

EXPERIENCES BUILDING AN ENVIRONMENT FRIENDLY ITS IN THE CITY OF HUAINAN

Session No.: TS36

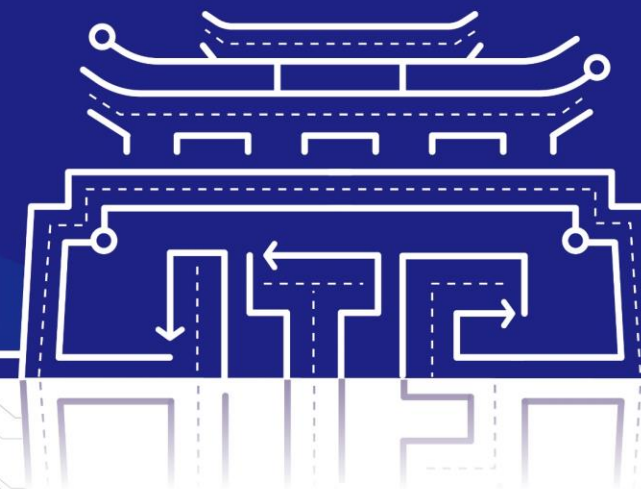
Session Date: 2023-10-19

Speaker's Name: Elmar Brockfeld

Speaker's Organization: Institute of Transportation Systems
German Aerospace Center (DLR-TS)
Berlin, Germany



29th ITS WORLD
CONGRESS



City of Huainan

- Located in Anhui Province, 450 km from Shanghai
- Around 3.4 million residents (2020)
- Area: 5,533 km², Density: 620/km²
- Extending transportation system and network
- Since 2013, the number of motor vehicles and drivers has risen by more than 500 %



Huainan ITS Project – Overview

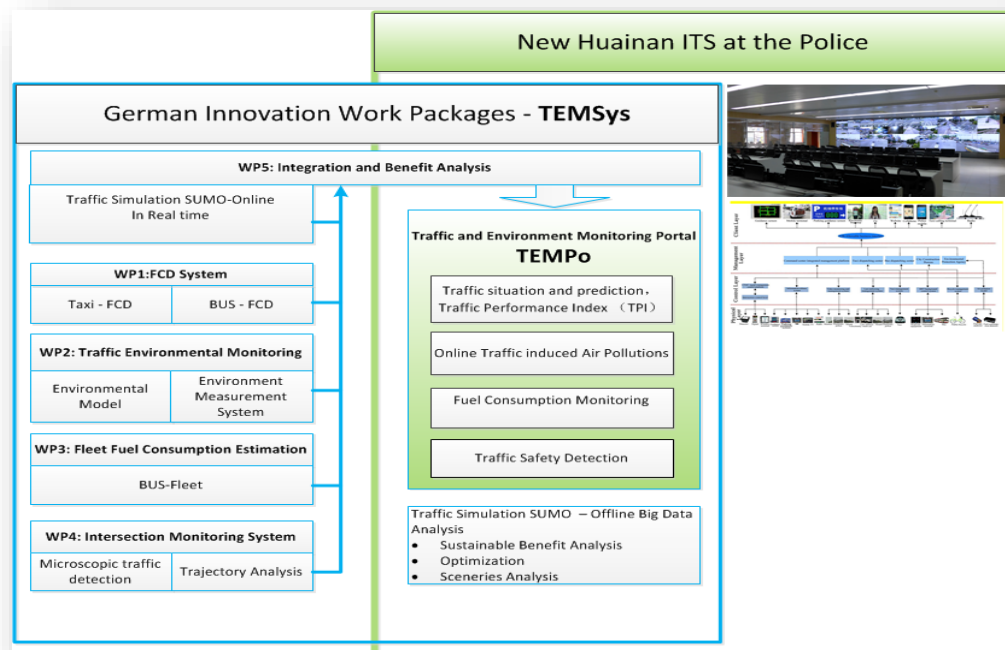
City of Huainan was building its ITS system with a new traffic management center

- First ITS project of German Aerospace Center (DLR) in chinese traffic management center
- Total budget: 18 million €
- DLR - work: 1 million €
 - 2 years Installation & Implementation (11.2018 – 10.2020)
 - 3 years Maintenance & Training (11.2020 – 10.2023)



