



POTSDAM INSTITUTE FOR
CLIMATE IMPACT RESEARCH

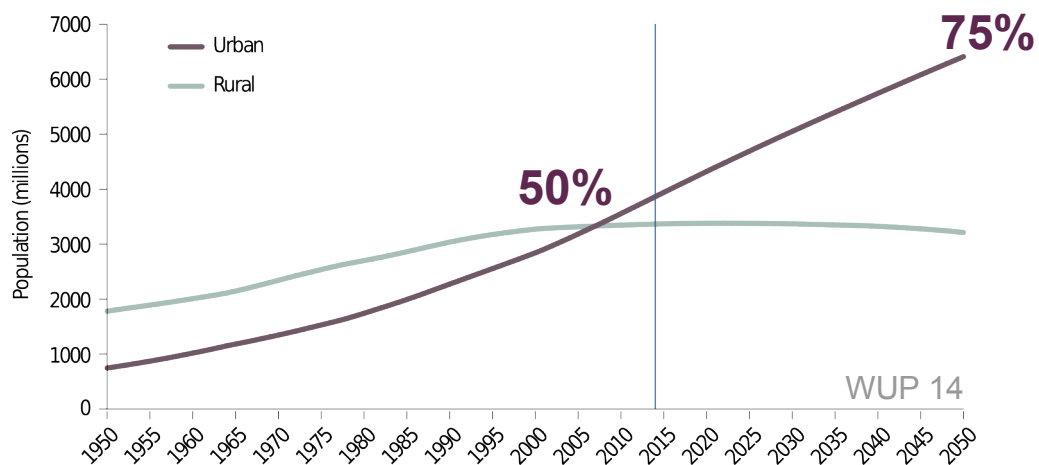
10.000 Städte im Klimawandel...

Was wissen wir dank GIS?

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19. November 2014

Global Urbanization:



Cities are most responsible for Climate Change ...

... Climate Change highly threatens Cities.

Space for Mitigation:

over 70 % of global GHG emissions (IEA 2008):

- Energy Consumption
- Transportation
- Heating (building insulation)
- Air pollution



Space for Adaptation:

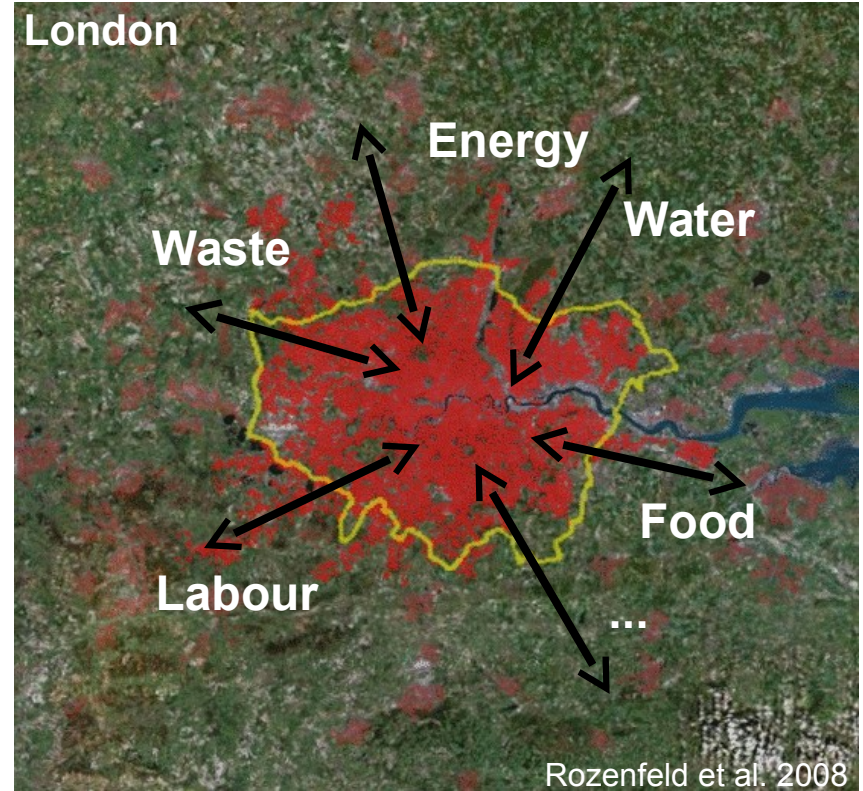
- wind storm
- drought, heatwave, increased mortality, decreased water availability
- sea level rise and storm surge flooding, river flooding, intense rainfall flooding
- building and infrastructure subsidence and landslides
- diseases

How to define a City?

