THE DESCRIPTION OF THE RESEARCH PROJECT

1. The importance and the relevance of the scientific content

The time series analysis is an ample domain of study, implying multiple approaches, in the time [1-5] and in the frequency domain [6]. After the apparition of the book [1], the study of the stationary time series was developed, in the economic and financial domains [8-13], electronic and telecommunications, image processing [14], medicine [15-17]. The difficulties that appear in the modeling of the non - stationary time series are, essentially: the noise presence, the elaboration of the techniques of noise estimation and removal [18-20], the perturbations detection and measurement [21, 22], the long dependence in the data series [23-26], the errors propagation. There is also the question on the accuracy of the entrance data.

Generally, the models from the nature sciences [27-31] have a deterministic a stochastic component. The pure stochastic models are used if the causality relations of the phenomena are not known. The pure deterministic ones are developed especially in meteorology and try to reproduce the dynamic of the rainfall field, based on Navier-Stokes equations, blunted, approximated and then numerical integrated (in the hypothesis of scale homogeneity) [32, 33]. In despite of simplifying, the resulted equations remain complex, the calculation is difficult and the scales are independently studied one to others. So, the algorithm and the calculus methodology must be improved.

There is the tendency to work in restrictive hypotheses on the data (stationarity, homoscedasticity, independence etc.) or one tries to bring them in standard form, by different transformations. But, in majority, the hydrological series are not stationary [34, 29] and homoscedastic, needing decomposition procedures, to be modeled. In plus, they follow varied statistical laws [35, 36] and the data are not independent, presenting usually a long or short dependence in time.

The existence of the long dependence (and the calculation of Hurst's parameter) of the hydrological series is of great interest because its determination is difficult to do in practice, in despite of the clear theoretical formulation [37 - 41].

Sometimes, The central limit theorem or The weak low of big numbers are abusively invocated (it is known that it works for independent, identically and normal distributed variables), as in the case of the determination of the distribution of some extreme events [44].

The deviations of the empirical distributions from the normal low are experimentally confirmed [36], leading to quest some asymmetrical lows to describe the nature phenomena [35]. There is also the possibility to remove the aberrant values, but the models obtained will not be useful to predict the extreme events.

The extremes predetermination, based on sophisticated methods of fitting probability lows, remains sensible at the sampling errors and at the errors issued from the choosing of the probability laws [45].

The models based on a single scale are not adequate due to the relations between the phenomenon realizations on different scales. The spatial and spatial - temporal multi - scaling models [46-49] favor one scale, unjustifiable point of view of physics. *But these models must represent a series on different scales, with the same parameters' values for conformation to the reality. The fractal* [50-56] *and multifractal* [57-61] *modeling constitute an instrument susceptible to solve the presented problems*.

The objective of the multi – fractal approach is to release the scale and the intensity of the cascade processes that concentrate matter and energy in spatial and spatial - temporal domains smaller and smaller. In the multifractal approach all the singularities (that are expectances, as extremes) are generated by the same elementary process. This relation between the extremes and a field expectance can be understood by universality properties: in despite of the dependence of a multifractal field on an infinite number of parameters, only a small number of these parameters is significant. The direct relation between the mean field and extremes can also be realized using the phenomena of critical self organization [62, 63].

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2. Objectives

- The *general objective* of this project is to increase the cognizance area in the field of the modeling the hydrological time series and the application of this knowledge to solve some concrete problems (the rainfalls in Dobrogea).

The most important problems that will be solved by this project concern the multiscale modeling, the long range dependence and the noise presence in the data series.

1. Although well known, the time series decomposition in trend, seasonal component and random component is a method that was especially used in the economic sciences. We propose its application on additive and multiplicative models and the residuals study for the reasons that the rainfall data have a seasonal behaviour and the residual analysis can give an indication on the steps to be followed in the series modeling.

2. The problem of the detection of the data dependence in time appears because the data are generally dependent ones to others and they have not the same expectance and variance.

Box-Jenkins methods will be used to model the stationary rainfall series. It was used till now to model the river flows and offers the opportunity to give short time predictions.