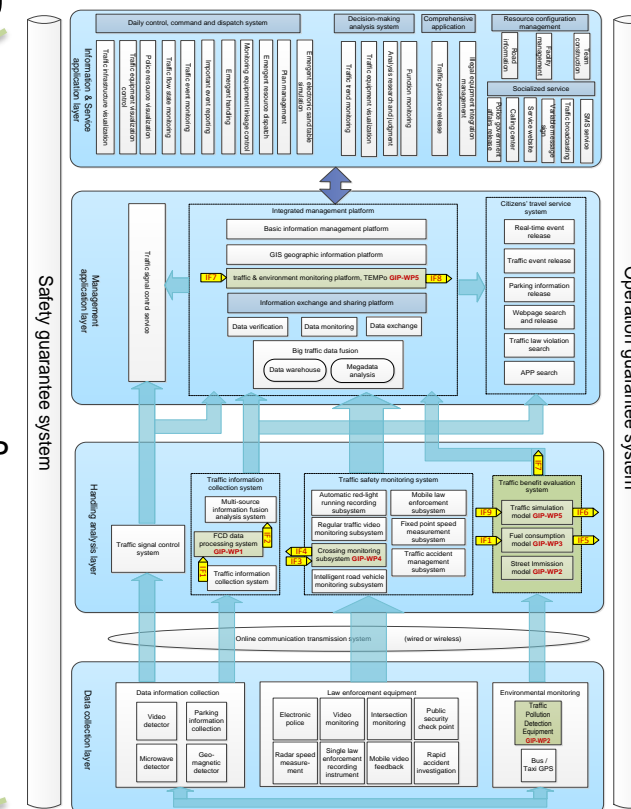
GIP of the DLR in the Huainan Project

German Innovation Package (GIP) is fully integrated in the General Contracting Package (GCP)



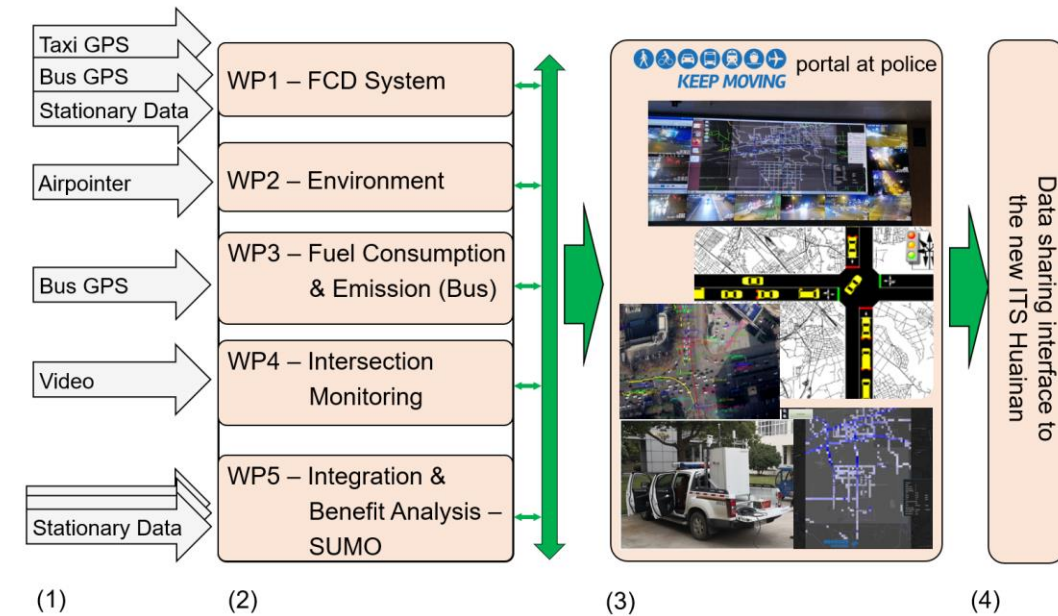
GIP

GCP



DLR - Real-time traffic monitoring platform

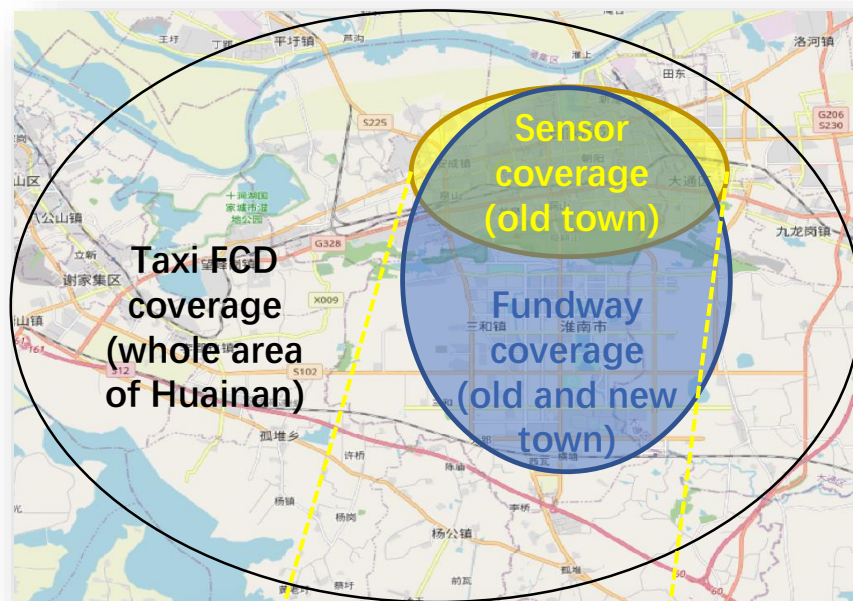
- DLR's Keep Moving Portal - Combination of area wide traffic information based on FCD + sensors and Environmental Monitoring
- DLR's online calibration process with SUMO* - real-time monitoring of city-wide road traffic
- Intersection Monitoring delivers conflict parameters and trajectories
- Analysis of the long-term impact of ITS and scenario analyzes
- Environmental impact evaluation of the new ITS



