

International Young Scientists School and Conference
on Computational Information Technologies
for Environmental Sciences
and Information Systems

CITES-2015

26 June – 30 June 2015, Tomsk, Russia



Международная молодежная школа и конференция
по вычислительно-информационным технологиям
для наук об окружающей среде

CITES-2015

26 июня – 30 июня 2015, Томск, Россия



Организаторы CITES 2015

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Благодарим за финансовую поддержку:

Проект РФФИ 15-35-10151 мол_г
Мегагрант Минобрнауки РФ №14.В25.31.0026
«Внетропический гидрологический цикл в современном и будущем климате: неопределенности и предсказуемость»
(Институт океанологии им. П.П. Ширшова РАН)

Aknowledgements:

RFBR project 15-35-10151 mol_g
Mega-grant of Ministry of Education and Science
of Russian Federation №14.V25.31.0026
“Extra-tropical hydrological cycle in the current
and future climate: uncertainties and predictability”
(P.P. Shirshov Institute of Oceanology RAS)

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Three-layer informational-computational system for presentation of predicted values of urban air pollution by sources of anthropogenic and biogenic emission

¹Bart A.A., ¹Starchenko A.V., ^{1,2}Fazliev A.Z., ³Tsar'kov D.V.

¹ Tomsk State University, Russia

² Institute of Atmospheric Optics SB RAS, Tomsk, Russia

³ School of Computer Science, University of Manchester, UK

E-mail: bart@math.tsu.ru, starch@math.tsu.ru, faz@iao.ru, tsarkov@cs.man.ac.uk

Impurities in the surface layer of the atmosphere appear due to both biogenic and anthropogenic pollution. Information about the pollution sources, their type, location, and modes of operation and understanding of the processes occurring in the atmosphere are necessary to control the air quality. In addition, the air quality in cities is influenced by meteorological conditions that determine the formation of air pollution.

At present, the prediction distribution of the parameters of the atmospheric processes contributes by new high-performance hardware and original methods of computation. Traditionally important are computational problems that characterize the state of the atmosphere. Additionally the information tasks related to the presentation and integration of information resources on a regional scale are beginning to play an important role. In this paper we consider both computational and informational aspects of building informational-computational system (ICS) «UniQuE» using three-layer architecture

In the Semantic Web approach the interpretation of the terms «data», «linked data» and «ontology» is associated with the semantics of formal languages (XML, RDF and OWL). Moreover, this interpretation leads to the use of the terms «data and applications layer», «information layer» and «layer of knowledge», introduced by e-Science [2] to describe the infrastructure of information resources and information systems.

ICS «UniQuE» is designed to calculate the concentrations of impurities contaminating the air in the atmospheric boundary layer, and to present properties of the results of the calculation in the form of data, information and knowledge both for researchers and software agents.

Data and applications layers of the system consist of the mathematical model described in [1] and corresponding data (global meteorological forecast and emission sources description) respectively.

A novel feature of the ICS «UniQuE» is an ontological representation of the results predicted by the numerical model of impurity transport with consideration of chemical reactions. In this paper ontology is a logical theory that describes the levels of the atmospheric boundary layer above the city.

The main purpose of the knowledge layer of the ICS «UniQuE» is to classify properties of the solutions of the short-term air quality forecast problem. In particular that allows the user to perform semantic search of reliable air quality forecasts with a high degree of credibility. The system performs the classification of levels of the boundary layer and parts largest concentrations of impurities and the degree of coincidence of the measured and predicted data is performed using OWL 2 DL reasoner FaCT++ [3]. In order to be able to reason about the data comparison, FaCT++ was extended with additional reasoning facilities.

This work was performed by order of the Ministry for education and science of the Russian Federation No. 5.628.2014/K.

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