Project Summary

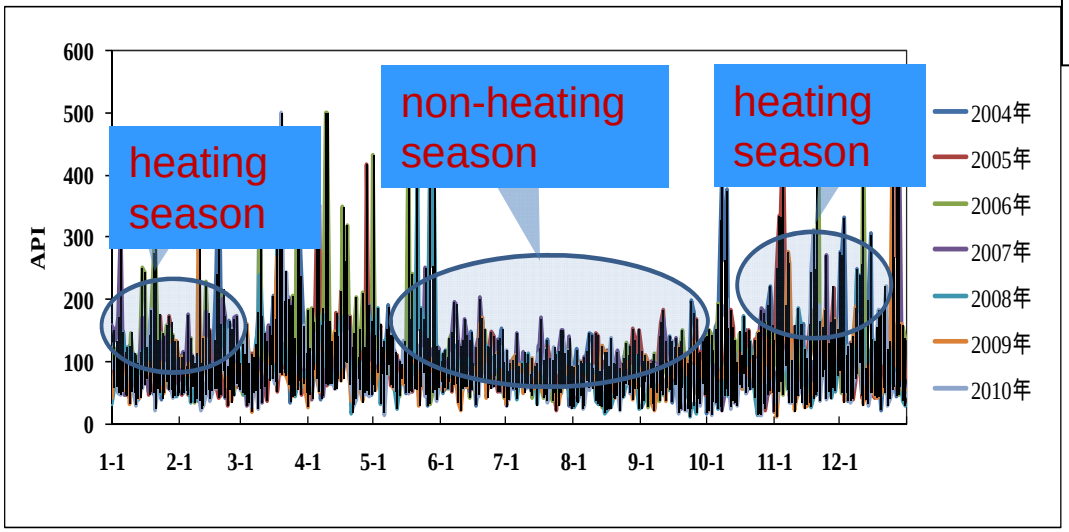
Proposal ID: 5295

Use of Earth Observation in Support of Major Sport Events

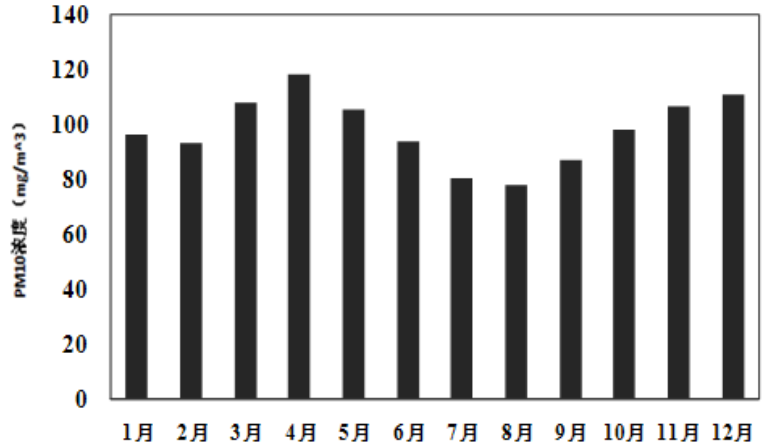
24 June 2011

Main Results

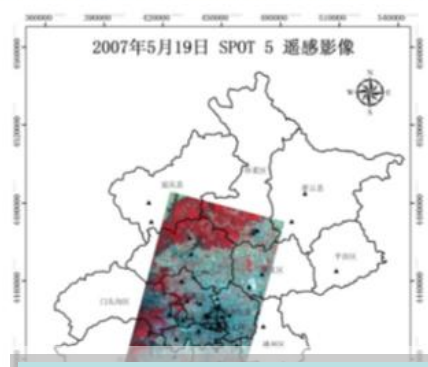
The situation of atmosphere pollution has been analyzed based on API monitoring conventional data and relevant meteorological factor from 2004 to 2010 in the present study. It is found that API levels during heating period are basically higher than those in the non-heating period except for 2009 with slight increase. The level of air pollution index has shown a downtrend. Meanwhile, particular concentration has been proved to have an intensive correlation with meteorological factors.

