Impacts of HSR Infrastructure on City-Making Across China

China offers a unique opportunity to study the interaction of rapid development in major mobility infrastructure and urbanization
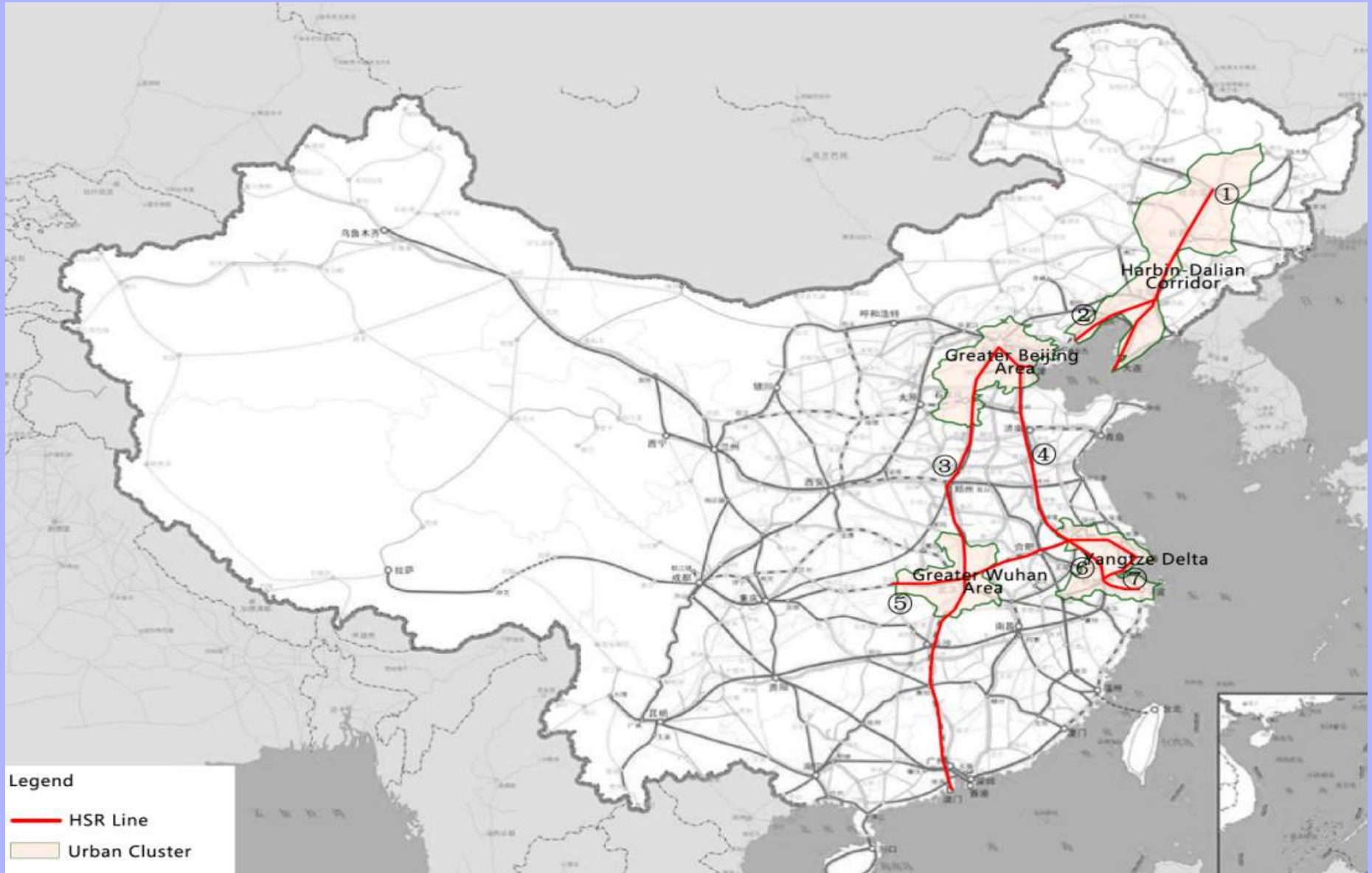
19,000 km. HSR network built in 9 years

57 story tower built in 19 days →

Exploring HSR infrastructure development across China reveals three patterns

Corridor Mode (CM) emulates Shinkansen with single route linking mega-cities

Metro Tokyo - 32.5 million population

Metro Osaka -
18.7 million population

Monocentric Radial Mode (MRM) echoes French TGV network linking regional cities through a financial and political hub

Multicore Network Mode (MNM) HSR serve new spatial (re)structuring of commuting within 21st century supercities like Jing-Jin-Ji

- *Jing* = Beijing; *Jin* = Tianjin; *Ji* = Heibi Province
- Population: 130 million; physical area 90% of United Kingdom;
- **Commuting time by HSR ≤ 1 hour**

HSR Infrastructure Attributes

	HSR Length (km)
Harbin-Dalian Corridor (CM)	1,509.8
Yangtze Delta Network (MNM)	1,465
Jing-Jin-Ji Supercity (MNM)	1,143
Greater Wuhan Hub (MRM)	1,042

Accessibility assessment method for rail network nodes
Monzon *et. al.*, 2013

$$A_i = \frac{\sum_j P_j}{\sum_j P_j \cdot I_{ij}}$$

Accessibility is measured by dividing a HSR station's importance in the network (population or GDP) by generalized travel time to other stations in the network

Corridor Mode accessibility analysis shows HSR working to spread regional growth
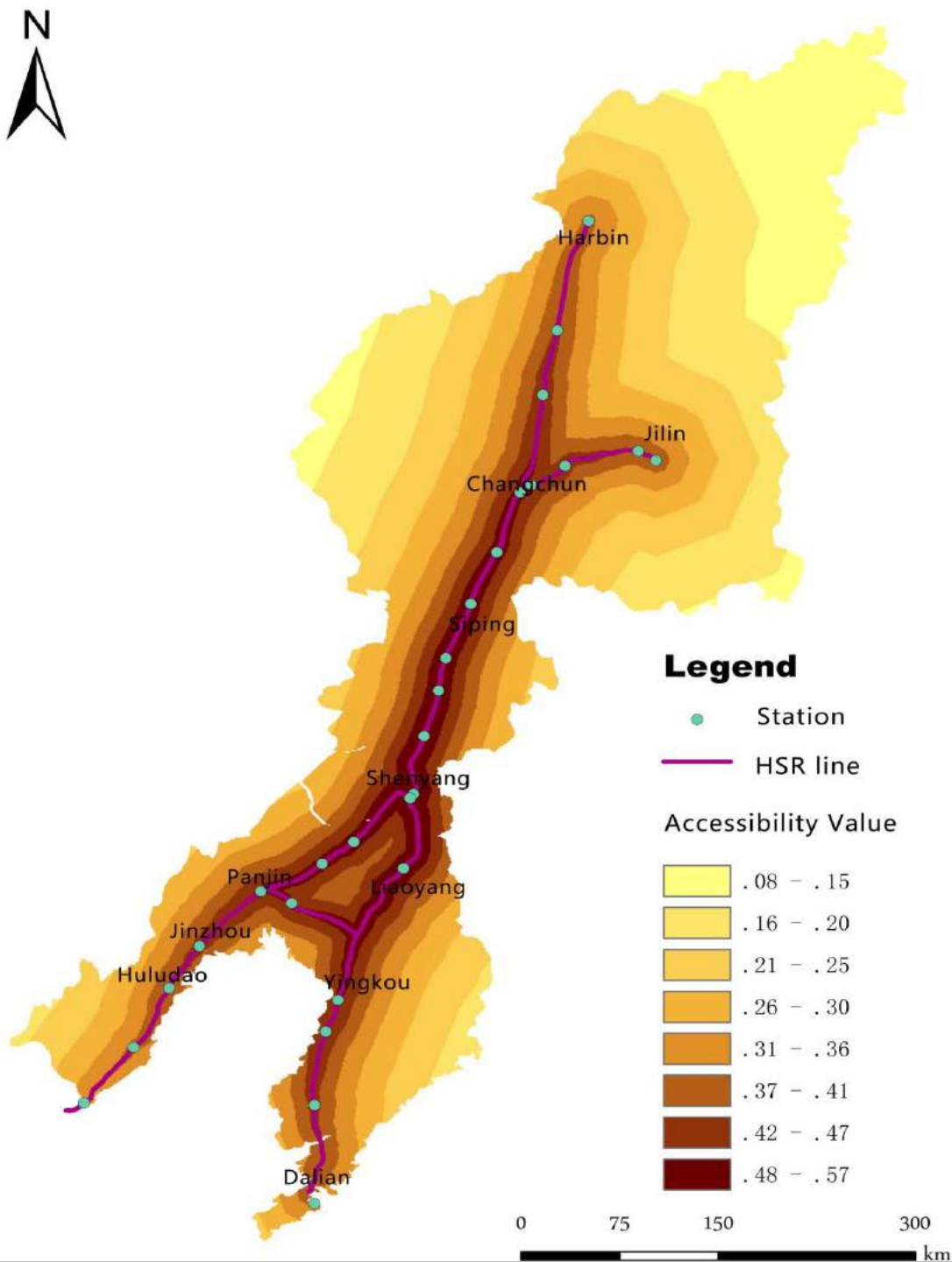

