Book Review

ENCYCLOPEDIA OF ENVIRONMETRICS

Edited by
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Environmetrics is a new discipline situated at intersection of environmental and quantitative sciences. The environmetrics activity consists in the utilization of measurements in the analysis, modeling, interpretation and prediction of environmental phenomena. The second edition of "Encyclopedia of Environmetrics" is an update of the first edition published in 2002. The entries are listed alphabetically and the subjects are divided in 14 sections, since the authors added two new sections (*Environmental Engineering and Technology*, *General*) to the original 12 (*Chemometrics, Ecological Statistics, Environmental Health, Environmental Policy and Regulation, Extremes and Environmental Risk, Natural Resources and Agriculture, Hydrological and Physical Processes, Spatial/Temporal Modeling and Analysis, Statistical and Numerical Computing, Stochastic Modeling and Environmental Change, Statistical Theory and Methods*).

The *Encyclopedia of Environmetrics* is addressed to students, researchers, environmental managers, regulators and policy makers which are interested in environmetrics. The authors provide valuable reference sources, so only in the first volume are presented 109 articles well structured. Each article cover adequate information on the subject treated: definitions, explanations of terms, calculation models, effects, description of evaluation methods, algorithms, examples etc. The entries are from *A* to *C*:

Absorption and ingestion toxicology relates to the environmental toxicity and involves the identification of the toxicants, their distribution and possible modes of absorption in the human body.

Abundance: population size and density estimation offer an overview of approaches for wildlife population estimation. The methods presented for estimating population are: classical probability sampling, distance sampling, capture-recapture sampling, harvest sampling and other sampling techniques.

Acid rain includes general information about acid rain, sources of acid deposition, effects of acid deposition (aquatic and terrestrial effects).

Adaptive designs – an adaptive design study information is used to alter treatment allocation probabilities. The article presents also adaptive randomization to gain power, dose finding, bandit methods for treatment selection, response adaptive urn designs, asymptotically optimal and exactly optimal sequential designs.

Adaptive management as systematic approach for improving resource management deals with recurrence and uncertainty decision problems, include objectives, potential actions, models of system to response to actions etc., and can be a passive or active adaptive management.

Aerial survey data – the overall goal of surveys is to estimate by photography population over

some regions of the earth using methods like plot sampling, distance sampling, capture-recapture etc.

Age-growth modeling offers information about the growth of nonhuman living individuals; presents the sigmoid curves, cumulative growth and increment curves and describes the types of age-growth models.

Agricultural runoff deals with water that moves across the land surface. The article includes also the intencity units and statistical analysis in agricultural runoff studies and monitoring.

Agrobiodiversity presents data about research on biological diversity in agricultural ecosystems.

Agroforesty helps conservation and protection of natural resources by sequestration of carbon; by providing the adaptive tools and methods the study is meant to support agencies responsible for forestry, agriculture and environment.

Air quality presents pollutants, air quality monitoring strategy (monitoring scheme for reviewers and assessments), resource constraints and issues, quality assurance and control, site selection, sampling strategy, monitoring equipment and calibration standards.

Air quality index facilitating communication with – deals with air quality indicators, index design, structure, advantages and disadvantage.

Air quality indicators, pollutant specific – follows the use of National Ambient Air Quality Standard related to the pollutant specific.

Alpha-designs – the article shows construction, choice, availability and analysis of this bloke structure also called incomplete block designs.

American Society for Testing and Materials – presents an organization devoted to development and delivery of consensus standards (more than 12,000 standards).

American Statistical Association, Section on Statistics and the Environment – presents this organization which has special interest in application and interpretation of statistics in various disciplines, development/improvement of statistical theory and improvement of training in environmental statistics.

Ames assay – includes description of a method that has an important position in genetic toxicology and consists of four or five doses of the test compound.

Analysis of variance – the article deals with this method whose goal is to take the observed variation and separation of these in components in order to analyse different measurements.

Analysis of variance, multivariate – the article accurately describes the calculation model.