The long range dependence (LRD) is related to the presence of the statistical auto similarity that can be characterized by the auto similarity parameter, *H*. If an auto similar process has a constant growing parameter and if $H \in (1/2, 1)$, then the increasing sequence has a LRD, with the Hurst parameter *H*.

LRD is a statistical property difficult to deal with. It can be thought in the time domain and in the frequency domain.

The series with LRD property are slowly convergent to the expectance. Hurst parameter is perfectly defined point of view of mathematics, but it is very difficult to be measured because the form of the spectral density must be a priori known. The best estimation methods are parametric (Whittle estimator, local Whittle). *H* estimated can be biased if the function of spectral density is not correct. As a consequence, we will try to improve the methods based on periodogramme, to estimate and to reduce the biais of *H*.

We shall try to apply a method that represents the estimators of *H* as functions of a parameter that balances the displacement from the variance. The method will be tested on simulated signals and will be used in correlation with other methods of *H*'s determination, on the real data.

A program that calculates *H* will be elaborated.

3. In physics, geophysics, hydrology, meteorology etc. the research, the studies, the technological and operational developments blunder into a fundamental difficulty: the extreme variability on a large range of scales in time and space, derived by the nonlinear interactions between the scales and also between different phenomena. To surpass this difficulty, without artificial parameterizations, we shall try to develop some specific instruments (in order to obtain simple theoretical representations) and some methods of quantitative evaluation of this variability, permitting to be repeated in a simple manner at different scales. It implies the use of the scale or fractale invariance, evolving a unifying approach in the mentioned domains.

4. The noise presence is one of the impediments that affects the data accuracy and has an impact on the correctness of a mathematical model. Interesting methods for the noise detection and removal from stationary series are known. In the case of nonstationary series there are some recent approaches (based on the recurrence points, the analysis of cross-correlation sum) for the dynamical systems, in which the evolution lows are known. In our study we shall try to apply a new methods based on the determination of the curves of logarithmic displacements, applied on quasi - stationary parts of the series, taking into account that the evolution low is unknown. The hidden frequencies (relieved by Fourier analysis) will be determined, adapting an algorithm that use the recurrence points and that function on simulated cases.

- *The specific objectives* are:

- the critical evaluation of the known methods of time series analysis and the relieve of them limits;
- the generalization of some analysis methods and the elaboration of new ones, in order to use them in modeling the hydrological time series;
- the determination of ARIMA/ FARIMA type models for the rainfall series;
- the characterization of the studied series using the fractional dimensions (Box, Hausdorff);
- the elaboration of multifractal models for the studied series and the comparison with the classical ones (deterministic);
- the robustness study for the proposed models.

- *The original contributions* of the project:

- the systematic study of the precipitations in Dobrogea, in the last 50 years;
- the study of the type of the precipitations series and the their different treatment, function of their stationary /non – stationary character;
- the realization of some programs for Box dimension and of Hurst coefficient calculation, used in the studies of cases.
- the prediction of rainfall apparition (particularly of the torrential ones) in Dobrogea, using the built models.

- We consider that the project is *important* for the domain because:

- the main purpose is the study of some hydrological series, unexplored till now, using new methods of modeling and prediction of the time series;
- it also has as a purpose to test some hypotheses related to the distribution low of the extremes events (torrential rainfalls) at the earth scale, in order to complete the knowledge in this domain;
- the objectives subsumes in the research directions of the hydrology worldwide;
- the use of the fractal models drop out the difficulties related to the existence of different measurement scales.

- *The estimated impact of the project*:

- it gives the possibility to apply new methods in the modeling of the nature phenomena;
- it opens new research directions in domains where models of these types can be applied (hydrology, meteorology, biology etc.)
- the research process will be intensified, by the increase of the information volume processed. The programs elaborated can be used in didactic and scientific purposes, for similar studies;
- confirming or infirming the mentioned hypotheses, the studied problems can be better understood and new investigation directions of the hydrological phenomena will be open;
- the predictions can be applied to plan the irrigations works in Dobrogea.