Past:



Present:

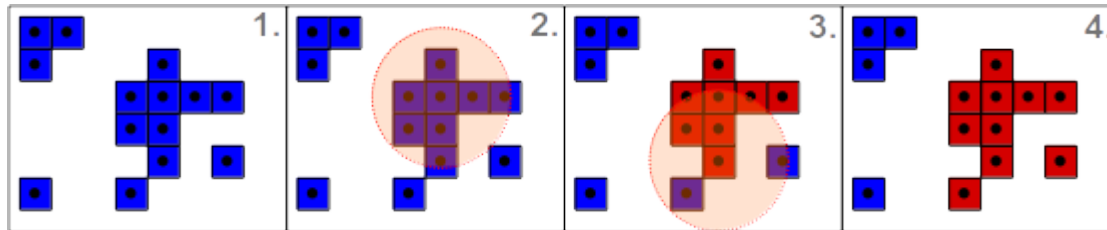


Cities are no standalone entities

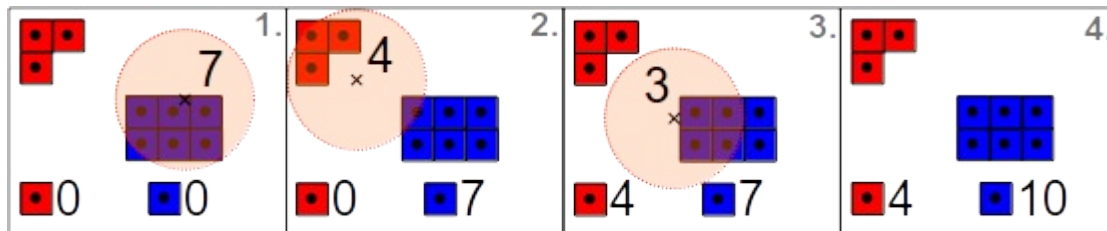
So far a lot of different case studies on cities exist,... but in most cases not comparable

Automated and consistent City identification with City Cluster Algorithm (Rozenfeld et al. 2008)

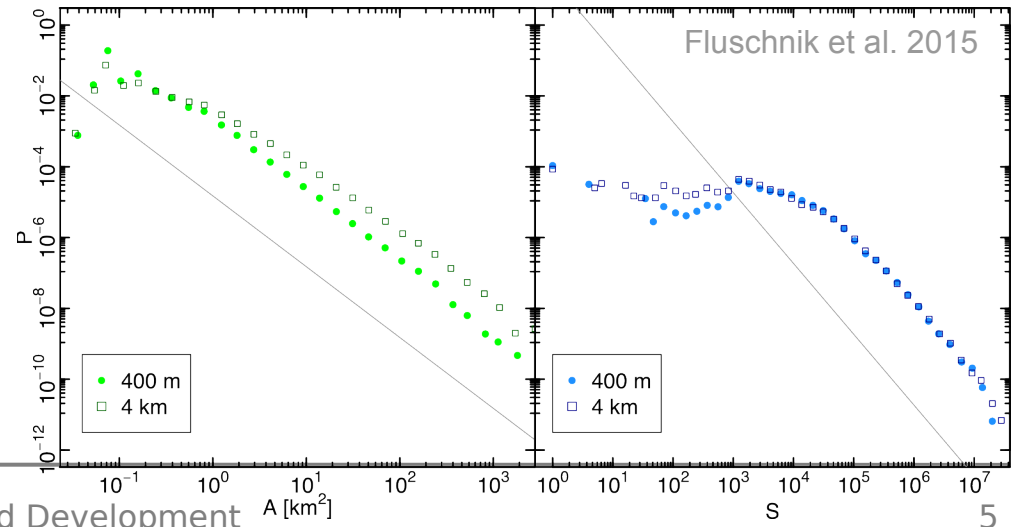
allows automated identification of cities based on satellite received land-cover ...



