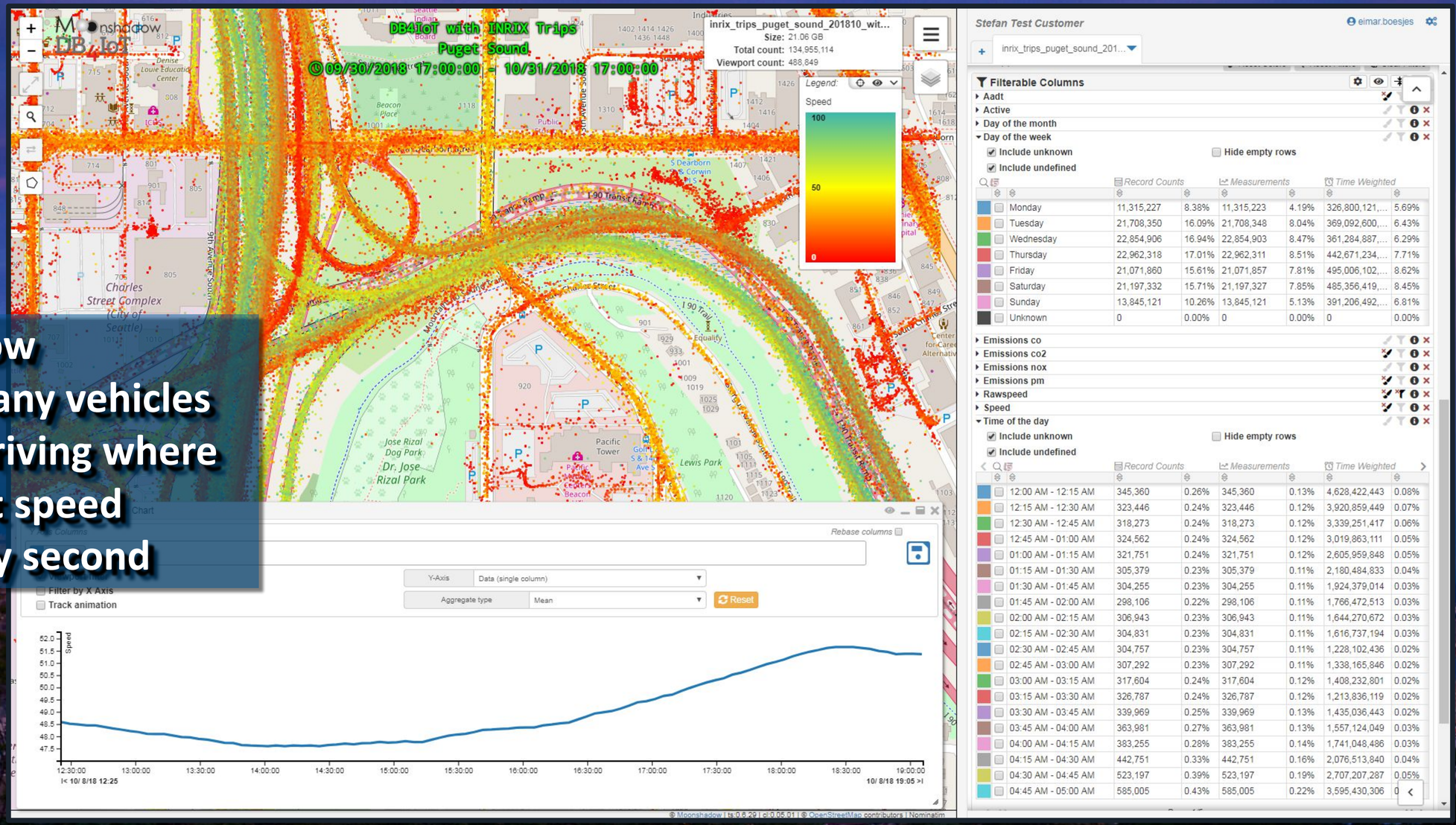
Proof of Concept:
Emissions values
not validated

