Multi-instrument space-borne observations and validation of the physical model of the Lithosphere-Atmosphere-Ionosphere-Magnetosphere Coupling

Abstract

We propose an investigation of the near-Earth space plasma dynamics and electromagnetic environment by multiparameter analysis from variety of space-based missions and creation of physical model of the coupling between lithosphere, atmosphere, ionosphere and magnetosphere which are linked by the chain of processes initiated by atmospheric boundary layer modification by air pollution (dust aerosols, nuclear disaster) and modification of boundary layer by major natural disasters: earthquakes, tsunamis, hurricanes/typhoons and volcanoes.

Our intention is to find from experimental data and their detailed analysis the key processes in atmosphere, which modify the Earth plasma environment system under various geophysical conditions including natural and anthropogenic disasters. As input for analysis and modeling we will use the data products about atmosphere, ionosphere and magnetosphere from different satellites, including NASA EOS (TERRA, AQUA), NOAA/POES, and ESA/ EUMETSAT (METEOSAT, ENVISAT, SWARM), DEMETER/CNES, FORMOSAT-3/COSMIC, as well as ground observations of GPS/TEC, ground electromagnetic (EM) fields meteorological monitoring data, geochemistry, etc. Statistical studies that use these data sets individually have already proven the complex nature of the interconnection between lithosphere and atmosphere events and earth space environment through the Global Electric Circuit. Just recently the members of this team came independently to same conclusion that many processes in atmosphere of different origin create the similar variations in the space plasma environment what implies the existence of common physical mechanism of their generation. One of the main drivers for such coupling is the change of the boundary layer conductivity through the air pollution, Ion Induced Nucleation triggered by natural and anthropogenic radioactivity, and mesoscale atmospheric systems such as tropical hurricanes/typhoons. Combining data from space- and ground-based instrumentation will provide the experimental background for the first-principal physical modeling in the whole column from the ground surface up to the ionosphere and magnetosphere.

The team of the leading world experts in different disciplines will provide the unique opportunity of the knowledge fusion to make breakthrough in the understanding the coupling process between atmosphere of our planet and space environment.

Scientific rationale, goals, and timeliness of the project

The coupling processes within the system Atmosphere-Thermosphere-Ionosphere attract more and more attention from the scientific community. Electric discharges to the ionosphere (blue jets and red sprites), galactic cosmic rays effects on the global cloud coverage, role of the global electric circuit in the ionosphere variability are only few from many new topics actively discussed in scientific community. One of the most discussed recently topics is the coupling mechanism which generates anomalies in different near-Earth shells starting from boundary layer of atmosphere up to magnetosphere of our planet few weeks/days/hours before moderate/strong/mega seismic events. It was also established recently that many of different natural and anthropogenic phenomena contain

similarity of their behavior and effects on atmosphere and ionosphere. For example, the radioactive pollution during emergencies on atomic power plants (Three-Mile Island, Chernobyl, Fukushima) produce through the Ion Induced Nucleation (IIN) the thermal anomalies similar to those registered before earthquakes from satellites. Simultaneously EM phenomena (variations of atmospheric electric field, variations in different layers in the ionosphere) imply the coupling between the atmospheric thermal and atmospheric and ionospheric EM phenomena. Different groups of scientists proposed the physical mechanisms of coupling. One of such attempts was generalized in the form of the Lithosphere-Atmosphere-Ionosphere Coupling (LAIC) model. But many parts of the model have the qualitative character and do not permit to make the quantitative modeling in different geophysical conditions. This situation clearly demonstrates the distinct lack of knowledge on the atmosphere-ionosphere coupling especially when we consider the effects on the ionosphere from below. Existing conception of the Global Electric Circuit only claims the existence of potential difference between the ground and ionosphere but do not provide any instruments to estimate how the changes of electric properties of the near ground layer of atmosphere will reflect in the ionosphere.

Nevertheless, during the last decade of studies the coupling processes the following facts were established:

1. Ionization plays important role in many natural processes such as stimulation of the cloud coverage by galactic cosmic rays, formation of the short-term earthquake precursors, dynamics of hurricanes and typhoons, producing anomalies of radio wave propagation in the near ground waveguide
2. As the main sources of ionization at least three should be considered: natural ground radioactivity, galactic and solar cosmic rays, thunderstorm discharges, anthropogenic radioactive pollution (nuclear tests, radioactive leaks and explosions at nuclear power plants, etc.)
3. Ion Induced Nucleation as a catalytic exothermic process plays key role in coupling between atmospheric thermal and electric phenomena.

Combining the stated lack of knowledge in the coupling mechanisms and established facts we can formulate the principal goals of the present project:

1. To consider ionization processes in the near ground layer of atmosphere and troposphere to estimate the dependences of main atmospheric constituents from the rate of ionization and atmospheric conditions
2. To consider the atmospheric plasmachemistry reactions after formation of primary ions and formation of ion clusters and their temporal and special dynamics
3. To consider the consequences of Ion Induced Nucleation – formation of the large hydrated clusters and complexes, namely: thermal effects, meteorological effects, effects in atmospheric electricity
4. To estimate the energy effectiveness of intensive ionization in formation of the anomalous fluxes of the latent heat and infrared emission
5. To estimate the effects of intensive ionization and consequent ion induced nucleation of electric properties of the boundary layer of atmosphere

6. To create the complete atmosphere-ionosphere model taking into account of variations of electric properties of the boundary layer of atmosphere

The accomplishing of the goals mentioned above would lead to creation of the complex atmosphere-ionosphere model, which will unite existing separately the Global Electric Circuit model and different ionospheric models. It would be the real breakthrough in our knowledge of coupling mechanisms in the atmosphere-ionosphere system.

Simultaneously the new approach to the atmosphere thermodynamics will be created which takes into account the global effects of natural radioactivity and galactic cosmic rays.

To meet this science challenge we invited the several leading experts in disciplines involved in the proposed activity of the model development and validation. The activity of the team will be engineer in two directions: (1) theoretical modeling and (2) validation data analysis of known typical cases for ionization effects using ground and satellite based sensors. The extended satellite databases and different kind of ground observations will be used as baseline for comparison with the theoretical modeling.

All effects mentioned above were registered by different spacecrafts and by ground based measurements. With the help of LAIC model they have plausible explanation. Now the science community needs to make the next step – to quantify the described effects in the form of first principal models and to verify these models using results of the ground based and satellite monitoring of ionization effects leading to anomalous variability of atmosphere and ionosphere. We propose four steps plan towards advancing this goal:

(i) The first stage of the present project will be to **build the bridge between natural radioactivity and atmosphere thermodynamics using the process of Ion Induced Nucleation as a main source of energy transformation** developing criteria for conditions of intensive latent heat release and its effects in different layers of atmosphere from boundary layer up to the tropopause. This will require to consider the microscopic aspects of the ionization, ion cluster formation and hydration, formation of aerosol-size (1-3 microns) particles, aerosol layers and massive latent heat release. Effects of latent heat release on meteorological conditions and infrared radiation variability should be considered. The proposed science team was designed to include the leading international scientists on the field of atmosphere plasmachemistry and thermodynamics, an important fact we expect to play a critical role in the achieving of projected goals

(ii) The second stage of the project would be the **creation of atmosphere-ionosphere coupling model using parameters of the Global Electric Circuit (GEC) modified by the ionization**, what will require to find the correct approach to take into consideration the air conductivity vertical profile modified by ionization, generation of anomalous vertical electric field, additional current systems created by convection and charge separation processes, and influence of aerosols on atmospheric electricity. The correct evaluation of parameters of atmospheric electricity will provide opportunity to estimate the additional electric fields in the ionosphere and corresponding ionospheric variability associated with the effects of anomalous electric fields. The two world best ionospheric models will be considered as candidates for their modification to extend their validity down from the ionosphere through atmosphere up to the ground surface.