... and census based population data.



Zipf's law:
 $p(X) \sim X^\zeta$, where $\zeta \approx 2$



Development of a city data base:



e.g.: Combination of GlobCover2009 + GRUMP settlement points provides:

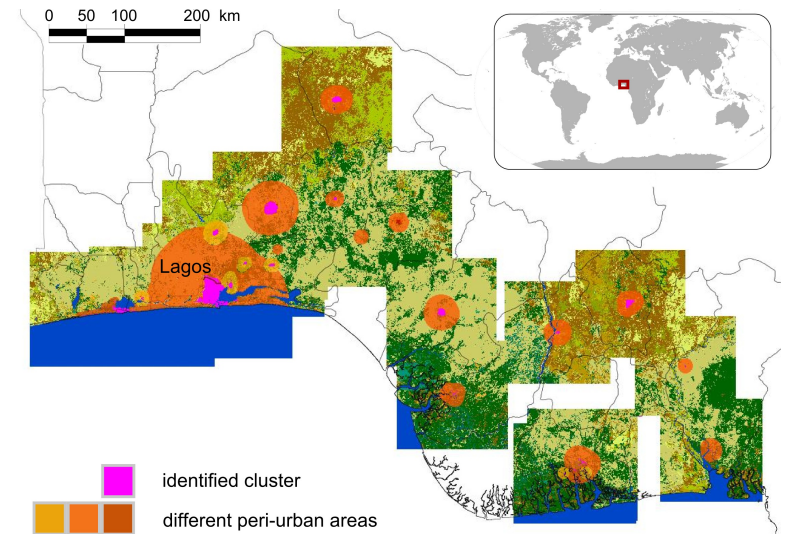
- area, population and population density for over 32.000 locations
- over 2838 cities with more than 100.000 inhabitants

Definition of peri-urban as a buffer with size:

$$A_i^{PU} = A_i^U \cdot \rho_i / \rho_{ref}$$

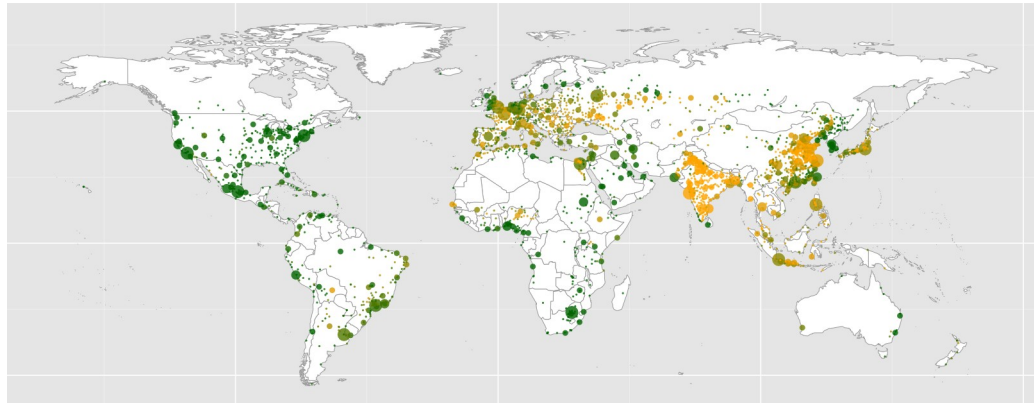
Possibility of further investigation:

- Structure of cities and peri-urban areas
- Classification of cities
- proportion of urban green
- ... or



example: Potential of peri-urban agriculture

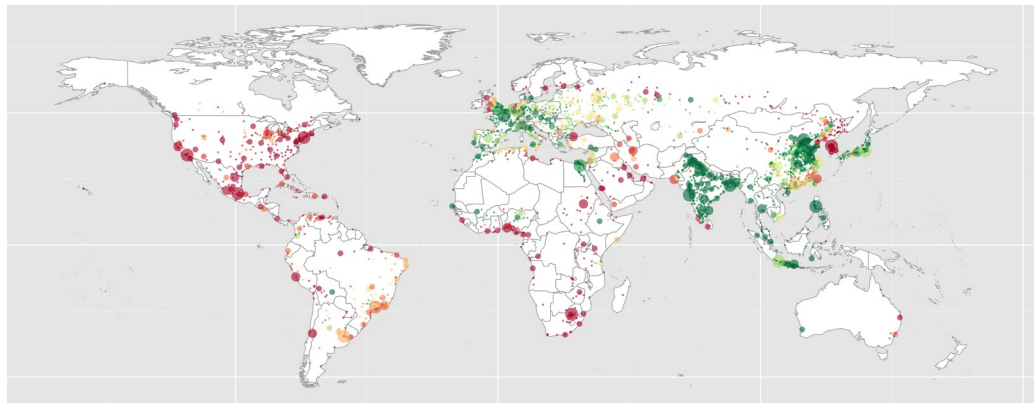
Potential of peri-urban agriculture



Population in millions > 0.1 • > 1 • > 5 • > 10 •