Harbin – Dalian HSR corridor: 905 kilometres

Legend

- Station
— HSR line

Accessibility Value

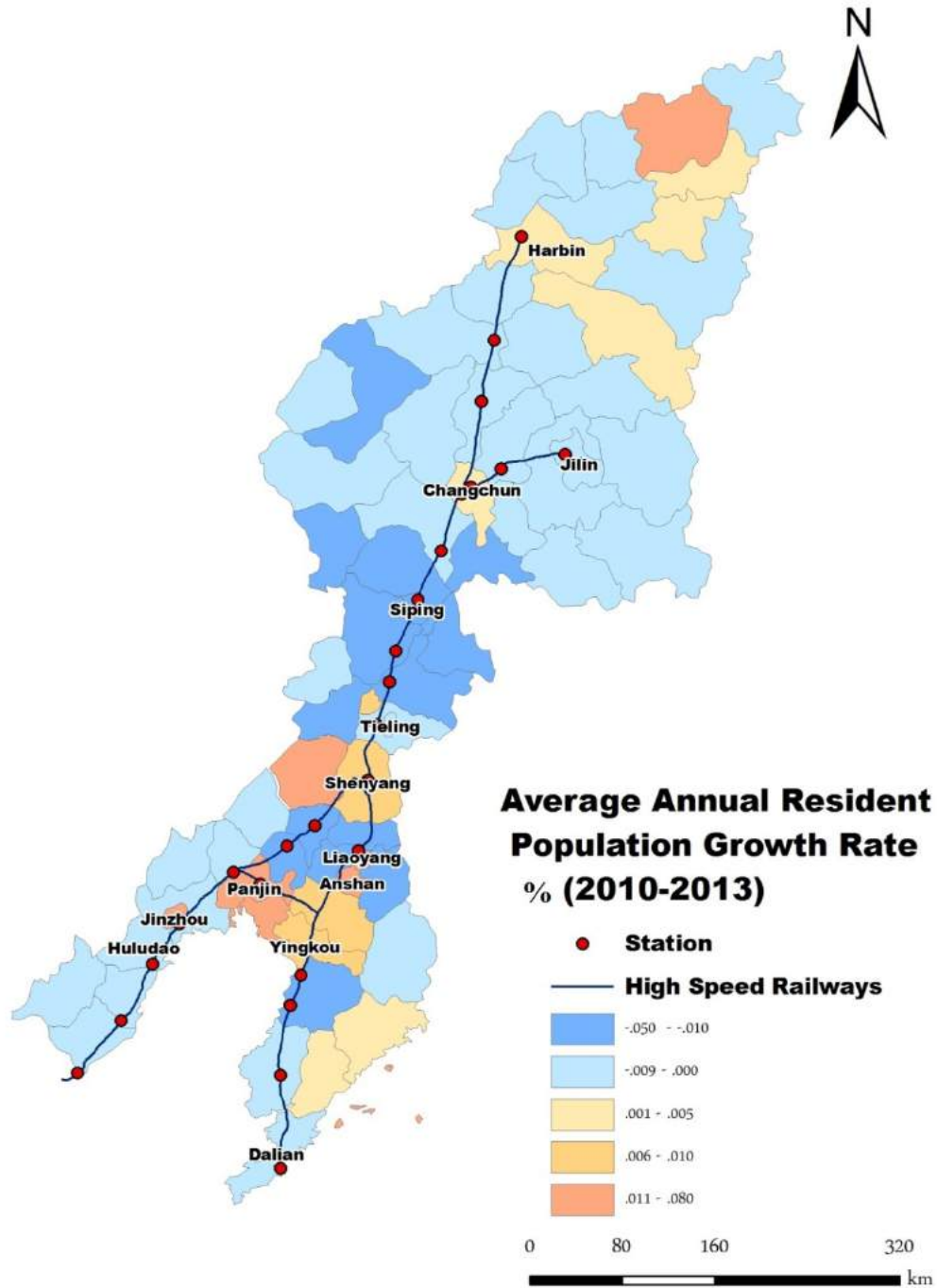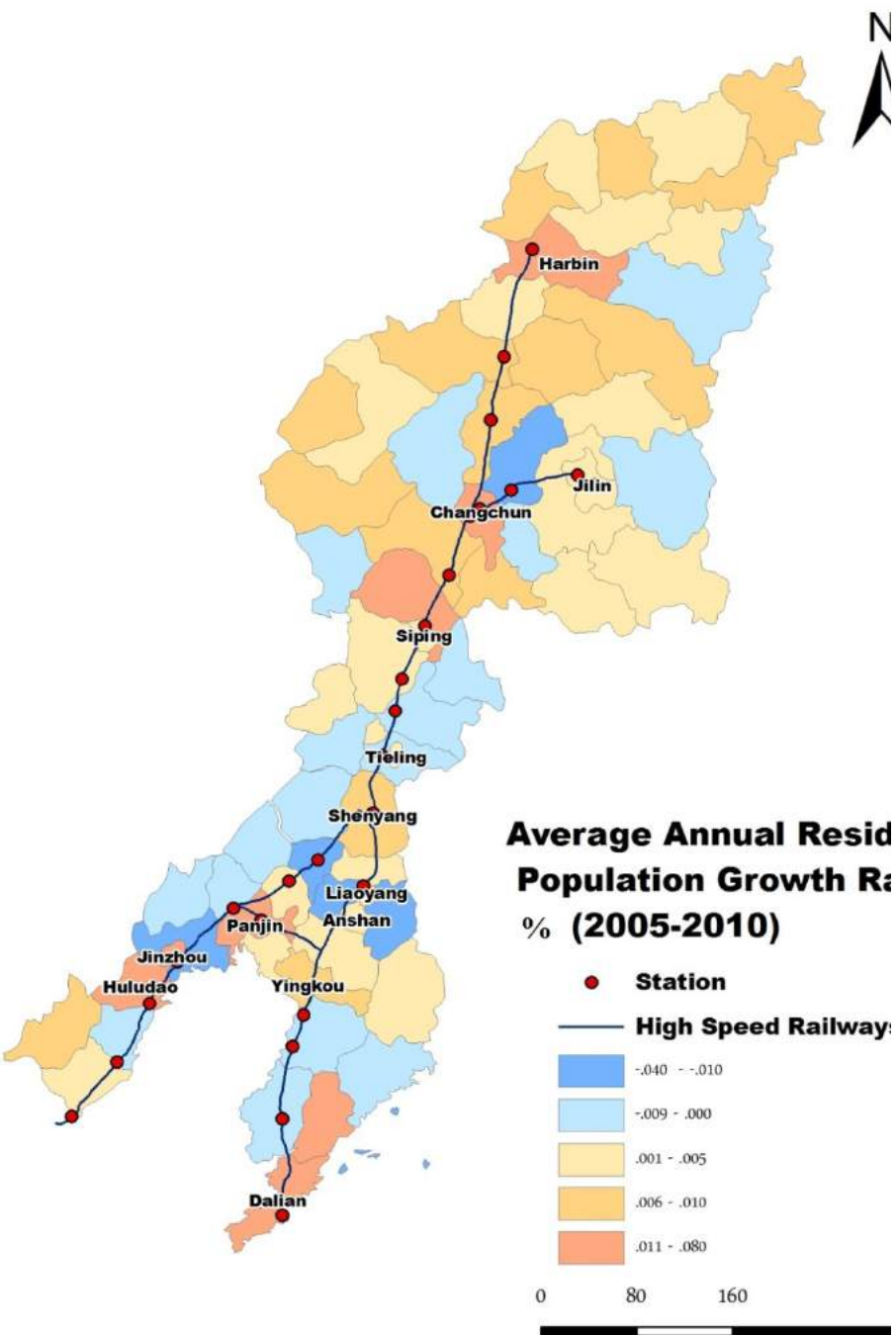|	
	.08 − .15
	.16 − .20
	.21 − .25
	.26 − .30
	.31 − .36
	.37 − .41
	.42 − .47
	.48 − .57