(iii) The third stage of the project is a **synergy of the thermal and EM processes initiated by ionization.** On the first two stages of the project thermal effects in atmosphere and

modification of the ionosphere were considered separately. But we should keep in mind that both of them were initiated by the common source, and Ion Induced Nucleation contributes in both: the larger clusters are formed – the more latent heat is released, but simultaneously the larger clusters are formed – the lower atmosphere conductivity is. Actually the process of ionization and its effects on atmosphere and ionosphere should be considered as complex open system with dissipation what is characteristic task for synergetics. This complex system tends to self-organization and explosive character of development while approaching to the critical point. At least two examples can be put forward: hurricanes and earthquakes. Experimental analyses of several cases have shown the synergy in behavior of different atmospheric and ionospheric parameters while approaching to the main shock in the earthquake case. Main task of this part of the project would be search of the threshold parameters and generalized parameters which will permit to estimate the whole system development.

(iv) Developed approaches will be checked for **natural and anthropogenic phenomena** including hurricanes (Katrina 2005), sand storms (August 2012), Fukushima nuclear plant emergency (March 2011), strong earthquakes (Wenchuan, China, 2008; L'Aquila, Italy 2009; Tohoku, Japan, 2011 and other strong and moderate earthquakes). Selection will take into account earthquakes inland and under ocean at high, middle and low latitudes (this is important for ionospheric effects which are dependent on latitude).

We consider reaching the project goals during the 18 months interval having 3 meetings of 1 week duration.

Here are the major objectives for the following project:

1) Comprehensive review of the current and historical the Lithosphere-Atmosphere-Ionosphere-Magnetosphere Coupling physical concept related to different geophysical phenomena, such as hurricanes, thunderstorm discharges, sand storms, earthquakes and volcanoes, nuclear pollution;
2) Assess the latest progress in space plasma observation from satellites DEMETER, SWARM, GPS FORMOSAT-3/COSMIC and ground GPS observations of Total Electron content (IGS, GIM/TEC) for reconstruction of ionospheric parameters correlated with ionospheric variability associated with the low atmosphere ionization processes (Table 1);
3) Analysis of the satellite methodology of using (near infrared) NIR and (thermal infrared) TIR data from polar satellite (NASA TERRA/AQUA, EUMETSAT/ENVISAT/MERIS and AATSR) and Geosynchronous satellite (ESA/MSG/SEVIRI along with (long-wave radiation) LWR from NOAA POES and NASA AQUA/AIRS and EUMETSAT/MetOp for detection of thermal atmospheric anomaly associated with the low atmosphere ionization processes (Table 1);
4) To conduct the further development of the Lithosphere-Atmosphere-Ionosphere Coupling model to the level of numeric simulations of the principal model elements: ionization, cluster formation, cluster hydration, particle growth, changes of atmosphere conductivity atmosphere thermodynamics taking into account the anomalous fluxes of the latent heat, infrared emission, ionospheric variability associated with the modification of the GEC parameters;
5) Verification the completeness of the LAIC concept by validating the synergy between the

ionospheric and thermal transient fields through their dynamic development during the lithosphere - atmospheric coupling;

6) Perform multi parameter and multi satellite analysis for the selected cases of natural and anthropogenic phenomena associated with low atmosphere ionization.

	Parameter	Instrument	Platform	Data Availability	Methodology	Agency
Ionosphere	TEC variations	GPS/TEC	IGS	2005-2013	Ionospheric perturbation detection	GNSS/IGS
	Ionospheric variations	Langmuir Probe (LP)	DEMETER	2004-2009		CNES
	Electrical field and plasma	LP, AC/DC	Swarm	2013-		ESA
	Electron density profiles	Occultation GPS	FORMOSAT1-2/ COSMIC	2006 -2013	Radio Occultation technique	Taiwanese Space/NOAA
Low Atmosphere	LWR: Long wave radiation	AVHRR AIRS Met Op A ,B	POES AQUA MetOp	1997-2013 2003-2013 2006-2013	Detection in transient radiation field	NOAA NASA EUMETSAT/ ESA
	SWR: Latent Heat Flux (LHF)	NCEP Ensemble	NOAA NCEP-NCAR	1948-2013	LHF anomalous variations	NOAA
	VIS-NIR Earth radiation	MODIS SEVIRI AASTR,MERIS	TERRA, AQUA MSG-2,3 ENVISAT	2000-2013 204-2013 2002-2012	Clouds and aerosol detection	NASA EUMETSAT ESA
Boundary layer	Temperature(AT) and Relative Humidity (RH)	NCEP	NOAA	1970-2013	Time series data analysis	NOAA
	Land/Sea surface Temperature	MODIS AASTR,MERIS	TERRA AQUA ENVISAT	2000-2013 2002-2012	Change in surface temperature	NASA ESA

Expected output

A. Review the observation of atmosphere/ionosphere transient phenomena associated with presence of intensive ionization source in the lower atmosphere/troposphere for different natural and anthropogenic events. Determine the range of variability of different atmospheric and ionospheric parameters and thermal radiation and understand their causes by using multi satellite observations and LAIC mechanism. Satellite data and methods exchange to facilitate standard processing and analysis of data. Prepare publication of results.

B. Perform parameterization of the different kinds of variability of atmospheric and ionospheric parameters to assimilate by the model calculations. Perform cross-layer calculations (ground-boundary layer-troposphere-tropopause) for main thermodynamic parameters of atmosphere including air temperature, air humidity, latent heat, infrared emission in different bands. Perform cross-layer calculations (atmosphere-bottom ionosphere-topside ionosphere-magnetosphere) of

GEC parameters and effects in main ionosphere constituents. Use data obtained from various satellite and ground based sensors for independent verification of the model calculations of the coupling processes. Prepare publication of results.

C. Estimate synergetic effects of the thermal and electromagnetic coupling. Provide cross sensor approach for common classification of multi-parameter satellite observations during strong ionization impact. Perform joint analysis of atmospheric thermal and ionospheric instability in relation to ionization intensity in different geophysical conditions for the selected significant events of natural and anthropogenic origin. Facilitate a good cohesion and exchange of data and methodologies between several other International projects, which members of this team are also represented. Define future development in multi sensor observations towards understanding the coupling processes within the Lithosphere-Atmosphere-Ionosphere chain. Prepare publication of results and final report.

