

2005 Annual Report of Inter-Association (IAGA/IASPEI/IAVCEI) Working Group of Electromagnetic Studies on Earthquakes and Volcanoes (EMSEV)

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1) Introduction

EMSEV has been very active throughout 2005. The activity up to November, 2005 is detailed in the attached minutes of two meetings held in Toulouse, July and Mexico, November (Referred to as “The Minutes I & II”).

2) Membership

Regular 35 EMSEV members ([list attached](http://www.emsev-iugg.org/emsev/)) and well over 200 corresponding members are enlisted in EMSEV mailing “<http://www.emsev-iugg.org/emsev/>”

3) Activity in 2005

3-1) Inter-Association Initiative activity: Volcano Taal investigation

As a part of EMSEV’s 4-year project of Inter-association Initiative, field campaigns for magnetic, self-potential, degassing and temperature measurements

were conducted on Volcano Taal near Manila, with cooperation of PHIVOLCS.

Four EMSEV scientists (J. Zlotnicki, Y. Sasai, M. Harada and H. Hase) and 11

PHIVOLCS colleagues participated to the project. The campaigns were in Jan. 6-

16, Feb. 15-24 and Nov. 8-18, 2005, as it was found that the features are showing

intense and rapid time variations that may be extremely important.

Results of the first two campaigns have promptly been published in Proc. Japan Academy, vol. 81(B), 261-266, 2005, whereas the report of the third, including installation of continuous recording station, is attached (“Taal Report”).

The field work was made possible by the support from IUGG and Associations (\$3,100 from 2004 budget for January campaign) and, (\$1,000 IAVCEI, \$700 IAGA, and \$500 IASPEI from 2005 budget for November campaign), some funds from Japanese and French sources, and PHIVOLCS support for its 11 scientists. The campaign was extremely successful and timely in the survey as well as in science/technology transfer, so that PHIVOLCS can now make repeat surveys over the volcano, which is showing signs of renewed volcanic activity after 28 years of quietness. This campaign will continue to be a major EMSEV endeavor for assisting developing countries.

3-2) Istanbul Workshop, Feb. 1-2, 2005 (“The Minutes I”)

International Workshop on “Early Warning Systems For Earthquake Monitoring By Using Space Technology” was held in Kandilli Observatory.

Workshop was organized with active participation of EMSEV members. Together with Turkish scientists 16 foreign scientists participated in the Workshop.

Following an overview (Uyeda), Rundle (USA) presented the progress in earthquake prediction using statistical seismology. The results of satellite EM observation were reported by Bleier (USA, Quakesat) and Parrot (France, DEMETER). The satellite technologies of detecting thermal (infrared) and ionospheric short term precursors were presented by Ouzounov (USA) and Pulinets (Mexico/Russia). Liu (Taiwan) reported about the integrated Search for Taiwan Earthquake Precursors (iSTEP) project. The series of presentations was finished by the proposal made by Pulinets of the satellite constellation for the global monitoring of short-term earthquake precursors.

3-3) IWSE (International Workshop for Seismo-Electromagnetics) in Chofu, Japan, March 15-17, 2005 (“The Minutes I”)

Workshop was organized by Hayakawa. About 200, including 90 foreign participants from 15 countries attended. Two special issues including the presented papers are under way; (1) Special Issue in Physics and Chemistry of the Earth and (2) Special Issue in Trans. Institute of Electrical Engineers of Japan.

3-4) First DEMETER Guest Investigator Workshop, Paris, France, May 2-4, 2005.

Seventy scientists from the 24 CNES guest teams attended. Overall, DEMETER satellite is in a good condition and improving stability and data performance.

Current altitude is 710km, which will be lowered to around 600km in 2006. Parrot presented the first results of pre-earthquake EM signals for seven earthquakes in Asia, as will be published in special issue of Planetary and Space Science. First Science Conference of DEMETER mission will be held in Paris, June 2006.

3-5) IAGA General Assembly, Toulouse, France: July 18-29.

There were several EMSEV related symposia, two of which were convened by EMSEV members, i. e. GAIO1 Monitoring earthquakes and volcanic activity by magnetic, electric and electromagnetic methods. (Convenors : Zlotnicki, Johnston, Sasai), and GAIO2 EM imaging of volcanoes and active faults (Conveners: M. Ingham, Y. Ogawa).

An EMSEV Business Meeting was held there ("The Minutes I"). To assist participants \$ 1,300 from IAGA was used.

3-6) International Workshop "Frontiers of Seismo-Volcano Electromagnetics", Puerto Vallarta ,Mexico: November 3-4, 2005 ("The Minutes II").

Pulinets organized this meeting as a part of the Annual Meeting of the Mexican Geophysical Union (UGM) and other Mexican societies. Workshop sessions included 30-science presentations from 10 countries. The Workshop was organized in four sessions:

EM theory, Processing and methodology I&II

EM Monitoring I&II,

EM Satellite and remote sensing I&II

Posters

The Workshop provided an excellent opportunity to establish close contacts with Mexican colleagues. EMSEV Business Meeting was held on Nov 4, 2005 ("The Minutes II"). \$1,200 from IUGG was used for assisting participation and \$500 from IASPEI for LOC expenses.

3-7) AGU Fall Meeting, December 8-9, 2005, San Francisco.

Two sessions: T43E(8 Oral presentations) & T51B(17 Posters) , entitled "Progress in Understanding Electromagnetic Phenomena Related to Earthquakes (I & ID)" were convened by EMSEV members (Ouzounov, Pulinets, Parrot, & Uyeda).