0   75   150   300
km

Harbin- Dalian corridor's accessibility distribution is boosted along the infrastructure, peaking where the HSR corridor splits into two branches

Effect of greater accessibility between Harbin & Dalian suggest growth in intermediate cities has eclipsed growth at endpoints

- 905 km. length

- 3.5 hour trip end to end

- Shared tracks

- Harbin – 3.5 million pop.

- Dalian – 3.24 million

Corridor is similar in length to Melbourne-Sydney, with lower population in the Chinese endpoints than Australia

Average Annual Resident Population Growth Rate % (2005-2010)

- Station
- High Speed Railways

	-.040 - -.010
	-.009 - .000
	.001 - .005
	.006 - .010
	.011 - .080

0   80   160

Average Annual Resident Population Growth Rate % (2010-2013)

- Station
- High Speed Railways

	-.050 - -.010
	-.009 - .000
	.001 - .005
	.006 - .010
	.011 - .080

0   80   160   320
km

Stations (labeled on maps): Harbin, Jilin, Changchun, Siping, Tieling, Shenyang, Liaoyang, Anshan, Panjin, Jinzhou, Huludao, Yingkou, Dalian

Monocentric Radial Mode suggests HSR infrastructure can distribute growth across a region centred on a hub
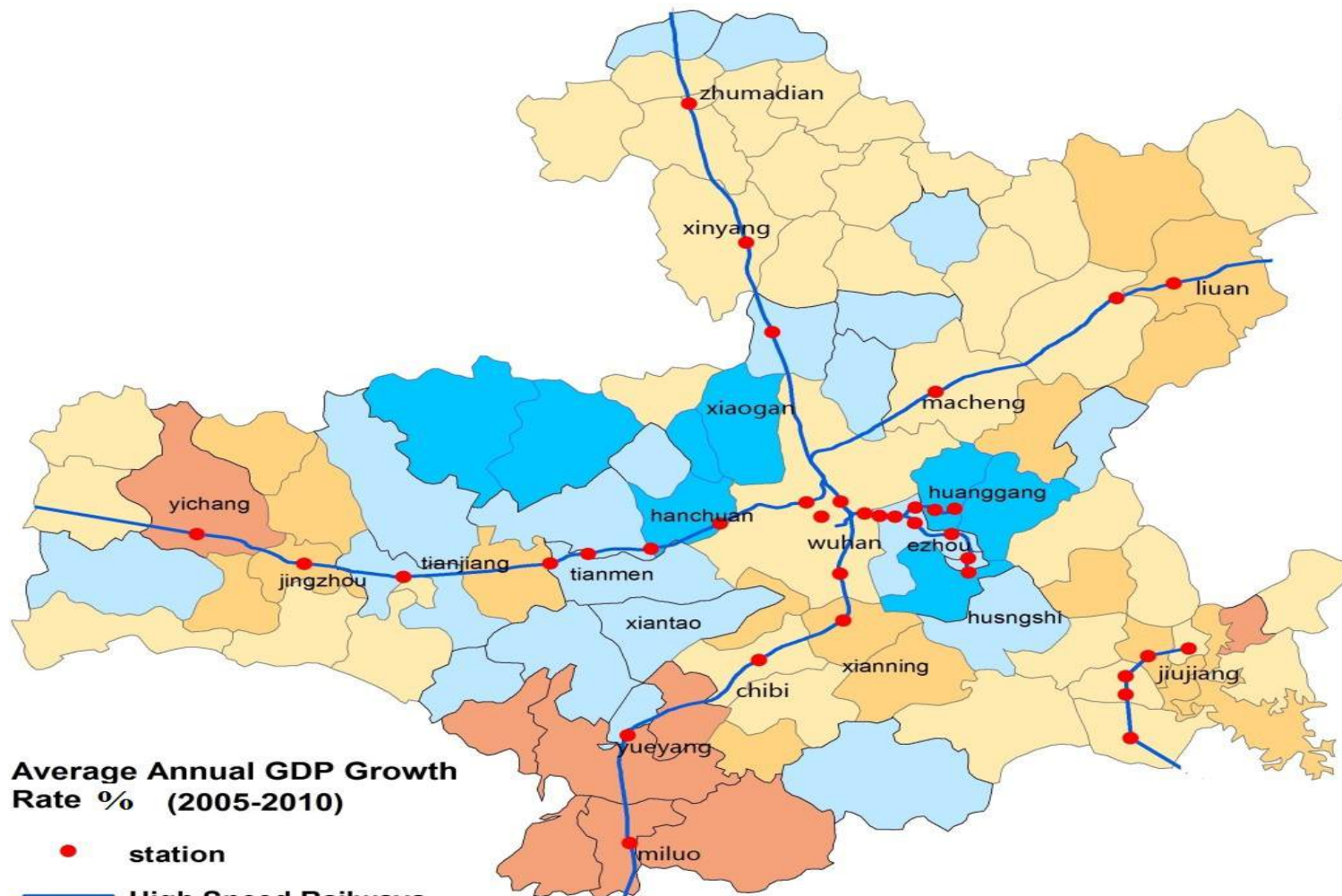

China High-speed Railway Map

1,042 HSR route km. converge at Wuhan

Legend

Corridor Mode (CM)

Monocentric-Radial Mode (MRM)

Multicore Network (MNM)