• What added value does ISSI provide for the implementation of the Team activity?

The proposed project is based on the analysis and evaluation of existing unique space and ground data collected by different teams all over the world. ISSI will provide the necessary cross-discipline bond between the various disciplines within the space field such as utilizing space data for Earth sciences, which will be difficult for individual experimenters to study.

International team, involved in the project, unifies Russian, American, Chinese, European and Japanese leading scientists. The unique scientific environment offered by ISSI, joint efforts of leading international science experts, as well as the world scientific information availability provide the potential for a successful realization of the project.

• Schedule of the project, i.e., number and duration of meetings, anticipated periods, list of potential experts etc.

#	Date	Duration, weeks	Team	Activity	Deliverable
1	**January-February 2014**	1	9	- Review of previous and latest development of LAIC. - Review of previous ionospheric and thermal satellite and ground data application. - Project plan compiling.	- Review of previous researches. - Set up a WWW site for the project - Project plan compiling.
2	**October-November-2014**	1	7	- Parameterization of the ionospheric and thermal variability and provide the means for data assimilation by the model - Perform the model calculations	- Plan of publication. - Unification on the sample data sets, formats and processing approach - New version of LAIC model

3	**March-April 2015**	1	8	- Multi parameters coordinated analysis of major test cases. -Define future development in multi sensor observations towards LAIC model validation	- Plan of publication. - Report on Synergy Analysis - Report on cases studies - Plan for Final report

• Facilities required, e.g., computer equipment, access to Internet etc.

1) Personal computers and Internet with wireless connection
2) Projector and Skype ready for conferencing
3) Accesses to Science Journals Database, Printer and Xerox machine
4) Data collecting archiving capabilities
5) Office room for group's discussions

• Financial support requested of ISSI (see Section 6)

	Meeting	Participants	Duration, week	Participants x week
1	January-February 2014	9	1	9
2	October-November 2014	7	1	7
3	March-April 2015	8	1	8
			Total	24

• Participants list

1. Sergey Pulinets – team leader, Institute of Space Research RAS, Russia
2. Dimitar Ouzounov – team leader, Chapman University, CA, USA
3. Josef Huba - Naval Research Laboratory, Washington, DC, USA
4. Alexander Namgaladze- Murmansk State Technical University, Murmansk, Russia
5. Alexander Baklanov- Danish Meteorological Institute, Kopenhagen, Danmark
6. Michel Parrot- LPC2E/CNRS, France
7. Tiger Liu - National Central University, Gungli, Taiwan
8. Katsumi Hattori- Chiba University, Chiba, Japan
9. Alexander Karelin - TsNIIMASH, Roskosmos, Russia

SELF SUPPORT MEMBERS OF THE TEAM

1. Kirill Boyarchuk- NIIEM, Roskosmos, Russia
2. Lou Lee – Academia Sinica, Taipei, Taiwan
3. Valerio Tramutoli, DIFA/University of Basilicata, Potenza, Italy
4. Andrzej Krankowski, University of Warmia and Mazury in Olsztyn, Poland

Annexes• List of confirmed members with (appended) short CVs,

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AREAS OF EXPERTISE: Space Electrodynamics, Physics of the Ionosphere, Topside Sounding, High Frequency Radio-spectroscopy of the space plasma; Lithosphere-Atmosphere-Ionosphere Coupling concept

SUMMARY
Prof. Sergey Pulinets is a Principal Research Scientists in the Space Research Institute of the Russian Academy of Sciences, Moscow, Russia. He has more than 35 years of experience in Space Plasma Physics, Physics of the Ionosphere, and Geophysics. Dr. Pulinets is a leader of an international team of scientists proposing the Lithosphere-Atmosphere-Ionosphere coupling concept related to seismo-tectonics, active faulting and earthquake processes. Dr. Pulinets is a co-convener of the American Geophysical Union, fellow of IUGG Inter Association Working Group on Electromagnetic Studies of Earthquakes and Volcanoes (EMSEV), correspondent member of International Radio Science Union (URSI), International Committee of Space Research (COSPAR), fellow of URSI/COSPAR International Reference Ionosphere (IRI) Working Group, fellow of United Physical Society of Russia, member of editorial board of Geomagnetism and Aeronomy journal.

EDUCATION
D.Sc. Radio Physics, IZMIRAN, Russia, 1991
Ph.D. Geophysics, IZMIRAN, Moscow, Russia, 1980
M.Sc. Physics, Lomonosov Moscow State University Moscow, Russia, 1972

PROFESSIONAL EXPERIENCE
2009-present Principal Research Scientist, Space Research Institute RAS, Moscow Russia
2008-2012 Head of Laboratory, Fiodorov Institute of Applied Geophysics, Moscow, Russia
2007-2008 Deputy General Director, Scientific Center AEROCOSMOS, Moscow, Russia
2002-2007 Senior Scientist, Institute of Geophysics, National Autonomous University of Mexico
1972-2002 Scientist, Senior Scientist, Head of Laboratory, Head of department, Deputy Director of Pushkov Institute of Terrestrial Magnetism, Ionosphere, and Radiowave Propagation of the Russian Academy of Sciences (IZMIRAN)

HONORS & RECOGNITIONS

- Intercosmos Council Award for active participation in Soviet-France ARAKS Project, 1975
- USSR National Economy Achievements Exhibition Bronze medal, 1976
- USSR National Economy Achievements Exhibition Silver medal, 1980
- Diploma of the Cosmonaut's Federation of Russia, 1994
- Sergey Korolev medal for the Coronas-I Mission contribution
- 2003-2012 American Geophysical Union Fall Meetings, Co-convener of Tectonophysics and Seismology Sessions: EM phenomena related to earthquake processes
- 2005 Co-Chairman, Early Warning Systems For Earthquake Monitoring By Satellite

Technology, Istanbul, February 1-2, 2005, Turkey

PUBLICATIONS

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Pulinets S. A., Physical mechanism of the vertical electric field generation over active tectonic faults, Advances in Space Research, 44, 767-773, 2009

Pulinets S.A, Lithosphere-Atmosphere-Ionosphere Coupling (LAIC) Model, In Electromagnetic phenomena associated with Earthquakes, Ed. by M. Hayakawa, Trivandrun Research Network, Kerala, India, Chapter 9, 235-254, 2009

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AREAS OF EXPERTISE: Satellite Earth observation of near-space EM environment; Lithosphere-Atmosphere-Ionosphere Coupling; Geodynamics; Geocomputing

SUMMARY

Research Scientist with more than 25 years of experience in Geophysics, Satellite Earth Observations, and Geocomputing. Conducts research on utilizing near-space observations for studying Earth EM environment and the global geodynamics. In mid 2000 Dr. Ouzounov proposed a new approach of using geo-space earth radiation observation and thermal transient field to study Lithosphere-atmosphere-ionosphere coupling and joint an international team of scientists validating the new geophysical theory. Dr. Ouzounov won multiple NASA grants, has served on NASA panels, international committees, and has chaired several science-working groups. As a keynote speaker, he attended WHO and UN international conferences, hosted sessions on AGU,EGU,,ESC and SPIE conferences. He published more then 150 papers, coordinates international initiatives on utilizing space-borne and ground observations for global geodynamics hazards assessments.