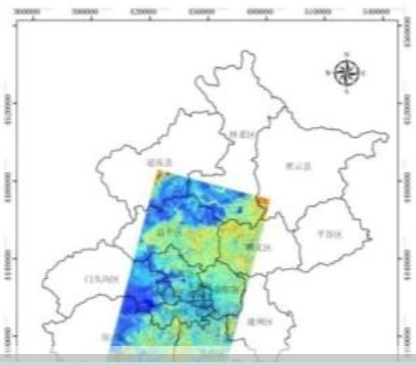


2004-2009 PM_{10} month average value



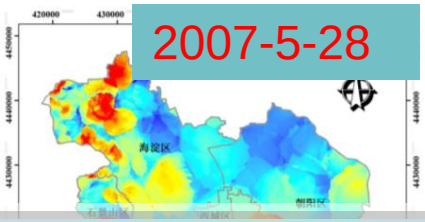
Main Results



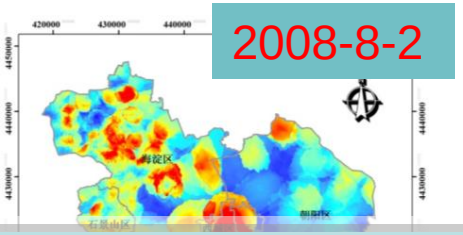


AOD Results

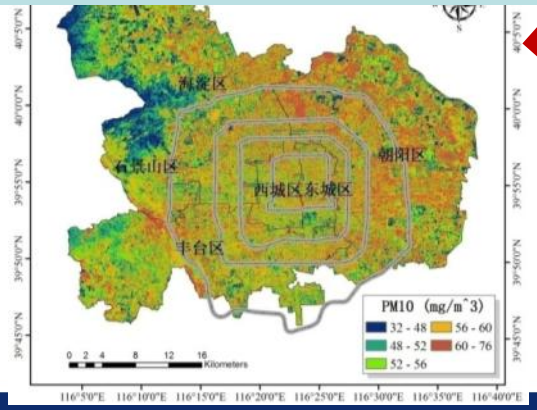
2007-5-28

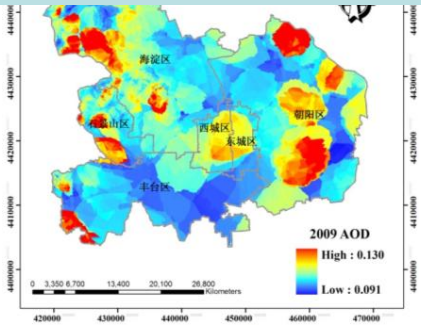


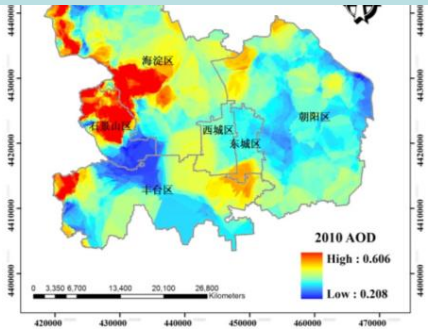
2008-8-2



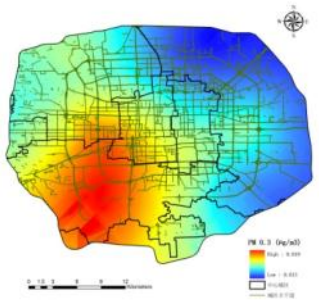
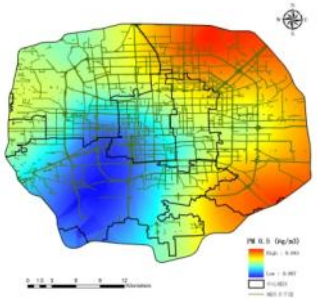
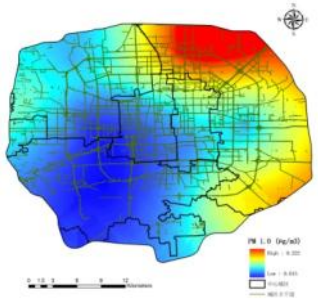
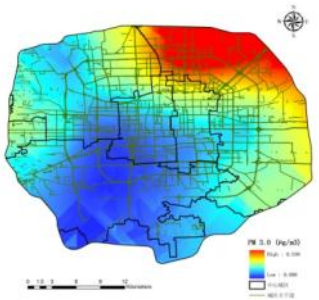
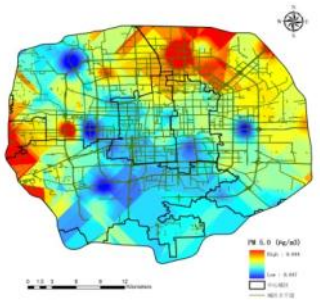
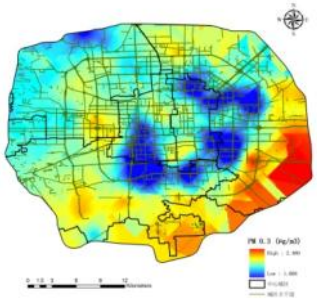
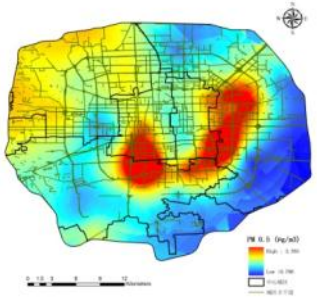
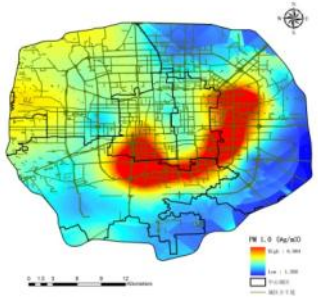
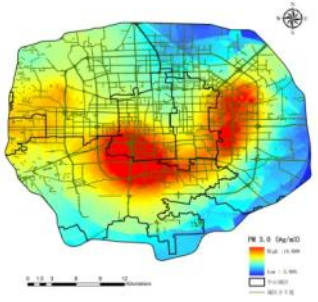
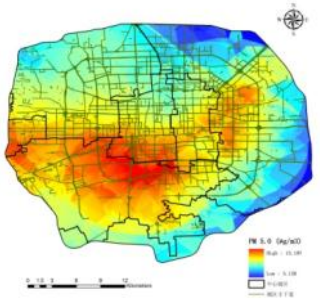