Each point now represents a number of vehicles at a point in time



Proof of Concept:
Emissions values
not validated

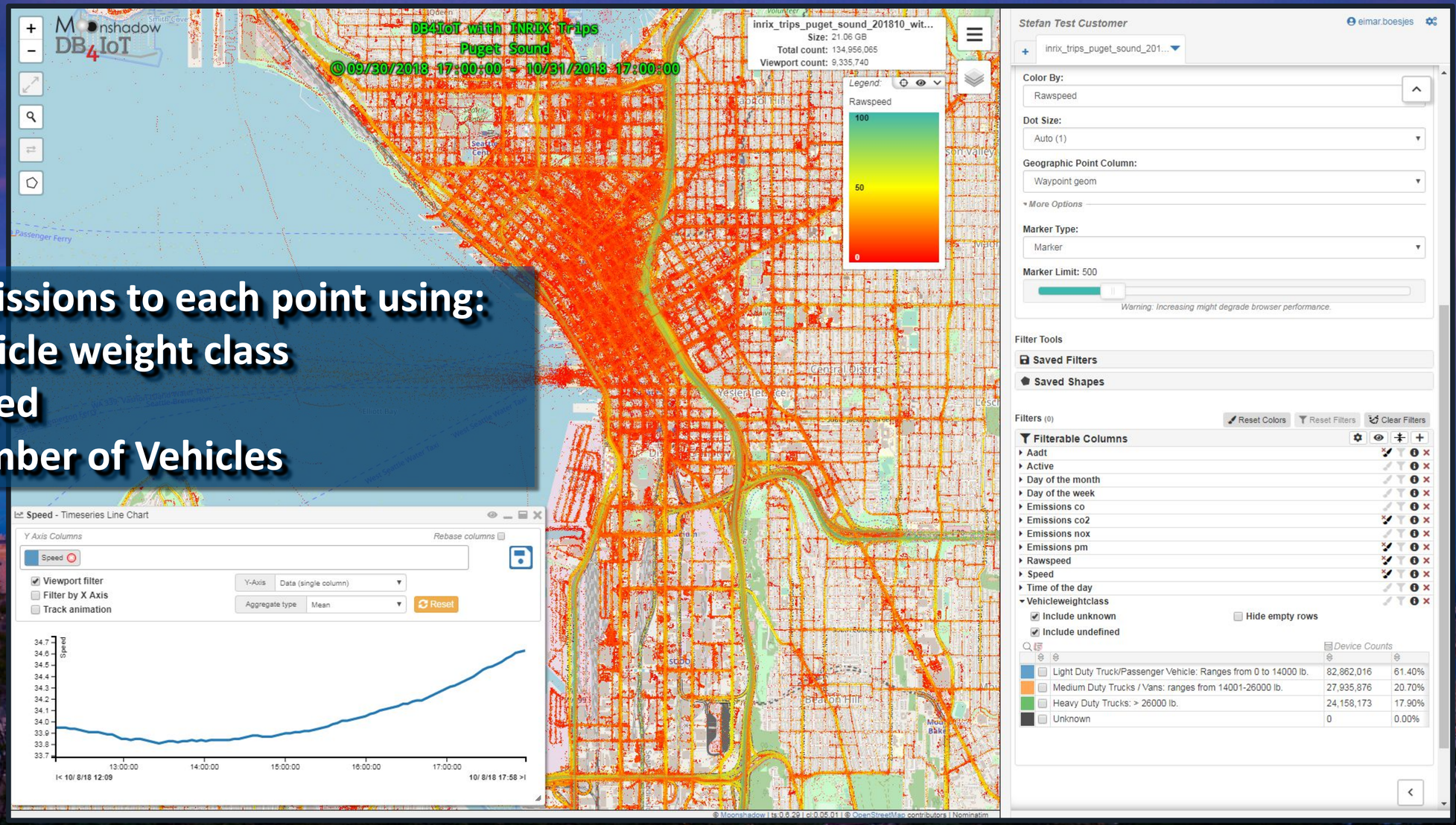
Speed data is time-weighted per second



We know how many vehicles were driving where at what speed at every second

Proof of Concept:
Emissions values