Wuhan's HSR hub serves a population of over 70 million and a regional GDP of over $500 billion
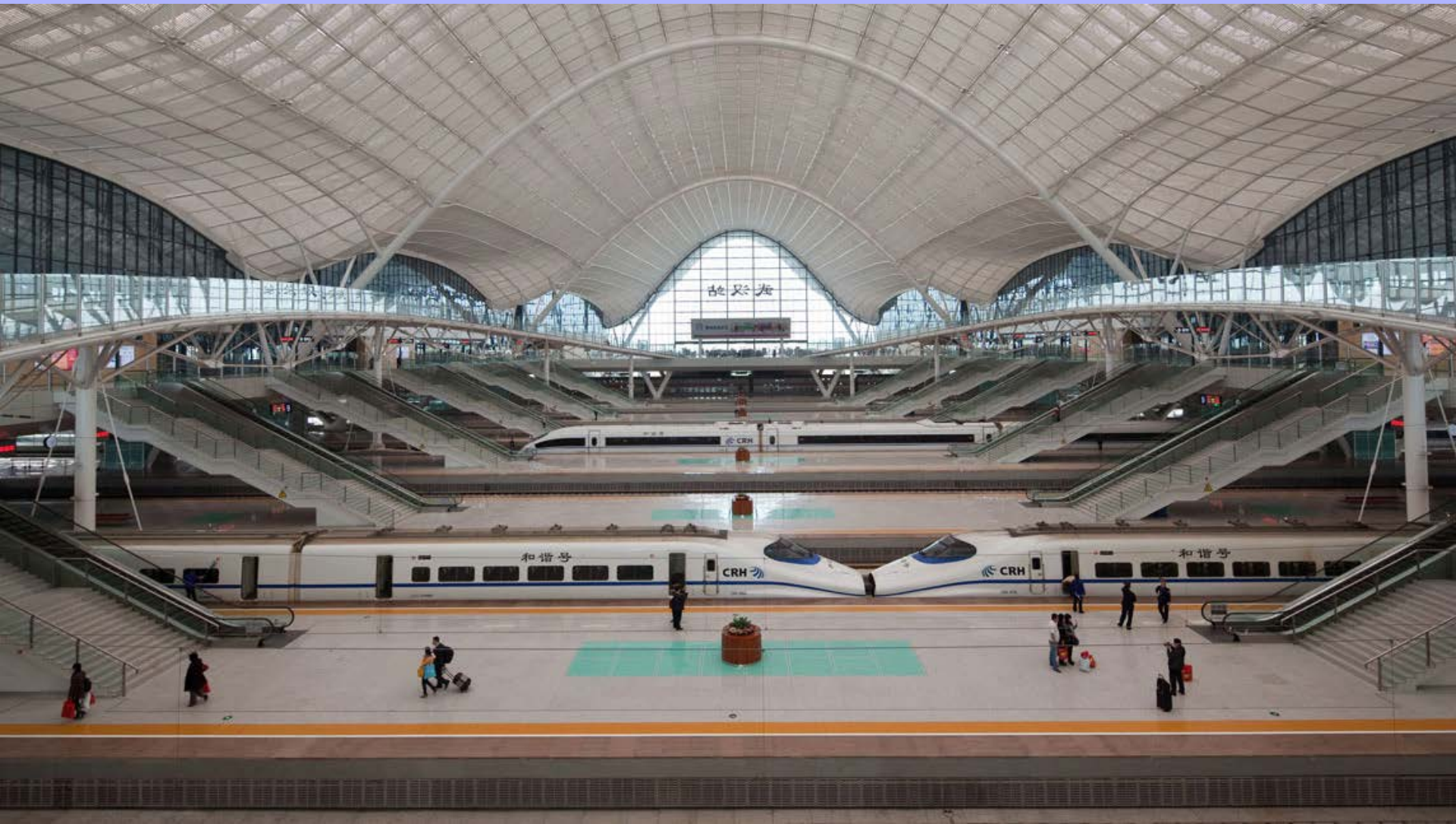
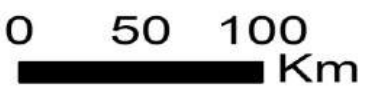# Wuhan's HSR infrastructure configuration concentrates accessibility, but extends, and then distributes, growth

Average Annual GDP Growth
Rate % (2005-2010)

- station
- High Speed Railways
- 0-0.10
- 0.11-0.20
- 0.21-0.30
- 0.31-0.40
- 0.41-0.70
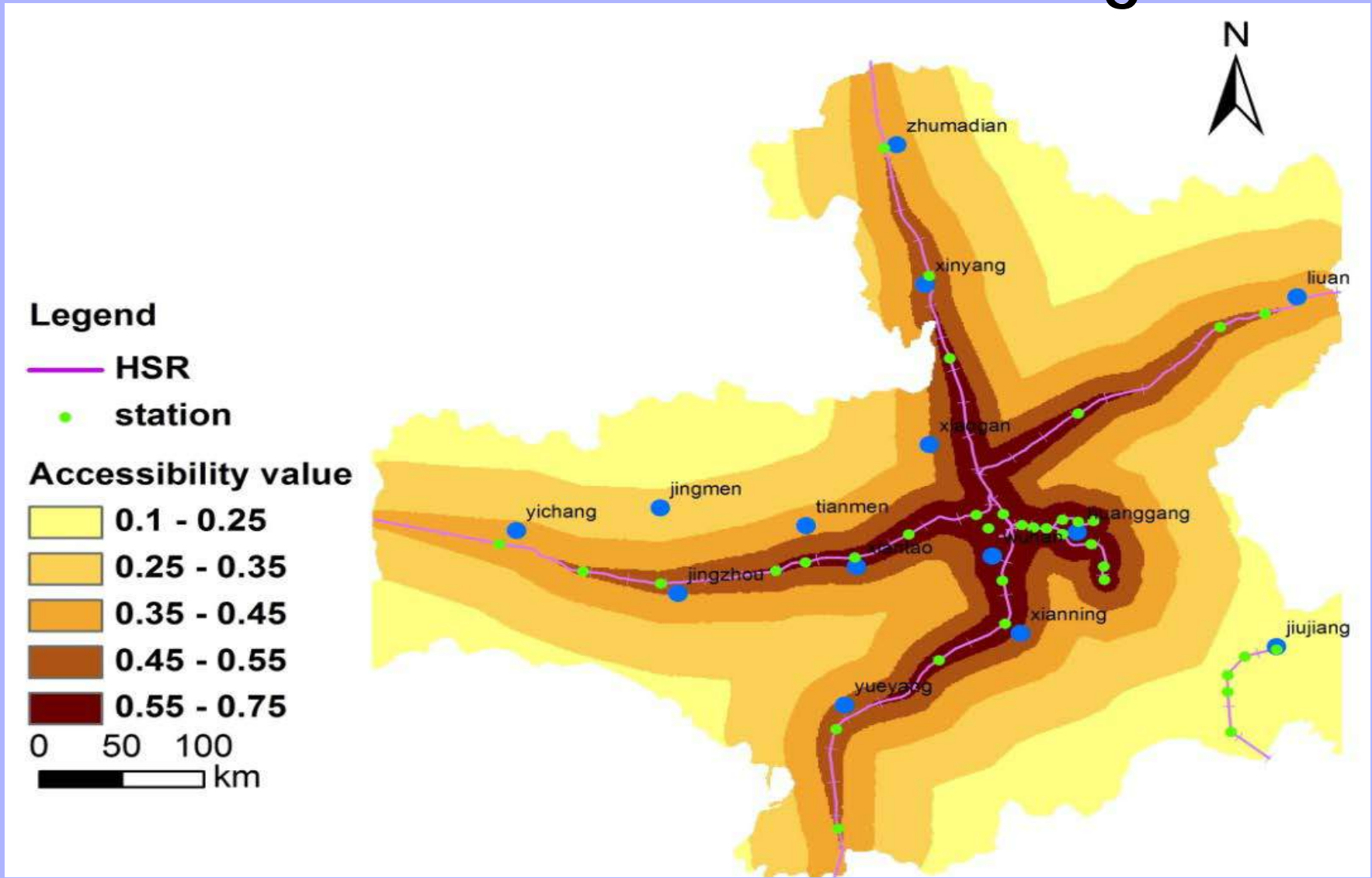
0   50   100
Km
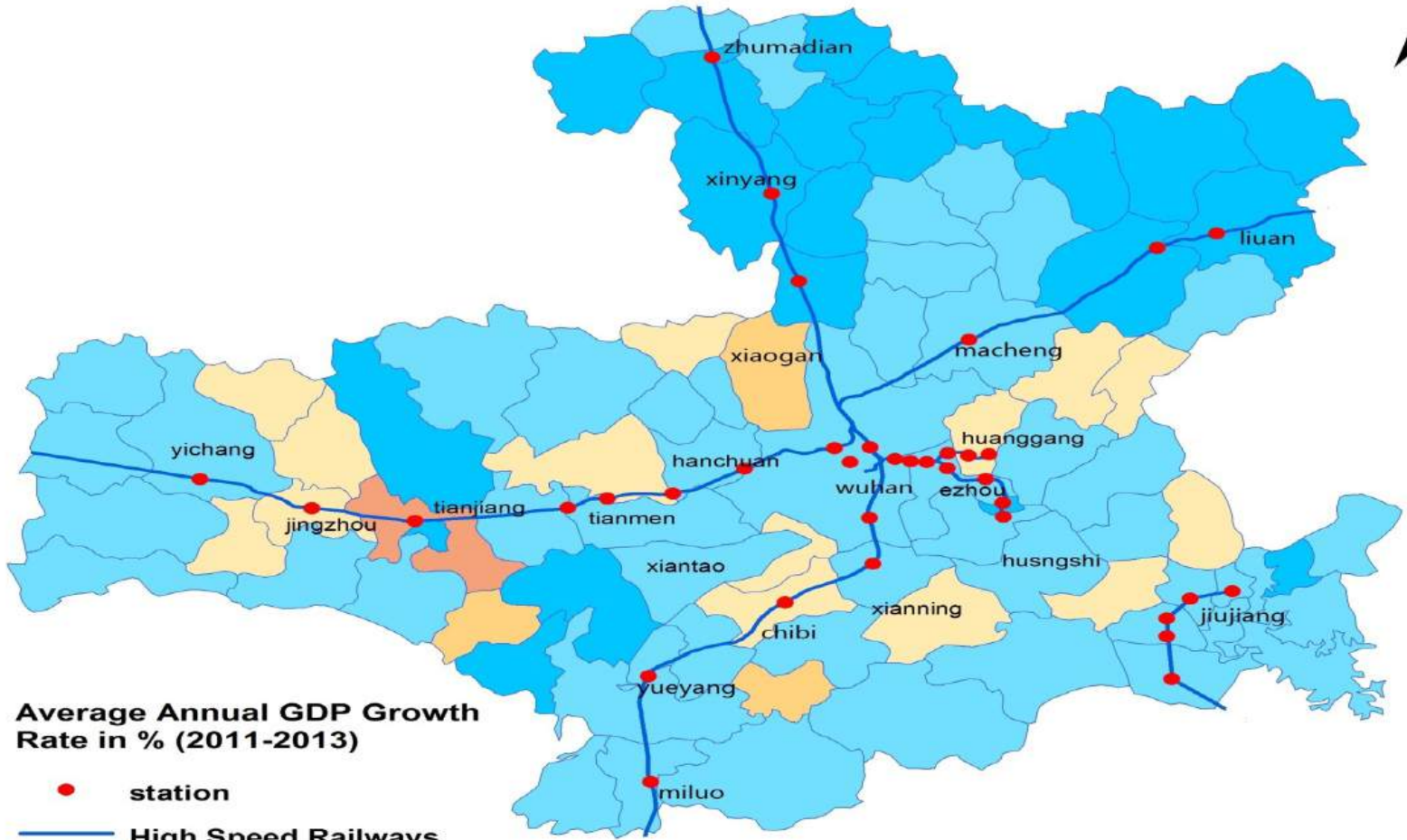
Average Annual GDP Growth Rate in % (2011-2013)