- *The interdisciplinary character*:

The hydrological time series belong to the large class of time series. As a consequence, the elaboration of some analysis methods, the generalization of the known ones or their improvement are of big importance for all the domains where time series appear (economy, finance, electronic, telecommunications, physics, medicine etc.). So, the proposed project has an interdisciplinary character, asking the cooperation of hydrologists and mathematicians. This is because the mathematical methods must be adapted to the research field, the resulted models must have physical significations, and the results must be interpreted and used for the prediction of the studied phenomena.

The interdisciplinary character also results from the use of statistical instruments for the analysis of the constituted series, the parameters determination, the models validation and the events prediction. It implies the use and the elaboration of informatics programs (for example, for the calculus of Box dimension and of Hurst coefficient) in order to improve the speed of data processing and interpretation, the results of the research being useful for hydrologists and mathematicians.

3. The research methodology

- *The stages of the deterministic modeling*:

1. The conceptualization:

- the choosing of the model dimension (1D, 2D, 3D);
- the choosing of the work hypothesis;
- the realization of the data synthesis;
- the choosing of the limit and initial conditions;
- the identification of the variables (input, stage and output variables) and of the parameters of the models;

2. The choosing of the model type, based on the criteria: the research objective, the model simplicity, the series length etc.

3. The calibration, that supposes the estimation of the unknown parameters such that the response simulation is close to reality. The operation supposes the choosing of the events and the parameters estimation.

4. The model validation, that supposes: the final choosing of the parameters of the model, the application of the model on a sample of known events, unused at the calibration, the result appraisal and the errors calculation.

5. The sensibility analysis, that allows: the classification of the parameters importance, testing the measurement errors influence on the parameters, the interpretation of the model generality and of its reliability to be used outside the calibration domain. This analysis is used to verify if the model is coherent with the theory, to indicate the effect of the errors of each input variable or parameter on the output, to identify the most sensible parameters and input variables. Since the determination of the incertitude sources is not possible, Monte - Carlo method is used to analyze the output variable.

- *The stages of the deterministic modeling*

1. The constitution of the data series, that supposes the preliminary analysis and the calibration;
2. The definition of the characteristic variable;
3. The control of the value series by:

- hydrological methods (the double cumulation, the residual cumulation)
- tests on the random character (Kendall), autocorrelation (correlation coefficients, autocorrelation function, partial autocorrelation function), trend (Spearman, Wald–Wolfowitz, Andersen), breaking (Mann-Whitney, Buissard).

4. The study of long or short dependence and of the stationary character of the data series.
5. The proposal of the possible models, function of the result from the 4^{th} stage.

If the series has short dependence in time, we try to choose ARMA type models. If not, we try to determine a FARIMA model (which is a generalization of ARIMA(p, d, and q) processes, for a non - integer d) or the building of multi-fractal cascade and the determination of Hurst coefficient. These will serve to give a model for the extreme values. To do it:

- We determine the level for which the probability to be exceed has an imposed value, q and the probability that the higher annual value be greater than some level, with a given probability, p;
- We want to test the hypotheses that for a return period greater than 20 years, the distribution function of the precipitations is a hyperbolic one.

- *The advantages* of the stochastic modeling methods proposed are:

- they can be used for any type of time series;
- the programming of the algorithms is relatively simple;
- blot out the difficulties related to the choosing of the representation scales;
- represents an alternative at the classical modeling, i.e. a tool of building alternative or new models in the cases when convenient models can't be obtained or the working methodology is extremely laborious.

4. Necessary resources:

4.1 Human resources

4.1.1. The project manager

4.1.1.1 The scientific competence of the project manager

The grant manager is doctor in Mathematics of Al.I.Cuza University, Iasi (1997) and Economic Sciences of ASE Bucharest (2003). She graduated the Mathematics Faculty (1987) and The Law Faculty (1996). She made research stages in Italy - ICTP Trieste (2004 and Germany (2005). She is the winners of a research grant in 2007 (July-august) at Graz, Austria

- In the last 5 years, she was chairman at:

- The 3-rd International Conference on Applied Mathematics, 13-16.10.2002, Baia Mare;
- Conference 2004: Dynamical systems and applications, 5 - 10.07.2004, Antalya, Turkey.