not validated

Emissions per second are assigned to each waypoint

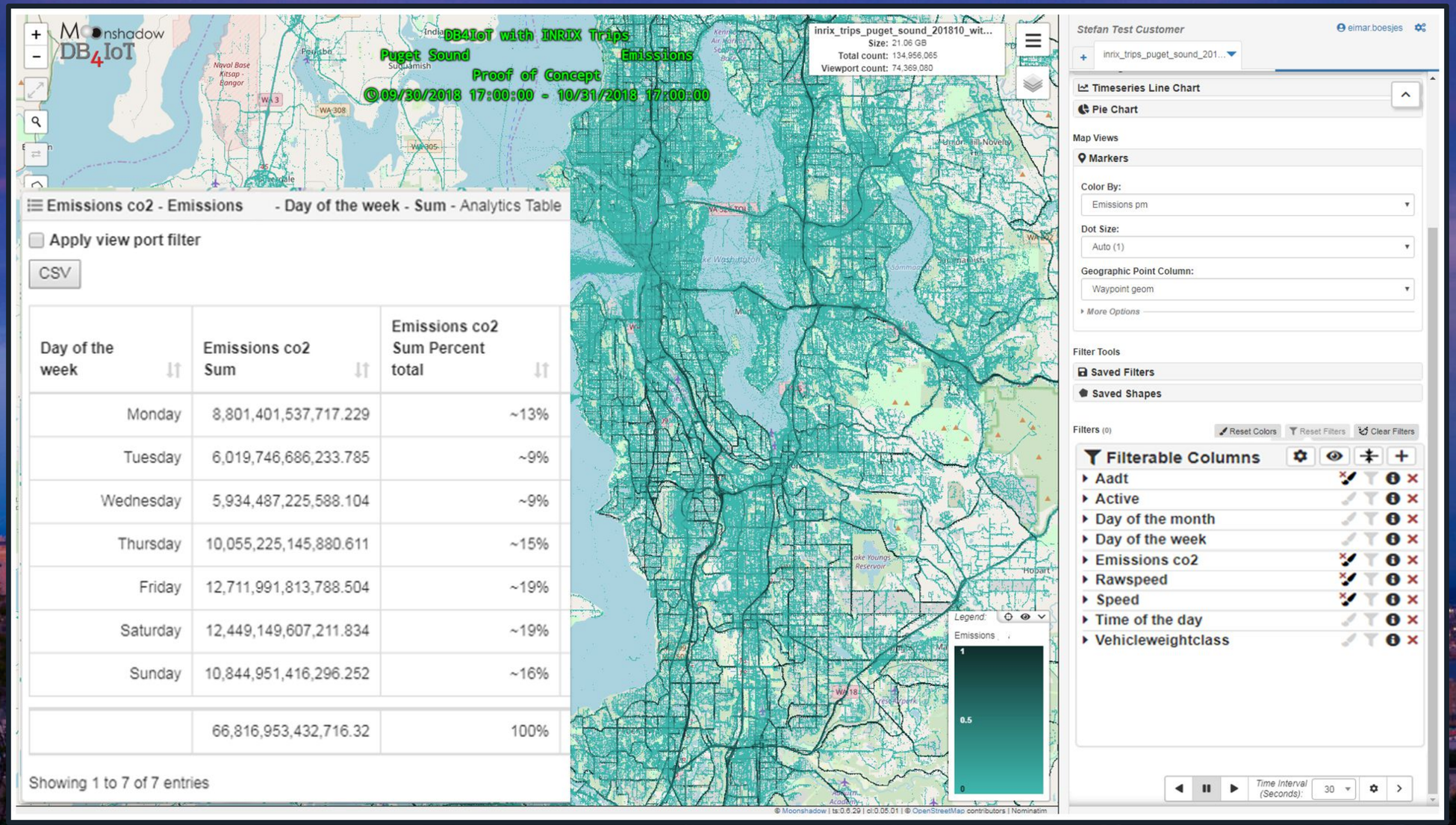


Assign emissions to each point using:

- **Vehicle weight class**
- **Speed**
- **Number of Vehicles**

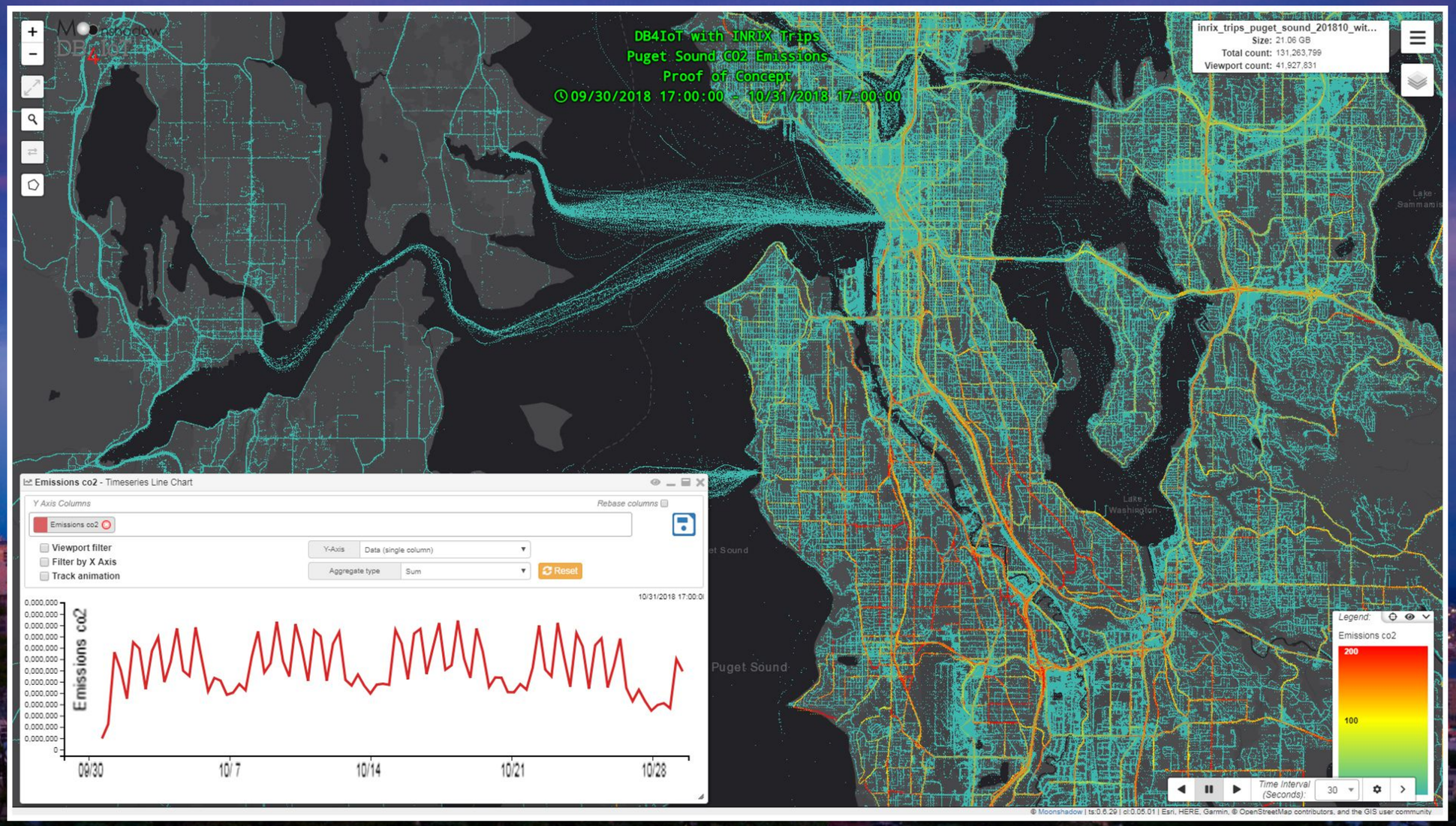
Proof of Concept:
Emissions values
not validated