EDUCATION

Ph.D. Geophysics, The Schmidt Institute of Physics of the Earth, Russia, 1990
M. Sc. Applied Mathematics & Informatics Technical University, Bulgaria, 1985
B. Sc. Applied Geophysics, University of Mining and Geology, Bulgaria, 1983

PROFESSIONAL EXPERIENCE

2008-present Associate Professor *Chapman University, Orange, CA, USA*
2008-2012 Senior Scientist, *Applied Sciences, NASA Goddard SFC/SSAI, Greenbelt, MD, USA*
2007-2008 Research Professor, *George Mason University, Fairfax, VA , USA*
2004-2008 Principal Investigator, *Geodynamics, NASA Goddard SFC/SSAI, Greenbelt, MD, USA*
1999-2004 Staff Scientist, *GES DAAC, NASA Goddard SFC/SSAI, Greenbelt, MD, USA*
1990-1997 Research Scientist, *Geophysical Institute, Academy & Sciences, Sofia. Bulgaria*

INTERNATIONAL PROJECTS

2004-2007 Thermal response before strong earthquakes by analyzing multisensor satellite data, (NASA, USA), (role: PI);
2005-2010 Study Earth near space electromagnetic environment using DEMETER satellite measurements, (CNES, France), (role: PI);
2009-2010 Validation of Satellite Thermal signals associated with major geodynamics activities, (NASA & FEMA, USA) , (role: PI);
2011-2013 PRE-EARTHQUAKE, (Italy/Russia, source: FP7 EU), (role: Invited Co-I).

RESEARCH ACTIVITIES

- Guest Editor for Natural Hazards and Earthquake Predictability for *Journal Asian Earth Sciences*, *International Journal of Geophysics* and *Research in Geophysics*;
- Member of the American Geophysical Union (AGU); European Geophysical Union (EGU); Japanese Geoscience Unions)JpGU); Seismological Society of America (SSA), The International Society For Optical Engineering (SPIE), and IUGG WG on Electromagnetic Studies of Earthquakes and Volcanoes (EMSEV).

HONORS/AWARDS

- Top-50 most cited article of published articles in *Tectonophysics*, Elsevier, 2006 – 2011
- NASA Group Achievement Honor Award, member of GSFC Applied Sciences, 2008
- SSAI Excellence in science publications award, 2007
- NASA Group Achievement Award as a member of EOS DISC Centers Support, 2006
- Top-25 most cited article in *Earth and Planetary Science*, ASR, Elsevier, 2005
- NASA Goddard Space Flight Center Achievement Award GES DAAC, 2002
- NASA GSFC Achievement Award, member of MODIS Mission Support Team, 2001

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Physics World, May 26, 2011,Tohoku quake coincided with sky'anomalies'
Live Science, May 18, 2011, Japan Earthquake Was 'In the Air' Days Before, Scientist Claims
CS Monitor, May 18, 2011, Japan earthquake: Big, shallow quakes have a warning signal, say researchers
Technology Review, May 18, 2011, Atmosphere Above Japan Heated Rapidly Before M9 Earthquake
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AREAS OF EXPERTISE: Magnetospheric/ionospheric/thermospheric coupling physics, magnetic reconnection, ionospheric irregularities (e.g., equatorial spread F), computational plasma physics

EDUCATION:
University of Maryland, College Park, MD Business M.B.A. (1982)
University of Maryland, College Park, MD Physics Ph.D. (1975)
University of Notre Dame, South Bend, IN Physics B.S. (1971)

APPOINTMENTS:
3/95 - present Head, Space Physics Section, NRL
7/90 - 2/95 Research Physicist, NRL
6/83- 6/90 Head, Geophysical and Plasma Dynamics Branch, NRL
5/81- 5/83 Research Physicist, NRL
10/77- 4/81Research Physicists, SAI
10/75 - 9/77 Post Doc, NRL

AWARDS/HONORS:
2011: NSF CEDAR Prize Lecture Award
2008: NRL E.O. Hulburt Award (highest honor by NRL for scientific achievement)
1992, 1999, 2003: Editor's Citation for Excellence in Refereeing (JGR)
1981, 2004, 2010: NRL Berman Research Publication Award
1992: APS Fellow (Division of Plasma Physics)

SYNERGISTIC ACTIVITIES:
Developed the NRL ionosphere models SAMI2, SAMI3, SAMI3/ESF (with G. Joyce)
Open sourced SAMI2 (June, 2001) and developed its website
Member of Decadal Survey Theory, Modeling, and Data Exploitation WG (2011)
Member of NSF Site Visit Team of HAO (2011)
Member of NSF Committee of Visitor Review Panel (2011)
Member of the NSF CEDAR Science Steering Committee (2008 -2010)
Member of NASA LWS panel (2010)
Developed the 3D Hall MHD code VooDoo
Publication reviews: Journal of Geophysical Research, Geophysical Research Letters,
Physical Review Letters, Physics of Plasmas
Convener of AGU Chapman Conference of Ionosphere/Therm. Modeling (May, 2011)
Associate Editor for the Journal of Geophysical Research (1983 - 1986)
Assistant Editor of the Reviews of Geophysics (2000-2003)

PUBLICATIONS:
Over 165 publications in peer-reviewed journals Publications related to the proposal:
Huba, J.D., G. Joyce, and J.A. Fedder, SAMI2 (Sami2 is Another Model of the Ionosphere):A new low-latitude ionosphere model J. Geophys. Res., 105, 23,035, 2000.
Huba, J.D. and G. Joyce, Global modeling of equatorial plasma bubbles, Geophys. Res. Lett. 37, L17104, doi:10.1029/2010GL044281, 2010.
Huba, J.D., G. Joyce, and J. Krall, Three-dimensional equatorial spread F modeling, Geophys. Res. Lett. 35, L10102, doi:10.1029/2008GL033509, 2008.
Huba, J.D., G. Joyce, J. Krall, and J. Fedder, Ion and electron temperature evolution during equatorial spread F, Geophys. Res. Lett. 36, L15102, doi:10.1029/2009GL038872, 2009.

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Murmansk State Technical University
Sportivnaya St., 13, 183010, Murmansk, Murmansk Region, RUSSIA
Fax +78152232492
E-mail: namgaladze@yandex.ru

AREAS OF EXPERTISE: Plasma Physics, Physics and mathematical modeling of the ionospheric disturbances, Ionospheric irregularities

EDUCATION

DSc, Physics, S-Petersburg State University, Russia, 1981
PhD, Physics, S-Petersburg State University, Russia, 1970
M.Sc, Physics,S-Petersburg State University, S-Petersburg, Russia, 1966

SUMMARY

Dr. Namgaladze team developed the global self-consistent model of the ionosphere-thermosphere-protonosphere system (GSM TIP), combining the model of the lower and upper ionosphere with the global 3D thermosphere model and with electric potential equation (1988). At this time, the GSM TIP was the only global model in the world including ionosphere, plasmasphere, outer polar ionosphere, thermosphere and electrodynamics in the height range from 80 km over the Earth surface to 15Re of geocentric distance.
In parallel with this work A. Namgaladze wrote and published (together with his teacher Prof.B.E. Brunelli) the monograph "Physics of the Ionosphere" (M. Nauka,1988).
In 1989 A. Namgaladze moved from Kaliningrad to Murmansk, to take up work as Vice-Director of the Polar Geophysical Institute of the Russian Academy of Sciences and then (since 1993) as Head of Physics Department of the Murmansk State Technical University. Later (2003) he became Deputy Provost of the university.