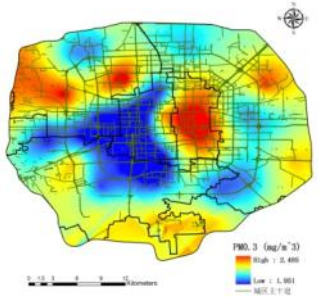
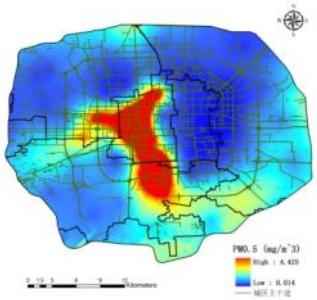
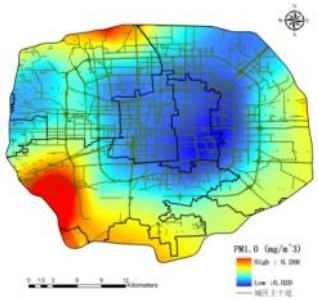
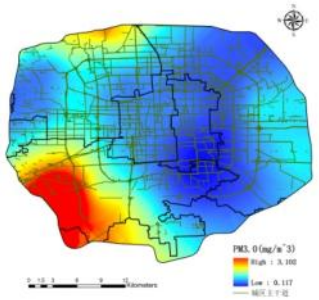
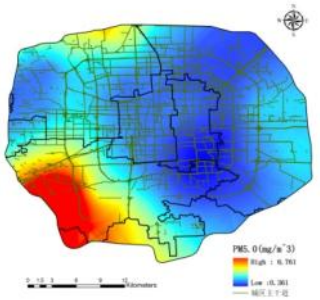
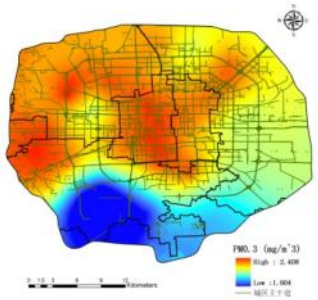
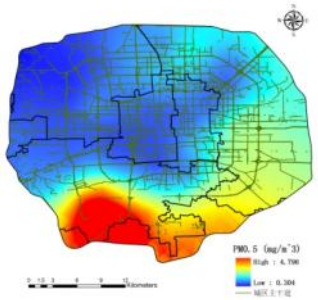
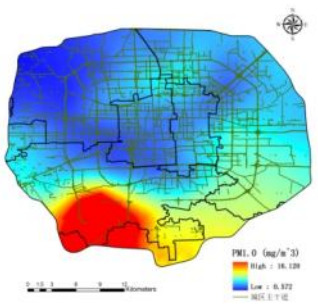
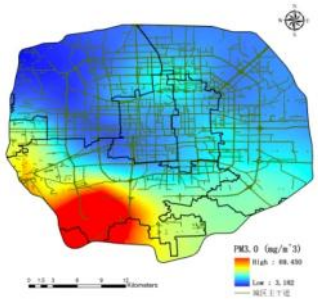
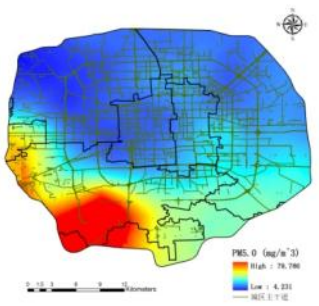
The result derived from remote sensing images has proved a severe pollution suffered in Beijing. Main polluted area was centralized at southeast plain area; mountain area in northwest was weaker. Pollution level in central city was also relatively high. Obviously, the spatial distribution of aerosol was strongly correlated with various factors.