We can now visualize and quantify emissions



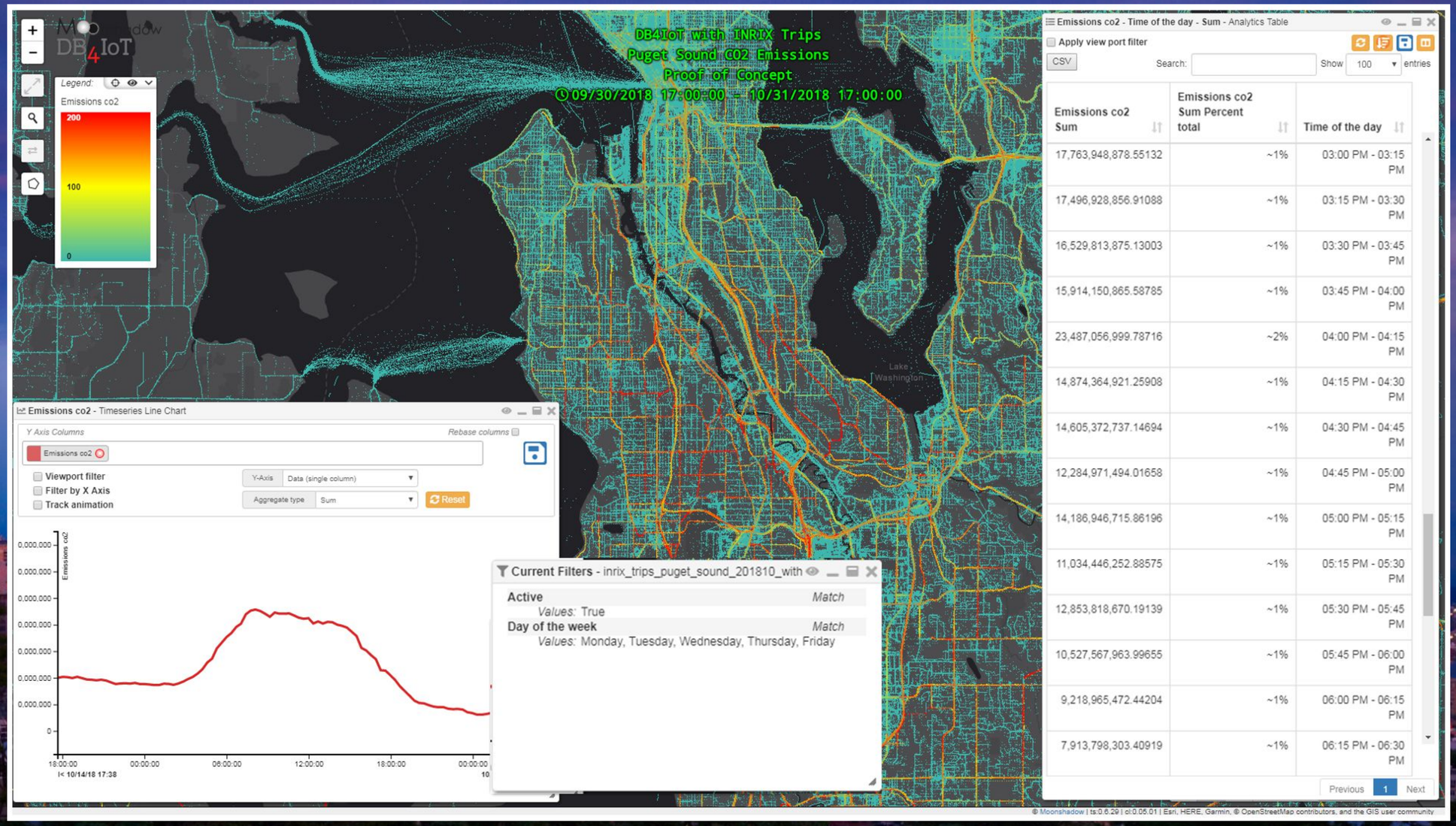
Proof of Concept:
Emissions values
not validated