Animal movement models – describes in detail discrete time-discrete state, continuous space models, continuous time – discrete states, continuous time – continuous space models for animal movement.

Aquatic toxicity tests – are presented in this article; the tests are mainly used for estimation of water samples toxicity.

Aquatic toxicology – represents the study of stressors in fresh water and marine environments;

statistical methods and future developments are highlighted.

Artificial intelligence – presents a description of a product of the computer age, brief presentation of development of artificial intelligence history.

Asthma – focuses on describing of the one most common disease which affects children.

Asymptotic relative efficiency – provide a comparison of two statistical procedures; the method is explained in detail.

Atmospheric boundary layer –represents the lower part of the atmosphere on the Earth; the characteristics and structure in nocturnal and daytime conditions are presented.

Atmospheric dispersion basic – the article deals with key factors influencing atmospheric dispersion (spatial and temporal characteristics of the atmosphere, structure, importance of the wind field, temperature profile and scale of atmospheric dispersion), main categories of atmospheric dispersion models and details of key type models in historical order.

Atmospheric dispersion: complex terrain – presents more complicated aspects about flow phenomena, analytical techniques, fluid modeling.

Atmospheric dispersion: heavy gases – highlights density calculations, cloud dynamics (driven by the combined forced of gravity and wind), heat transfer from the ground (which affects the dispersion by modifying cloud density and by producing additional turbulence).

Attributable risk – (measure for the impact quantification of smoking on lung cancer occurrence), explains methods of calculation and presents range, synonyms, interpretation and usefulness, properties, basic principle of estimation.

Automatic differentiation – this method for numerical differentiation of computer algorithm is described in the article.

BACI model – (BACI - *Before- After-Control-Impact*) was constructed for evaluation of changes in environmental conditions; detailed explanation of the model is provided.

Bartlett test – the steps in the calculation of the model are highlighted.

Bayes factor – emphasizes the calculation methods; the factor gives the posterior probability of the entertained models in Bayesian methods.

Bayesian computation – usually high-dimensional integration – presentation of the Bayesian model is given.

Bayesian methods and modeling – is an overview of Bayesian methodology, starting from Bayes theorem.

Behrens-Fisher problem – describes the problem which starts from concentration measurements of particular contaminant on samples taken from two sites in an environmental study.

Benchmark analysis – analyzes the benchmark approach which is a statistical procedure applied to dose-response data from different studies.

Benthic ecology – gives information about benthos, describes litoral, sublitoral benthic communities, profundal benthos, highlights the quantitative significance of benthic communities and presents the benthos monitoring as a tool in sensing anthropogenic change.

Beta-binomial distribution – presents a method which can be used for modeling the underlying random structure.

Binary data – can be attributed to environmental data in order to solve a problem, the article provide a description of binary data.

Binomial distribution – presents Bernoulli variables, binomial variables, asymptotics, statistical inference.

Bioabundance – characterizes the quantity which describes number of individuals of a species in an area spatial patterns and pointed relative abundance among species.

Bioaccumulation – describes contaminants accumulation in organisms, biomagnification, metabolism and elimination.

Biodiversity – gives a brief description, general principles and an instructive example.

Biogeography – presents four typical inferences in biogeography, distribution of single species, distribution of communities, historical and island biogeography.

Bioindicators – discusses categories of bioindication, biodiversity related indicator and relevance of biondicator are the main issues.

Biological Assay – presents the methods for characterizing the potency of a stimulus and is applied to living organisms.

Biomarkers – defined as cellular, biochemical or molecular changes in a biological system, the article presents the main issues: types of biomarkers, biomarkers in cancer research and challenges.

Biomass - highlights aspects of the biomass in the ecosystem, estimation of biomass.

Biomonitoring – describes designing biomonitoring studies and how to design these studies and analyze the data.

Brivate distributions; Box-Cox transformation; Boxplo; Branch and bound algorithm; Branching process – describes these different methods (based on mathematical algorithms) with applications in environmental science.

British Ecological Society –provides a presentation of the society whose vision is to advance ecology, also the activities from past and present are pointed.