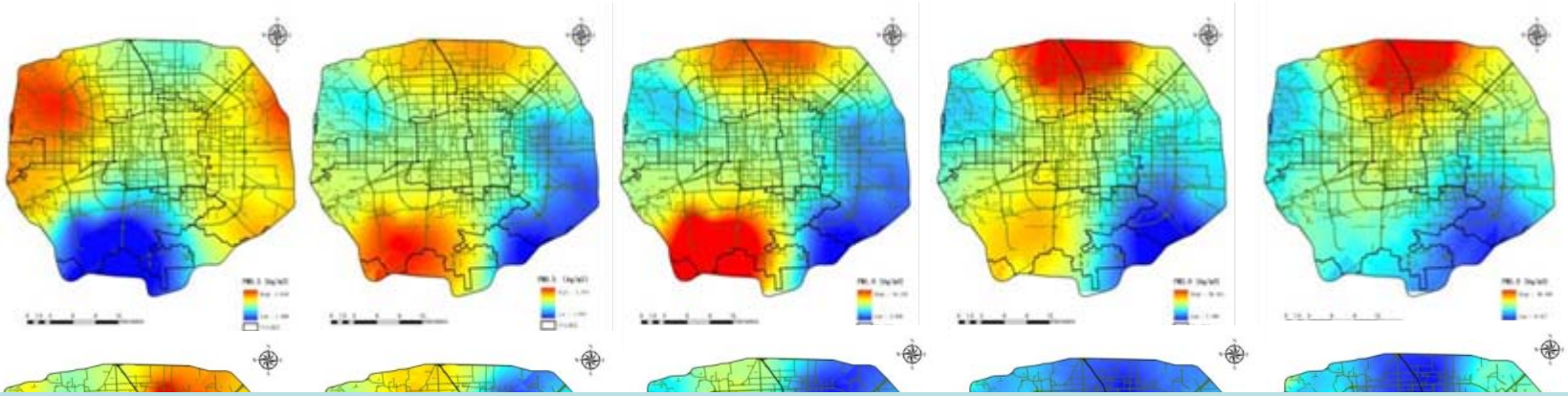
Heating season

	PM0.3	PM0.5	PM1.0	PM3.0	PM5.0
2007					
2008					
2009					
2010					

Un-heating season

PM0.3 PM0.5 PM1.0 PM3.0 PM5.0

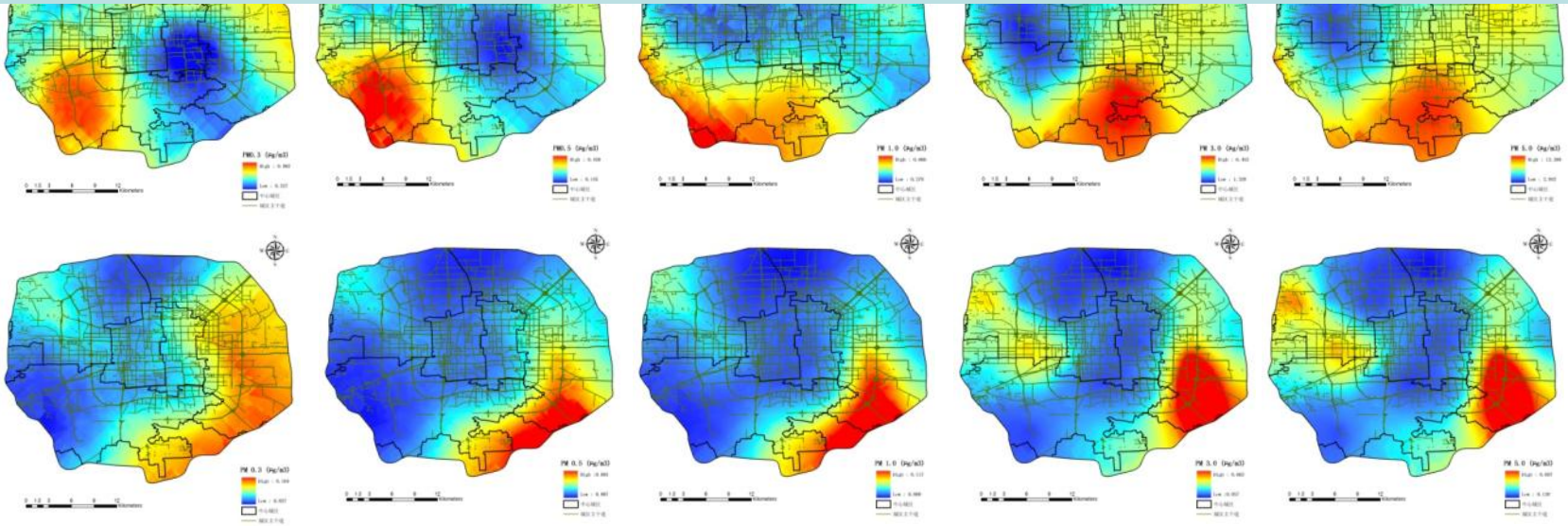
2007



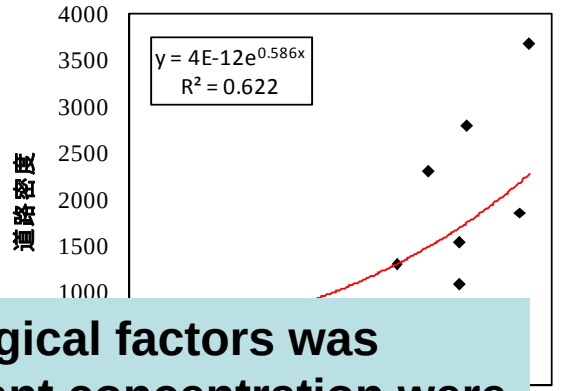
The inhalable particles pollution in Beijing has dramatically decreased both in pollution level and areas; the main polluted area was centralized at southwest area of the city. Pollution level in suburban areas was worse than in central city.