- (1) Data import from different sources
- (2) A series of interconnected data processing modules corresponding to each work package
- (3) Data visualization using Keep Moving integrated ITS portal
- (4) Data provision and sharing to other modules of the new ITS System

Traffic situation based on multiple data sources

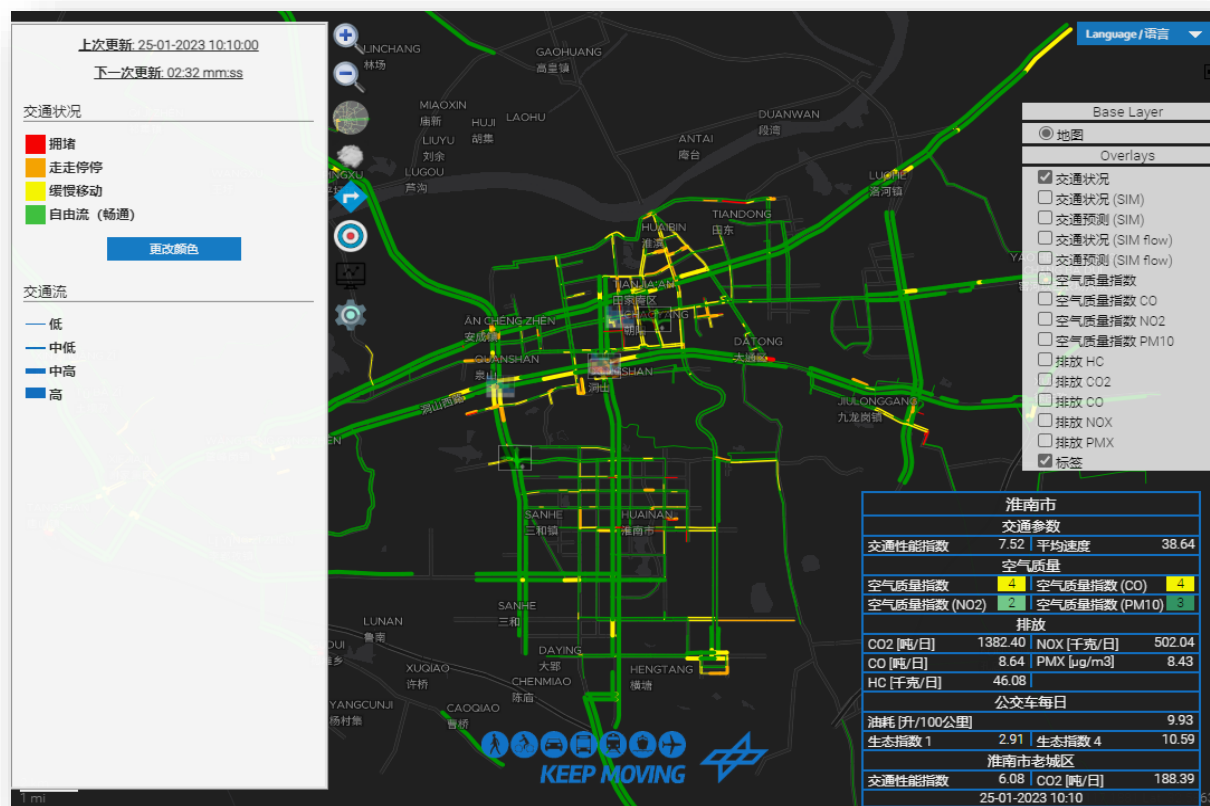
Data
coverage



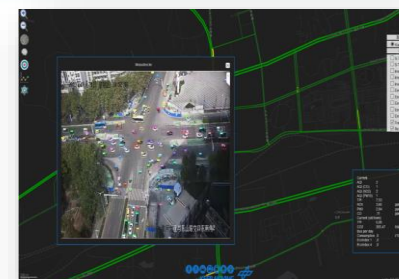
Sensors in “old-town”
(blue: microwave
red: cam)

