Challenges and benefits from crowd-sourced atmospheric data for urban climate research using Berlin, Germany, as testbed



Fred Meier, Daniel Fenner, Tom Grassmann, Britta Jänicke, Marco Otto, Dieter Scherer 9th International Conference on Urban Climate (ICUC9)



Chair of Climatology, Department of Ecology Technische Universität Berlin, Germany fred.meier@tu-berlin.de



Introduction



Introduction



Material and methods: crowdsourcing atmospheric data



netatmo weather station http://www.netatmo.com

"Automatic upload of data from sensor ('Internet of Thinks') and sensor network" (Muller et.al. 2015)



Material and methods: comparative measurements









Raw data availability (01.01.2015 - 30.06.2015)

number of netatmo stations (data quality level 0)



Crowd sourced hourly records of air temperature from netatmo outdoor devices Data quality level 0 -> raw data



Quality Level	Data Filter Criteria for each station	Potential Error Sources
0	Raw data	netatmo API server limits
1	> 80 % hourly data per day	Intermittent failure of wireless network, loss of battery power at netatmo sites
2	> 80 % daily data per month	see above
3	Invalid latitude, longitude or altitude	User-specific operating error
4	Monthly average of daily minimum Ta UCON threshold rural and urban site	User-specific installation error (misuse) Netatmo device has been set up indoors
5	Daily maximum Ta UCON threshold rural and urban site	Netatmo device has not been set up in the shade (no radiation shield)

Urban Climate Observation Network (UCON), Fenner et al. 2014

Crowd sourced hourly records of air temperature from netatmo outdoor devices Data quality level 5





Urban morphology covered by netatmo weather stations?

Urban morphology data of netatmo weather stations in Berlin (radius=250 m)









Relation between SVF or CSAR and monthly mean nighttime UHI in June

Conclusion and outlook

- High spatio-temporal data availability (city-specific)
- Basic metadata is available
- Quality assurance is a huge challenge
- User-specific operating errors and misuse
- Full range of urban morphologies is covered in Berlin
- Night-time air temperature records are suitable for UHI analysis
- Excellent complement to traditional observation networks
- Urban and non-urban reference sites should be available
- Measurement height above ground?
- Development of new filter techniques (regression analysis)

Conclusion and outlook



Conclusion and outlook

research platform: Urban Climate and Heat Stress (UCaHS)

http://www.ucahs.org/



Thank you for your attention



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Spatio-temporal data availability (air temperature raw data)



Separation between outdoor and indoor air temperature records



Netatmo outdoor measurement devices



http://wiki.wetterstationen.info/index.php?title=Netatmo_NWS01

Review paper: crowdsourcing for climate and atmospheric sciences



Muller, C. L., Chapman, L., Johnston, S., Kidd, C., Illingworth, S., Foody, G., Overeem, A., Leigh, R. R. (2015): Crowdsourcing for climate and atmospheric sciences: current status and future potential. International Journal of Climatology, doi:10.1002/joc.4210.

Spatio-temporal data availability (air temperature)