2009

2010



correlation coefficient	Green Land	Construction land	VCR
$PM_{0.5}$	-0.244	0.518	-0.261
PM_1	-0.285	0.553	-0.309
PM_3	-0.685	0.874	-0.677



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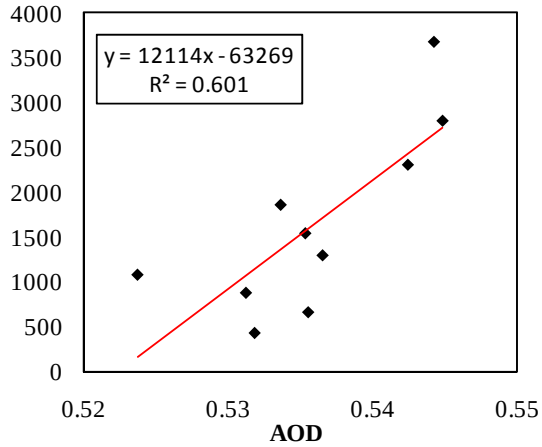
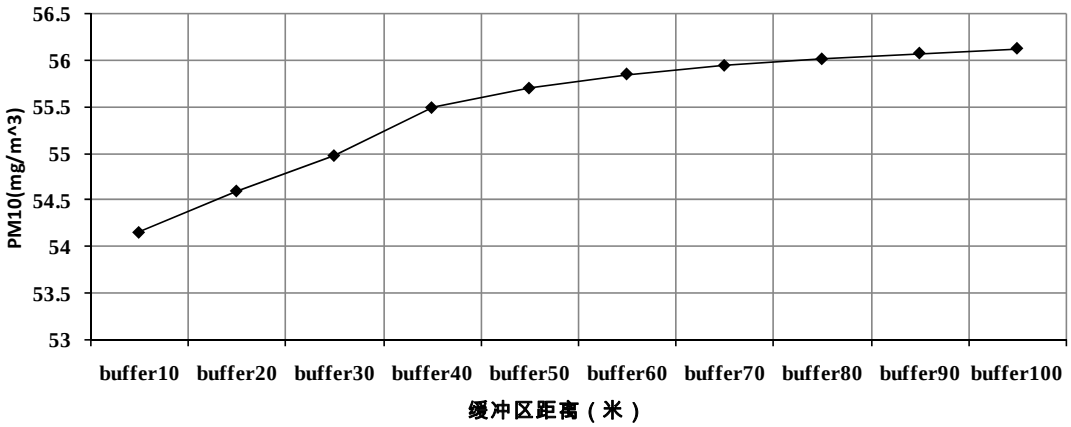
Meanwhile, the correlation between IPM and meteorological factors was discussed; the influences of different factors on pollutant concentration were compared.

season					
temperature	-0.203	0.456	0.524	0.529	0.640
humidity	-0.332	0.667	0.670	0.719	0.713
Wind speed	0.434	-0.560	-0.667	-0.656	-0.789

Non-heating season	$PM_{0.3}$	$PM_{0.5}$	$PM_{1.0}$	$PM_{3.0}$	$PM_{5.0}$
temperature	0.084	-0.071	-0.090	0.027	0.051
humidity	-0.147	0.173	0.232	0.325	-0.064
Wind speed	0.245	-0.529	-0.413	-0.213	-0.123





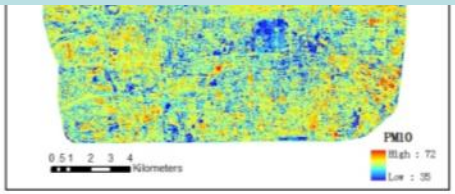
PM10 increasing with the distance from Park increased. When the buffer range reaches to 80m, the increasing was become slow.

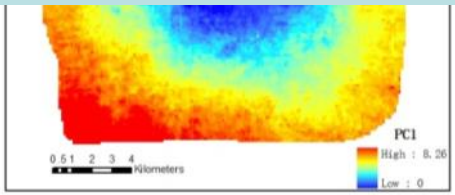
	Traffic flow magnitude	$PM_{0.3}$	$PM_{0.5}$	PM_1	PM_3	PM_5
Traffic flow magnitude	1					
$PM_{0.3}$	0.0553	1				
$PM_{0.5}$	0.1012	0.9378	1			
PM_1	0.3208	0.9179	0.9601	1		
PM_3	0.4915	0.4955	0.3985	0.6323	1	
PM_5	0.56878	0.4760	0.3657	0.6028	0.9984	1