- Taxi-FCD (2.800 veh., ~20 sec freq.)
- Stationary (500 microwave, 200 cams)
- Third-party traffic data (Fundway)
- Realtime microscopic traffic-simulation SUMO is calibrated with these online data

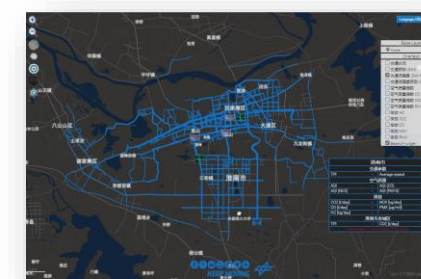
Features for operators



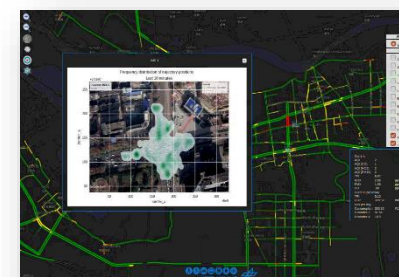
traffic state map and dashboard for traffic+pollutant key values



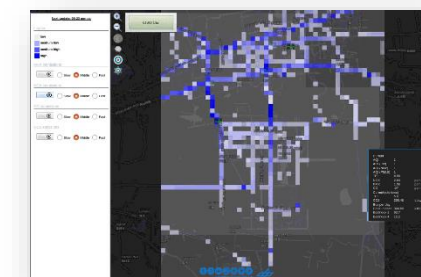
video streams



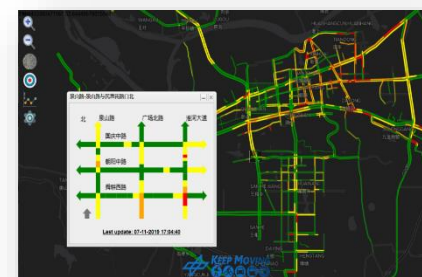
SUMO traffic volumes



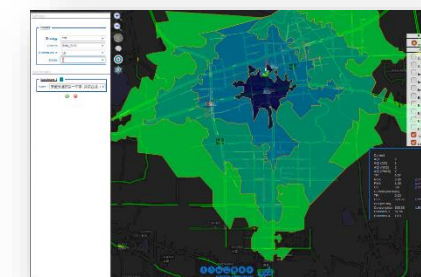
intersection monitoring



emissions / immissions



variable message signs (VMS)



isochrones

Dashboard

Visualisation and continuous update of current key values, partially with coloring according to states

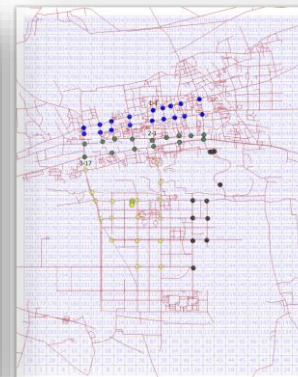
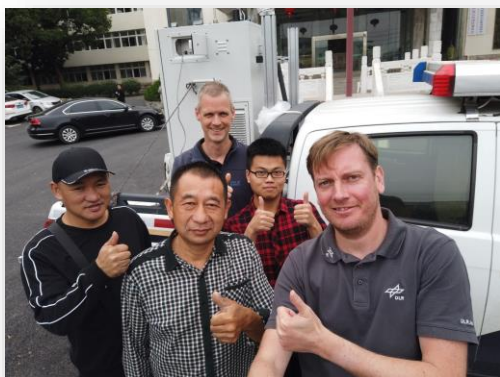
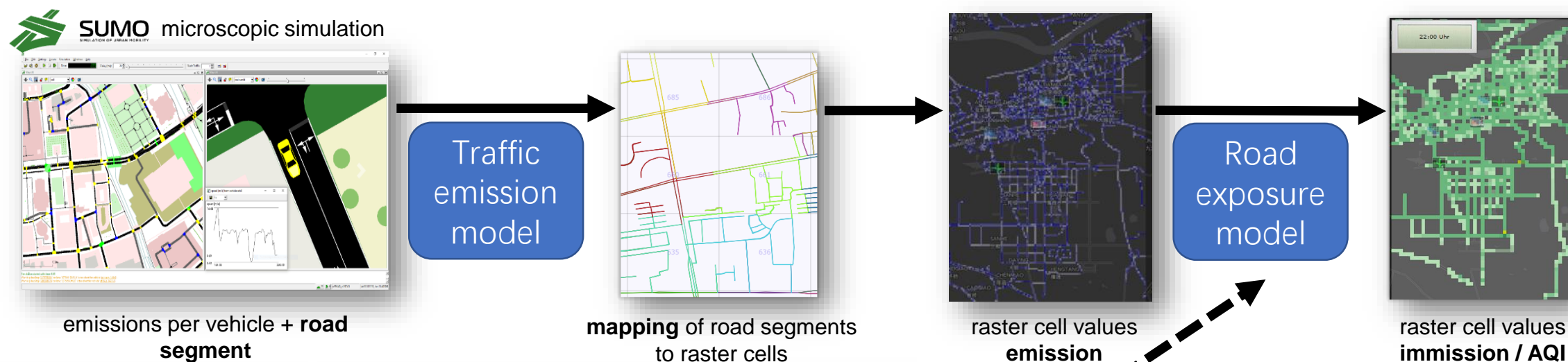
- Pollutant **emissions** and air quality values (**AQI**)
- Traffic performance index (**TPI**) and **average speeds** for the whole city and only the central district in the north
- Daily updated average fuel **consumption** and **emissions** of **selected buses**, whose drivers were trained concerning low emission driving.