Agricultural area in % 0 10 20 30 40 50 60 70 80 90 100

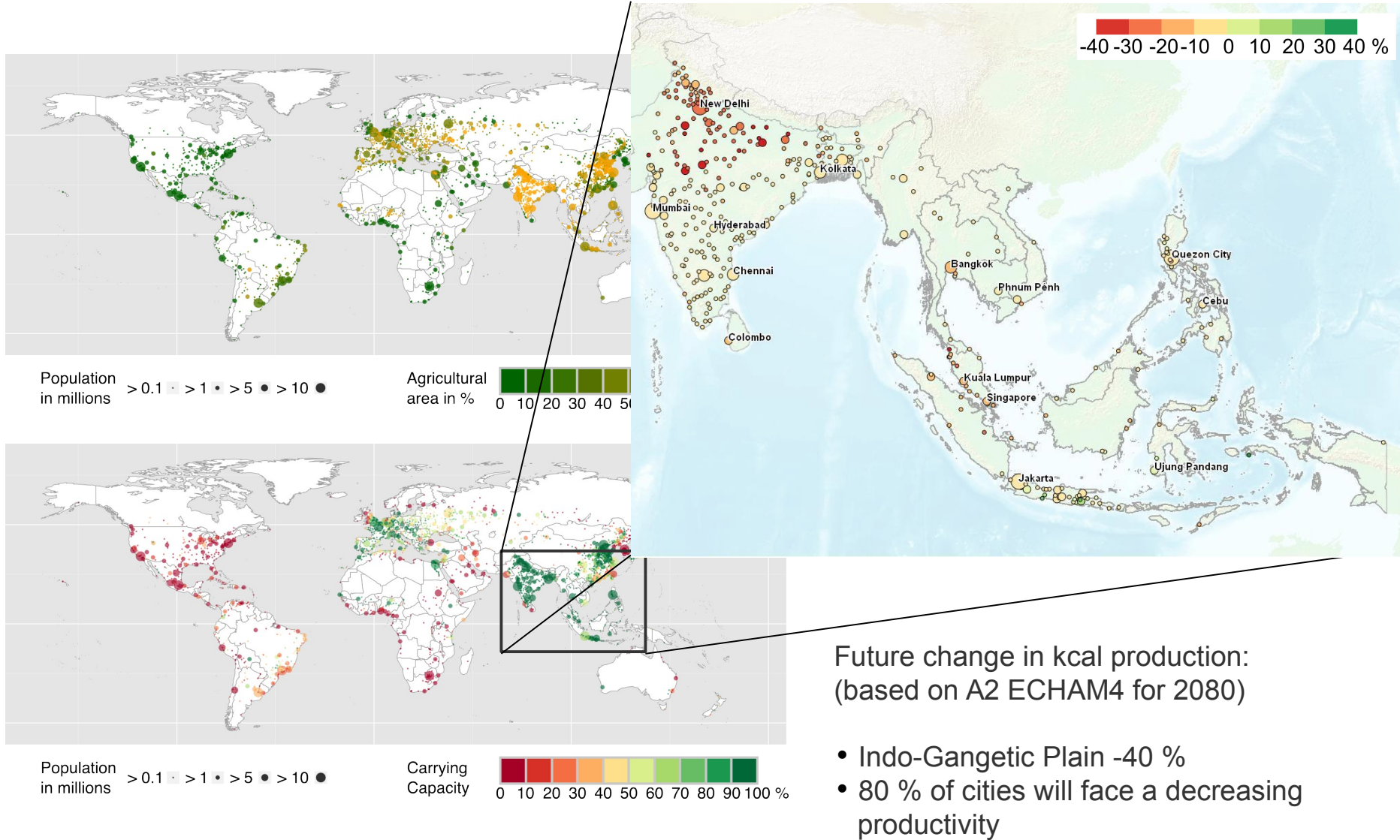
- 67 % of all urban areas
- 28 % (60 %) of global (urban) population
- Around 5 % of global agricultural area
- Peri-urban areas composition:
 - 47 % Farmland
 - 41 % Natural area
 - 12 % non-arable area