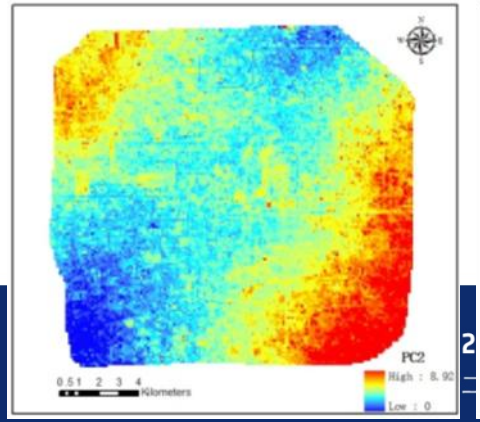
Comprehensive Analysis on influence factors

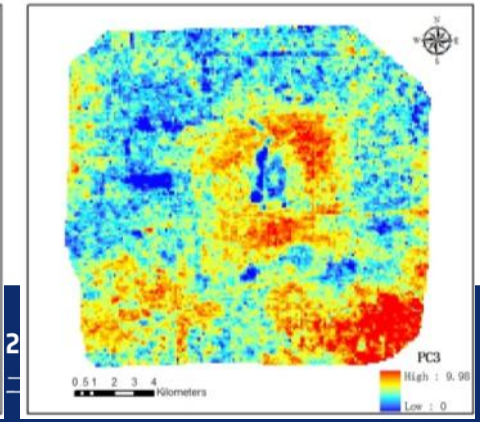
PC	Wind speed	temperature	Road density	Population density	Impervious Surface Area	relative humidity
1	0.52631	-0.54242	-0.05351	0.1333	-0.24347	0.59065
2	0.14725	0.39787	-0.4522	0.78437	-0.01322	0.01074
3	-0.65165	-0.08153	-0.19436	0.04922	0.66619	0.62802

The contributions of various parameters to urban PM concentration were estimated using principal component analysis (PCA), which is helpful to integrate useful information and reduce redundancy.









relative humidity;

The second principal component reflects Population density;

The third principal component reflects underlying surface types.

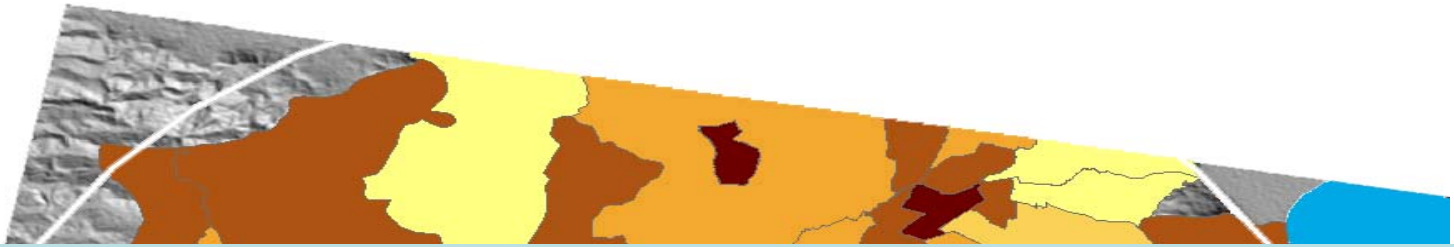
Partner's Results

- **Asimakopoulos Dimosthenis (1), Cartalis Costas (1),**
- **Petrakis Michael (2), Stathopoulou Marina (1),**
- **Adaktylou Nektaria (1), Chrysoulakis, Nektarios (3)**

Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) orthorectified were used as reference datasets to geometrically correct the time-series of the Landsat images.

Urban components may show significant brightness differences, but they share the same characteristics. The normalization method highlights the shape information while minimizing the effects of absolute reflectance values.