4) Financial Report 2005 ("The Minutes I")

In the year 2005, EMSEV was allocated a total of \$ 6,000 from IUGG and Associations. This was considerably less than \$10,200 of the year 2004, due largely to suspension of the IUGG "Inter-association initiative" funds and to our too late submission of support requests.

Break –up and usage are:

- a) \$ 2,000 from **IUGG** for general activity.

This was budgeted for the EMSEV Annual Workshop and Meeting in Mexico.

Actually, \$1,200 was spent for partial travel support of two participants; D. Stanica and J. Izutsu. Left-over: \$800

b) \$2,000 from **IAGA**.

Budgeted for EMSEV activity (GAI01 session) at IAGA GA in Toulouse, France. Actually, only \$1,300 was spent for participation of Marina Devidze and Tuncer Sengor.

The remaining \$700 allocated to a Philippine scientist was not used due to his cancellation. It was used for the Volcano Taal project in November 2005.

c) \$ 1,000 from **IASPEI**.

This was budgeted for the EMSEV Annual Workshop and Meeting in Mexico. Actually, only \$500 was used for LOC expenditure. Left-over: \$500 was used for the Volcano Taal project in November 2005.

d) \$ 1,000 from **IAVCEI** was used for the Volcano Taal project in November 2005, as budgeted.

In summary, the 2005 funds spent for the three activities are as follows.

IAGA GA in Toulouse, France: \$ 1,300 from IAGA.

Annual EMSEV WS and Meeting in Mexico:

\$1,200 from IUGG general activity funds and \$500 from IASPEI.

Field campaign on Taal volcano, Philippines:

and \$1,000 from IAVCEI, \$700 from IAGA and \$500 from

IASPEI.

Thus, a total of \$800 is left over for 2006.

5) Activity for 2006-2007 ("The Minutes I & II")

iSTEP (integrated Search for Taiwan Earthquake Precursors), March 6-9, 2006, National Central Univ., Taiwan. (Prof. J-Y Liu)

DEMETER First Science Meeting, June 14-16, 2006, Toulouse, France. (Dr. Michel Parrot)

EMSEV 2006 Workshop and Business Meeting, Nov. 20-22, 2006, Agra, India.
“International Workshop on Electromagnetic Studies related to Earthquakes and Volcanoes”. (Dr. Birbal Singh)

2007, IUGG General Assembly, Perugia, Italy. (Prof. Seiya Uyeda)

Proposed EMSEV Symposia "PROGRESS IN ELECTROMAGNETIC STUDIES ON EARTHQUAKES AND VOLCANOES" consists of four sessions as follows:

Session 1: “VOLCANIC STRUCTURE AND ACTIVITIES”

Convenor: Viacheslav V. Spichak;

Co-convenors: Jacques Zlotnicki, Yoichi. Sasai, Domenico Patella and Ciro Del Negro

Session 2: “ELECTROMAGNETIC FIELDS ASSOCIATED WITH EARTHQUAKES AND ACTIVE FAULTING”

Convenor: Malcolm Johnston;

Co-convenors: Naoto Oshiman, and Antonio.Meloni

Session 3: “CRUSTAL INSTABILITIES AND EARTHQUAKE PRECURSORS”

Convenor: Pier Francesco Biagi;

Co-convenors: Masashi Hayakawa, Jann-Yenq Liu, Toshiyasu. Nagao

Session 4: “SEISMO- ELECTROMAGNETIC STUDIES USING SPACE TECHNOLOGY”

Convenor: Ramesh Singh;

Co-convenors: Sergey Pulnits, Michael Parrot, Dimitar Ouzounov, and Valerio Tramutoli

6) Concluding Remarks

EMSEV has continued to play a major role in promoting international and interdisciplinary research in the physics of pre-, co- and post-event EM phenomena related to earthquakes and volcanic eruptions.

New aspects of the physics and mechanics of fault failure and volcanic activity, particularly the role of fluids, electrical charge generation during fracture and mechanical property changes, are becoming clearer with EM data. Further integration of these data with seismic, geodetic strain and hydrologic data will continue to improve our knowledge of these processes. The EM data provide a new window into seismo/volcanic processes. On active volcanoes,, magnetic and SP-potential measurements have shown clear changes possibly associated with initial intrusions, final explosive eruptions and post-eruptive activity that reflect the physical processes within the volcano. On active faulting, co-seismic magnetic effects are observed that scale with moment/magnitude deduced from source theory.

DC to higher frequency (to 1000 Hz) EM signals before earthquakes have also been actively investigated. In even higher frequency bands (kilohertz to megahertz), pre-seismic transmission anomalies of EM waves have been reported by many radio scientists, indicating disturbances in the atmosphere ionosphere and magnetosphere before earthquakes. Monitoring of these regions with land based ionosondes, total electron concentration (TEC) derived from GPS data, and from

satellites has shown statistically significant results. Even some physical models have been put forward to explain these phenomena, collectively called Lithosphere-Atmosphere-Ionosphere (LAI) coupling. Although the importance of these new aspects of EM phenomena is not fully appreciated by the geophysical community at large yet, we are definitely making significant progress.

Considering that this science covers a wide variety of disciplines beyond conventional branches of geophysics/seismology/volcanology, namely radio science, space physics, and solid state physics, it is of essential importance for further progress to develop thorough mutual understanding among them.