淮南市			
交通参数			
交通性能指数	7.52	平均速度	38.64
空气质量			
空气质量指数	4	空气质量指数 (CO)	4
空气质量指数 (NO2)	2	空气质量指数 (PM10)	3
排放			
CO2 [吨/日]	1382.40	NOX [千克/日]	502.04
CO [吨/日]	8.64	PMX [µg/m3]	8.43
HC [千克/日]	46.08		
公交车每日			
油耗 [升/100公里]			9.93
生态指数 1	2.91	生态指数 4	10.59
淮南市老城区			
交通性能指数	6.08	CO2 [吨/日]	188.39
25-01-2023 10:10			

淮南市			
交通参数			
TPI	7.26	Average speed	38.83
空气质量			
AQI	4	AQI (CO)	4
AQI (NO2)	2	AQI (PM10)	3
排放			
CO2 [t/day]	1382.40	NOX [kg/day]	502.04
CO [t/day]	8.64	PMX [µg/m3]	8.43
HC [kg/day]	46.08		
淮南市老城区			
TPI	6.00	CO2 [t/day]	188.39
26-09-2023 08:00			

Traffic emission and immission calculation

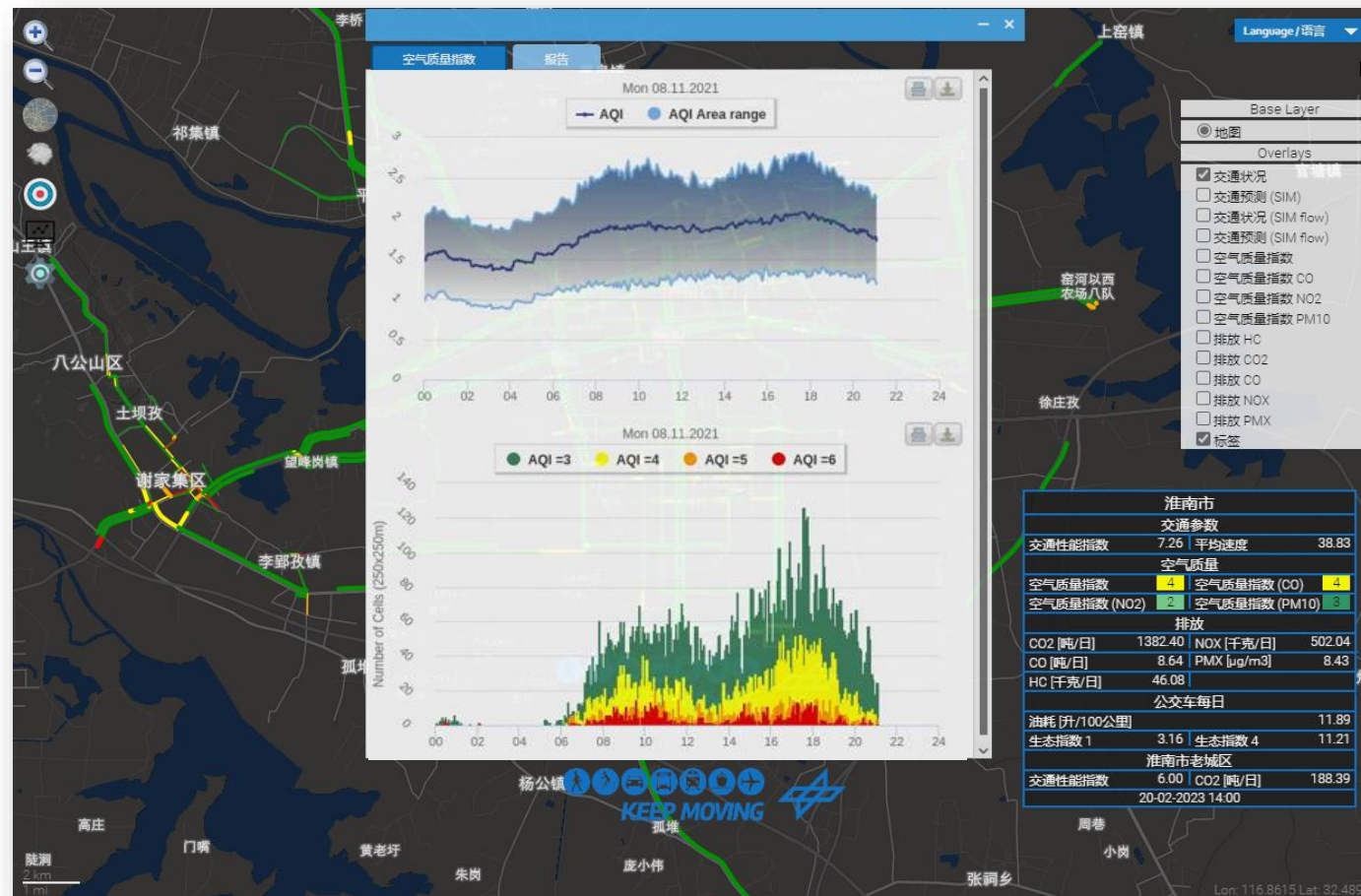
every 5 minutes



Pollutant immissions – AQI as 24-h motion



Pollutant immissions AQI - Current daily variations



After click on dashboard

- Daily variation diagram with confidence-interval
- Daily variation stacked with worse to worst AQI values

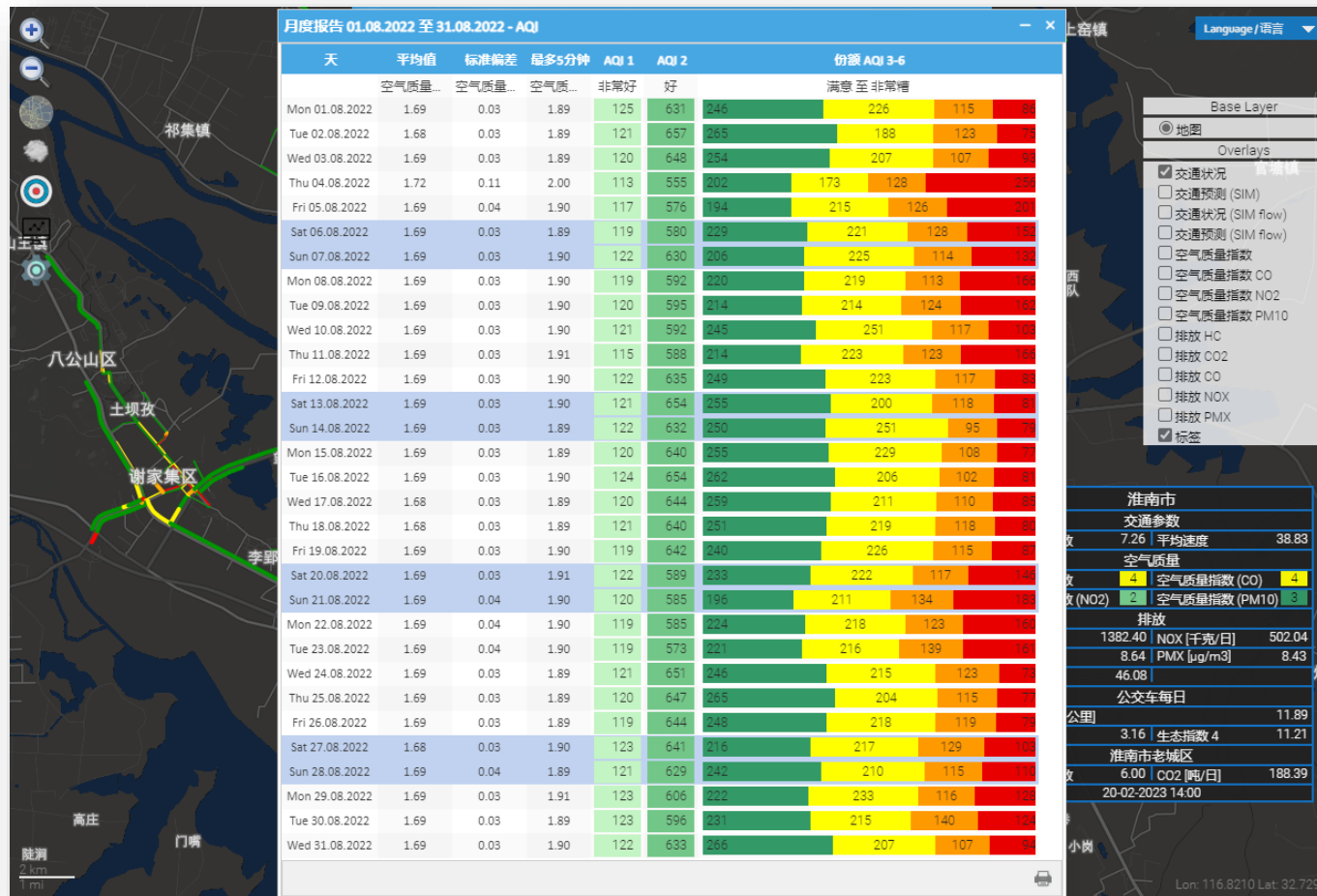
Pollutant immissions AQI – weekly reports