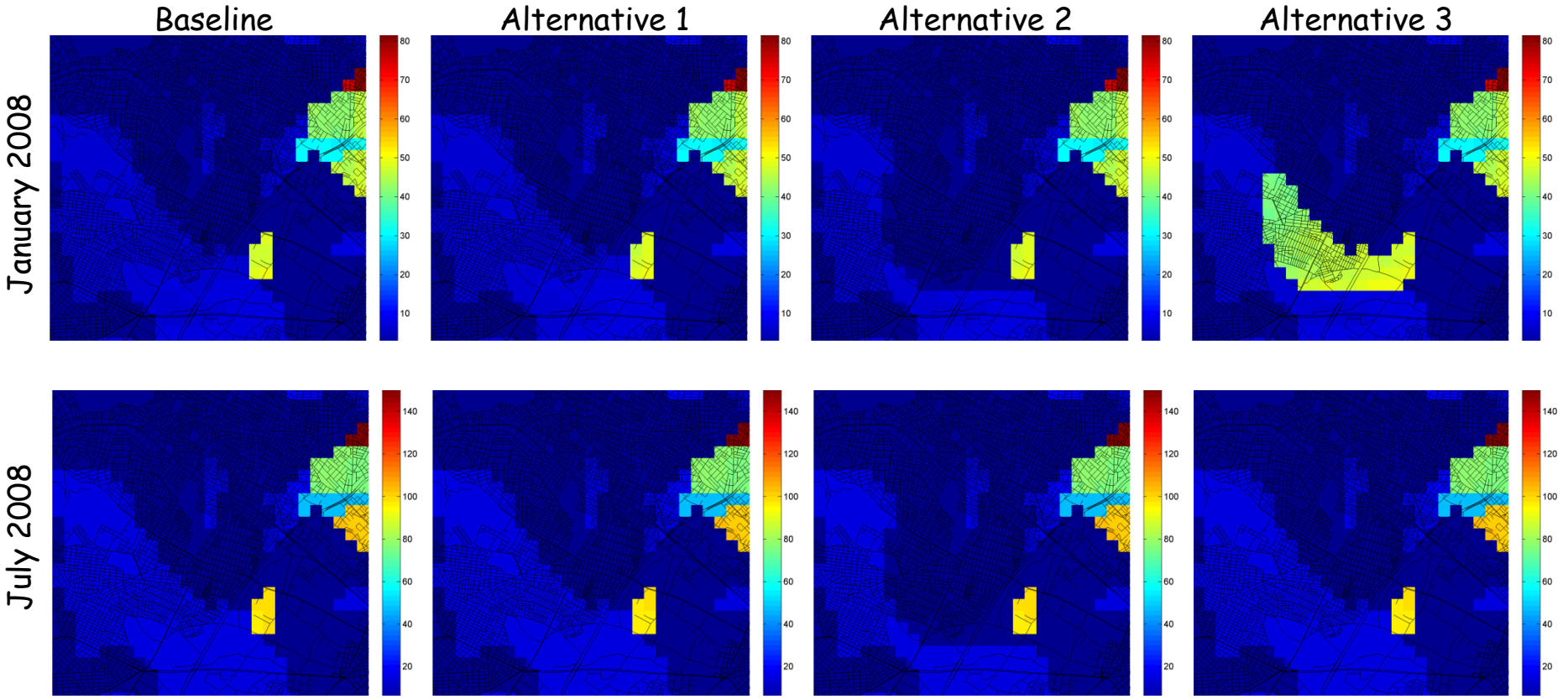
Hence, spectral normalization aims at reducing the spectral variations between pure land use types in order to eliminate the brightness differences between similar land cover types.



- Planning alternative 1
  - use of cool materials in the urbanized area of Egaleo
- Planning alternative 2
  - Change of Eleonas land use: brownfield/industrial to urban area
  - New building blocks were generated and considered
  - New roadnet was produced and considered
- Planning alternative 3
  - Change of Eleonas land use: brownfield/industrial to green area
  - 100% coverage of the Eleonas area (111ha) by green vegetation & open spaces

Latent Heat Flux

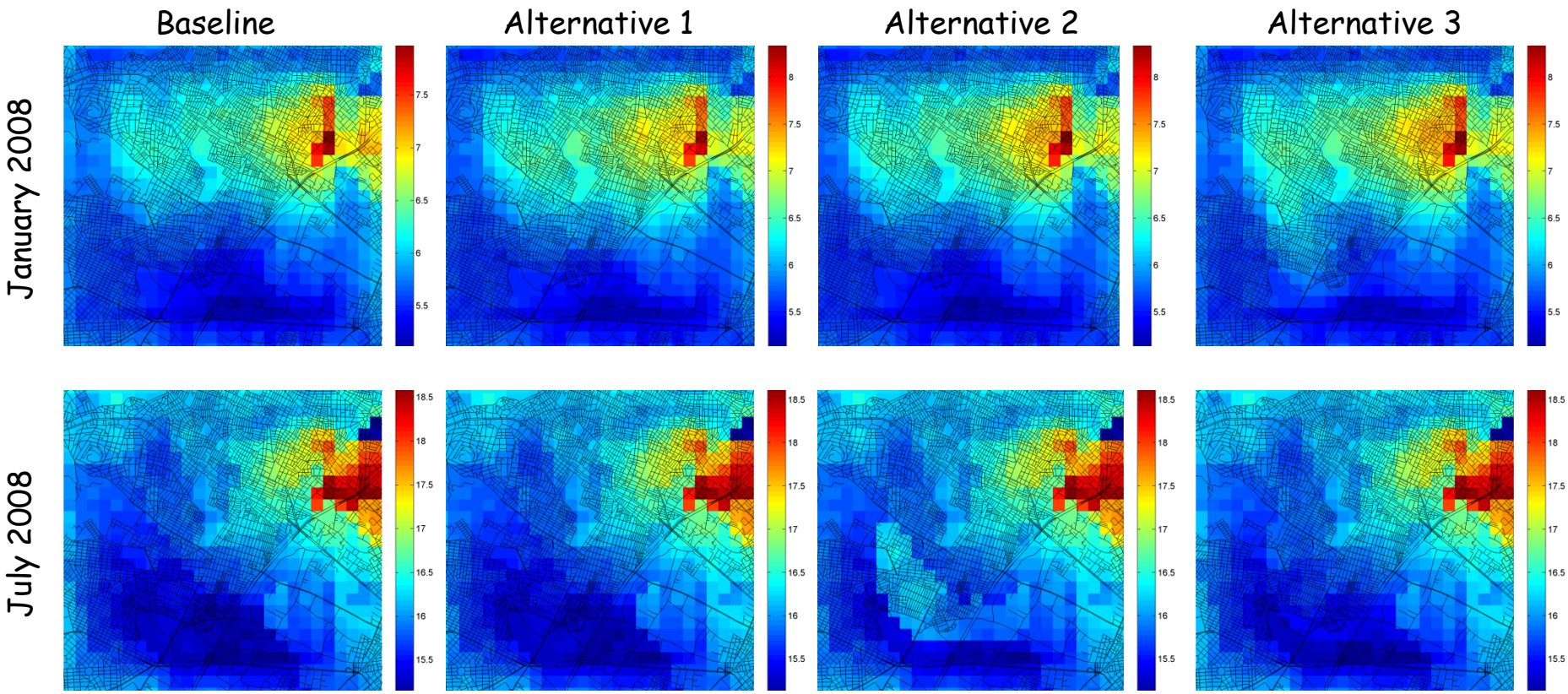
- W/m^2 (average for 12:00 Local Time)



