DIW BERLIN · Deutsches Zentrum für Luft- und Raumfahrt e.V. in der Helmholtz-Gemeinschaft · Julius-Maximilians-Universität Würzburg · SOEP The German Socio-Economic Panel Study

Synergies in Socioeconomic and Remote Sensing Data

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Within a pilot study between the SOEP and the German Remote Sensing Data Center (DFD) – a research institution of the German Aerospace Center (DLR) – methods for synergistic, interdisciplinary utilization of socioeconomic and remotely sensed data are sought. The DFD is concerned with the reception, processing, archiving, distribution and utilization of earth observation (EO) data. These data sets are acquired by means of remote sensing with satellite or aerial imagery. Today, various kinds of remote sensing systems and sensors are utilized for various applications such as: Urban planning/urban development, environmental monitoring/forest monitoring, satellite-based crisis information (DFD-ZKI) for rapid acquisition, processing, analyzing and mapping of natural and environmental disaters (e.g. floodings) or meteorological applications just to name a few. The advantage of remote sensing technology is the fast acquisition of area-wide information of the earth's surface. Since the survey year 2000, geographical coordinates at block level are available for SOEP households, which allows us to identify the exact position of each household in external spatial data. The aim of this pilot study is the integration of spatial information of the earth's surface with social scientific questions.

Remote Sensing for Intra-Urban Structuring

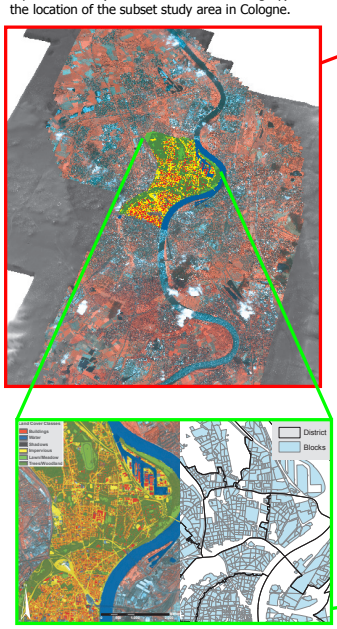
Introduction

One added value of the joint analysis of socioeconomic data and remote sensing data is the integration of neighborhood information of the respondents in terms of the natural and urban characteristics of the area. Very high resolution (VHR) optical satellite imagery (e.g. Ikonos) provides detailed spectral and spatial information on the highly structured urban landscape. Additionally, airborne laserscan data is integrated to derive detailed information on each building for a better differentiation of the built landscape in terms of size (area, floors), shape, and type of the buildings.

An object-based image processing workflow was developed to integrate landcover information and morphological information of single buildings to represent areawide the local and regional neighborhood for each individual. The aim of the study is a better understanding of neighborhood information within the city, to know "who settles where?". Based on spatial parameters like density, location in the city, and physical parameters of the neighborhood, an objective description of the area can be done.

Study areas

Input data sets (satellite and laserscan imagery) and the location of the subset study area in Cologne.



Highly detailed urban landcover classification (l) and the comparison of the spatial representation of administrative boundaries and building blocks (r).

SOEP households are represented on block level precision. Position of points do not indicate the exact location.

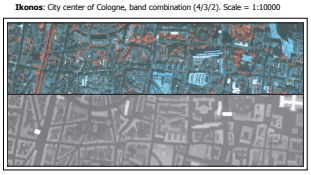
The output of the joint analysis of satellite and laserscan imagery is a structuring of the city in terms of *Urban structural types (UST)*. These are neighborhood areas on block level characterized by similar landcover information and similar urban morphology (building types). These spatial units represent the closest neighborhood information of the SOEP households. This neighborhood information is defined by a variable which is merged to the SOEP database based on the geocoded SOEP households on block level precision.

Extracted buildings classified by their size (area, elevation) and shape.