Per day

- diagram stacked daily variations
- average
- standard deviation
- 5 minute max value
- counts of cells per AQI value

Pollutant immissions AQI – monthly reports



- per day as weekly report, but without diagrams
- highlighting of weekends

Weekly / monthly reports – print views

[illegible]

Drucken

Insgesamt: 1 Papierbogen

Drucker

Foxit PDF Editor Printer ▼

Kopien

1

Layout

☒ Hochformat

☐ Querformat

Seiten

☒ Alles

☐ z. B. 1-5, 8, 11-13

Farbe

Farbe ▼

Weitere Einstellungen ▼

Mit Systemdialog (Ctrl+Shift+F) drucken

Druckerproblembearbeitung

Minutenbericht 01.09.2021 bis 30.09.2021 - DLR_2_TMF über DLN/Temperatur

Tag	Min vor		Min nach		Wkt.	Mittel	Min	Anzahl Stunden im Verkehrszustand
	Minuten	Minuten	Minuten	Minuten				
								gesteigert stockend abkühlend
Mo. 01.09.2021	32	19	32	15	11		0	2.3 2.8 13.1
Din. 02.09.2021	30	20	30	16	11		6.1	2.3 4.3 11.8
Fr. 03.09.2021	20	21	21	15	11		0	3.4 5.6 11.9
Sa. 04.09.2021	18	19	19	14	11		0.3	2.6 4 10.5
So. 05.09.2021	16	37	37	16	11		0.6	1.7 14 10.9
Mo. 06.09.2021	74	33	74	20	11		0.8	2.9 14 2 10.9
Di. 07.09.2021	35	20	30	16	11		0.3	2.9 4.6 11.8
Mi. 08.09.2021	30	21	30	16	11		0.8	1.8 4.2 12.4
Do. 09.09.2021	32	20	32	16	11		0.8	3.1 3.8 11.1
Fr. 10.09.2021	18	116	116	17	11		4.7	3.7 4.1 11.8
Sa. 11.09.2021	17	33	33	14	11		2.4	2.8 3.6 10.8
So. 12.09.2021	14	24	24	14	11		0	1.1 0.1 10.1
Mo. 13.09.2021	31	18	31	15	11		4.9	1.7 4.1 10.9
Di. 14.09.2021	30	19	30	15	11		0	2 3.7 10.6
Mi. 15.09.2021	20	34	34	16	11		7.6	1.9 2.1 10.8
Do. 16.09.2021	20	17	20	16	11		0.4	2.5 3.3 8.7
Fr. 17.09.2021	-	-	-	-	-		-	-
Sa. 18.09.2021	-	-	-	-	-		-	-
So. 19.09.2021	-	-	-	-	-		-	-
Mo. 20.09.2021	-	-	-	-	-		-	-
Di. 21.09.2021	20	21	21	16	11		0.3	1 3.4 8.9
Mi. 22.09.2021	26	10	20	14	11		0.6	1.2 4.7 20.1
Do. 23.09.2021	20	20	20	16	11		4.6	3.9 4.6 14.2
Fr. 24.09.2021	19	21	21	15	11		0.7	2.7 4.3 10.9
Sa. 25.09.2021	16	22	22	14	11		0.7	2.1 1.8 10.8
So. 26.09.2021	15	17	17	13	11		0.2	1.1 1.6 20.9
Mo. 27.09.2021	16	28	28	15	11		0.7	1.4 3.6 10.3
Di. 28.09.2021	31	18	31	15	11		4.8	2.8 4.1 13
Mi. 29.09.2021	37	19	37	16	11		0.7	1.5 1.3 10.7
Do. 30.09.2021	20	20	20	14	11		0.9	2.8 2.8 10.9

Traffic induced CO2 emissions

- Traffic-induced CO2 emissions calculated by the ITS Huainan system normally are in the range of about

990 to 1400 t / day (see monthly report at the right)

- Traffic-induced CO2 emissions in the range of 9,6 to 13,6 % are reasonable (by now no trucks and buses are simulated!)