Simulations by WRF/UCM-EMIMO-CMAQ (FP7-BRIDGE, Universidad Politécnica de Madrid)

Thermal Comfort Index

- Cooling Power (Monthly Mean)



Simulations by WRF/UCM-EMIMO-CMAQ (FP7-BRIDGE, Universidad Politécnica de Madrid)

Issues and Recommendations

◆According to the results, we should pay attention to how to choose a feasible place for building the Sport s Stadium.

◆Different kinds of analysis after OG should be emphasized.

◆The spatial / temporal features of IPM should be gone deep into its fact.

List of Publications

- 基于地统计学的北京市可吸入颗粒物时空变异性及气象因素分析, 环境科学学报，2010.30(11): 2154-2163.（**权威核心**）
- 基于RS与GIS的固阳县土地利用变化研究，测绘与地理空间信息，2008, 31(1): 52-57.
- 中巴资源二号卫星影像在土地利用变化中的应用, 首都师范大学学报, 2007, 12(1): 41-49.
- A preliminary study of urban airborne inhalable particle spatial distribution and their mechanism in Beijing using RS and GIS，IGARSS 2008 Symposium program. Paper ID: 2160 (**EI检索**)
- Spatial variation of inhalable particulate matter and its influence factor analysis during the regional air pollution study，IGARSS 2009 Symposium program. Paper ID: 3287 (**EI检索**)
- 北京市可吸入颗粒物的空间分布特征及与气象因子的CCA分析，地理与地理信息科学， 2009, 25(1): 71-74.
- Temporal and Spatial Variation of Urban Airborne Inhalable Particle and It's Influence Factor Analysis using GIS & RS，Geoinformatics 2009 Paper ID:127 (**EI检索**)
- Spatio-temporal variations of the distribution of urban inhalable particulate matter and its impact on respiratory diseases EPPH 2009 ID：P1634（**EI& ISTP检索**）
- A Fuzzy Object-based Data Processing for High Resolution Remote Sensing Image，2010 Seventh International Conference on Fuzzy Systems and Knowledge Discovery，volume 5, 2299-2302.
- Evaluating the air quality impacts of the 2008 Beijing Olympic games: the spatial distribution of inhalable particulate matter and their impact factors，Dragon 2 Programme Mid-term Results 2010. The ESA publication number is SP-684. (**EI检索**)
- GIS Spatial Analysis of Population Exposure to Fine Particulate Air Pollution in Beijing, China. Environmental Geosciences. Volume 17, 2010. Issue 1: 1-16.（SCI检索）
- GIS Analysis of Spatial and Temporal Changes of Air Particulate Concentrations and Their Impacts on Respiratory Diseases in Beijing, China. Middle States Geographer(USA), 2009. 42: 73-82.（通讯作者）
- 基于面向对象的重大工程土地利用变化信息提取，国土资源遥感 2009.12:83-86.
- 基于不同插值方法的 PM1 污染物浓度研究，测绘，2010（8）：172-175.
- 基于SPOT影像的可吸入颗粒物遥感反演，国土资源遥感（待刊）

Project Planning – 2011 and 2012

- Seeking the understanding of the administration (e.g. BeijingEPB).
- Add some study about pre OG.(IPM, thermal environment….)
- Continue to monitor the IPM over Beijing urban city. (New instrument….)
- the use of EO for air quality (especially during the Games' period) and for the post Games assessment.
- Further study about IPM retrieval by other RS data, especially EO data.

Thanks for your attention!