CO2 emissions over time and space



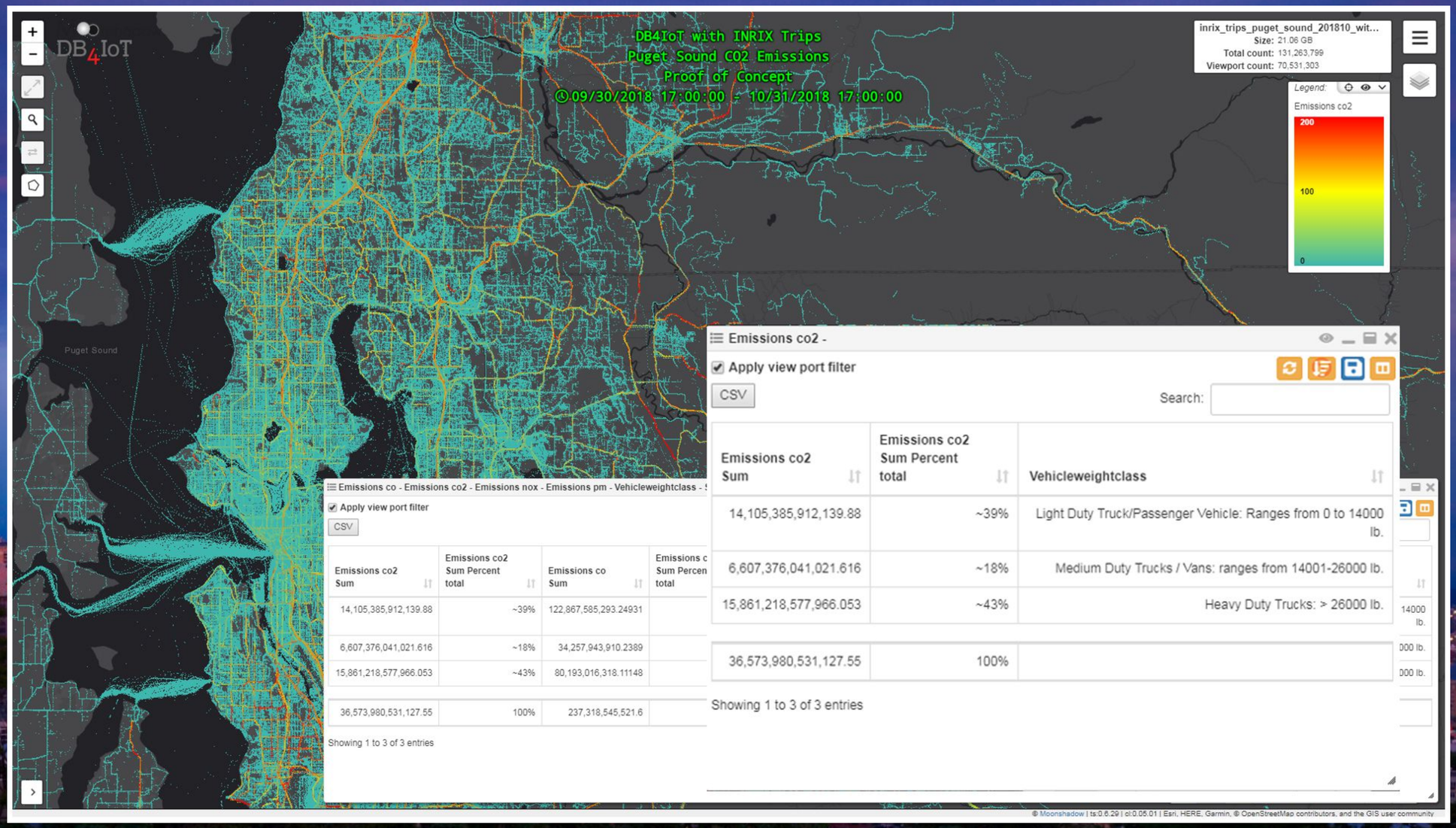
Proof of Concept:
Emissions values
not validated

CO2 emissions by time of day on weekdays



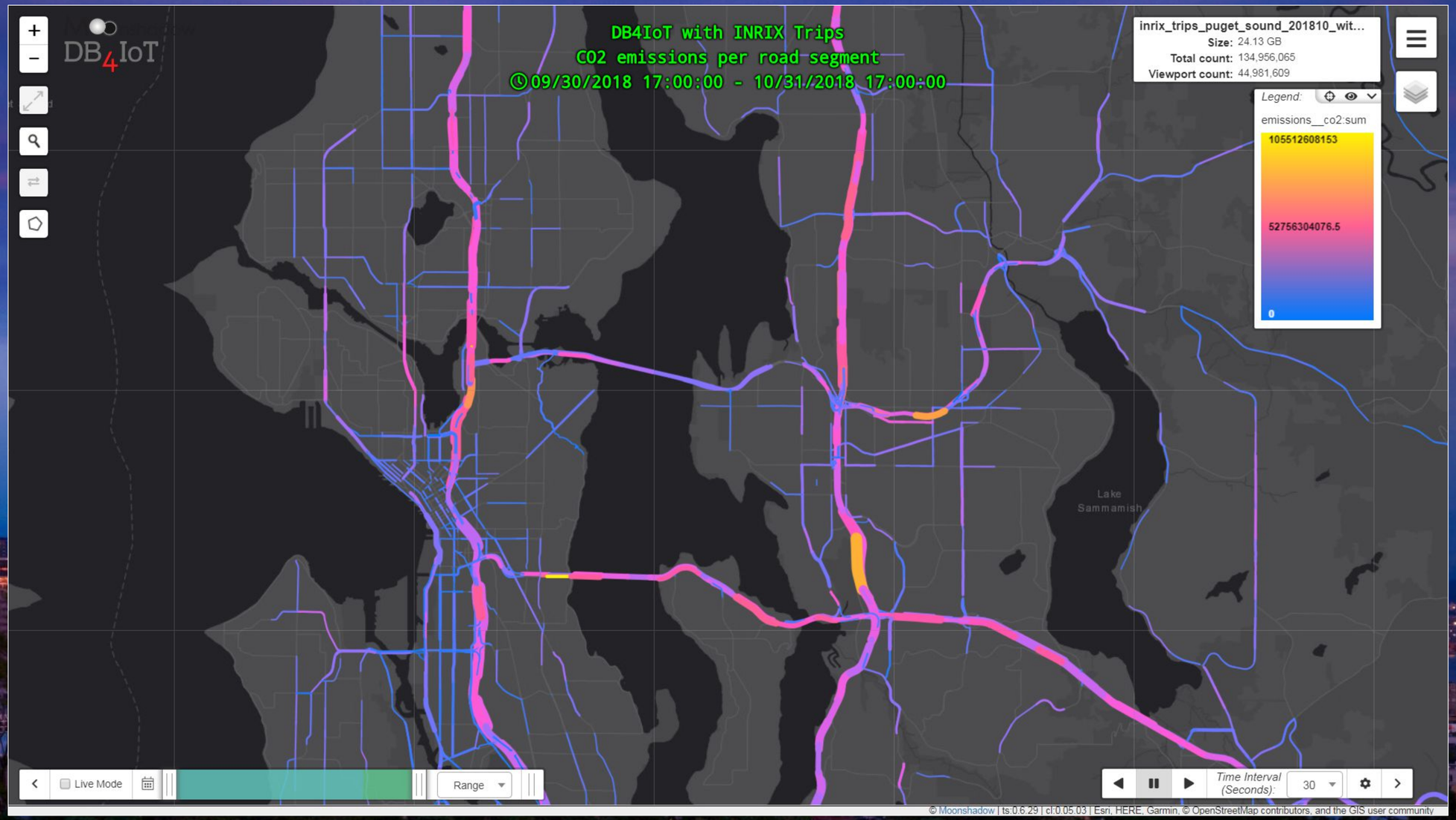
Proof of Concept:
Emissions values
not validated

