



Investigations of Air Quality Aspects with the Urban Climate Model PALM4U

R. Wegener, U. Javed, R. Dubus, and D. Klemp

Energie & Umwelt / Energy & Environment

Band / Volume 622

ISBN 978-3-95806-741-7

Forschungszentrum Jülich GmbH
Institut für Energie- und Klimaforschung (IEK)
Troposphäre (IEK-8)

Investigations of Air Quality Aspects with the Urban Climate Model PALM4U

R. Wegener, U. Javed, R. Dubus, and D. Klemp

Schriften des Forschungszentrums Jülich
Reihe Energie & Umwelt / Energy & Environment

Band / Volume 622

ISSN 1866-1793

ISBN 978-3-95806-741-7

Table of Contents

1	Overall objective of the project	3
1.1	Embedding of subproject TP6 in phase 1 of the funding program	3
1.2	Relationship of project TP6 to the funding policy objectives of phase 2 of the joint project	4
1.3	Processed topic packages	6
2	State of science and technology; previous work	7
2.1	Previous work of the applicants	7
2.2	The mobile measurement laboratory of FZ Jülich (MobiLab).....	8
3	Results	9
3.1	Provision of vehicle emission data for PALM4U	9
3.1.1	<i>Continuation of the tunnel studies in the Heselacher Tunnel</i>	9
3.1.2	<i>Studies on the temperature dependence and weekday/weekend dependence of the emission behavior</i>	14
3.2	Determination of the heterogeneity of urban pollutant concentrations by mobile measurements with high time resolution	16
3.3	Model studies on local ozone formation based on actual precursor investigations.....	18
3.4	Urban-surrounding studies	27
3.4.1	<i>On the role of background ozone</i>	28
3.4.2	<i>Determination of the contribution of biogenically emitted VOCs based on simultaneous VOC and NO_x sampling</i>	29
3.4.3	<i>Cold air flows and urban heat island effects in the Stuttgart area</i>	30
3.5	PALM4U-model evaluations	34
3.5.1	<i>Analysis of the results of the simple PALM4U chemistry module (photostationary equilibrium) based on VALM01 (Berlin, winter 2017)</i>	34
3.5.2	<i>Analysis of the results of the simple PALM4U chemistry module (photostationary equilibrium) using VALM04 (Stuttgart, summer 2018)</i>	42

3.5.3	<i>Investigations on ozone production from the PALM4U chemical module CBM4: comparison of results with those of an explicit zero-dimensional model (MCM-3.3.1).....</i>	47
3.5.3.1	<i>Comparison of local ozone production of CBM4 and MCM 3.3.1.....</i>	48
3.5.3.2	<i>Comparison of ozone production over the course of a day (cumulative ozone production) when a polluted air mass is transported from urban to rural areas.....</i>	54
3.6	Use of PALM4U in other applications	61
3.6.1	<i>On the importance of the shadow effect on the NO/NO₂ ratio in a street canyon (PALM4U simulation using the simple PSS module).</i>	61
3.6.2	<i>PALM4U simulation of the surroundings of Berlin's Ernst-Reuter-Platz using the PALM4U chemistry module with photochemical ozone production.....</i>	66
3.6.2.1	<i>First linkage of PALM4U to a current regional chemistry and transport model (EURAD-IM) for the relevant chemical components.</i>	66
3.6.2.2	<i>Visualization of high-resolution calculations of oxidant formation for the the surroundings of Ernst-Reuter-Platz in Berlin with PALM4U and the chemistry module CBM4</i>	70
3.7	Further applications of the results.....	77
4	Literature	80
5	List of figures.....	84
6	List of tables	90
7	Abbreviations	91
8	Acknowledgements	93

Energie & Umwelt / Energy & Environment
Band / Volume 622
ISBN 978-3-95806-741-7

Mitglied der Helmholtz-Gemeinschaft