- station
- High Speed Railways
- 0-0.10
- 0.11-0.20
- 0.21-0.30
- 0.31-0.40
- 0.41-0.70

0   50   100
                Km

Multicore Network Mode infrastructure takes metropolitan development to an unprecedented scale

China High-speed Railway Map

212,000 square kilometre supercity served by HSR in JingJinJi

Legend

Corridor Mode (CM)

Monocentric-Radial Mode (MRM)

Multicore Network (MNM)
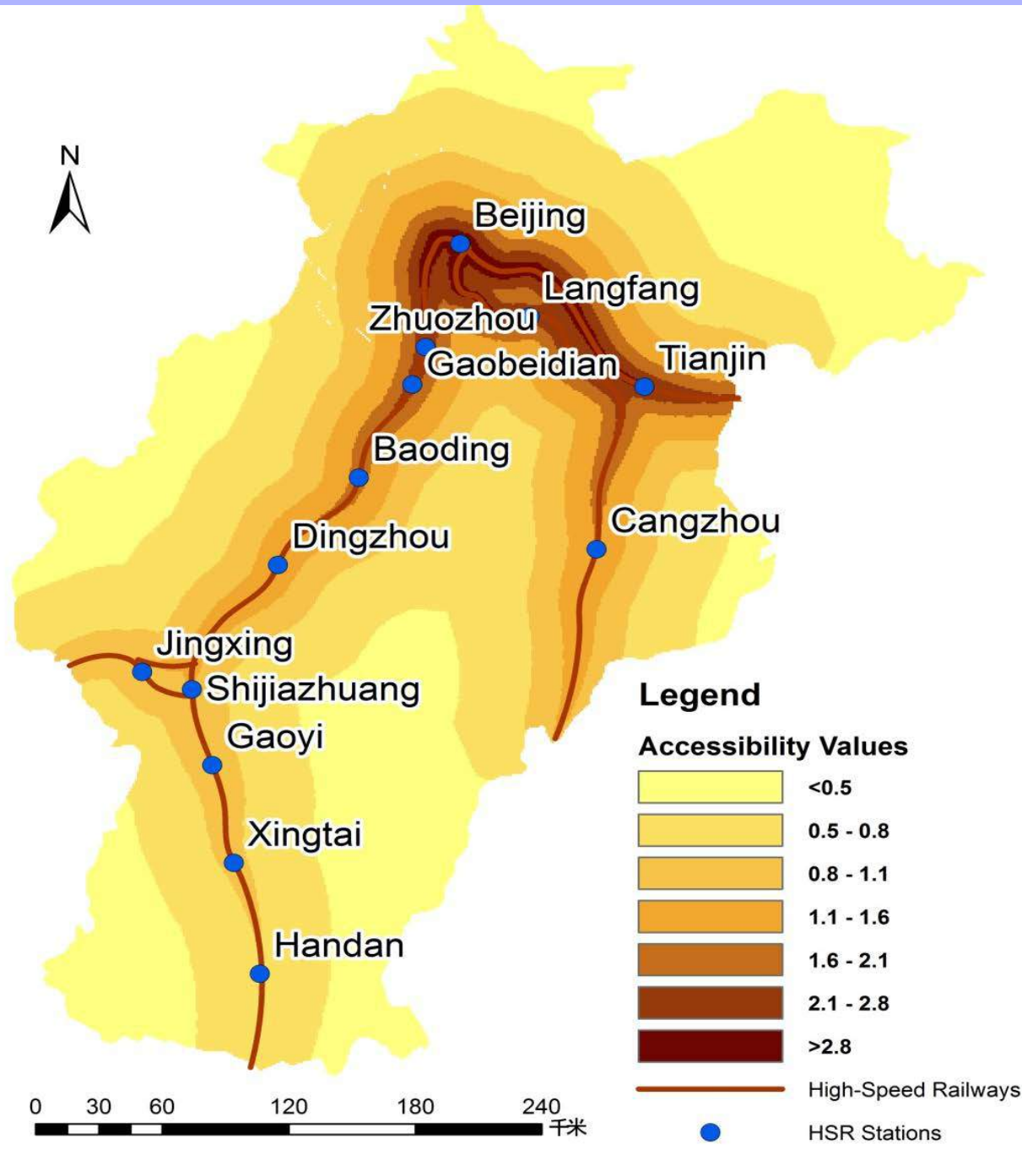
Jing-Jin-Ji supercity accessibility is a work in progress

More HSR infrastructure will be needed to catch up with the growth of "bedroom cities" within Jing-Jin-Ji