Emissions per vehicle weight class



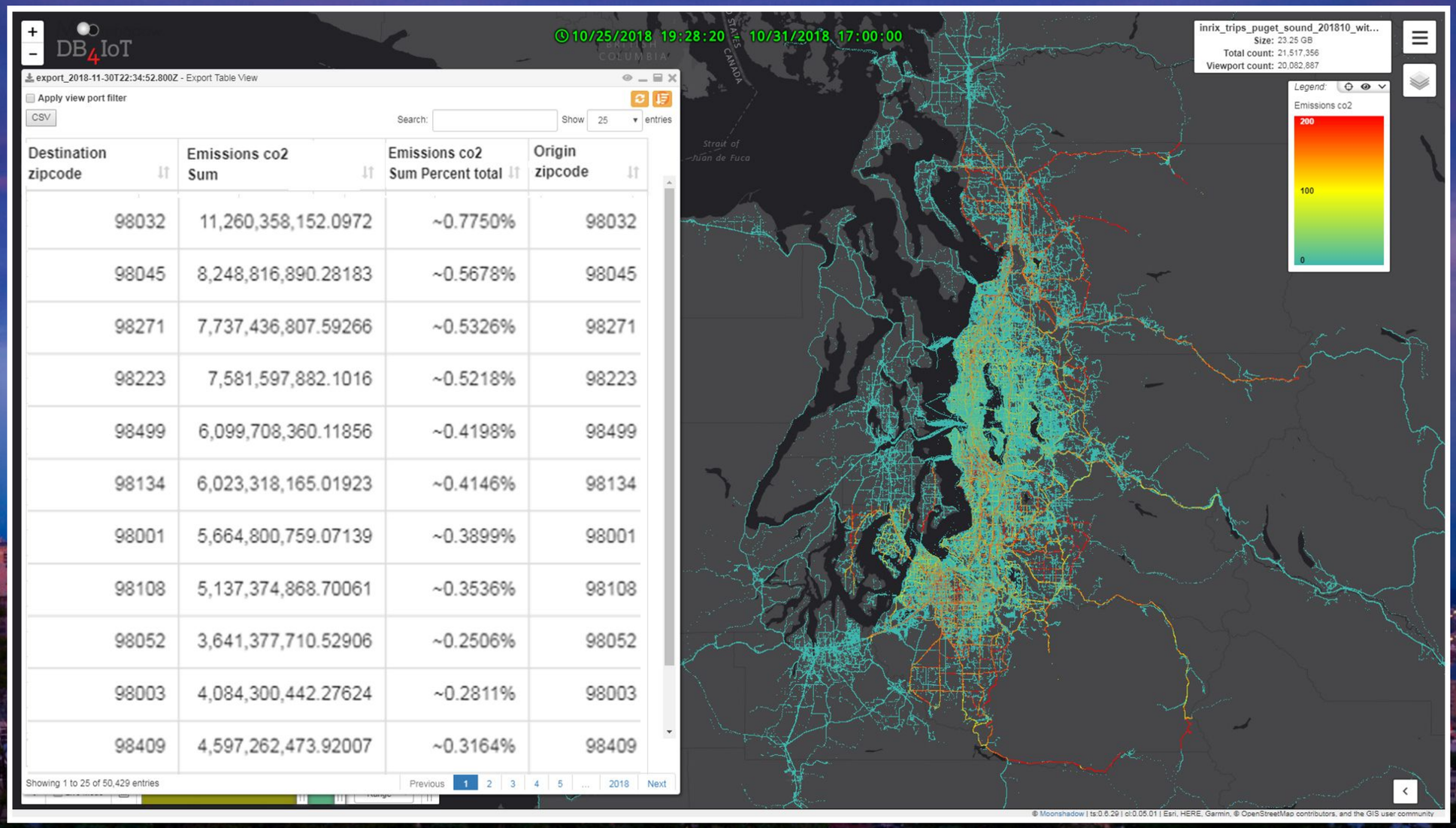
Proof of Concept:
Emissions values
not validated

CO2 Emissions per Road Segment



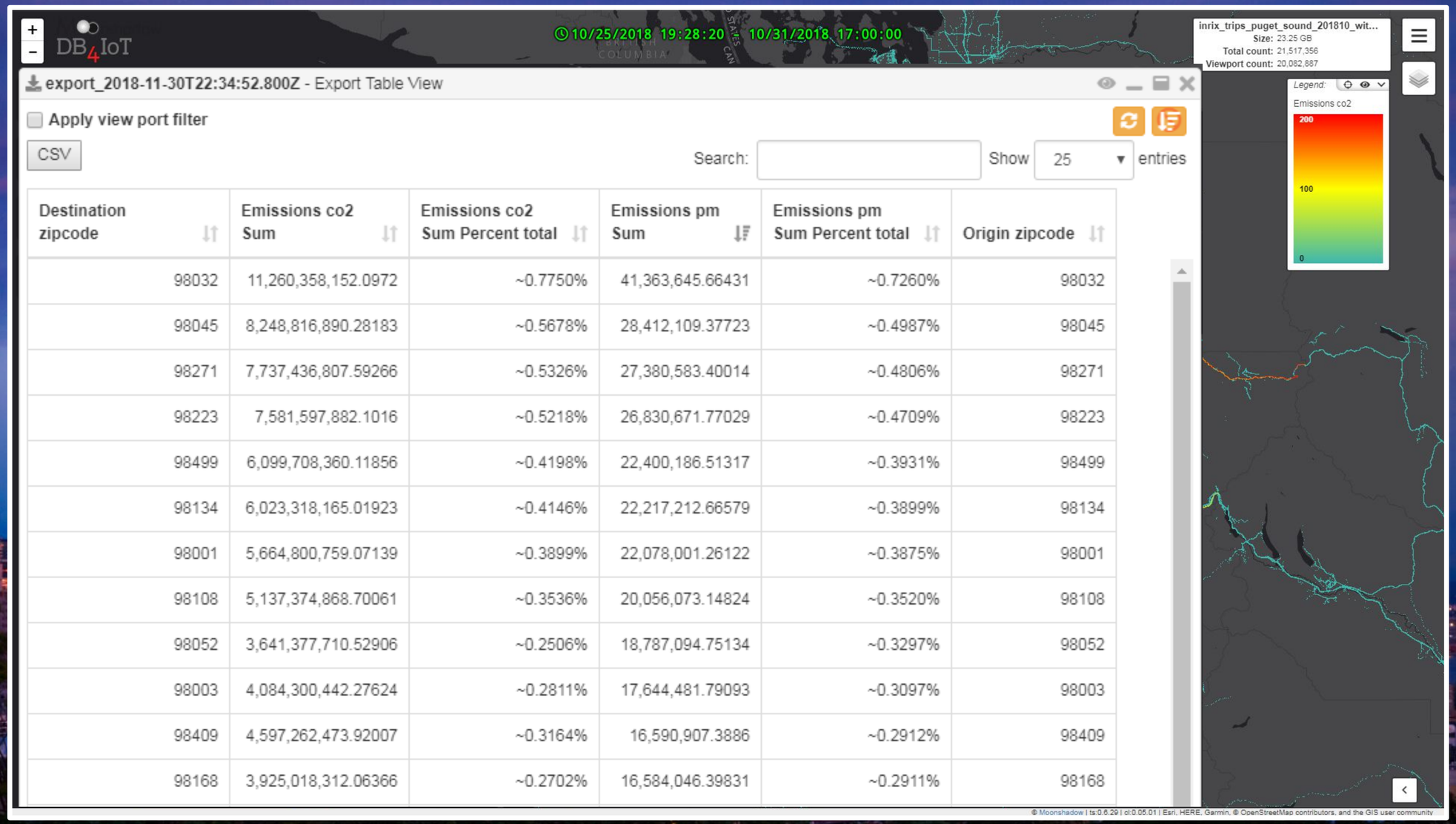
Proof of Concept:
Emissions values
not validated