SELECTED PUBLICATIONS

Namgaladze A.N., O.V. Evstafiev, B.Z. Khudukon and A.A. Namgaladze, Model interpretation of the ionospheric F-region electron density structures observed by ground-based satellite tomography at sub-auroral and auroral latitudes in Russia in January-May 1999, Annales Geophysicae,21, 4, 1005-1016, 2003.
Namgaladze A.A., Yu.V.Zubova, A.N. Namgaladze, O.V.Martynenko, E.N.Doronina, L.P.Goncharenko, A. Van Eyken, V. Howells, J. P. Thayer, V. I. Taran, B. Shpynev, Q. Zhou. Modelling of the ionosphere/thermosphere behaviour during the April 2002 magnetic storms: A comparison of the UAM results with the ISR and NRLMSISE-00 data. Advances in Space Research, doi:10.1016/j.asr.2005.04.013, v.37, Issue 2, p.380-391, 2006.
Korableva I. V., A.A. Namgaladze, and A.N. Namgaladze. High_Latitude Ionosphere during Magnetic Storms of October 26, 2003–November 1, 2003: Tomographic Reconstructions and Numerical Modeling.Geomagnetism and Aeronomy, v.48, No. 5, p.642–651, 2008.
Namgaladze A. A., M.V. Klimenko, V.V. Klimenko and I.E. Zakharenkova. Physical Mechanism and Mathematical Modeling of Earthquake Ionospheric Precursors Registered in Total Electron Content. Geomagnetism and Aeronomy, 2009, v.49, No. 2, p. 252–262, 2009.
Namgaladze A.A., O.V. Martynenko and M.G. Botova. The influence of ionic temperature on plasmasphere structure formation. Russian Journal of Physical Chemistry B,v.5, No.3, p. 363-368, 2011
Namgaladze A.A., M. Förster, B.E. Prokhorov, O.V. Zolotov. Electromagnetic drivers in the upper atmosphere: observations and modeling.The Atmosphere and Ionosphere. Elementary Processes, Discharges and Plasmoids.Bychkov, Vladimir; Golubkov, Gennady; Nikitin, Anatoly (Eds.), Springer, 284 p., 2012

ALEXANDER BAKLANOV
Research Department, Danish Meteorological Institute, Lyngbyvej 100, DK-2100 Copenhagen Ø, Denmark
Phone: +45 50876306; Fax: +45 39157460, E-mail: alb@dmi.dk; http://dmi.dk

AREAS OF EXPERTISE: Boundary layer meteorological processes; Atmospheric long-range transport and aerosol dynamics modelling; Environmental modelling, impact and risk

EDUCATION

D Sc. Meteorology and Climatology, Hydro meteorological University, St.-Petersburg, Russia, 1998
Ph D. Physics, Computing Centre, Russian Academy of Sciences, Novosibirsk, Russia, 1983
M.Sc. Physics, Novosibirsk State University, Russia, 1979

EXPERIENCE

1/11-present	Adjoin professor at the Neil's Bohr Institute of the University of Copenhagen, Denmark
01/07-07/12	Deputy-director of Danish Centre for Energy, Environment and Health (CEEH), Denmark
08/98-present	Senior scientist at Danish Meteorological Institute, Research Department, Denmark
01/94-07/98	Visiting scholar, University of Umeå, Umeå, Sweden
06/95-03/96	Research scholar at International Institute for Applied Systems Analysis, Austria.
01/89-01/94	Head of Department, Environmental Institute, Academy of Sciences, Apatite, Russia

HONORS AND AWARDS

- 7FP EC project 'MEGAPOLI: Megacities: Emissions, urban, regional and Global Atmospheric POLlution and climate effects, and Integrated tools for assessment and mitigation' (2008-2011), 'MACC: Monitoring Atmospheric Composition and Climate' (2009-2011), 'PEGASOS: Pan-European Gas-AeroSol-climate interaction Study' (2010-2014), 'PBL-PMES: Atmospheric Planetary Boundary Layers: Physics, Modelling and Role in Earth System' (2008-2013), 'TRANSPHORM: Transport related Air Pollution and Health impacts' (2010-2014);
- Member of WMO Scientific Advisory Group for GURME: GAW Urban Research Meteorology and Environment (since 2008); International Commission for Polar Meteorology (since 2003);
- Member of the Eurasian Academy of Sciences (since 2012);
- Member of proposal evaluation panels of EC DG Research FPs, NSF, NASA;
- Member of EC DG Research &Environment Group and co-author of EU Air Policy Review.

SELECTED PUBLICATIONS

More than 400 scientific publications, H-index - 22, i10-index is 72, and 2106 citations

Baklanov, A. and B. Grisogono (Eds.), 2007: *Atmospheric Boundary Layers: Nature, Theory and Application to Environmental Modelling and Security*. Springer, 248 p., ISBN: 978-0-387-74318-9

Baklanov A., U. Korsholm, A. Mahura, C. Petersen, A. Gross, 2008: ENVIRO-HIRLAM: on-line coupled modelling of urban meteorology and air pollution. *Advances in Science and Research*, 2, 41-46.

Baklanov A, J.H. Sørensen, A. Mahura, 2007: Methodology for Probabilistic Atmospheric Studies using Long-Term Dispersion Modelling. *Environ. Model. Assess*., DOI 10.1007/s10666-007-9124-4

Baklanov, A., P. Mestayer, A. Clappier, S. Zilitinkevich, S. Joffre, A. Mahura, N.W. Nielsen, 2008: Towards improving the simulation of meteorological fields in urban areas through updated/advanced surface fluxes description. *Atmospheric Chemistry and Physics*, 8, 523-543.

Baklanov, A., S. Grimmond, A. Mahura, M. Athanassiadou, 2009: *Meteorological and Air Quality Models for Urban Areas*. Springer, 2009, 184 p.

Baklanov A., B. Grisogono, R. Bornstein, L. Mahrt, S. Zilitinkevich, P. Taylor, S.E. Larsen, M.W. Rotach, H. J. S. Fernando (2011): The Nature, Theory, and Modeling of Atmospheric Planetary Boundary Layers. *Bull. Amer. Meteor. Soc*., 92, 123–128. doi: 10.1175/2010BAMS2797.1

Grell, G. and A. Baklanov (2011): Integrated Modeling for Forecasting Weather and Air Quality: A Call for Fully Coupled Approaches. *Atmospheric Environment*, doi:10.1016/j.atmosenv.2011.01.017.