Brownian motion – discusses the mathematical model, properties and the Brownian motion in higher dimensions.

Calibration – explains the calibration methods (calibration- measuring the light absorbance of a series of samples).

Canadian environmental sustainability indicator: *on population –weighted ground-level-ozone*- presents the indicator and also the data sources and methods.

Capture – recapture methodology is a method of detection and identification of individuals. Some studies are analysed in this article.

Capture – recapture models, spatially explicit –includes a presentation of the models, steps in performing identification/detection of species.

Capture – recapture sample design – the article deals with estimation of animal populations.

Carbon capture and storage, regulation framework – contains regulation about carbon capture from combustion of exhaust gas of cool, oil or gas from point sources.

Carcinogenesis environmental – gives some information about cancer.

Cardiac toxicology – deals with cardiovascular diseases.

Cascade model – presents the origin from statistical formulation of turbulence as phenomenological framework.

Catch statistics – the article is related especially with fishing, data collection and stock assessment methods are given.

Catchment hydrology – deals with a part of hydrological cycle that relates to the concept of catchment, the model types are presented, also the simulation of catchments and prediction in catchment hydrology.

Categorical data – describes in detail enumerations and classifications of individuals or events into groups.

Causal assessment – are used for establish conclusions on how effects happened/produced.

Censored data analysis – represents missing data in different situation, the article presents besides the method, and a simple example.

Center for Global Environmental Research – was founded to provide solution of environmental problems, a brief presentation is provided.

Center for statistical Ecology and Environmental Statistics – has a program of research that integraates ecology, statistics and environment, and a scientific journal.

Change, detecting – deals with detection of changes in environmental systems, the article provides the methods and control charts.

Change in ratio – deals with methods used for estimation of parameters for ecological populations to differential removals.

Change-point methods – the article describes this methods.

Chemical mass balance – presents the use of chemical mass balance in management air quality and the methodology.

Chemometrics – deals with application of quantitative methods to chemistry; the typical application areas for chemometrics are given.

Circular data – presents the circular data which are directional data.

Classification – presents classification which involves setting for a large set of objects, similar or pattern behavior, responses.

Clean Air Acts and *Clean Water Act, US* – presents a brief history for each.

Climate change and North American Great Plains drought – presents the cause of drought, historical drought trends, and future droughts.

Climate change, cryosphere, and atmospheric chemistry – deals with matching and correlation of (Paleo)climatic records and spatial modeling of cryospheric and climatic variables.

Climate change scenarios for impact assessment – presents statistical downscaling, climate scenario uncertainty, intercomparison scales and prospectus.

Climatology – provides a description of this discipline.

Clustering – describes the data matrix, similarities, dissimilarities, hierarchical and nonhierarchical methods, cluster validation, literature and software on clustering.

Coarse woody debris (describe wood from dead trees) – the article includes information about sampling methods, studies of decomposition rate.

Costal processes – gives description of tides, internal tides, waves, other processes.

Co-limitation (biomass production of organisms is restricted by essential resources): the article presents the algorithm of calculation.

Common principal components – describes this tool used in derivate analysis.

Community, ecological – the article presents ecological community.

Community food webs – describes mathematically the feeding relationship between the species of an ecological community.

Compartmental analysis – deals with the compartment models.

Competing risk analysis – presents the method for analysis performing.

Composite sampling – provides the method and applications.

Compositional data – describes mathematical models.

Computer-intensive sampling methods in ecology and *Computer modeling* deals with application of computer models in environmental field.

Concentration, ambient – provides information about concentration of atmospheric gases, mass concentrations and compositions of tropospheric aerosols.

Conditional entropy profiles – presents the hierarchical Markov Transition Matrix Models.

Conditional simulation – describes the procedure and provides an example.

Confounding – the article include a brief presentation of effects confusion.

Conservation planning – presents the environmental planning, conservation biology, ecosystems services and gives five examples.

Constrained optimization – describes optimum of a function in presence of constrains.

The last two articles present *Control group* and *Control theory*.

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