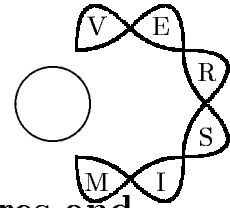


IAGA/URSI  
Joint Working Group on



## VLF/ELF Remote Sensing of Ionospheres and Magnetospheres

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Editor: A J Smith

Newsletter

No. 14 — June 2000

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Dear colleagues,

This seems an appropriate time to send you another *VERSIM Newsletter*, as we are about halfway between the IUGG and URSI General Assemblies, held last year in respectively Birmingham and Toronto, and the IAGA 9th Scientific Assembly to be held next year in Hanoi. Below you will find reports from the former and details of a VERSIM session at the latter. This is the first Newsletter to be distributed entirely electronically. It will be available to be downloaded from the VERSIM website (see below for details). I hope that this works well for everyone.

### IAGA, 2001

The 9th Scientific Assembly of IAGA will be held in Hanoi, Vietnam, 18-30 August 2001. It will be a combined meeting with IASPEI. Contact: IAGA-IASPEI 2001 Secretariat, Institute of Geophysics, Box. 411 Buu Dien Bo Ho, Hanoi, Vietnam; fax: +84 4836 4696; phone: +84 4756 2802; email: [IAGA-IASPEI@fpt.vn](mailto:IAGA-IASPEI@fpt.vn). More details on the website: <http://www.IAGAandIASPEI.org.vn/>

### Whistlers, Particle Precipitation and Low-latitude VLF Phenomena

This joint Division II/II session was proposed and approved at the VERSIM meeting in Birmingham (see report below). It will consist

of a half-day oral session plus posters, and will be convened by A.J. Smith (British Antarctic Survey, UK) and A.R.W. Hughes (Natal University, South Africa). It is on the subject of whistlers (including ion whistlers) in the magnetosphere and ionosphere, their propagation and interaction with particle populations, and the induced effects in the ionosphere, particularly precipitation. Presentations and posters in this field are solicited, and contributions on whistlers and related VLF phenomena on low *L*-shells mapping to the inner magnetosphere and low latitude ionosphere, are especially welcomed. Instructions for submitting abstracts will be published later.

### VERSIM Business meeting

There will be a VERSIM business meeting arranged during the assembly; more details will be provided nearer the time.

### URSI, 2002

The 27th URSI General Assembly will be held in Maastricht, the Netherlands, in August 2002. There will be no specifically VERSIM session, but the following topics have been proposed for symposia at Maastricht, which, together with the Open Sessions, should cover all areas of interest to VERSIM: *Wave and Coherent Structures in Space Plasmas, Plasmaspheric Structure and Phenomena, Spacecraft and Ground Observations of Stimulated and Natural Space-Plasma Waves, Lightning Effects in the Ionosphere and the Radiation*

*Belts, Analysis methods for plasma waves and turbulence.* There will be a VERSIM business meeting arranged during the assembly; more details will be provided nearer the time.

## URSI, Toronto, 1999

The 26th URSI General Assembly was held in Toronto, Canada, 13–21 August 1999.

### Pitch-angle scattering (and acceleration) of trapped particles by waves in magnetospheres

This VERSIM-sponsored session (Session H3) which was a follow-up to the successful “waves and the radiation belts” session at Lille, broadened to include waves other than whistler mode and radiation belts other than Earth’s, was convened by **A.J. Smith**, **J. Lemaire** and **U.S. Inan**. The oral session was held on Friday 20 August 1999, and the posters on Thursday 19 August 1999. The programme is on the web at: <http://www.nerc-bas.ac.uk/public/uasd/versim/h3prog.html>

**U.S. Inan** (Stanford University, USA) began the proceedings with a paper on observations of Trimpi events from the HAIL array of stations in central USA. Bursts of electron precipitation from the radiation belts were detected with increasing time delays at the higher latitude stations, consistent with an interaction with obliquely propagating whistlers. Observations which had previously been explained in terms of electron scattering by ducted whistlers were reinterpreted as being caused by non-ducted signals. **M. Walt** (Stanford University, USA) reviewed the wave scattering of both trapped electrons and trapped protons. The former was well established, though the relative importance of various types of whistler mode waves (whistlers, chorus, plasmaspheric hiss, VLF transmissions) in different  $L$ -ranges, and of ducted vs. non-ducted whistlers was still uncertain, mainly because of the lack of experimental data on wave amplitudes, etc., for use in models. Experimental evidence for the wave scattering of ions was much more sparse.

**C.J. Rodger** (British Antarctic Survey, UK) reported on magnetospheric line radiation, a spectrally structured VLF emission, possibly related to power line radiation, and a potential scatterer of trapped electrons. Occurrence statistics and characteristics of such events, as observed at Halley station were presented. No convincing evidence was found for any connection with power line radiation. A report by **F. Darrouzet** (Institute for Space and Aeronomy, Belgium) and others highlighted the current lack of empirical models and maps of VLF/ELF wave distributions throughout the magnetosphere, analogous to the existing particle models of the radiation belts. Many satellite wave data exist in various places, but there was a need to synthesise this information into a model which would be useable for radiation belt studies. It was proposed that a first step should be identifying and cataloguing of the various data sources.

**J.M. Albert** (Air Force Research Lab., USA) described a theory of cyclotron resonance interactions in the radiation belts using a relativistic Hamiltonian approach with  $1\frac{1}{2}$  degrees of freedom. Adiabatic invariance breaks down at resonance. Returning to the subject of the experimental wave intensity data needed for modelling the wave-particle interactions in the radiation belts, **A.J. Smith** (British Antarctic Survey, UK) reported a statistical study of whistler occurrence and characteristics at Halley station, Antarctica. Subject to some assumptions about the propagation conditions, it was possible to infer average wave intensities of ducted whistlers in the magnetosphere.

**D. Summers** (Memorial University of Newfoundland, Canada) addressed the topic of the enhanced fluxes of relativistic electrons which appear in the magnetosphere during magnetic storms and are sometimes known as “killer electrons” because of the damage they can cause to space engineering systems. He gave a theory of how these fluxes could be accelerated by wave particle interactions, by applying relativistic diffusion theory to a “seed population” of electrons. Finally in the oral session, **Y. Zhang** (University of Saskatchewan, Canada) described a survey of whistler mode waves in geospace, carried out by the GEOTAIL satellite. The waves intensities are well-correlated with plasma densities. In the poster session on 19 August, **A.G. Demekhov** (Institute of

Applied Physics, Russia) reported calculations of the self-consistent modelling of ring current ions, and **D.L. Pasmanik** (of the same institute) presented a model describing localised energetic particle precipitation in the vicinity of high plasma density gradient regions such as the plasmapause.

## The Plasmasphere rediscovered: a tribute to Donald Carpenter

This special workshop, convened by **J. Lemaire** and **L.R.O. Storey** was held in Toronto on Saturday 14 August 1999 in honour of Don Carpenter and his achievements in helping to discover and understand the plasmasphere and plasmapause using whistlers. Don was instrumental in founding the VERSIM group, originally known as the working group on *Passive Electromagnetic Probing of the Magnetosphere*. The report of the workshop by the conveners is to be found on the web at <http://www.magnet.oma.be/ws-h/index.html> and is reproduced below.

“This workshop was held at the University of Toronto, Canada, in connection with the 26th URSI General Assembly. It was co-sponsored by URSI Commissions H and G, by COSPAR, by IAGA, and by the Belgian Institute for Space Aeronomy (IASB), and was attended by many friends and colleagues of **Don Carpenter** (Stanford University) to whom it was dedicated.

**Bob Helliwell** (Stanford University) opened the formal proceedings by reviewing Don’s landmark discovery of the plasmapause and the developments that led up to it. **Bruce Tsurutani** (JPL, Pasadena) explained the nature of magnetospheric whistler waves and how they interact with trapped energetic electrons gyrating and drifting in the geomagnetic field. Then **Brian Fraser** (University of Newcastle, Australia) addressed the question of whether the plasmapause is a preferred source region for electromagnetic ion cyclotron waves in the magnetosphere.

During the 1960s, whistler observations in the Antarctic played an important role in determining the local time dependence and the storm time dynamics of the plasmasphere and of its outer boundary, the plasmapause; these

developments were reviewed by **Andy Smith** and his colleagues **Neil Thompson**, **Mark Clilverd** and **Barbara Jenkins** from the British Antarctic Survey, UK. Then, in turn, **Kozo Hashimoto** et al., **Roger Anderson** et al., and **Don Carpenter** et al. presented their latest findings based on in-situ wave data, respectively from the GEOTAIL, ISEE, CRRES and POLAR missions. Next, **Masato Nakamura** et al. showed the very first EUV image of the terrestrial plasmasphere, from the X-ray/UV scanner on the Japanese spacecraft PLANET-B. This outstanding “first” was a highlight of the workshop; almost half a year before the launch of the IMAGE spacecraft, it anticipated the global views of the plasmasphere that the IMAGE team is expecting to “see”, as **Dennis Gallagher** (MSFC, Huntsville) described in his presentation which closed the morning session.

When the workshop resumed in the afternoon, EFI/POLAR and ALPHA-3/INTERBALL-2 observations of the plasma density near the plasmapause, as well as their variations as a function of local time and UT, were reported by **Harry Laakso** (FMI, Helsinki), and likewise by **Vladlen Bezrukhikh** (IKI, Moscow) who was a co-worker of the late **Konstantin Gringauz**. Plasmaspheric observations at geosynchronous orbit from the LANL MPA instruments were described by **Yi-Jiun Su** from the Los Alamos National Laboratory.

Besides these reports of new experimental results, various theoretical papers were presented, some invited and some contributed. **Iwane Kimura** and his co-investigators described their tomographic methods for the determination of plasmaspheric density profiles by analyzing Omega signals with ray-tracing techniques. Other theoretical matters were discussed by **Jim Horwitz** (University of Alabama, Huntsville) in a review of fluid and kinetic modeling of plasmaspheric processes. **Guru Ganguli** and **Anthony Reynolds** (NRL, Washington D.C.) presented some plasmasphere model calculations with convection included, and compared their new kinetic results with earlier MHD simulations. **Philip Webb** (La Trobe University, Melbourne) outlined a global plasmasphere model. **Philip Richards** and **Hugh Comfort** (University of Alabama, Huntsville) showed their results on modeling the annual variation of the plas-

maspheric electron density. At the end of this first afternoon session, brief oral previews were given of eight contributed poster papers which were on display during the one-hour break that followed.

In the second session of the afternoon, **Viviane Pierrard** and **Joseph Lemaire** (IASB, Brussels) discussed exospheric models of the plasmasphere with unsaturated populations of trapped particles. **Dennis Gallagher** and **George Khazanov** (MSFC, Huntsville) recalled the role of instabilities in the plasmaspheric heating of refilling flux tubes and in the development of spatial structures. **Joseph Lemaire** explained that the corotating plasmasphere is never in barometric/hydrostatic equilibrium, even after a long period of low geomagnetic activity; he pointed out that a protonosphere in hydrostatic/barometric or diffusive equilibrium would be unstable with respect to "pure interchange" and even more so with respect to gravitationally driven quasi-interchange. Then **Andy Smith** chaired a half-hour of lively discussion which concluded the day's proceedings.

The abstracts of the six invited and sixteen contributed papers have been placed on the Web (<http://www.magnet.oma.be/ws-h/index.html>). Most of the papers presented at this meeting, as well as additional solicited or submitted contributions concerning the plasmasphere, will be published in a special issue of the *Journal of Atmospheric and Solar Terrestrial Physics*.

In the evening, a banquet was held in Don's honour, attended by his family, friends and colleagues. Various speeches were made, culminating in a most amusing speech by **Owen Storey** on whistlers, including demonstration of their dispersion and echoing using a "slinky".

## Other sessions at Toronto

Other sessions held in Toronto also contained contributions of interest to the VERSIM group: *Terrestrial Electromagnetic Environment, Electromagnetic coupling including seismic activity between the ground and the upper ionosphere and magnetosphere, Lightning-Ionosphere interaction, Active experiments in-*

*volving space plasmas, Wave-particle interactions: quantitative comparison between observations, theory, simulations and modelling, Theory and simulation of nonlinear kinetic processes in space plasmas, Wave propagation: observation and data analysis*, and a tutorial lecture by L.R.O. Storey on *The Measurement of Wave Distribution Functions*.

## VERSIM Business meeting

There was a meeting of the VERSIM working group during the Toronto Assembly, on Tuesday 17 August 1999.

The following were present: Andy Smith (UK), Michel Parrot (France), Elisabeth Blanc (France), Craig Rodger (UK), Orsolya Ferencz (Hungary), Richard Horne (UK), Steve Cummer (USA), Vikas Sonwalkar (USA), Umran Inan (USA), Ondrej Santolik (Czech Republic), Jyrki Manninen (Finland), Antti Oikarinen (Finland), Tim Bell (USA), Katsumi Hattori (Japan), Yasuhide Hobara (Japan), Hal Strangeways (UK), Joseph Lemaire (Belgium).

Andy Smith took the chair, and after welcoming those present, presented the triennial report of the working group for 1996-99 compiled by Michel Parrot (France), the URSI co-chairman of the group. This report was subsequently published in *The Radio Science Bulletin* No. 290 (September 1999), p. 46.

It was agreed to recommend to the relevant Commissions (G and H) that the VERSIM working group should continue for the next triennium, with Michel Parrot as URSI co-chairman (this was subsequently agreed at the Commission G and H business meetings). Several of those present reported on the latest VERSIM activities and future plans at their institutes or in their countries. Andy Smith passed on a report received from Arthur Hughes (South Africa) who had chaired a business meeting of VERSIM at the recent IUGG Assembly in Birmingham (see below). It had been proposed and agreed that there would be a VERSIM symposium at the next IAGA General Assembly (Hanoi, August 2001) on *Whistlers, particle precipitation and low latitude VLF phenomena*. As regards the next URSI General Assembly in the Netherlands (2002) it was decided not to propose a spe-

cific VERSIM symposium, as there were already many proposed symposia titles which would satisfactorily cover the VERSIM field. Finally Joseph Lemaire put forward a resolution to support a survey of the spatial distributions of VLF and ELF waves in the magnetosphere. The VERSIM group endorsed this and it was subsequently put forward to and agreed by Commission H and the URSI Council. For more details, see below.

## IUGG, Birmingham, 1999

The 22nd General Assembly of the International Union of Geodesy and Geophysics, which encompasses IAGA, was held at the University of Birmingham, UK, 19–30 July 1999.

### VERSIM Business meeting

There was a meeting of the VERSIM working group during the Birmingham Assembly, on Tuesday 20 July 1999. In the absence of the IAGA co-chairman, A.J. Smith, the meeting was chaired by A.R.W. Hughes (South Africa). Here is his report: “Those present: A. Hughes (chair), J. Lemaire, M. Clilverd, C. Rodger, K. Tang.

Agreed: That the WG should continue and that Andy Smith be asked to continue as chairperson. AH indicated that AS was prepared to accept this position. Division 2 Chairperson made an announcement at the beginning of the meeting suggesting that symposia proposed for Hanoi should take into account the possible interests of the local participants. With this in mind it was proposed that VERSIM request a symposium entitled: *Whistlers, particle precipitation and low latitude VLF phenomena*. Andy Smith was proposed as convener of this session. AH said he would take the session proposal to the Business meetings of Divisions 2 and 3. JL announced that the proceedings of the meeting in honour Don Carpenter at URSI would be published in a Special Issue of JAS-TP and that the issue would be open to contributors who did not submit papers to the URSI meeting.

The working group unanimously agreed to support the proposal by J Lemaire and col-

leagues to Commission H of URSI that a model be developed of the wave background in the magnetosphere. JL pointed out that models existed for particles, the ionosphere and the atmosphere but that no models existed for the wave environment and that this was a disadvantage to theoretical studies of the magnetosphere. AH pointed out the need to establish such a model as a base for EM pollution studies of the magnetosphere. JL and colleagues had already made a list of satellites that had recorded wave information. AH said that he had unpublished global maps of the occurrence VLF waves. CR pointed out that the results from the French micro-satellite, Deme-ter would contribute to such a model.

MC reported on the VLF work at BAS and outlined their plans for studying the effects of the solar eclipse on 11 August 1999. AH reported on the Natal programme and outlined the studies on whistler ghosts, requesting that workers keep a look out for ghosts and stressing the value of observations at different latitudes. JL reported on his polar wind studies. KT reported on the work being done in Beijing.

A vote of thanks was passed to Andy Smith acknowledging his excellent contribution to the working group.”

## SEVEM (Survey of ELF and VLF Experiments in the Magnetosphere)

At the VERSIM meeting held during URSI General Assembly in Toronto, a Recommendation was put forward by Joseph Lemaire (Belgium) to support a modelling effort to survey and map the ELF and VLF wave environment in the magnetosphere. The first stage would be to identify and catalogue the many satellite data sets of VLF/ELF waves. The recommendation was subsequently approved by URSI Commission H and the URSI Council. The text is available on the web at <http://www.magnet.oma.be/sevem/URSI-Recommendation.html> and is reproduced below. It was agreed that VERSIM would support the development of comprehensive empirical global 3-D models/maps for the distribution of ELF and VLF waves in the magnetosphere.

## Recommendation

M. Panasyuk     R. Horne

### Survey of the spatial distributions of VLF and ELF waves in the Magnetosphere

Considering:

1. the lack of comprehensive maps of the distribution of VLF and ELF waves in the magnetosphere,
2. the need of this information to evaluate properly the losses of radiation belt particles due to resonant wave particle interactions,
3. the need of this information to evaluate the electromagnetic noise levels in different frequency ranges in designing antennae for future space missions

URSI recommends:

1. that a comprehensive spatial survey of the power spectrum (intensity versus wave frequency), of the polarization and of the propagation directions ( $\mathbf{k}$ -vector) be undertaken in the magnetosphere,
2. that already available data sets from Radio Antennae flown in the Magnetosphere be first identified, catalogued and analyzed in order to build empirical models and maps of the 3-D distribution of these wave parameters in the Radiation Belts and in the whole magnetosphere,
3. that comprehensive maps of the occurrence frequency of special wave emissions (whistlers, chorus, plasmaspheric hiss, etc...) observed in the magnetosphere be produced based on existing and future wave measurements.

List of proposers

V. Baskirov	M. Parrot
M. Clilverd	C. Rodger
F. Darrouzet	A.J. Smith
P. Dcreau	L.R.O. Storey
J.L. Green	K. Tang
M.K. Hudson	B. Tsurutani
R.W. Hughes	M. Walt
U.S. Inan	F. Lefeuvre
J.F. Lemaire	H. Matsumoto

and the VERSIM Community (VLF/ELF Remote Sensing of Ionospheres and Magnetospheres).

### Web site

A web site has been set up at <http://www.magnet.oma.be/sevem/> which presents a comprehensive documented catalogue of missions/satellites that surveyed the electromagnetic VLF and ELF environment in the terrestrial magnetosphere since 1959. The orbital parameters are given for each satellite, as well as contact persons, bibliographical references concerning the experiments and preliminary results. The location where the data are stored is also given. There is a link from the VERSIM home page to the site, which is maintained by Fabien Darrouzet ([Fabien.Darrouzet@bira-iasb.oma.be](mailto:Fabien.Darrouzet@bira-iasb.oma.be)); please send him any comments you may have.

### VLF/LF/MF transmitter now operating at high altitudes near Earth

The IMAGE spacecraft was successfully launched on 25 March 2000. Don Carpenter ([d1c@nova.stanford.edu](mailto:d1c@nova.stanford.edu)) sent the following information about the radio sounder. "A transmitter capable of radio sounding as well as whistler mode wave injection is now operating on the IMAGE satellite in an elliptical polar orbit, with apogee at about 7 Earth radii altitude and perigee about 1000 km. The interest of ground and satellite radio observers is solicited in experiments to determine conditions under which signals from the satellite can be received at ground stations or on satellites of opportunity. The radio sounder, or Radio Plasma Imager (RPI) on IMAGE, for which the principal investigator is Bodo Reinisch of U. Mass. Lowell, is capable of transmitting in the range 3 kHz–3 MHz. Present plans call for conventional radio sounding in free space modes during satellite operations at high altitudes outside the plasmasphere. Within the plasmasphere and at low altitudes over

the Southern Polar Cap it is will be possible to operate so as to excite the whistler mode, using frequencies from 3 kHz to 500 kHz, depending upon satellite position. An initial program would involve transmission of a sequence of 0.5 second pulses at 3, 5, 7, 9, 11, 13, and 15 kHz, at a pulse rate of 1 Hz. These experiments are not yet scheduled, but are expected to begin by July 2000 so as to take advantage of winter conditions in the southern hemisphere ionosphere. Further information when available will be posted on the Web at <http://image.gsfc.nasa.gov>. If you are interested in recording during RPI transmissions, please advise Don Carpenter ([d1c@nova.stanford.edu](mailto:d1c@nova.stanford.edu)) regarding the location of your station(s), so that you may be advised of upcoming schedules by email. For the present, only transmissions in the 3–15 kHz range are envisaged. However, transmissions in the 400–500 kHz range are also under consideration.

## DEMETER

DEMETER is a low altitude micro-satellite (800 km) mainly aimed the study of electromagnetic signals generated by seismic or volcanic events, to be launched in 2002. CNES (the French National Space Agency) will issue a call for Guest Investigators by the end of 2000. Anyone interested should contact Michel Parrot ([mparrot@cnsr-orleans.fr](mailto:mparrot@cnsr-orleans.fr)) who sends the following information about DEMETER:

**Frequency range, *B*:** 10 Hz – 18 kHz

**Frequency range, *E*:** DC – 4 MHz

**Particles: electrons** 30 keV – 10 MeV

**Ionic density:**  $5 \times 10^2 - 5 \times 10^6$  ions/cm<sup>3</sup>

**Ionic temperature:** 1000–5000 K

**Ionic composition:** H<sup>+</sup>, He<sup>+</sup>, O<sup>+</sup>, NO<sup>+</sup>

**Electron density:**  $10^2 - 5 \times 10^6$  cm<sup>-3</sup>

**Electron temperature:** 500–3000 K

The wave experiment will record in:

- BURST MODE

- waveforms of 3 electric components up to 15 Hz,
- waveforms of 6 components of the EM field up to 1 kHz,
- waveforms of 2 components ( $1B + 1E$ ) up to 17 kHz,
- spectra of one electric component up to 3.5 MHz
- waveforms of one electric component up to 3.5 MHz (snapshots).

- SURVEY MODE

- waveforms of 3 electric components up to 15 Hz,
- spectra of 2 components ( $1B + 1E$ ) up to 17 kHz,
- spectra of one electric component up to 3.5 MHz.

## News from the Czech Republic

Pavel Triska ([PTR@ufa.cas.cz](mailto:PTR@ufa.cas.cz)) sends the following report. “Our activities in magnetospheric wave phenomena research continue. At the present time we continue (since May 1998) to record VLF broadband up to 20 kHz the E and B components using the Czech micro-satellite (68 kg) MAGION-5 in RTT regime. This S/C was launched together with INTERBALL-2 on 29 August 1996, perigee 750 km, apogee 19300 km, inclination 65°. We have got many interesting records from the equator plane to the polar magnetosphere, most data belong to the plasmasphere region.”

## VLF summary plots from BAS stations

VLF/ELF

summary plots from British Antarctic Survey at Halley, Antarctica (65°S, 27°W,  $L = 4.3$ ), and the Automatic Geophysical Observatories (AGOs) poleward of Halley, are now available for browsing via the world-wide-web. Go to: <http://www.nerc-bas.ac.uk/public/uasd/data/dataserv.html> and select the link to “VLF summary plots”.

## VERSIM Bibliography

The bibliography on the VERSIM website has been updated to 1999 by Michel Parrot, the URSI co-chairman of the VERSIM working group, who should be contacted at [mparrot@cnrns-orleans.fr](mailto:mparrot@cnrns-orleans.fr) if you have any additions, modifications, or other comments. The web address is:

<http://www.nerc-bas.ac.uk/public/uasd/versim.html#bib>

## History

Some information about the history of the working group is now on the web at: <http://www.nerc-bas.ac.uk/public/uasd/versim/vrsmhist.html>

## VERSIM Electronic Mailing List

An electronic mailing list for the VERSIM Community has been set up so that VERSIM Newsletters can be distributed more quickly, cheaply and conveniently now that nearly everyone is reachable by email. However, it is also free for anyone to use for communicating with the community as a whole on matters of interest. Details about the mailing list (including how to subscribe and unsubscribe) and posting guidelines, are available on the VERSIM website at: <http://www.nerc-bas.ac.uk/public/uasd/versim/vrsmeml.html>. It's your mailing list. Please feel free to use it, but please read the guidelines first. Send any comments to [owner-versim@mail.nerc-bas.ac.uk](mailto:owner-versim@mail.nerc-bas.ac.uk).

## The role of the VERSIM Working Group

The working group serves as a forum for workers studying the behaviour of the magnetosphere and ionosphere by means of ELF and VLF radio waves, both naturally and artificially generated. Originally the emphasis was on probing of the magnetosphere by whistlers, but later the scope became somewhat broader. The group aims to promote

research in this field by facilitating the exchange of ideas, information and experience between active research workers and other interested scientists. This is done through regular meetings at IAGA and URSI Assemblies, and via the circulation of a newsletter. The group has also been active in sponsoring scientific symposia at IAGA and URSI Assemblies, in areas relevant to its field of interest, and in coordinating observational campaigns. There are currently ~100 scientists from 22 different countries (Australia, Austria, Belgium, Brazil, China, Czech Republic, Denmark, Finland, France, Germany, Hungary, India, Japan, New Zealand, Norway, Russia, South Africa, Sweden, Ukraine, UK, USA, and Yugoslavia) on the VERSIM mailing list.

Please send any information of interest to other members of the working group, directly to the electronic mailing list (see above) at [versim@mail.nerc-bas.ac.uk](mailto:versim@mail.nerc-bas.ac.uk). It will be automatically sent on to everyone who is subscribed to the list.

IAGA Co-chairman of the JWG:

A J Smith  
British Antarctic Survey  
High Cross  
Madingley Road  
Cambridge CB3 0ET, UK

Telephone: +44 1223 221544

FAX: +44 1223 221226

Electronic mail:

[A.J.Smith@bas.ac.uk](mailto:A.J.Smith@bas.ac.uk)

URSI Co-chairman of the JWG:

M Parrot  
Laboratoire de Physique et Chimie de l'Environnement, CNRS  
3A, Avenue de la Recherche Scientifique  
45071 Orléans Cédex 02, France

Telephone: +33-2-38255291

FAX: +33-2-38631234

Electronic mail:

[mparrot@cnrns-orleans.fr](mailto:mparrot@cnrns-orleans.fr)

VERSIM World Wide Web page:

<http://www.nerc-bas.ac.uk/public/uasd/versim.html>