Tag	Tagessumme [t/day]	5 Minuten Min [t/day]	5 Minuten Max [t/day]
Mi. 01.09.2021	1069.77	169.85	2002.61
Do. 02.09.2021	1075.54	159.15	1997.60
Fr. 03.09.2021	1075.12	170.97	2059.67
Sa. 04.09.2021	990.00	174.11	2015.89
So. 05.09.2021	1074.48	169.66	2025.84
Mo. 06.09.2021	1074.42	176.00	2021.39
Di. 07.09.2021	1080.47	167.17	2020.14
Mi. 08.09.2021	-	-	-
Do. 09.09.2021	1096.43	165.93	2149.19
Fr. 10.09.2021	1120.72	160.35	2092.69
Sa. 11.09.2021	1121.88	158.86	2206.40
So. 12.09.2021	1082.51	174.47	2025.56
Mo. 13.09.2021	-	-	-
Di. 14.09.2021	1088.29	173.39	2087.65
Mi. 15.09.2021	1072.35	164.00	2046.10
Do. 16.09.2021	1072.20	164.51	2041.82
Fr. 17.09.2021	995.53	165.83	2087.19
Sa. 18.09.2021	1077.12	165.02	2069.69
So. 19.09.2021	1081.64	165.64	2040.65
Mo. 20.09.2021	1079.36	155.04	2056.43
Di. 21.09.2021	1053.72	178.84	2009.88
Mi. 22.09.2021	1069.32	169.94	2054.56
Do. 23.09.2021	1340.78	159.64	3093.00
Fr. 24.09.2021	1096.73	156.58	2139.20
Sa. 25.09.2021	1089.28	165.87	2080.95
So. 26.09.2021	1099.45	169.67	5154.45
Mo. 27.09.2021	1096.84	156.64	2106.20
Di. 28.09.2021	1093.12	167.81	2113.18
Mi. 29.09.2021	1082.64	162.29	2089.90
Do. 30.09.2021	1120.47	169.56	2083.16

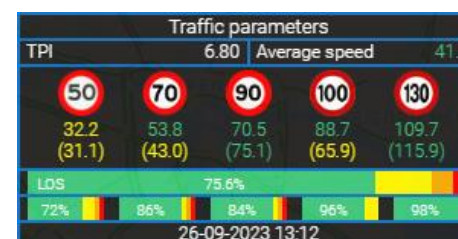
Summary & future work (1/2)

Keep Moving Control Center for police operators in Huainan was enhanced, especially by:

- development of city-wide **key values** concerning **traffic and pollutant states**
- giving traffic operators possibility to observe its **current states** and **development over time**
 - visualization of key values in an **enhanced dashboard**
 - visualization of **daily development** of key values
 - possibility to create **weekly and monthly reports**

Current / future work (1/2)

- enhancement of dashboard and reports concerning traffic key values
- yearly reports



Current / future work (2/2)

Scenario analysis E-cars

Huainan SUMO*
Modell 2020



Business as usual (BAU) scenario:

(Huainan City 14th Five-Year Plan for Air Pollution Prevention and Control 2021-2025)

- Year targeted to analysis: **2025**
- Share of E-cars: **0 up to 30%**
- Climate conditions: **cold, normal, warm**
- Radius of public charging stations in urban areas less than **0.9 km**
- All conventional engine cars meet National III emission standard (equivalent to Euro III)

Source: <https://baike.baidu.com/item/%E6%B7%AE%E5%8D%97/197644>



Bike sharing / rental



Two-wheeler sun protection at intersections incl. safety aspect



Safe pedestrian walkways





Thank you for your attention!

Elmar Brockfeld, Alexander Sohr, Xiaoxu Bei
German Aerospace Center (DLR)
Institute of Transportation Systems
Rutherfordstr. 2
12489 Berlin

Qian Gong
Huainan Traffic Police Department
Guoqing West Road
Huainan City, Anhui Province, P.R.C.

E-mail: elmar.brockfeld@dlr.de
Phone: +49 30 67055 231