Limiting factor on supercity development will be intermodal connections with HSR

Multicore Network Mode HSR effects are most advanced in the Yangtze Delta

China High-speed Railway Map
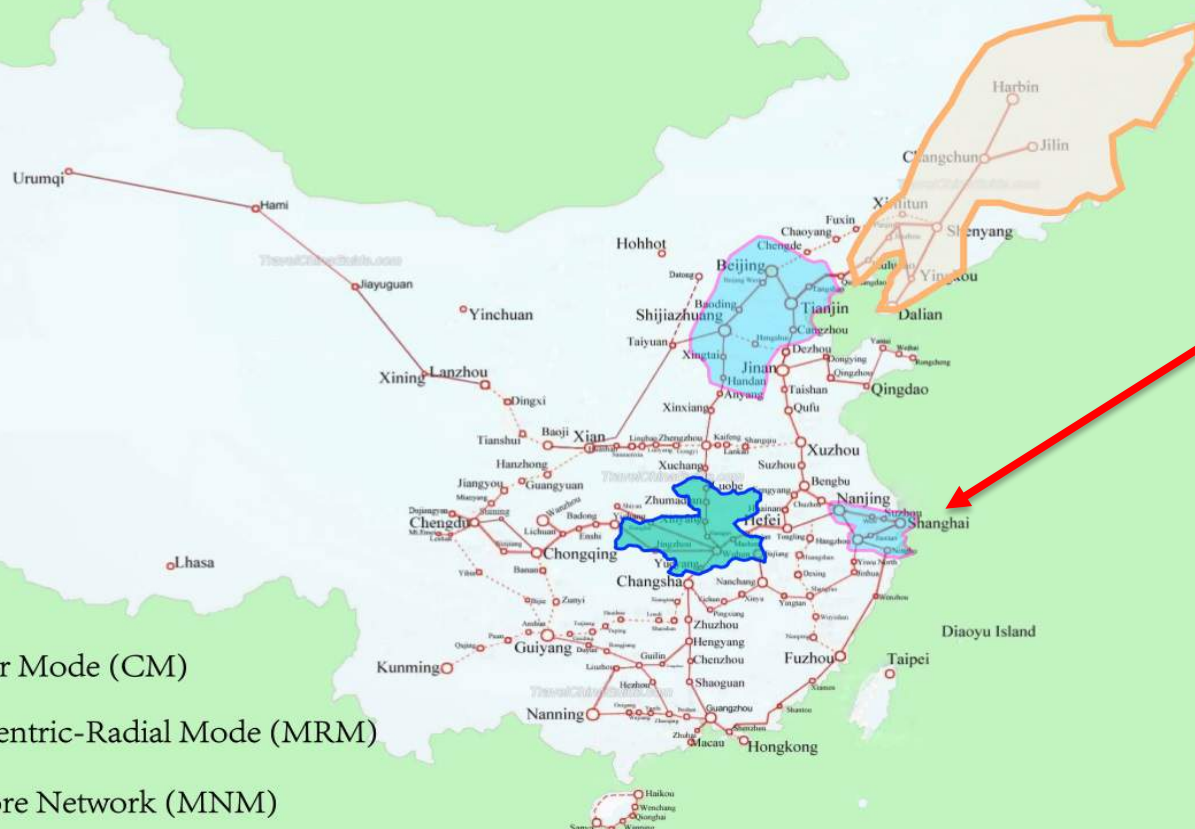
At high infrastructure density, Yangtze Delta has the greatest rail accessibility in China

Legend

Corridor Mode (CM)

Monocentric-Radial Mode (MRM)

Multicore Network (MNM)