Remote sensing data source

IKONOS	
Spatial resolution:	1m (pan) / 4m (ms)
Spectral resolution:	4 bands (ms) + 1 (pan)
Swath width:	11km
Date of acquisiton:	22/05/2007 + 08/07/2007 (Cologne)
	06/08/2007 (Dresden)

Ikonos: City center of Cologne, band combination (4/3/2). Scale = 1:10000



LiDAR: Representation of natural objects in height information (bright=high;dark=low)

LiDAR (Airborne Laserscanning)	
Spatial resolution:	1m
Date of acquisition:	2007 (Cologne)
	2001 (Dresden)

Resulting flat data file for further analysis in statistical packages:

hnr	persnr	UST	Distance (to Center)	Density
66176	20203	B.Blocks	1200	...
806145	8061401	Terraced	200	...
516066	5160601	Terraced	400	...
270920	2709202	Semi-/Det.	2800	...
304891	3048903	B.Blocks	2800	...
14230	142302	Highrise	100	...
702277	7022701	Block/Highr.	400	...
332348	3323401	Highrise	1000	...
813796	8137903	B.Blocks	3300	...
272027	2720202	Terr./Blocks	6100	...
...	...	...	...	...

Remote Sensing of Air Quality

Introduction

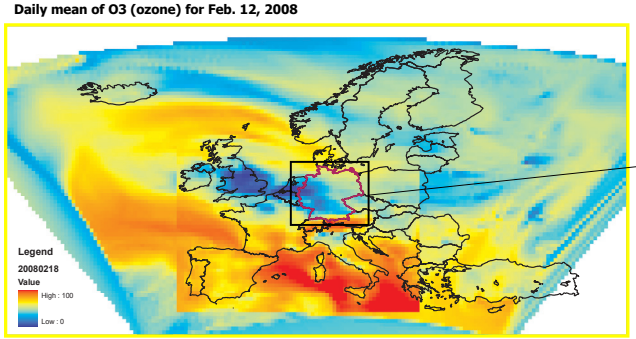
The objective of this study is to investigate possible effects of air quality or pollution on the population, e.g., on health, residential mobility or even satisfaction. SOEP data and available environmental data are matched using **geo-coordinates** of the household on block level precision and the **date of the interview.**

Data source

Data from the "Integrated Air Quality Platform" provides spatiotemporal measurements of groundlevel air pollutants with a spatial resolution of ~50*50km and a snapshot for each hour. The data is a product of satellite data and integrated in-situ measurements, modelled and calculated by the "PROMOTE European Integrated Air Quality Platform".

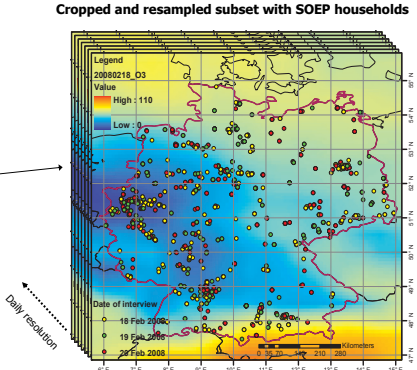
1 Read grid data for 24 hrs → 2 Calculate daily mean → 3 Crop to geographical location → 4 Resample resolution to 0.1° → 5 Match with SOEP respondents using coordinates and date of interview → 6 SOEP Analysis

Daily mean of O3 (ozone) for Feb. 12, 2008



Source: PROMOTE European Integrated Air Quality Platform

Cropped and resampled subset with SOEP households



Resulting flat data file for further analysis in statistical packages:

hnr	persnr	date.p	O3	NO2	PM10
66176	20203	20080206	57,05	6,19	5,60
806145	8061401	20080208	27,64	38,04	45,02
516066	5160601	20080215	50,71	14,25	19,16
270920	2709202	20080220	5,58	64,10	45,59
304891	3048903	20080220	60,13	23,95	28,21
14230	142302	20080226	53,40	18,87	17,89
702277	7022701	20080229	65,04	7,80	5,88
332348	3323401	20080303	56,81	9,93	7,49
813796	8137903	20080311	70,78	6,02	2,83
272027	2720202	20080626	75,11	7,29	13,51
...	...	...	...	...	...

Distribution of environmental indicator for SOEP respondents in 2008: