The International ENVIRONMETRICS Society - TIES

Newsletter

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Editors: Teresa Alpuim and Sylvia Esterby

In This Issue:

1. A Message from the President,

Peter Guttorp

SARS and TIES 2003

On March 25, a subset of the TIES board of directors started discussing whether it would be feasible, in light of the increasing SARS epidemic in China, to actually hold TIES 2003 in Beijing. Soon the entire board, and shortly thereafter the entire membership, was involved in the discussion. The board is extremely grateful to all of our members who expressed their view on the feasibility of holding the meeting in Beijing. On April 22, meeting organizer and board member Ray Correll officially cancelled the Beijing meeting. The board discussed various alternatives, and eventually decided to accept Jacky Galpin's proposal to hold the meeting in Johannesburg, South Africa, November 3–7, 2003. The meeting will be held in conjunction with the 50th anniversary meeting of the South African Statistical Society. Jacky and Ray have agreed to co-chair the scientific program committee.

The decision to cancel the Beijing meeting was a very difficult one. However, in view of travel restrictions imposed by governments and companies (and a few days after our decision also by the World Health

Organization), it did not seem feasible to get the geographic breadth of participation, nor the needed number of participants, for a successful meeting. We are hopeful that there will be enough time to advertise and organize a successful meeting in Johannesburg. TIES will attempt to organize a future meeting in Beijing as soon as this is feasible.

TIES membership

Last year marked the lowest number of individual subscribers to *Environmetrics* in recent time. The introduction of an electronic subscription option seems to have helped: the subscriptions up through April already exceed the total number for 2002. We need to go further, though. The Society (which pays the subscriptions out of membership fees) gets more favorable rates of subscription once there are over 125 individual subscriptions. We are still far from that number. The rates are the result of long negotiations with Wiley, resulting last December in a four-year contract spelling out the detailed relationship between the publisher and the Society. Let us know what could persuade some of you who are not currently subscribing to *Environmetrics* to change your mind!

Last summer the board decided to make student memberships free (without the journal). As a consequence, the student memberships have more than doubled. Those members in academic institutions are encouraged to try to persuade their students to become TIES members. We hope that being student member can give a better understanding of what the Society is about. The board will discuss further membership benefits at the Johannesburg meeting, and as always would welcome any suggestions.

The membership directory is now available for searching on our web site at URL,

http://www.nrcse.washington.edu/ties/membership/ties-search.html,

as decided by the general meeting in Genoa. Only name, email and affiliation are displayed for those members who have not opted out.

Where is environmetrics going?

In the previous newsletter, I promised to give something of a preview of my talk with (almost) this title at the SPRUCE meeting in June. Here are some of the directions I see (or would like to see) our field going:

1. Realistic space-time models of stochastic processes on the globe. The last decade or so most of the focus has been on realistic covariance structures. It is time to go back and think seriously about the trend component. We need models that take into account vertical aspects or pollutants as well as horizontal.

2. Improved combination of mathematical models with data. More seamless integration, realistic stochastic partial differential equations, serious assessment of uncertainty are all directions in which the field is already advancing,

3. Better health effects analysis. Most health effect studies look at acute effects, while more or less ignoring chronic aspects of pollution. A combination of toxicological models detailing the effect inside the body, models for ambient air infiltration into homes, and for behavioral patterns for populations particularly at risk is needed.

4. Identification of pollution sources. A weakness of most air quality models is the imprecision in estimating output from pollution sources. For point sources, there have been recent developments of realistic source-receptor models, taking into account spatio-temporal dependence. The resulting emission estimates cast some doubt over "official" emissions data bases, which in the US are largely based on company disclosure. Better multipollutant receptor instruments are expected to yield higher quality data, and in the future we should be able to combine advection/transformation models with these data to solve the inverse problem of where the pollution originated, and estimate actual point emissions.

5. Statistical involvement in environmental decision-making. There are no statisticians on the scientific advisory boards for the Inter-governmental Panel on Climate Change, or on the United Nations Environment Programme Global Environment Facility, nor on the latter's roster of 430 scientific experts. TIES and ISI need to work together to ensure that the statistical community is heard in these important global contexts.

TIES activities this summer

TIES are organizing two sessions at the SPRUCE conference in Lund, Sweden, June 13–16. Anders Grimvall has put together a session on the IMPACT project, an EU-funded project on estimation the human impact on the environment. Speakers are Anders Grimvall and Claudia Libiseller (University of Linköping, Sweden), Hans Wackernagel (Paris School of Mines, France) and Andreas Hense (University of Bonn, Germany). Marian Scott has organized a session on environmental models, with speakers Marian Scott

(University of Glasgow, Scotland), Bruce Beck (University of Georgia, USA) and Peter Challoner (Southampton University, England).

At the Joint Statistical Meetings in San Francisco, USA, August 3–7, I am organizing a panel discussion, entitled How To Tell the President the Facts. The purpose is to discuss approaches to scientific communication with decision-makers. The panelists are Sally Morton, Rand; Gerald van Belle, University of Washington; Peter Preuss, U.S. EPA; Haiganoush Preisler, USDA Forest Service and Adrian Bremauntz, Instituto Nacional De Ecologia, Mexico.

At the same San Francisco meeting Loveday Conquest will award the El-Shaarawi award to last year's recipient, Brad Carlin from the University of Minnesota, USA.

TIES 2004/Spatial Accuracy Symposium

TIES 2004 will be a joint meeting with the Spatial Accuracy Symposium. The time and place are not decided yet, but there has been mention of Portland, Maine, in northeastern USA, in late June 2004.

The aim of the Spatial Accuracy Symposia series is to bring together experts from environmental science, spatial statistics and geographic information science to further develop theory and practical application of handling spatial uncertainty in the environmental sciences. This Symposia series is the international meeting place for experts with special interests in the assessment, modeling, visualization and propagation of uncertainty in spatial data and spatial process models. Clearly, we have substantially overlapping interests, and having a joint meeting will hopefully further the interactions between the groups.

Program chair is Ronald McRoberts, US Forest Service. The program committee is being set up, and will have members from both TIES and the Spatial Accuracy group.

Peter Guttorp (peter@stat.washington.edu)

2. TIES News

2.1. New Members

Richard Katz

Welcome to the 16 new members who have joined TIES between November 2002 and April 7, 2003. Conferences, the web page and promotion of TIES by current members continue to be the major means by which individuals are learning about the Society.

Budhathoki, Chakra Bahadur	USA
Dobbie, Melissa	Australia
Ellis, Rodney	Australia
Erbas, Bircan	Australia
Greisbach, Ann L.	Australia
Hancock, Stacey	USA
Henderson, Brent	Australia
Karatzas, Kostas	Greece
Kuhnert, Petra M.	Australia
Mason, Nina	Australia
Meiring, Wendy	USA
Mengersen, Kerrie	Australia
Nixon, Zachary J.	USA
Stewart-Koster, Ben	Australia
Stewart, Robert B.	USA
Wilson, Kerrie Ann	Australia

2.2. Member's News

- **Teresa Alpuim**, member of TIES and Professor of Statistics at the University of Lisbon, is currently spending her sabbatical year at McMaster University, Hamilton, Canada. During this stay she will carry out a collaborative research project about asthma incidence in Canada with Prof. Roman Viveros-Aguilera, from McMaster University. Geographic Information Software (GIS) together with recently developed Statistical methodology will be used to identify geographical patterns in the distribution of asthma incidence rates across Canada.

- **Rick Katz**, Secretary of TIES, will be on sabbatical leave from the Environmental and Societal Impacts Group of the National Center for Atmospheric Research, Boulder, Colorado, USA during May through October. He is visiting the Statistics Group at the Swiss Federal Institute of Technology, Lausanne, Switzerland from 1 May to 31 July, and then the Institute for Meteorology and Geophysics at the University of Innsbruck, Innsbruck, Austria, from 1 August to 31 October. For TIES secretarial purposes, he can still be contacted through his NCAR email (rwk@ucar.edu) during this time period.

- **Eduardo Severino**, member of TIES, successfully defended his Ph. D. Thesis, January 13 2003, at the University of Lisbon, Department of Statistics and Operations Research, under the title "Space-time linear prediction. An Application to Area Rainfall Measurement." His work, under the supervision of Prof. Teresa Alpuim, focus on the study of linear

predictors based both in the spatial and temporal correlation structure of data. Part of this work was presented at TIES 2001 Conference, Portland, USA, where Eduardo Severino was a co-winner of the Best Student Presentation Award. His external examiner was Abdel El-Shaarawi, National Water Research Intitute, Canada.

- **Claudia Libiseller**, member of TIES, successfully defended her thesis in Statistics, Department of Mathematics, Linköping University, April 25, 2003. Her supervisor was Anders Grimvall and her thesis external examiner was Marian Scott, University of Glasgow. A short abstract of the thesis is given below.

  "Considering Meteorological Variation in Assessments of Environmental Quality Trends"

  Time series of environmental data are collected to monitor the effectiveness of new emission reduction policies or to determine the general state of the environment. Small gradual changes in such variables can, however, easily be concealed by large fluctuations caused by prevailing weather conditions. Hence, there is a real need for procedures that facilitate separation of such natural variation from anthropogenic effects. Two different approaches were used in the present research: multivariate non-parametric tests and parametric normalisation procedures. Issues concerning the selection of explanatory variables are discussed in this thesis, and covariates derived from physics-based models are proposed as alternatives to measured variables.

2.3. Society News

TIES is happy to announce the 2003 recipient of the Abdel El-Shaarawi Young Researcher's Award. **Montserrat Fuentes** is an Assistant Professor of Statistics at North Carolina State University. Prof. Fuentes' research focuses on nonstationary environmental processes, analysis of atmospheric and climate data, spatial-temporal models, and Bayesian modeling for model validation and spatial interpolation. The award consists of a certificate, a cash award, complimentary registration at the TIES conference, and one year's complimentary membership in TIES. Congratulations, Montse!

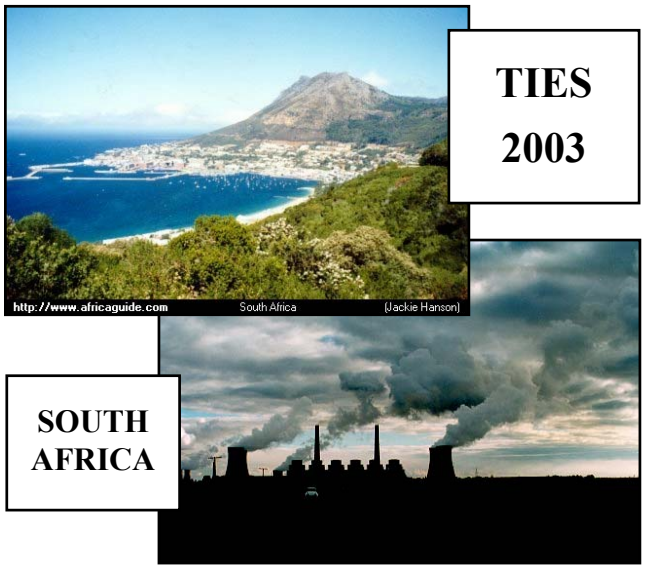
Loveday Conquest,
President of the Award Committee

3. Environmetrics Conferences

3.1. Forthcoming TIES Conferences

TIES 2003, Johannesburg

Jacky Galpin



The **13th International Conference on Quantitative Methods for the Environmental Sciences** was to be held from 21-24 August 2003 at the Friendship Hotel in Beijing, China. Due to the SARS virus. the conference has been moved to South Africa, and will be held as a parallel conference to the 50th Anniversary conference of the South African Statistical Association (SASA). The meetings will take place from 3 to 7 November in Caesar's Palace, Johannesburg. Although the two conferences will be run separately, the costs will be the same, and registering for one conference will gain you access to the other conference – two conferences for the price of one!

The main theme of the conference will be "Quantifying how our environment affects us". The conference program is still under development (see websites for updates), but highlights include:

- official opening on Monday 3 November, followed by a workshop on Estimating space-time trends (Peter Guttorp, Paul Sampson and Wendy Meiring)
- panel discussion on "Where do environmetricians come from? Issues of education and outreach", with panel members including Thomas Polfeldt, Peter Guttorp and Ian Ferris.

- scientific tour on Tuesday 4 November, and will include a tour of the 'Cradle of Mankind' (a World heritage site), Hartebeespoort dam (an 'enriched' lake), and other environmentally interesting sites.
- **Hunter Lecture**: **'**Modelling Environmental Space-Time Series' by Prof. Jim Zidek, University of British Columbia.
- **Presidential Address**: **'**Making Environmental Statistics Useful: A Third World Perspective' by Thomas Polfeldt, Statistics Sweden

Currently scheduled SASA conference highlights are:

- 'The present position of statistical science' by Sir David Cox, Plenary session, Wednesday;
- Workshop on 'Popular methods for supervised learning' by Trevor Hastie, Tuesday;
- 'Support Vector Machines, Logistic Regression and Boosting', by Trevor Hastie, plenary session, Friday;
- 'Two applications of Itô calculus in data analysis problems' Freek Lombard, plenary session, Thursday;
- Financial Risk management workshop, Monday;
- Workshop on 'Applying SAS time series methods to financial risk management', Tuesday;
- Official statistics workshop: SA Census 2001, Monday;
- Education workshop 'teaching statistics at school level' (training workshop for statistics subject advisors): Monday and Tuesday.

Pre and post conference tours will be arranged by Safari Travel, and a few possible tours are listed on the websites. The conference fees are shown on the loose insert into the newsletter.

The conference organiser is Lesley Stephenson (stephensonl@ebe.wits.ac.za), and all queries about conference arrangements should be directed to her.

With the change of venue and date of the conference, we are calling for further papers. The scientific program co-chairs are Ray Correll, CSIRO, Australia, and Jacky Galpin, Wits University, South Africa (jacky@galpin.co.za). We are calling for further papers for the conference. Please send abstracts to Ray Correll. (Ray.Correll@csiro.au)

The technical topics of the Conference are:

- Air quality monitoring and assessment;
- Chemometrics;
- Cleaner production methods;
- Ecological monitoring;
- Energy and Environment;
- Environmental Economics;
- Environmental human health statistics;
- Environmental Management Systems;
- Environmental Monitoring;
- Environmental risk assessment;
- Environmental standards;
- Environmental sustainability and environmetrics;
- Environmental transport and mixing processes;
- Environmetrics in meteorology and climatology;
- Global Environmental Problems;
- Integrating remote sensing in monitoring;
- International environmental statistics;
- Modeling environmental systems;
- National environmental statistics;
- Remediation Techniques;
- Statistical modeling of spatial data in ecology;
- Training in environmental statistics;
- Water quality monitoring and assessment

For further information see the websites:

http://www.cmis.csiro.au/ties2003/

and

http://www.sastat.co.za

3.2. Other Forthcoming Conferences

The **SPRUCE VI** Conference (Statistics in Public Resources and Utilities, and in Care of the Environment) will be arranged by the division for Mathematical Statistics at the Centre for Mathematical Sciences in Lund, Sweden, June 15-19, 2003. Detailed information about this conference is available on the conference web site:

http://www.maths.lth.se/conferences/spruceVI/.

The conference will include sessions on application areas as well as on statistical methodology, with invited speakers and contribution by the participants. The opening lecture will be given by Peter Guttorp with a talk with the title: "Where is environmental statistics going?" The conference will include sessions on application areas and methodological themes.

Application areas:

Air and soil pollution; Climate change; Energy planning and supply; Health effects; Impact of human activities in the presence of natural variation; Ocean transportation and marine environment; Official statistics, legal aspects, rules; Water resource planning; Waste managing; Toxicology;

Methodological themes:

Databased mechanistic models; Dose-response type models; Environmental sampling and monitoring Extremes; Nonlinear modeling; Spatio-temporal models Time series

The following speakers were invited:

- Bruce Beck, University of Georgia
- Mark Berliner, Ohio State University
- Anders Grimvall, Linköping University
- Nils Gustafsson, SMHI, Sweden
- Peter Guttorp, University of Washington
- Gudmund Höst, Norwegian Computing Center
- Georg Lindgren, Lund University
- Gianfranco Lovison, University of Palermo
- Antti Penttinen, University of Jyväskylä
- Marian Scott, University of Glasgow
- Richard Smith, UNC Chapel Hill
- Jonathan Tawn, Lancaster University
- Hans Wackernagel, Ecole des Mines de Paris

Please visit the SPRUCE VI Web site at:

www.maths.lth.se/conferences/spruceVI/speakers/

for titles and further details.

TIES is one of the sponsors of the Conference and will organize two sessions. There will be an IMPACT session organized by Anders Grimvall and a session dealing with construction and evaluation of environmental models by Marian Scott.

On Tuesday afternoon there will be a biking excursion to the Hven island with Tycho Brahe's castle and observatory. The conference dinner will be served on Wednesday evening in the dining-room of Grand Hotel. Welcome to Lund!

Scientific committee:

Clive Anderson, Vic Barnett, Georg Lindgren and Gianfranco Lovison.

Local organizing committee:

Ulla Holst (chair), Mona Forsler, Jan Holst, Jan Lanke, Georg Lindgren, Anders Malmberg and Lena Zetterqvist.

Information: ulla@maths.lth.se, mona@maths.lth.se.

The **International Conference On Environmental Statistics And Health** will be held July 16-18, 2003, on the campus of the Universidad de Santiago de Compostela, Spain. Montserrat Fuentes (North Carolina State University) will chair the Scientific Committee, and Wenceslao Gonzalez Manteiga (ISI-Spain) will chair the Local Arrangements Committee. The conference web address is:

http://isi-eh.usc.es

The members of the scientific committee are Lawrence Cox, Noel Cressie, Abdel El-Shaarawi, Wenceslao Gonzalez-Manteiga, Peter Guttorp, Dave Holland, Jorge Mateu, Doug Nychka, Louise Ryan, Richard Smith, Cliff Spiegelman, Michael Stein and Jim Zidek.

Preceding the conference there will be a short course in environmental statistics and Bayesian methods, including a geoBUGS tutorial.

There will be two invited lectures (1 hour technical talks), one given by Doug Nychka as opening for the conference and another by Louise Ryan as closure. Both lectures will serve as an introduction to environmental and health statistical research for graduate students and young researchers. There will be nine invited sessions organized by Zidek, Nychka, Cressie, Ryan, Spiegelman, Stein, Holland and McRoberts, Mateu and Guttorp, and a contributed

poster session. We will have a student paper award. Selected papers will be published in a special journal issue of Environmetrics. The proceedings for the conference will be also published.

The **sponsors** of this Conference are:

- The ISI Statistics and the Environment Committee;
- The International Environmetrics Society;
- The Center for Integrating Statistical and Environmental Science at the University of Chicago;
- The American Statistical Association Section on Statistics and the Environment;
- The National Center for Atmospheric Research (NCAR);
- The US Environmental Protection Agency;
- The National Center for Health and Statistics (NCHS) - Centers for Disease Control and Prevention.

There is funding to cover the travel expenses of young researchers. Preference will be given to graduate students who are presenting their research at the contributed poster session. Deadline for applications is April 15, 2003. To apply, please send: 1. A letter of recommendation; 2. A copy of the paper or an extended abstract for the proposed poster; 3. A CV; to

Dr. Montserrat Fuentes
Statistics Department
Box 8203
North Carolina State University
Raleigh, North Carolina 27695-8203

The First Joint Meeting of CAIMS (Canadian Applied and Industrial Mathematics Society) **and SIAM** (Society for Industrial and Applied Mathematics). This combines the 24th Annual Meeting of CAIMS and the 2003 Annual Meeting of SIAM. Among the Environmental issues tackled will be a three-part minisymposium organised by Philip Chatwin (University of Sheffield), Sam Shen (University of Alberta) and Paul Sullivan (University of Western Ontario). The three parts have the following titles: Climate Change Assessment; Turbulent Dispersion and Diffusion; Environmental Modelling. Each part will have four 25 minutes lectures. The meeting takes place 16-20 June in The Queen Elizabeth Hotel, Rene Levesque Boulevard West, Montreal. Information is to be found via

www.SIAM.org/meetings/an03/.

ICIAM (5th International Conference on Industrial and Applied Mathematics). is traditionally based on minisymposia and two typical ones are Stochastic Modelling of Turbulent Mixing Processes, organised by Mike Borgas (CSIRO) and Ben Devenish (UK Meteorological Office), and Environmental Mathematics, organised by Sam Shen. This year the meeting will be held 7-11 July in the Sydney Convention and Exhibition Centre, Darling Harbour, Sydney. The base website is

www.iciam.org.

The **XXIInd International Biometric Conference**, IBC2004, sponsored by the International Biometric Society, will be held from 11 to 16 July 2004 in Cairns, Queensland, Australia. For more information see the website:

http://www.ozaccom.com.au/ibc2004/

The Biennial Congress of the Modelling and Simulation Society of Australia and New Zealand, **MODSIM 2003** will be held in Townsville, Queensland, Australia at the Jupiter's Hotel and Casino from 14 to 17 July 2003. The main theme will be "Integrative Modelling of Biophysical, Social, and Economic Systems for Resource Management Solutions".

Papers are invited in all areas of modelling and simulation. Selected papers will be published in international journals. The key note speakers will be:

- **Professor Peter Phillips**, Cowles Foundation for Research in Economics, Yale University, USA. Laws and Limits of Econometrics.
- **Professor John Norton**, University of Birmingham, UK. Prediction for decision making under uncertainty.
- **Claudia Pahl-Wostl**, Professor for Resource Flow Management, Institute for Environmental Systems Research, University of Osnabrück, Germany. The importance of the human dimension in integrated assessment models and processes: Actor based analysis and modelling approaches.
- **Dr Graham Harris**, Chair CSIRO Flagship Programs. Ethics, biodiversity and complexity: An ecologist's view of catchment modelling and management.

The MODSIM 2003 Program will cover a broad range of topics within the theme including:

Water Resources, Oceanography, Climate and the Atmosphere; Global Change, Ecology, Agriculture, Forestry, and Fisheries; Socio-Economic Systems, Demography, Business and Tourism; Econometrics, Economics, Statistics, Finance, Risk and Uncertainty; Information Systems, Decision Analysis and Computing; Industrial, Mining and Operation Research; Medical Research, Public Health and Epidemiology; General Aspects of Modelling and Simulation.

Call For Papers:
Abstracts (300 words) by 29 November, 2002
Acceptance of abstracts by 20 December, 2002
Final papers (6 X A4) by 28 February, 2003

MODSIM 2003 Entitlements:
Registration entitles participants to congress icebreakers, bound proceedings or abstract volume and CD, lunches, morning and afternoon teas, a Congress bag with pen and notepad, access to all sessions and the Congress dinner.

For further details, see the Congress website

http://mssanz.cres.anu.edu.au/modsim2003.html

or contact the Convenor, Dr David Post, CSIRO Land & Water, david.post@csiro.au.

The **Joint Statistical Meetings** (JSM) is the largest gathering of statisticians held in North America. It is held jointly with the American Statistical Association, the International Biometric Society (ENAR and WNAR), the Institute of Mathematical Statistics, and the Statistical Society of Canada. The JSM 2003 will take place in San Francisco, California from 3 to 7 August. More information may be seen on the website at:

http://www.amstat.org/meetings/

The statistics and the environment section is organizing the following sessions:

- **Invited Paper Sessions:**

  - Multivariate spatial statistics.

  Organizer: Jay Ver Hoef.

  - Small area estimation in the natural resources.

  Organizer: Loveday Conquest.

  - Measurement and visualization of space-time events in public health with GIS.

  Organizer: Charles Croner.

- **Topics Contributed Panels**

  - Should Climate Models be Determined?

  Organizer: Montserrat Fuentes.

  - How To Tell the President the Facts.

  Organizer: Peter Guttorp.

- **Roundtable Luncheons**

  - Statistical Models for Spatial-Temporal Processes.

  Moderator: Michael L. Stein, University of Chicago

  - Statistical Issues in Air Pollution Risk Estimations

  Moderator: Francesca Dominici, John Hopkins University.

  - Sampling Ecological Resources

  Moderator: N. Scott Urquhart, Colorado State University

  - Spatial Analysis of Environmental Data.

  Moderator: Lance A. Waller, Emory University

- **Regular Contributed Paper Sessions**

  - Climate and meteorology;

  - Bayesian methods for environmental monitoring and modeling;

  - Spatial topics in environmental analyses;

  - Environmental methods;

  - Standards, monitoring, and detection;

  - Statistical methods for the natural resources.

The **17th Conference on Probability and Statistics in the Atmospheric Sciences**, sponsored by the American Meteorological Society and organized by the AMS Committee on Probability and Statistics in the Atmospheric Sciences, will be held 11-15 January 2004 as part of the 84th AMS Annual Meeting in Seattle, Washington.

Papers are solicited on all aspects of probability and statistics, in particular papers dealing with prediction, the theme of the 84th Annual Meeting. Possible topics include hypotheses testing; use of ensembles and especially their postprocessing in prediction; methods of conveying probability forecasts to sophisticated users and the general public on all time scales; use of probability forecasts with gridded products now being emphasized; methods of improving and manipulating

grids of probability forecasts as new information arrives; forecast evaluation especially of gridded forecasts; data assimilation; and objective forecasting of atmospheric phenomena such as air pollution, precipitation amount and type, and weather elements of importance to aviation.

The **Ninth International Meeting on Statistical Climatology** (9IMSC) will be held in Cape Town, South Africa during 25-28 May 2004. These meetings have been organized by a group of independent climatologists and statisticians since 1979.

The purpose of the IMSC meetings is to bring together climatologists and statisticians to exchange concepts and problems. Climatologists present statistical problems in climatology (including meteorology and related fields) and consider the methods that are currently used to deal with these problems. Techniques tailored by climatologists for the specific needs of climatology are also presented. Statisticians, on the other hand, present new, state-of-the art techniques developed within mathematical statistics and other scientific fields. By discussing the needs of climatology and the possibilities offered by modern statistics, synergetic effects are obtained, advancing the methodological basis of climatology and helping statistics to focus on relevant problems.

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4. Environmetrics Forum

Reference Measurement Methods for the Implementation of European Air Quality Directives

Jari Walden

Finnish Meteorological Instititute

In Europe the assessment and management of air quality is regulated by common legislation, Directives, laid down by the European Parliament and the Council of the European Union. The so-called Framework Directive (96/62/EC) defines, among other things, the relevant authorities, methods, areas (sites) and criteria for conducting air quality measurements in Europe. In addition to the Framework Directive the Commission has also laid down several so-called Daughter Directives for specific atmospheric pollutants. The overall objective of the Directives is to establish limit values and alert values for certain air pollutants to avoid, prevent or reduce harmful effects on human health and the environment as a whole. Other objectives are to assess the concentrations of the pollutants on the basis of common methods and criteria, to inform the public on the concentration levels of the pollutants and to maintain or improve the ambient air quality. The First Daughter Directive gives limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air (1999/30/EC). The Second Daughter Directive, giving limit values for benzene and carbon monoxide in ambient air (2000/69/EC) was adopted in 2000 and finally the directive relating to ozone in ambient air (2003/3/EC) was adopted in 2003.

The Daughter Directives also specify *Reference Methodologies* for the measurement of concentrations of the pollutants. However a Member State (MS) has the possibility to *'use any other method which it can demonstrate gives results equivalent to the above* (reference) *method'*. In addition the air quality Directives specify the so-called Data Quality Objectives (DQO) that have to be met in the performance of specific measurement tasks.

These data quality objectives consists of

- expanded uncertainties of measurement results at the limit value(s) set for each pollutant;
- time coverage of the measurements in relation to the reference period of the limit value;
- data capture of the measurement method, i.e., effective measurement time.

How to define a method that is equivalent to the reference method (and covers the DQOs) and how to test it. Two different definitions exists:

- A measurement method that meets the requirements set from the viewpoint of fitness-for-purpose for the intended use of the reference method
- A measurement method giving results that do not differ from those of the reference method within a specified statistical uncertainty

The Commission mandated the European Committee for Standardization (CEN) to prepare the standards for the reference method applicable to the measurements of the pollutants stated in the air quality Directives ((1999/30/EC, 2000/69/EC, 2003/3/EC).

It is the role of CEN to compare, validate and harmonise the current practice of this method in the Member States and to standardise this method.

The contents of the standard shall include the following items (where applicable):

- Range of application;
- Description of the reference method;
- Test methods and criteria for performance characteristics of the measuring system;
- Performance characteristics of the standard method;
- Test procedure for type approval of instrumentation;
- Equivalence procedure (only for methods without traceability standards);
- QA/QC of the measurements.

One may ask why not ISO standards? The requirements set up by the Commission for the new CEN standards are not covered by the ISO standards and therefore new standards are needed. I was invited as an expert to the CEN working group 12 "Determination of SO_2, NO_2, O_3 and CO in ambient air in Europe". Twenty one experts from thirteen different European countries with the convener Mr Ente Sneek, from the Netherlands, met fifteen times during 1996 and 2002. A lot of effort, exchange of knowledge and, finally, drafts of standards which cover the required items in a very suitable way. The drafts of the standards are now ready to be sent out to national bodies for comments. Depending on the comments, the drafts will or will not proceed to their final approval.

In the mean time, the working group for the equivalence method continues its work to define and propose test procedures for a candidate method to be equivalent with the reference method. Some interest may be found among statisticians towards a method to compare the candidate and the reference methods. The desired comparison method should take into account the uncertainty of both methods. Orthogonal linear regression or a specific method of general linear model should be applied.

References

- Council Directive 1996/62/EC on ambient air quality assessment and management (Framework Directive).
- Council Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particular matter and lead in ambient air.
- Directive 2000/69/EC of the European Parliament and of the Council relating to limit values for benzene and carbon monoxide in ambient air
- Directive 2003/3/EC of the European Parliament and of the Council relating in ozone in ambient air

5. Research Projects and Programmes,

Teresa Alpuim, Editor

In this section of TIES Newsletter members are invited to describe the Environmetrics research projects they are involved with. It is our aim, not only to show the many different ways quantitative methods are being applied to Environmental Sciences, but also to give knowledge about who is working on what problems. We believe that this will contribute to increased scientific interchange between TIES members. Contributions should be sent to Teresa Alpuim, email: talpuim@fc.ul.pt. Academic programmes related to environmental problems are welcome, too.

NRCSE Project Summary Available

Peter Guttorp
University of Washington

The National Research Center for Statistics and the Environment recently provided the US EPA with the final report for six years of EPA funding of the Center. The report is available in different formats at the NRCSE web site,

http://www.nrcse.washington.edu

During the period of the report, the Center organized or co-organized 14 workshops and two conferences. The 33 Center members (from 15 departments), 3 postdoctoral researchers, and 29 graduate students made 164 presentations at national and international scientific meetings, published 6 books, and 138 scientific papers in the peer-reviewed literature. In all, 229 visitors spent time at NRCSE or NRCSE-

organized events at the University of Washington campus. 44 different research projects have been pursued at the Center, and 7 outside subcontracts were awarded. 11 doctoral degrees and 9 Master's degrees were earned by NRCSE-funded graduate students.

A special issue of *Environmental and Ecological Statistics* focusing on research performed at the Center will appear shortly. It has been co-edited by Peter Guttorp and Paul Sampson. The papers in the issue are:

- Park, E. S., Guttorp, P. and Kim, H. "Locating Major PM10 Source Areas in Seoul Using Multivariate Receptor Modeling."
- Steel, E. A., Kelsey, K. A. and Morita, J. "The Truth about Science: A middle school curriculum teaching the scientific method and data analysis in an ecology context."
- Wakefield, J. "A Critique of Statistical Aspects of Ecological Studies in Spatial Epidemiology."
- Liermann, M., Steel, A., Rosing, M. and Guttorp, P. "Random Denominators and the Analysis of Ratio Data."

Special issue on environmental statistics

The *International Statistical Review* is publishing a special issue on environmental statistics this year. The issue is edited by Peter Guttorp, and contains the following papers:

- Laurent Bertino, Geir Evensen and Hans Wackernagel. "Sequential data assimilation techniques in oceanography."
- Francesca Dominici, Lianne Sheppard and Merlise Clyde. "Health effects of air pollution – a statistical review."
- Montserrat Fuentes, Peter Guttorp and Peter Challoner. "Statistical assessment of numerical models."
- Peter Guttorp. "Environmental statistics – a personal review."
- Christopher K. Wikle. "Hierachical models in environmental science."

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6. Forthcoming Papers in Environmetrics

Abdel El-Shaarawi, Editor-in-Chief

- G. Johannesson and N. Cressie. "Finding large scale spatial trends in massive global environmental datasets."
- Ryan M. Nielson, Robert T. Sugihara, Thomas J. Boardman, and Richard M. Engeman. "Optimization of ordered distance sampling."
- Ricardo Bolado and Jose Mira. "Trivial reductions of dimensionality in the propagation of uncertainties: A physical example."
- A. Fasso , A. Esposito, E. Porcu, A. P. Riverberi, F. Veglio. "Statistical. Sensitivity Analysis of Packed Column Reactors for Contaminated Wastewater."
- Peter Rothery, Suzanne J. Clark and Joe N. Perry. "Design of farm-scale evaluation of genetically modified herbicide-tolerant crops."
- Almuth Wameling. "Accuracy of geostatistical prediction of yearly precipitation in lower Saxony."
- A.F. Zuur, R.J.Fryer, L.T. Jolliffe, R.Dekker and J.J. Reukema. "Estimating common trends in multivariate time series using dynamic factor analysis."
- R.R. Sarkar and J. Chattopadhayay. "The role of environmental stochasticity in a toxic phytoplankton."
- S. Hussain, A. Elbergali, A. Al-Masri and G. Shukur. "Parsimonious Modelling, Testing and Forecasting of Long-range Dependence."

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7. Recently Published Books

Liliana Gonzalez (liliana@cs.uri.edu)

The objective of this section is to provide a list of recently published books likely of interest to members of our society. I encourage every one to send me information about recently published books they think should be listed in future sections of this Newsletter

- **Anderson, C.W., Barnett, V., Chatwin, P.C.** and **El-Shaarawi, A.H.** (Editors). *Quantitative Methods for Current Environmental Issues*. Springer-Verlag, 2002.

- **Buckland, S.T., Anderson, D.R.** and **Borchers, D.** *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*. Oxford University Press, 2001.
- **Christakos, G., Bogaert, P.** and **Serre, M**. *Temporal GIS, Advanced Functions for Field-Based Applications*. Springer-Verlag, *2002*.
- **Cox, D.R.** and **Reid, N**. The Theory of the Design of Experiments. Chapman and Hall/CRC, 2000.
- **Christensen, R**. *Advanced Linear Modeling - Multivariate, Time Series, and Spatial Data; Nonparametric Regression & Response Surface Maximization*, 2nd Edition. Springer-Verlag, 2001.
- **Davison, A.C.** *Statistical Models*. Cambridge University Press, 2003.
- **Duda, R.O., Hart, P.E.** and **Stork, D.G**. *Pattern Classification*, 2nd Edition. Wiley, 2000.
- **Dutter, R., Filzmoser, P., Gaher, U.** and **Rousseeuw, P.J**. *Developments in Robust Statistics*. Springer-Verlag, 2002.
- **Gibbons, R.D.** and **Coleman, D.E.** *Statistical Methods for Detection and Quantification of Environmental Contamination*. Wiley, 2001.
- **Houlding , S.W**. *Practical Geostatistics, Modeling and Spatial Analysis*. Springer-Verlag, 2000.
- **Johnson , E.W**. *Forest Sampling Desk Reference.* Chapman and Hall/CRC, 2000.
- **Lawson, A.** and **Denison, D.** (eds) Spatial Cluster Modelling Chapman & Hall London, 2002.
- **Mardia, K.V.** and **Jupp, P.E.** *Directional Statistics*. Wiley, 2000.
- **McCuen, R.H**. *Modelling Hydrologic Change, Statistical Methods*. Chapman and Hall/CRC, 2002.
- **Schabenberger**, **O.** and **Pierce**, **F.J**. *Contemporary Statistical Models for the Plant and Soil Sciences*. Chapman and Hall/CRC, 2002.
- **Sparks, T**. *Statistics in Ecotoxicology*. Wiley, 2000.
- **Verbeke, G.** and **Molenberghs, G**. *Linear Mixed Models for Longitudinal Data*. Springer-Verlag, 2000.
- **Webb , A.R**. *Statistical Pattern Recognition* (2nd Edition). Wiley, 2002.
- **Webster , R.** and **Oliver, M**. *Geostatistics for Environmental Scientists*. Wiley, 2001.

8. Book Reviews

Liliana Gonzalez, Editor

In the November issue of the Newsletter I called for volunteer reviewers and I am most grateful to Edzer Pebesma (Utrecht University) and Joe Gani (Australian National University), for contacting me and providing the reviews included in this issue of the Newsletter. I am most pleased that the reviewers requested titles in the current areas of Bioinformatics and Data Mining, as we have not previously published a book review in these areas.

And of course, we would not have a book review section if publishing companies did not provide reviewers with complementary copies of their books. Thus, I wish to thank John Kimmel, Executive Editor of Statistics of Springer-Verlag, for his very prompt response to my request and for providing Joe and Edzer with copies of the books reviewed in this issue of the Newsletter. John also kindly offered us the following titles for review, which I believe are of interest to our members. Please contact me if you would like John to send you a complementary copy of any of the three books described below. Any one of the three texts would make for a wonderful summer read!

- **Estimating Animal Abundance**, Closed Populations (2002) by D. L. Borchers and S. T. Buckland. Springer-Verlag.
  Table of Contents: Part I Introduction.- Using Likelihood for Estimation.- Part II Simple Methods.- Plot Sampling; Removal, Catch-Effort, and Change-in-Ratio; Simple Mark-Recapture; Distance Sampling.- Part III Advanced Methods.- Extended Building Blocks; Spatial Modeling; Mark-Recapture Revisited; Integrated Models; Open Population Methods.- Part IV Overview Which Method?
- **Model Selection and Multi-Model Inference:** A Practical Information-Theoretic Approach (2002),Second Edition, by K. P. Burnham and D. R. Anderson. Springer- Verlag.
  Table of Contents: Introduction; Information Theory and Log-Likelihood Models: A Basis for Model Selection and Inference; Practical Use of

the Information-Theoretic Approach; Model-Selection Uncertainty with Examples; Monte Carlo and Example-Based Insights; Statistical Theory; Summary.

- **Wildlife Study Design** (2001), Edited by M. L. Morrison, W. M. Block, M. D. Strickland and W. L. Kendall. Springer-Verlag.
  Table of Contents: Concepts; Experimental Designs; Sampling Strategies: Fundamentals; Sampling Strategies: Applications; Impact Assessment; Inventory and Monitoring Studies; A Practical Guide to Study Design; Education in Design and Statistics for Students and Professionals; Synthesis: Advances in Wildlife Research Design.

Lastly, if the three titles above do not appeal to you, please feel free to choose any of the books in the list of "**Recently Published Books**" for review and I will make every effort to get you a complementary copy from the publisher.

The Elements of Statistical Learning; Data Mining, Inference and Prediction

by

Trevor Hastie, Robert Tibshirani
and Jerome Friedman

Springer-Verlag, New York, 2001, pp. 533. Hard Cover, US$74.95, Second Printing, ISBN 0-387-95284-5.

Reviewer: Edzer J. Pebesma
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This book provides a good introduction to the subject of statistical learning (or machine learning) for those who are familiar with regression analysis and/or multivariate analysis, and for those who do not shy away from matrix notation. The book treats a large number of techniques in a common framework, and shows very well how they all fit together. Most of this book (85%) deals with supervised learning techniques, which are techniques that aim at predicting an observed variable (output) given a number of known predictor variables (inputs); the rest of the book deals with unsupervised techniques that aim at describing the multivariate distribution of a large number of variables without making a distinction between inputs and outputs. The supervised methods chapters (2-13) deal with least squares and nearest neighbor methods, variable selection in regression, linear methods for classification, basis expansions and regularization, kernel methods, model assessment and selection, model inference and averaging, additive models and trees, boosting and additive trees, neural networks, support vector machines and flexible discriminants, and prototype methods and nearest-neighbors. Throughout the book, both classification and regression problems are discussed. Unsupervised methods (chapter 14) cover cluster analysis, self-organizing maps, principal components, principal curves and surfaces, independent component analysis and exploratory projection pursuit.

Chapter two sets off by presenting a two-way classification problem given two regressors, and then compares the simple linear regression predictor, where the predictant is coded as either -1 or +1 and the predicted class is found by the sign of the predictor, to the k-nearest neighbor predictors that use a majority vote. Many of the techniques dealt with in the book are shown to be variations of one or both of these simple approaches.

Two topics re-occur throughout large parts of the book. The first is the curse of dimensionality, which refers to the fact that the higher the dimensionality of a data set, the farther the nearest point appears to be, relative to the furthest point. This makes many kernel-based methods, such as n-nearest neighbor classifiers, less attractive in high dimensions. The second topic is regularization and variance-bias tradeoffs. For more complex models, the bias tend to decrease, but at some stage the variance dominates prediction error, and overfitting occurs.

S functions for some of the newer techniques discussed are available from the web site that accompanies the book. One of the strongest points of the book is the wealth of figures, which are all in full color and prepared with much care. It is well possible that this book is a little biased in favor of methods that are developed by the authors, but certainly not at the cost of the quality of explanations of competing techniques. In many cases, a number of competing techniques are tried on a sample data set, and test results are presented. The book is written by enthusiasts, and gives an up-to-date, accessible overview of the complex and fast moving field of machine learning.

Statistical Methods In Bioinformatics: An Introduction

by Warren J. Ewens and Gregory R. Grant

Springer-Verlag, New York, 2001, pp. xix + 476. Hard cover, US $ 79.95, ISBN 0-387-95229-2

Reviewer: Joe Gani.
Mathematical Sciences Institute, Australian National University, Canberra ACT 0200, Australia. E-mail: gani@maths.anu.edu.au

In their Preface, the authors define bioinformatics as the "emerging field of science growing from the application of mathematics, statistics, and information technology, including computers ... to the study and analysis of very large biological ... data sets". In attempting to introduce the reader to this field, they assume little or no background in biology, but provide an Appendix A at the end of the book, outlining relevant biological information. So far as mathematics is concerned, introductory courses in calculus and linear algebra are suggested as a necessary grounding; there is also a useful Appendix B of essential mathematical results. The focus of the book is on probability, statistics, stochastic processes and some important algorithms used in the analysis of bioinformatic data. Appendix C contains some computational aspects of two discrete distributions, while Appendix D provides an example of the BLAST Algorithm for sums of normalized scores.

The authors state clearly that their treatment of the subject is far from comprehensive. They stress that the book is intended as an introduction to the field, based on a two semester course given each year during 1995-2000 at the University of Pennsylvania. The book is designed to provide a first stepping stone for readers wishing to follow the current journal literature on the subject; in this aim, the authors have succeeded admirably.

The book consists of 14 chapters, which we describe briefly below.

Chapter 1. Probability Theory (i): One Random Variable. This is an introduction to the theory of discrete and continuous random variables (rv's), and some of their important distributions. Means and variances, as well as probability and moment generating functions (pgf's and mgf's) are considered. The memoryless property of the geometric and exponential distributions, and entropy are discussed.

Chapter 2. Probability Theory (ii): Many Random Variables. The properties of many discrete and continuous rv's and their mgf's are given, in both the independent and dependent cases. The concept of indicator rv's is explained, and an example given. Covariance and correlation are discussed, as are sums, averages, minima and maxima of n random variables. P-values, rare events and order statistics are considered, and the theory of transformations sketched.

Chapter 3. Statistics (i): An Introduction to Statistical Inference. The difference between classical and Bayesian methods is explained, before an account of classical methods of estimation and hypothesis testing is given. The chapter concludes with nonparametric alternatives to a two-sample t-test, the Bayesian approach to estimation and hypothesis testing, and finally a short example of multiple testing.

Chapter 4. Stochastic Processes (i): Poisson Processes and Markov Chains. The chapter begins with an account of the homogeneous Poisson process and the Poisson distribution. The relations between the Poisson, the binomial and the gamma distributions are pointed out. There follows a brief introduction to finite Markov chains (MC's), with and without absorbing states. The stationary distribution and graphical representation of a MC are discussed, as is its use in modeling.

Chapter 5. The Analysis of One DNA Sequence. The mechanics of shotgun sequencing in the analysis of DNA is explained, and the modeling of signals, with the derivation of weight matrices, is outlined in the cases of independence, Markov dependence and maximal dependence. An account is given of the analysis of patterns with (or without) overlaps. Generalizations are analyzed for arbitrary nucleotide probabilities, and arbitrary word lengths.

Chapter 6. The Analysis of Multiple DNA or Protein Sequences. The authors begin with a discussion of the frequency comparisons for two DNA sequences. Tests for the significant similarity of alignment of these sequences are discussed, and several algorithms for them presented. Substitution matrices for protein sequences are considered, and BLOSUM and PAM substitution matrices illustrated. The chapter concludes with a discussion of multiple sequences.

Chapter 7. Stochastic Processes (ii): Random Walks. Simple random walks are defined, and two approaches to them described, namely the difference equation approach and the mgf approach. The random walk concept is extended to general walks, and some asymptotic theory outlined; this includes the renewal

theorem, and an account of unrestricted and restricted walks.

Chapter 8. Statistics (ii): Classical Estimation and Hypothesis Testing. The chapter opens with some criteria for "good" estimators, and explores the theory of Maximum Likelihood estimation. Classical hypothesis testing for simple fixed sample size tests is then considered, and the likelihood ratio test described. There follows an outline of composite fixed sample size tests, together with the -2 log(lambda) approximation, and a brief account of sequential analysis.

Chapter 9. BLAST. This is the algorithm most frequently used to assess the similarity of two DNA or protein sequences; its principles are explained in detail, and examples given of the comparison of (a) two unaligned sequences, and (b) a query sequence against a database. Minimum significance lengths are discussed, and the relation of the algorithm to sequential analysis pointed out.

Chapter 10. Stochastic Processes (iii): Markov Chains. The theory of Markov chains is extended to include MC's with no absorbing states, higher order Markov dependence, and patterns in sequences with first order Markov dependence. The theory of Markov Chain Monte Carlo (MCMC) is outlined, and followed by an exposition of MC's with absorbing states. Continuous-time MC's are considered, and their time dependent and stationary solutions discussed.

Chapter 11. Hidden Markov Models. A hidden Markov model (HMM) is a discrete time MC such that when a particular state is visited, a letter from a fixed alphabet is emitted with a given probability. Three algorithms for calculating the hidden sequence of MC states are given. These are applied to modeling protein families, and multiple sequence alignments. The web-based resource Pfam is then presented, and gene finding discussed.

Chapter 12. Computationally Intensive Methods. This chapter concentrates on intensive methods of computation for both classical estimation and hypothesis testing. Bootstrap estimation and confidence intervals are discussed, and the bootstrap alternative to the 2-sample t-test presented. At the end of the chapter, the authors revisit multiple testing, and consider step-down procedures for t-tests, and a permutation test.

Chapter 13. Evolutionary Models. Simplified models of the evolutionary process, of particular use in phylogenetic trees, are presented. Discrete time models such as the Jukes-Cantor, Kimura, Felsenstein, HKY and simple symmetric PAM models are outlined. These are followed by an account of their continuous time analogues.

Chapter 14. Phylogenetic Tree Estimation. This chapter concentrates on binary phylogenetic trees with nodes representing common ancestors of the offspring nodes below them, and the lengths of the edges being measures of evolutionary time. Tree reconstruction is considered in the ultrametric and neighbor-joining cases, together with parsimony and Maximum Likelihood; an example is then worked through. The roles of modeling, estimation and hypothesis testing in such reconstructions are discussed.

Every chapter is followed by a list of Problems, illustrating and expanding on the material previously exposited. The book ends with the four Appendices mentioned earlier, 13 pages of references, a three page author index and an 11 page subject index.

The authors have written a timely and readily understandable book. I greatly enjoyed reading it, and learned much from its clear exposition; it can be warmly recommended to all students and research scientists interested in bioinformatics and its increasingly voluminous literature. No library should be without it.

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9. TIES Board of Directors

The following are the names of the elected members of TIES Board of Directors. All terms are from September 1, 2002, to August 31, 2004, except the 4-year terms of the regional directors.

President:

Peter Guttorp
(peter@stat.washington.edu)

President-Elect:

Anders Grimvall
(angri@mai.liu.se)

Secretary:

Richard W. Katz
(rwk@ucar.edu)

Treasurer:

Bronwyn D. Harch
(Bronwyn.Harch@csiro.au)

Publications Officer:

TIES Newsletter is a publication of the International Environmetrics Society (TIES). It is published semiannually, or whenever the need arises, by The International Environmetrics Society and distributed to TIES members as part of their annual dues. Contact Peter Guttorp,

peter@stat.washington.edu,

or Bronwyn Harch,

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for questions regarding membership and other benefits.

Objectives of the Newsletter include (but are not limited to):

- To keep TIES members informed of what is happening within the Society;
- To cover news in latest developments in theory and applications of environmetrics;
- To be a forum for discussion of a broad range of issues which are of interest to members of TIES and are consistent with the objectives of the Society.
- To facilitate communication between environmental scientists and statisticians about research problems of mutual interest.
- To provide details about upcoming conferences and workshops related to Environmetrics;
- To announce members' news that are worthy of notice or recognition (e.g., awards, prizes and honors received, promotions, appointments, etc.)

Communications, (e.g., contributions, comments and suggestions) regarding this publication should be addressed to the TIES Newsletter editors: Teresa Alpuim (talpuim@fc.ul.pt) or Sylvia Esterby (SREsterby@ouc.bc.ca).

The Editors would like to encourage TIES members to submit items for publication in the Newsletter. We would like to have a very comprehensive publication that is of interest to our members by including items such as members' and regional news, Environmetrics and related conferences, research projects and programmes, book reviews, letters to the editor and articles of general interest.

We would like to thank the members who responded to our call and contributed to this issue. It is our hope that the Newsletter will be a valuable platform for discussion and exchange of ideas among us. We will be happy to hear your views about the contents and style of this issue. We hope that you will be a reader as well as a contributor.

TIES Webpage:
http://www.nrcse.washington.edu/ties