Yangtze region accessibility via conventional rail network
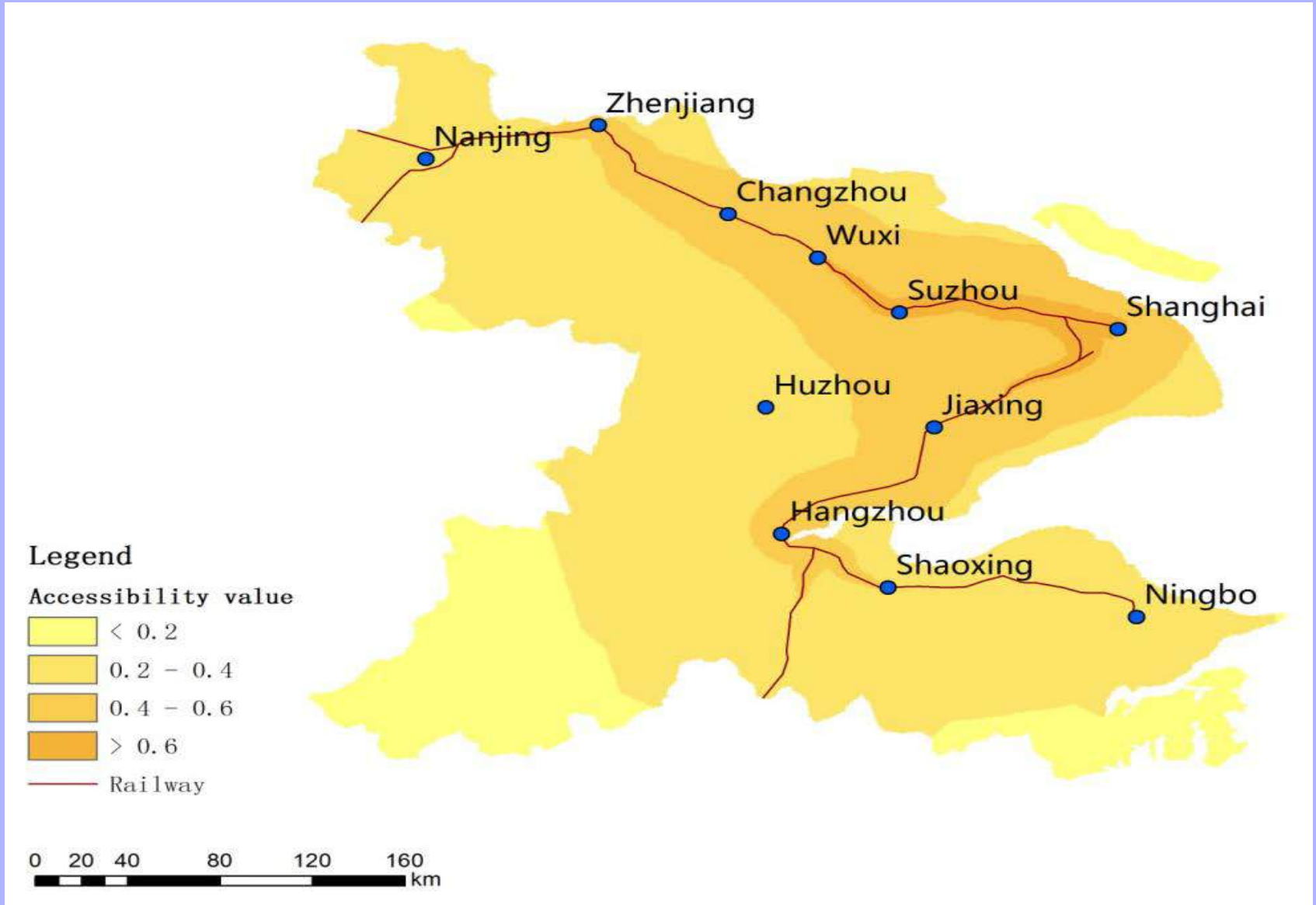
Yangtze Delta accessibility with HSR
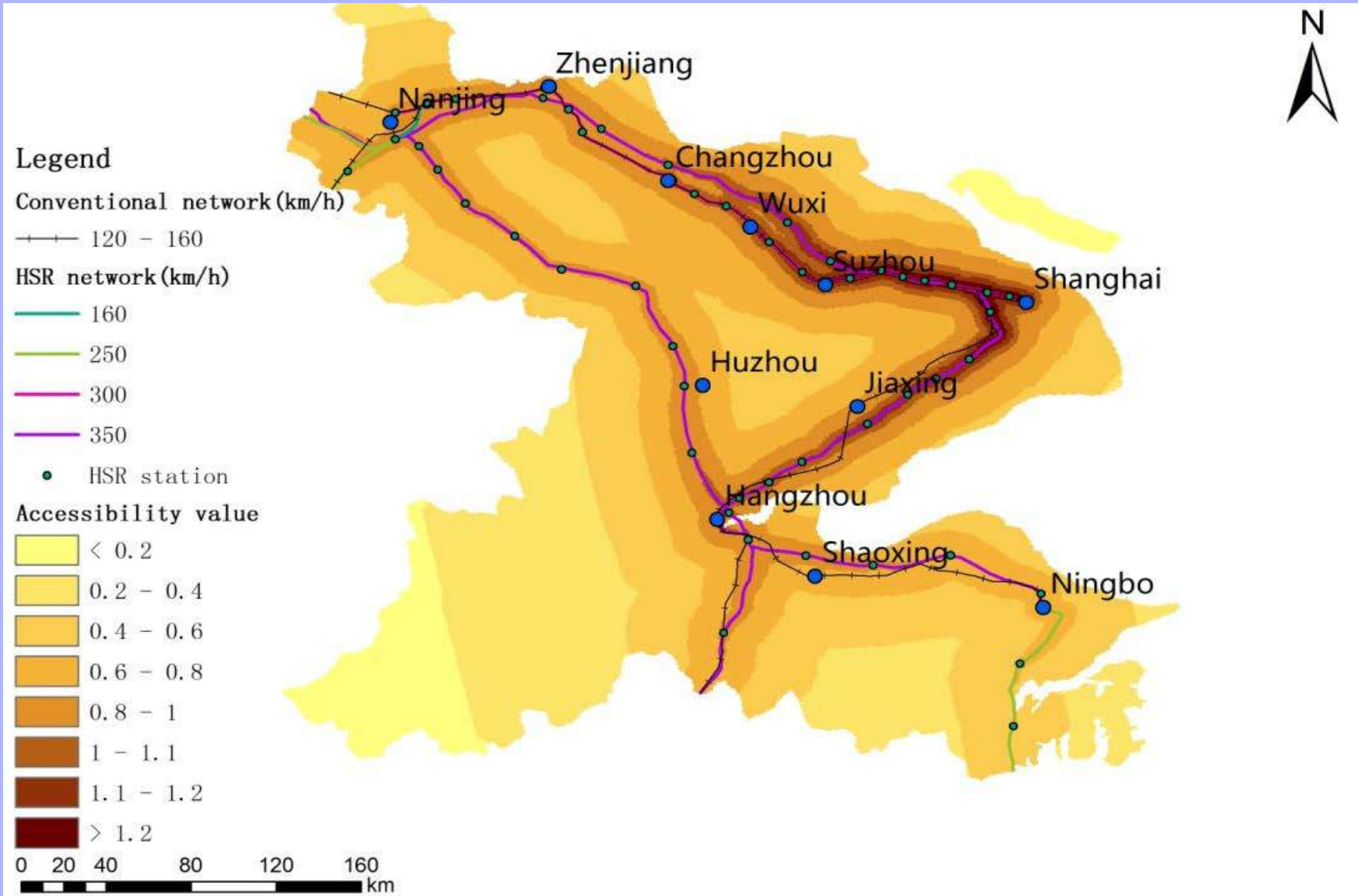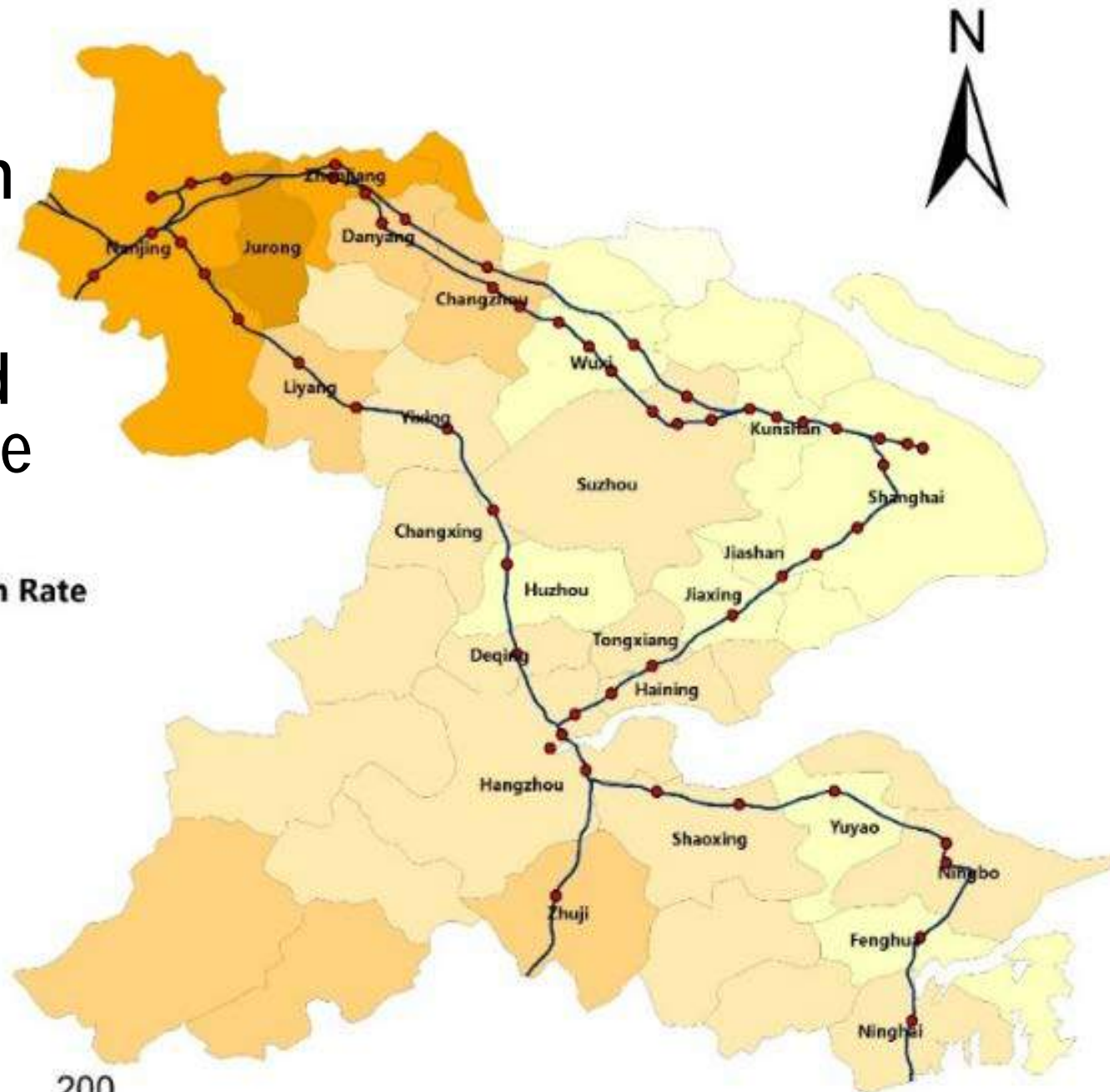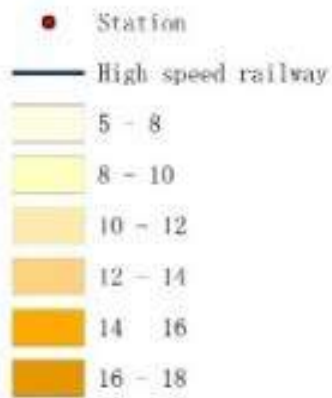
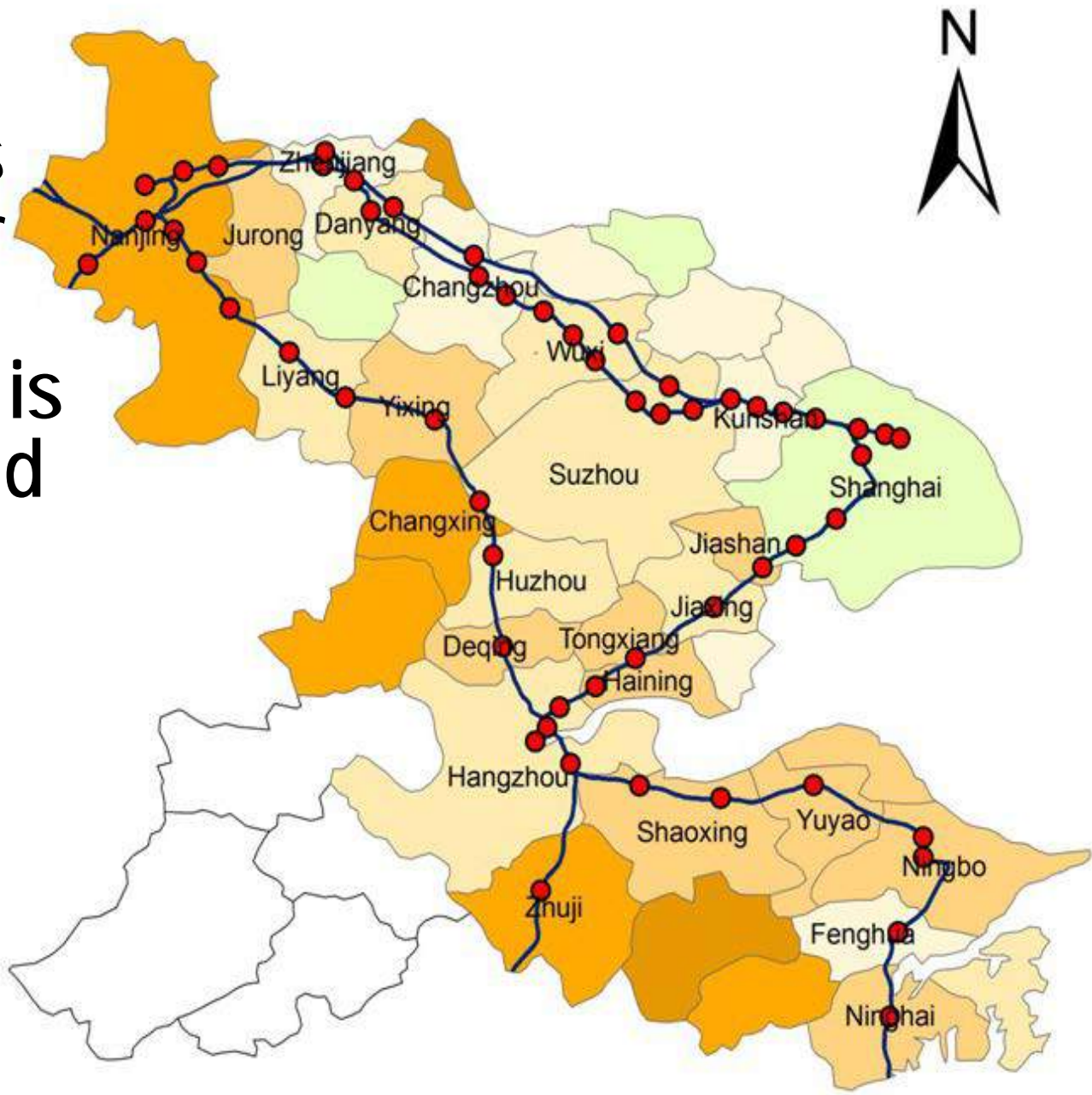HSR commuting in 2014, around (and beyond) Yangtze Delta
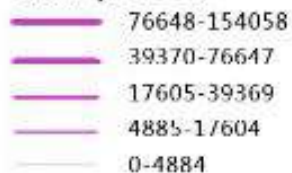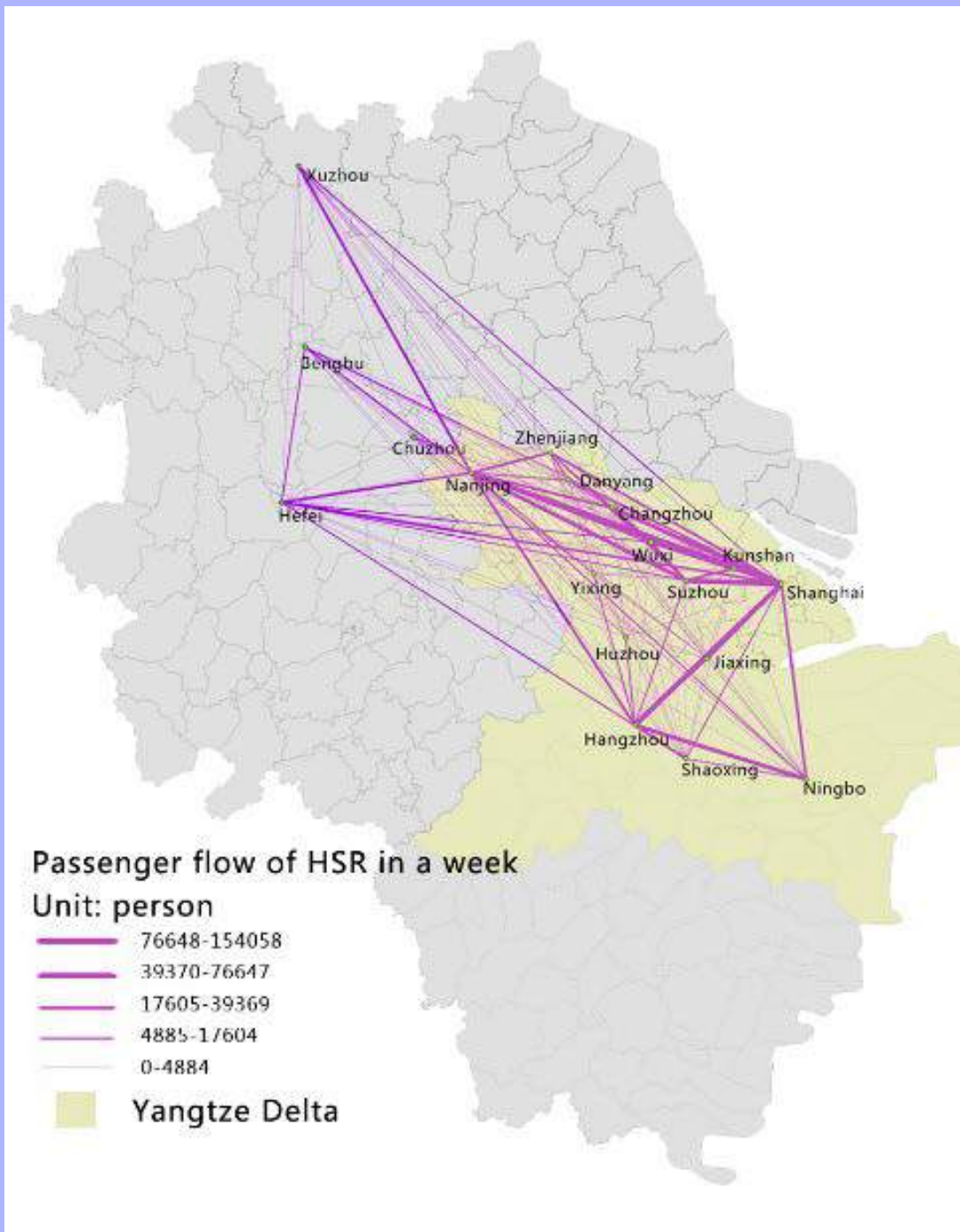
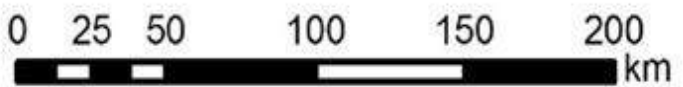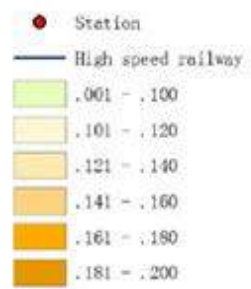Economic growth rates are highest in areas where accessibility has facilitated longer distance commuting

Average Annual GDP Growth Rate in % (2010-2014)

- • Station
- — High speed railway
- 5 – 8
- 8 – 10
- 10 – 12
- 12 – 14
- 14 – 16
- 16 – 18

Industrial growth has been faster where accessibility is high and land costs less

How will HSR shape urban development in China over the coming decades?

- China's HSR-enabled supercities will incorporate three times the population of metro Tokyo, four times that of the BeNeLux region

- New spatial dynamics can be expected for settlement, industry, and commerce.

- Exploring the land use interaction with HSR will yield valuable understanding about what HSR can contribute to the future of urban development.