ZIP to ZIP Origin-Destination emissions matrix



Proof of Concept:
Emissions values
not validated

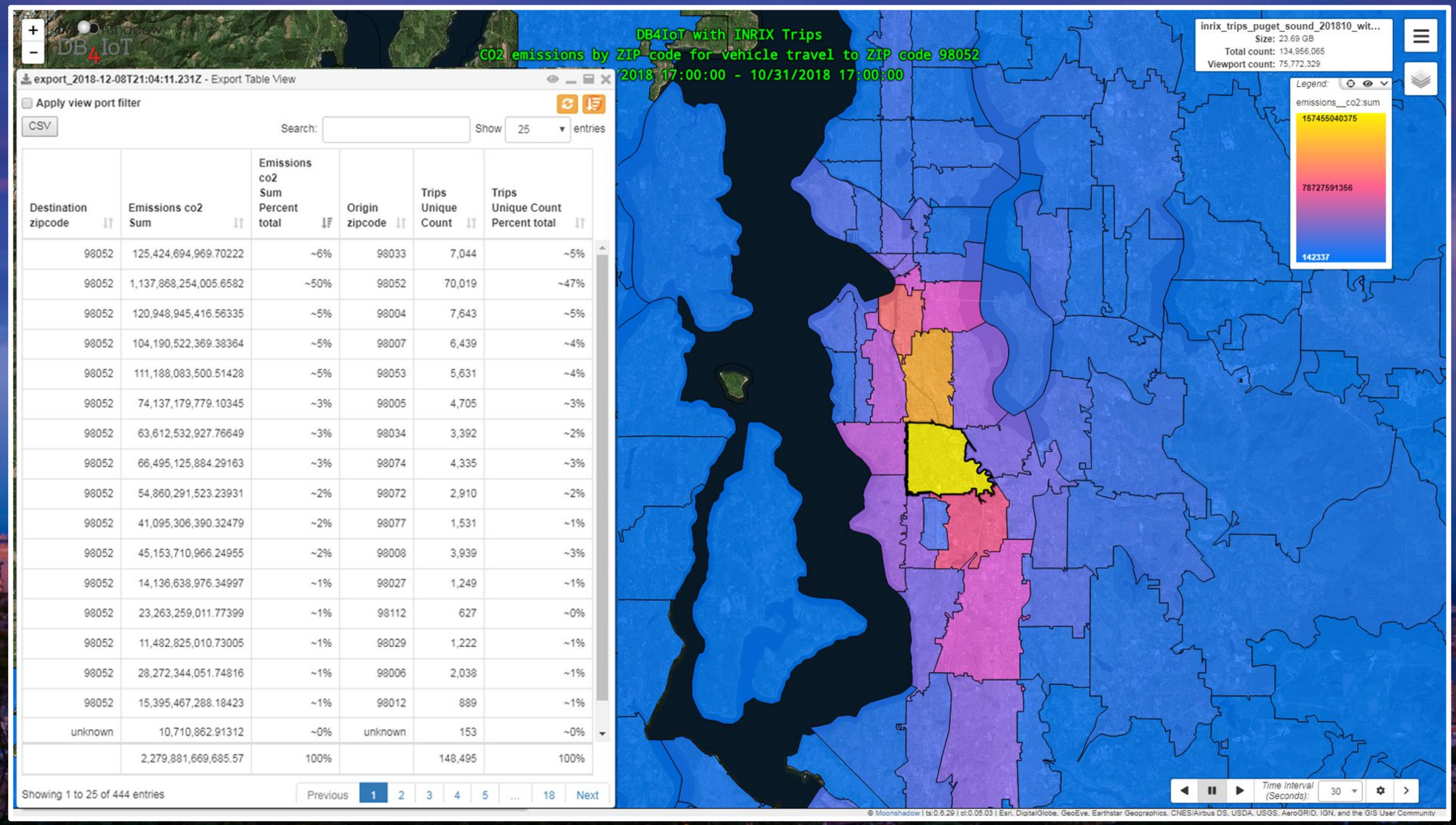
ZIP to ZIP O/D CO2 Matrix



Destination zipcode	Emissions co2 Sum	Emissions co2 Sum Percent total	Emissions pm Sum	Emissions pm Sum Percent total	Origin zipcode
98032	11,260,358,152.0972	~0.7750%	41,363,645.66431	~0.7260%	98032
98045	8,248,816,890.28183	~0.5678%	28,412,109.37723	~0.4987%	98045
98271	7,737,436,807.59266	~0.5326%	27,380,583.40014	~0.4806%	98271
98223	7,581,597,882.1016	~0.5218%	26,830,671.77029	~0.4709%	98223
98499	6,099,708,360.11856	~0.4198%	22,400,186.51317	~0.3931%	98499
98134	6,023,318,165.01923	~0.4146%	22,217,212.66579	~0.3899%	98134
98001	5,664,800,759.07139	~0.3899%	22,078,001.26122	~0.3875%	98001
98108	5,137,374,868.70061	~0.3536%	20,056,073.14824	~0.3520%	98108
98052	3,641,377,710.52906	~0.2506%	18,787,094.75134	~0.3297%	98052
98003	4,084,300,442.27624	~0.2811%	17,644,481.79093	~0.3097%	98003
98409	4,597,262,473.92007	~0.3164%	16,590,907.3886	~0.2912%	98409
98168	3,925,018,312.06366	~0.2702%	16,584,046.39831	~0.2911%	98168

Proof of Concept:
Emissions values
not validated

CO2 Emissions by ZIP code for travel to ZIP 98052



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Apply view port filter

CSV

Search:

Show 25 entries

Destination zipcode	Emissions co2 Sum	Emissions co2 Sum Percent total	Origin zipcode	Trips Unique Count	Trips Unique Count Percent total
98052	125,424,694,969.70222	~6%	98033	7,044	~5%
98052	1,137,868,254,005.6582	~50%	98052	70,019	~47%
98052	120,948,945,416.56335	~5%	98004	7,643	~5%
98052	104,190,522,369.38364	~5%	98007	6,439	~4%
98052	111,188,083,500.51428	~5%	98053	5,631	~4%
98052	74,137,179,779.10345	~3%	98005	4,705	~3%
98052	63,612,532,927.76649	~3%	98034	3,392	~2%
98052	66,495,125,884.29163	~3%	98074	4,335	~3%
98052	54,860,291,523.23931	~2%	98072	2,910	~2%
98052	41,095,306,390.32479	~2%	98077	1,531	~1%
98052	45,153,710,966.24955	~2%	98008	3,939	~3%
98052	14,136,638,976.34997	~1%	98027	1,249	~1%
98052	23,263,259,011.77399	~1%	98112	627	~0%
98052	11,482,825,010.73005	~1%	98029	1,222	~1%
98052	28,272,344,051.74816	~1%	98006	2,038	~1%
98052	15,395,467,288.18423	~1%	98012	889	~1%
unknown	10,710,862.91312	~0%	unknown	153	~0%
	2,279,881,669,685.57	100%		148,495	100%

Showing 1 to 25 of 444 entries

Previous 1 2 3 4 5 ... 18 Next

Proof of Concept:
Emissions values
not validated

The formula for this approach is simple

N = Number of Vehicles
E = Average Emission per Vehicle per Second
T = Time Length in seconds

Total Emissions = N * E * T

Proof of Concept:
Emissions values
not validated

Accuracy will increase as the input variables become more precise

Number of Vehicles:

- More connected vehicles
- More accurate counts from infrastructure

Average Emission per Vehicle per Second:

- Better information on composition of vehicle fleet
- Better data on emissions at different speeds
- Increased frequency of vehicle movement data

Proof of Concept:
Emissions values
not validated

DB4IoT

Contact Info

Visit us at Exhibitor Booth #754

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