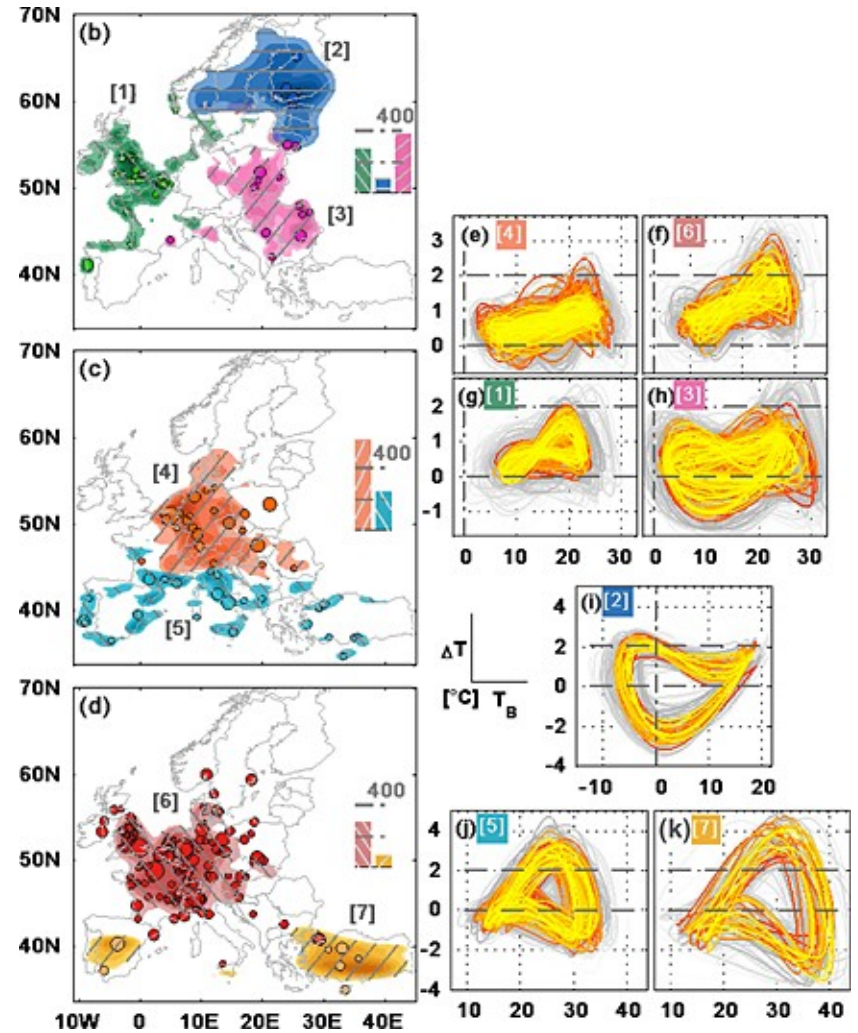
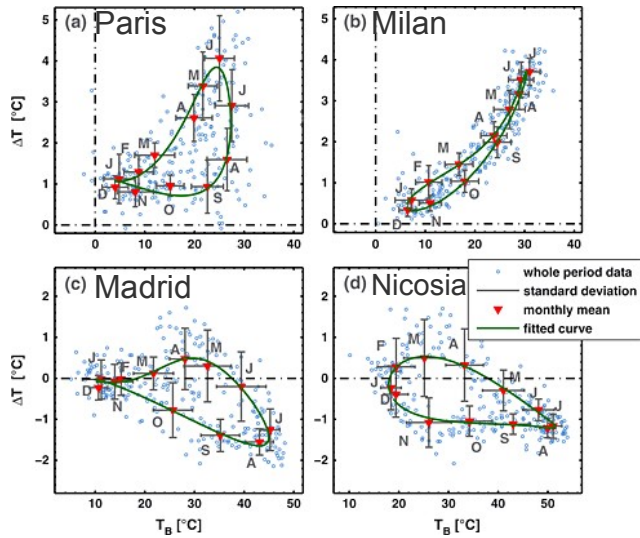
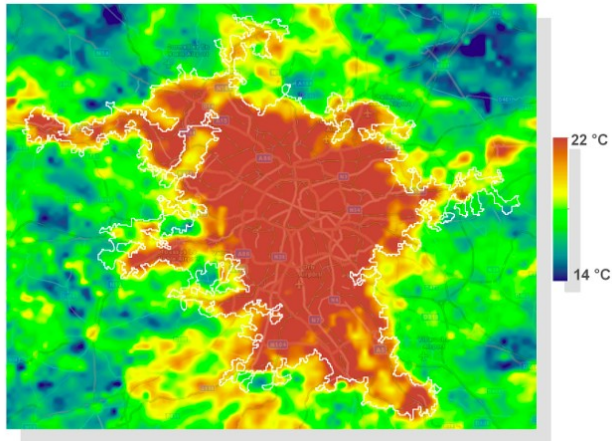
Population in millions > 0.1 • > 1 • > 5 • > 10 •

Carrying Capacity 0 10 20 30 40 50 60 70 80 90 100 %

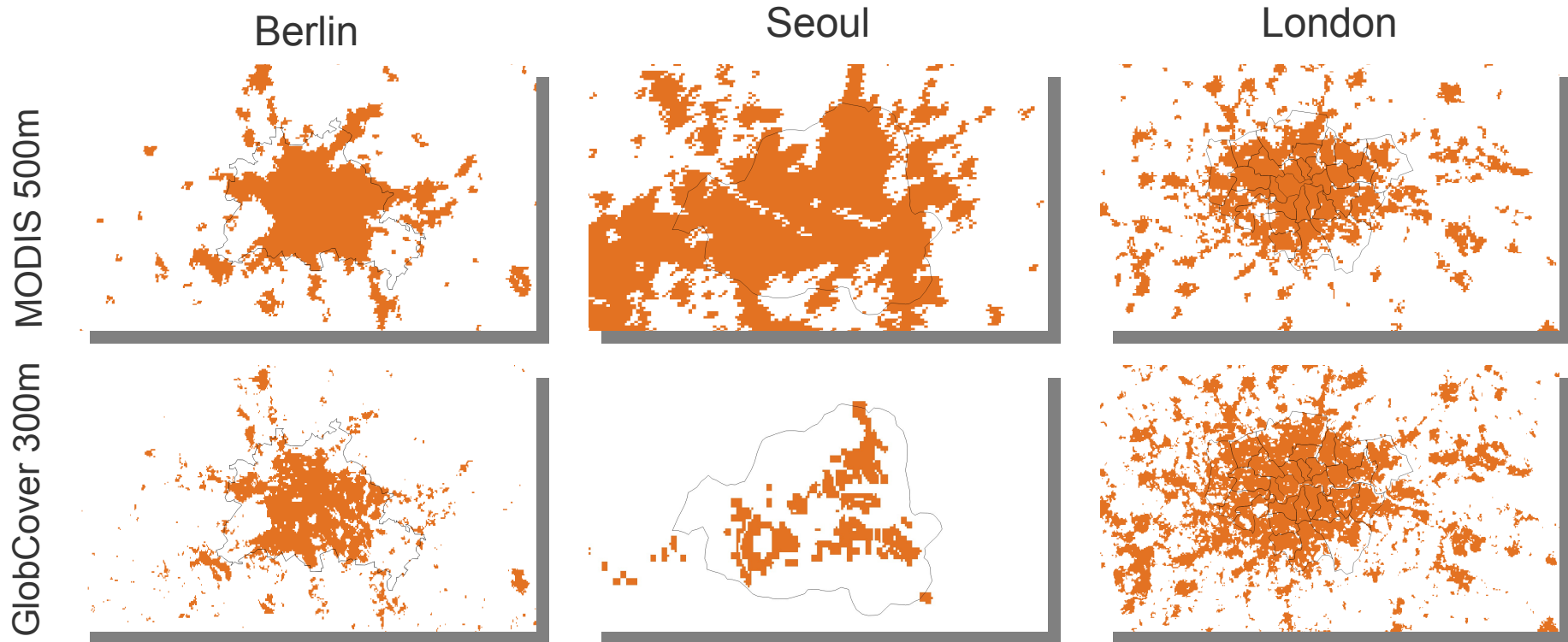
Potential of peri-urban agriculture



Statistics of urban heat island intensity (Zhou et al. 2013)



Quality of data – Different dataset; Different city!

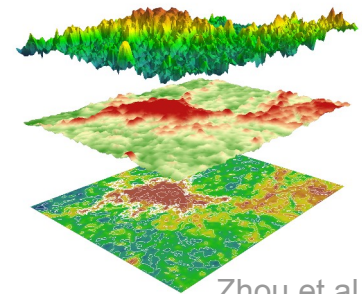


Total urban area:

GlobCover	=	313.000 km ²
MODIS	=	657.000 km ²

Outlook:

- Comparison with other datasets – Open Street Map
- City classification – fingerprint
- Impact analysis:
 - Damage functions for flood events
 - Impact on human health / mortality due to heat events
- Sustainable transition pathways



Zhou et al. 2013

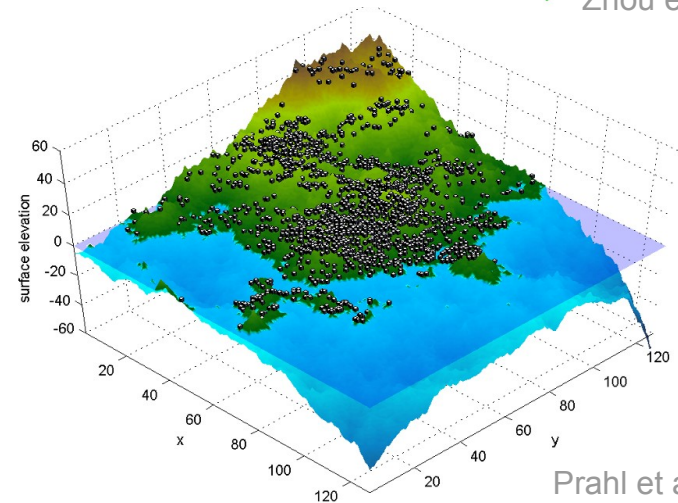
Thank you
for your attention.

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<http://www.pik-potsdam.de/~rybski/cities/>

<http://www.cigrasp.org> (cities module)



Prahl et al. 2014

References:

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