Zilitinkevich, S.S., I. Mammarella, A.A. Baklanov, and S.M. Joffre, 2008: The effect of stratification on the roughness length and displacement height. *Boundary-Layer Meteorology*. 129: 179-190.

ANDRZEJ KRANKOWSKI
Faculty of Geodesy and Land Management, Department of Astronomy and Geodynamics, University of Warmia &Mazury, Oczapowski St 1, 10-957 Olsztyn, POLAND
Tel: +48 89 5233279; Email kand@uwm.edu.pl

AREAS OF EXPERTISE: GPS geodetic control networks, GPS precise data processing, and precise ionosphere modeling based on GNSS data

SUMMARY
Prof. Andrzej Krankowski has an extensive research experience in classical and GPS geodetic control networks, GPS precise data processing in the frame of IGS and EPN services, and precise ionosphere modeling based on GNSS data. During his research he especially developed new algorithms for precise modeling and forecasting of disturbed ionosphere. Currently, his algorithms provide high spatial (150 – 200 km) and temporal (5 min.) resolution of TEC maps (especially over Europe). This high spatial and temporal resolution represents all local and regional features of TEC distribution and can be used for detecting ionospheric features associated with geomagnetic storms, solar flares, solar eclipses and seismic events. Prof. Andrzej Krankowski also developed several algorithms for long- and short-term precise TEC forecasting using autocovariance, autoregresion moving average – ARMA and artificial networks methods.

ACADEMIC DEGREES
Habilitation 2007 , University of Warmia and Mazury in Olsztyn, Faculty of Geodesy and Land Management. "*Modelling and foreacasting of disturbed ionosphere for precise GNSS positioning*"
Ph.D. 2000 , University of Warmia and Mazury in Olsztyn, Faculty of Geodesy and Land Management. Advisor: Prof. Lubomir W. Baran. Research topic: "*Analyses of positioning accuracy obtained using IGS GPS permanent observations*"
M.Sc. 1995 , University of Warmia and Mazury in Olsztyn, Faculty of Geodesy and Land Management. Advisor: Prof. Lubomir W. Baran. Research topic: "*GPS baseline processing using Bernese software in the frame of International GPS Service for Geodynamic* "

ACADEMIC APPOINTMENTS
2007 – present Associate Professor at the University of Warmia and Mazury in Olsztyn, Faculty of Geodesy and Land Management.
2000 – 2007 Assistant Professor at the University of Warmia and Mazury in Olsztyn, Faculty of Geodesy and Land Management.
1995 – 2000 Lecturer and Researcher at the University of Warmia and Mazury in Olsztyn, Faculty of Geodesy and Land Management

PUBLICATIONS
Krankowski A., Shagimuratov I.I., Zakharenkova I.E., 2006, Response of the ionosphere to the Baltic Sea earthquake of 21 September 2004, Acta Geophysica, Springer, Vol. 54, No.1, 90-101.
Zakharenkova I.E., Krankowski A., Shagimuratov I.I., 2006, *Modification of the low-latitude ionosphere before the 26 December 2004 Indonesian earthquake*, Nat. Hazards Earth Syst. Sci.,6, pp. 817-823.
Krankowski A., Shagimuratov I.I., Baran L.W., Yakimova G.A., 2007, *The structure of the mid- and high-latitude ionosphere during the November 2004 storm event obtained from GPS observations*, Acta Geophysica, Vol. 55, No.4, pp. 490-508, doi. 10.2478/s11600-007-0

KATSUMI HATTORI
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Tel +81-43-290-2801, Fax +81-43-290-2859, hattori@earth.s.chiba-u.ac.jp

AREAS OF EXPERTISE: GPS Geosciences Applications, Signal Processing and Image Processing, Ground electromagnetic observation

PROFESSIONAL EXPERIENCE

Mar. 1992 – Received Ph. D. in Electrical Engineering from Nagoya University
1992-1995 – Research Associate, Faculty of Engineering, Toyama Prefectural University
1995-1997 – Lecturer at Department, Gunma National College of Technology
1997-1998 – Researcher, International Frontier Research Program on Earthquakes
1998-2000 – Team Leader, International Frontier Research Program on
2001-2006 – Associate Professor of Marine Biosystems Research Center, Chiba University
2006-2007 – Associate Professor, Faculty of Science, Chiba University
July 2009 – present – Professor of Earth Sciences, Graduate School of Science, Chiba University

FIELD OF SCIENTIFIC DEVELOPMENTS

1987-1992 – Study on wave-particle interaction in the magnetosphere using satellite data
1992-1997Study on Signal Processing and Image Processing: Tomography, mono-camera view
1992 - Present Study on Signal Processing :Estimation of direction of wave arrival,
1997-Present- Study of seismo-electromagnetic observation in Kanto-Tokai region
2001-Present Study on magnetotelluric measurements

HONORS & RECOGNITIONS

Young Scientist Award of International Union of Radio Science, 1996
Award of Society of Atmospheric Electricity of Japan, 2005.

SELECTED PUBLICATIONS

Liu, J. Y., Chen, Y. I., C. H. Chen, Liu, C. Y., Chen, C. Y., Nishihashi, M., Li, J. Z., Xia, Y. Q.,Oyama, K. I., Hattori, K., and Lin, C. H., Seismo-ionospheric Anomalies Observed before the12 May 2008 Mw7.9 Wenchuan Earthquake, J. Geophys. Res., doi:10.1029 /2008JA013698,2009.

Nishihashi, M., Hattori, K., Jhuang, H. K., and Liu, J. Y., Spatial distribution of ionospheric GPS-TEC and NmF2 anomalies during the 1999 Chi-Chi and Chia-Yi Earthquakes in Taiwan, Terrestrial, Atmospheric and Oceanic Sciences, 20, 779-789, 2009.

Mezentsev, A. Y., Hayakawa, M., and Hattori, K., Fractal ULF signature related to seismic process, Journal of Atmospheric Electricity, 29, 81-93, 2009

Hayakawa, M., Hattori, K., and Ohta, K., Observation of ULF geomagnetic variations and detection of ULF emissions associated with earthquakes: Review, Electrical Engineering in Japan, 162, 1-8, 2008.

Hayakawa, M., Hattori, K., and Ohta, K., Monitoring of ULF (ultra-low-frequency) geomagnetic variations associated with earthquake, Sensors Journal, 7, 1108-1122, 2007

JANN-YENQ LIU
National Central University, Institute of space science, National Central University
Address: No.300, Jhongda Rd., Jhongli City, Taoyuan County 32001, TAIWAN
E-mail:jyliu@jupiter.ss.ncu.edu.tw

AREAS OF EXPERTISE: Ionospheric Pulsation; Ionospheric Radio; GPS Geosciences Applications Lithosphere-Atmosphere-Ionosphere Coupling

EDUCATION

Period	Degree	Field	School	Country
1976-1980	BS	Atmospheric Physics	National Central U.	TAIWAN
1983-1988	MS	Physics	Utah State U.	USA
1988-1990	PhD	Physics	Utah State U.	USA

PROFESSIONAL BACKGROUND

1997/8-Present Professor, National Central University
2011/1-Present Chief Scientist, National Space Organization
2011/1-2011/12 Director, Earth Science Research Promotion Center
2009/7-2010/7 Visiting Scholar, NCAR/HAO
2008/4-2009/5 Director, GPS Scientific Application Center, NCU/NSPO
2002/8-2005/7 Director, Institute of space science, National Central Univ.
2001/6-2001/9 Visiting Professor, RASC, Kyoto University
2001/2-2001/5 Visiting Professor, Academia Sinica
1994/8-1995/2 Visiting Scientist, EISCAT
1990/8-1997/7 Associate Professor, National Central University
1988-1990 Research/Teaching Assistant, CASS/Phys. Dept., USU
1985-1986 Research Assistant, NASA, Marshall Space Flight Center
1983-1985 Research/Teaching Assistant, CASS/Phys. Dept., USU

ACADEMIC AWARDS OR HONORS

USU Presidential Fellowship (1989-1990)
2006 Outstanding Research, National Science Council of Taiwan
Special professor of National Central University 2006-2009, 2010-2012

ACADEMIC SERVICE

COSPAR-Taiwan President: 2008/1-present
EMSEV- Bureau/IAGA Liaison: 2007-present
CGU Executive Committee: 2008-present
NSPO Consultative Committee: 2008-present
NSC Consultative Committee: 2009-present
AOGS STI (Solar Terr. Ionosphere) secretary: 2003/7~2005/6
URSI (International union of Radio Science) –SRS secretary: 2002~2004

SELECTED PUBLICATIONS

Liu, J. Y., Y. J. Chuo, S. J. Shan, Y. B. Tsai, Y. I. Chen, S. A. Pulinets, and S. B. Yu, Pre- earthquake ionospheric anomalies registered by continuous GPS TEC measurement, Annales Geophysicae, 1585-1593, 2004. (SCI)

Liu, J. Y.,* Y. I. Chen, C. H. Chen, C. Y. Liu, C. Y. Chen, M. Nishihashi, J. Z. Li, Y. Q. Xia, K. I. Oyama, K. Hattori, and C. H. Lin, Seismo-ionospheric GPS total electron content anomalies observed before the 12 May 2008 Mw7.9 Wenchuan earthquake, Journal of Geophysical Research, 114, A04320, doi:10.1029/2008JA013698, 2009. (SCI)

Liu, J. Y.,* C. H. Chen, Y. I. Chen, W. H. Yang, K. I. Oyama, K. W. Kuo, A statistical study of ionospheric earthquake precursors monitored by using equatorial ionization anomaly of GPS TEC in Taiwan during 2001-2007, Journal of Asian Earth Sciences, 39, 76-80, 2010. (IF:1.790)

VALERIO TRAMUTOLI
Department of Engineering and Physics of The Environment (DIFA)
University of Basilicata ,Via dell'Ateneo Lucano, 10, 85100 – Potenza, ITALY
tel/fax: +39-0971-205205; e-mail: valerio.tramutoli@unibas.it

AREAS OF EXPERTISE: Satellite observations; Remote sensing; Natural, environmental and technological hazards monitoring and mitigation.

Born 28/12/57, Degree in Physics at the Rome "La Sapienza" University. Since 1990 he is at the Department of Engineering and Physics of the Environment (DIFA), today School of Engineering (SI), at University of Basilicata as senior researcher (since 1993) holding (since 1997) courses of Satellite Remote Sensing at the Faculties of Sciences and of Engineering. Since 1991 he has been visiting scientist in the main international centres involved in the Earth's observation by satellite taking part in several international projects and initiatives of the main space agencies like ESA, NASA, NASDA and ASI. He as been the national coordinator of the SEISMASS (Seismic Area Monitoring by Advanced Satellite Systems) Project funded by the Italian Space Agency (ASI). He has been PI, or responsible of DIFA participation, to several international projects funded by NATO and by EC in the framework of the Science for Peace, FP6-IST, FP6-INTAS, FP6+FP7 GMES initiatives. In particular between 2008 and 2009 he has been responsible of the italian participation to the STREGEOS "Stress related geohazards in South Caucasus" project funded by EC in the framework of INTAS Programme. Since 2010 he is the coordinator of the European project PRE-EARTHQUAKES (Processing Russian and European EARTH observations for earthQUAKE precursors Studies, www.pre-earthquakes.org) funded by EC in the framework of the FP7-GMES-Space Program and, since 2012, PI for the participation of University of Basilicata to the first Italian Project (funded by the National Department of Civil Protection) on Short-term Earthquakes Prediction (https://sites.google.com/site/ingvdpc2012progettos3/). His research activity has been focused on the development of new satellite sensors and techniques for natural, environmental and technological hazards monitoring and mitigation. In this context he proposed the original RAT (now RST) change detection approach successfully used in a large spectrum of applications. He has been among the few scientists invited to partecipate, since 2001, to the IGOS-Geohazard Core Team instructed (by the most important space agencies, CEOS, FAO, UNESCO, ICSU, etc.) to define the new observational strategies for geo-hazards mitigation for the next decade. He act as referee for the most important journals in the field and as project evaluator for several funding agencies at European and extra-European level. Since 2009 he is member of the Editorial Board of the Geomatics, Natural Hazards and Risk international journal He is author or co-author of more than 130 papers published on international journals, scientific books and international conference proceedings. He has been chair, co-chair, organizer or invited speaker in the most important international conference (EGU, AGU, IUGG). Since 2007 he is permanent member of IUGG-Inter Association Working Group on Electromagnetic Studies of Earthquakes and Volcanoes (EMSEV). His paper on Tectonophysics has been one of the "Top-50 most cited" in January 2006 – February 2011 period.

Main Publications relevant to the proposal (http://www.researcherid.com/rid/E-6706-2011)

V. Tramutoli, C. Aliano, R. Corrado, C. Filizzola, N. Genzano, M. Lisi, G. Martinelli, N. Pergola. On the possible origin of Thermal Infrared Radiation (TIR) anomalies in earthquake-prone areas observed using Robust Satellite Techniques (RST). *Chemical Geology*, vol. 339, *157-168*

Bonfanti P., Genzano N., Heinicke J., Italiano F., Martinelli G., Pergola N., Telesca L., Tramutoli V. Evidences of CO2-gas emission variations in Central Apennines (Italy) during the L'Aquila seismic sequence (March-April 2009). *BGTA*, vol. 53, p. 147-168, 2012.

M. Lisi, C. Filizzola, N. Genzano, T. Lacava, F. Marchese, G. Mazzeo, N. Pergola, V. Tramutoli. A study on the Abruzzo April 6th 2009 earthquake by applying the RST approach to 15 years of AVHRR TIR observations. *Natural Hazards and Earth System Sciences*. vol.10, pp.395-406, 201

N. Pergola, C. Aliano, I. Coviello, C. Filizzola, N. Genzano, T. Lacava, M. Lisi, G. Mazzeo, V. Tramutoli. Using RST approach and EOS-MODIS radiances for monitoring seismically active regions: a study on the April 6th 2009 Abruzzo earthquake. Natural *Hazards and Earth System Sciences* ,vol. 10, pp. 239–249, 2010

N. Genzano, C. Aliano, R. Corrado, C. Filizzola, M. Lisi, G. Mazzeo, R. Paciello, N. Pergola, V. Tramutoli. RST analysis of MSG-SEVIRI TIR radiances at the time of the Abruzzo April 6th 2009 earthquake. *Natural Hazards and Earth System Sciences* - vol. 9, pp. 2073-2084, 2009.

Aliano, C., Corrado, C., Filizzola, C., Genzano, N., Pergola, N., Tramutoli, V., TIR Satellite Techniques for monitoring Earthquake active regions: limits, main achievements and perspectives, Annals of Geophysics, 50 (1), 303-317, 2008.

Aliano, C., Corrado, C., Filizzola, C., Genzano, N., Pergola, N., Tramutoli, V., (2008). Robust Satellite Techniques (RST) for the study of Umbria-Marche October 1997 earthquakes, Annals of Geophysics, 51 (2/3), 451-459.

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AREAS OF EXPERTISE: Earth Observation Satellite Systems; Space technology for Environmental and technological monitoring, Ionospheric irregularities

EXPERIENCE

2010 – Present, Director General, Research Institute of Electro Mechanic (NIIEM), Russia
Activity: Design and manufacturing of S/V, remote sensing
2005 – 2010 Deputy Director, Russia Institute of Electro Mechanic (VNIIEM), Russia
Activity: Design and manufacturing of meteorological S/V, remote sensing
2000 – 2005 Deputy Director, IZMIRAN, Troitsk, Moscow Region, Russia
Activity: Ionosphere research, prediction of earthquakes, remote sensing
1983 – 2000 Scientist, Russian Academy of Sciences, General Physics Institute, Moscow

EDUCATION

D.Sc., Physics, Russian Academy of Sci, General Physics Institute, Moscow, Russia, 1998
Ph.D., Physics, Russian Academy of Sci, General Physics Institute, Moscow, Russia, 1987
M.Sc, Physics, S-Petersburg State Universit, S-Petersburg, Russia

HONORS AND AWARDS

1999 - Gratitude the Russian Academy of Sciences, Russian Academy of Sciences
2001 – 2003: Grant in the field of natural sciences, Russian Science Support Foundation
2003 – Elected as a Fellow of the Institute of Physics, The Institute of Physics
2008 – Awarded for "International cooperation in astronautics», Federal Space Agency
2008 – The correspondent member, Russian Academy of Electrotechnical Sciences
2010 – Full member, Russian Academy of Electrotechnical Sciences

SELECTED PUBLICATIONS

Pulinets S.A., Boyarchuk K.A., Hegai V.V., and A.V. Karelin Conception and model of seismo-ionosphere-magnetosphere coupling, - Seismo Electromagnetics (Lithosphere-Atmosphere-Ionosphere Coupling), Eds. M. Hayakawa and O.A. Molchanov, TERRAPUB, Tokyo, 2002, pp. 353 – 361.
Pulinets S. A., Boyarchuk K. A. Ionospheric Precursors of Earthquakes, Springer Verlag Publ., Berlin 2004, 360p. ISBN 3-540-20839-9
Boyarchuk K.A., Karelin A.V., Shirokov R.V. The Base Model of Kinetics of the Ionized Atmosphere, VNIIEM Publ., Moscow, 2006, 203p. ISBN 5-903194-01-X
Boyarchuk K.A., Lomonosov A.M., Pulinets S.A., Hegai V.V., Variability of the Earth's Atmospheric Electric field and Ion-Aerosol Kinetics in the Troposphere, Studia Geophysica et Geodaetica, 42, 1998, pp.197-206
Boyarchuk K.A., Lomonosov A.M., Pulinets S.A., Hegai V.V., Impact of Radioactive Contamination on Electric characteristics of the atmosphere. New Remote Monitoring Technique, Physics/Supplement Physics of Vibrations, 61, No.4, 1997, pp.260-266
Boyarchuk K.A., Lomonosov A.M., Pulinets S.A., Electrode Effect as an Earthquake Precursor, BRAS Physics/Supplement Physics of Vibrations, 61, No.3, 1997, pp.175-179

MICHEL PARROT
LPCE/CNRS, 3A Avenue de la Recherche, ORLEANS, 45100, FRANCE
mparrot@cnrs-orleans.fr

AREAS OF EXPERTISE: Ionospheric and magnetosphere observations; Ionospheric perturbations in relation with the seismic activity

Dr. Michel Parrot was born in Chateauroux, France, on February 7, 1948. He received his 3rd cycle thesis in the University of Orleans, France, in 1975. Since this date, he has been employed in LPC2E/INSU/CNRS where he is a research scientist. His work is essentially related to the analysis of natural and artificial signals observed in a frequency range from a few Hz up to 1 MHz by magnetospheric satellites. Concerning the emissions coming from the surface of the planets, he studied the effects of the waves emitted by the anthropogenic activities in the terrestrial ionosphere and the dust electrification in the Martian atmosphere. He participated in the definition and the data processing of many experiments on-board satellites (GEOS 1 and 2, ARCAD-3, INTERBOL, CLUSTER, and MARS96). Until the end of the mission in December 2010, he was the principal investigator of the DEMETER micro-satellite, which was dedicated to the study of ionospheric perturbations in relation with the seismic activity (launched in 2004). He is author and co-author of 210 papers published in journal with referees.

Main Publications relevant to the proposal:

F. Li, and M. Parrot, Total Electron Content variations observed by a DORIS station during the Sumatra earthquake, Journal of Geodesy, doi 10.1007/s00190-006-0053-9, 2006.

Nemec, F., O. Santolik, M. Parrot, and J. J. Berthelier (2008), Spacecraft observations of electromagnetic perturbations connected with seismic activity, Geophys. Res. Lett., 35, L05109, doi:10.1029/2007GL032517.

Němec, F., O. Santolík, and M. Parrot (2009), Decrease of intensity of ELF/VLF waves observed in the upper ionosphere close to earthquakes: A statistical study, J. Geophys. Res., 114, A04303, doi:10.1029/2008JA013972.

M. Parrot, Anomalous seismic phenomena: View from space in Electromagnetic Phenomena Associated with Earthquakes, Ed. by M. Hayakawa, Transworld Research Network, 205-233, 2009.

Akhoondzadeh, M., Parrot, M., and Saradjian, M. R.: Electron and ion density variations before strong earthquakes (M>6.0) using DEMETER and GPS data, Nat. Hazards Earth Syst. Sci., 10, 7-18, 2010.

Akhoondzadeh, M., Parrot, M., and Saradjian, M. R.: Investigation of VLF and HF waves showing seismo-ionospheric anomalies induced by the 29 September 2009 Samoa earthquake (M_w=8.1), Nat. Hazards Earth Syst. Sci., 10, 1061-1067, doi:10.5194/nhess-10-1061-2010, 2010.

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