In the period of 1-7.07.2007, A.Barbulescu will be chairman at Conference 2007: Dynamical systems and applications, Selcuk, Turkey.

- In the last 5 years, she was in the organizing committee at:

- International Working Conference on Analysis and Optimization of Differential Systems, sept.2002, Constanta;
- Pannonian Applied Mathematical Meetings Interuniversity Network in Central Europe, 2002, Constanta;
- The 7th Balkan Conference on Operational Research, 25 - 28.05.2005, Constanta.

- Participation at 25 international conferences, in the last 5 years; between them:

- Conference on Dynamical systems and applications, Antalya, Turkey, 2004
- Conference on Practical applications of fractals, Abdus Salam ICTP - Trieste, Italy, 2004
- Congreso Internacional Mediterraneo de Matemáticas, Almería, España, 2005
- Second Conference on Self-Similarity and Applications, Toulouse, France
- Modern statistics: Theory and Applications, Kiev, Ukraine, 2006

- She was a reviewer at International Journal of Pure and Applied Mathematical Sciences in 2005.
- Research activities in the domains: Mathematical modeling (Time series, Fractal analysis), Mathematical and Economical Statistics, Economics.

The scientific activity is materialized in:

- 15 books; between them, 3 monographs;
- 61 articles: between them 28 in international journals (3 in ISI quoted journals, the others in BDI indexed journals) or proceedings of international conferences and 4 in journals on Romanian Academy;
- the participation in the last 5 years in research teams of 3 finalized projects (at Ovidius University, 2 at the Department of Civil Engineering and 1 at Mathematics and Computer Sciences Department) and a program running:

- Grant CNCSIS 1075/2005: *Computational algebra and applications in geometry and computer sciences*; value: 20000 lei;
- Grant CNCSIS 1071/2005, The themes 1/2005, 2/2006, 3/2007: *The modeling and optimization of the water circulation and the storage in the active soil* layer; value: 20000 lei.

The projects themes concerned: the modeling of the climateric processes that participate at the dimensioning of an irrigation system in arid areas, the optimization of the hydrotechnical schemes in irrigation systems, mathematical modeling of the processes in unsaturated zone, computational algebra and applications in geometry and computer sciences.

The personal contributions were: the elaboration of some models used in didactic activities, the elaboration of some models for the evaluation of water consumption and of provided and unprovided expenses; the analysis of some technical and economical indices, based on their variation graphs, for different exploitation degrees of the system; the building of a data base, necessary in the solutions selection to improve the analyzed system; the relieve of the critical zones, economically inefficient, in order to increase the decisional capability in the operative administration of an irrigation system; the mathematical modeling of water circulation and storage in the soil active layer: the determination of the analytical expression of the function that describes the circulation and the storage in the soil active layer, the determination of the hydraulic conductivity equation.

- the collaboration at interdisciplinary research teams, in the directions:

- the study of cavitation in different stationary liquids. We participated to the caption of the signal induced by the cavitation bubbles in ultrasonic field and we realized the mathematical models of that signal in different media;
- models of some materials corrosion in different stationary liquids;
- the thiols extraction with alkaline solutions from sour petroleum: The models for the dependence of the mass transfer coefficient on the column filling, NaOH concentration, the specific aria and the superficial speed of the disperse faze were obtained.

The essential theoretical contributions: the time series analysis and the study of the fractional dimension of some sets. In all the works realized, the study of the time series had a central place, their essential characteristic residing in the dependence of time of the studied phenomena, time which is an essential concept point of view of sciences, but also of the philosophy.

The time series analysis can be made in the frequency or in the time domain. In many scientific branches (astronomy, meteorology, hydrology, physics, electronics, chemistry, medicine, demography, economy and finances) many problems related to the time series appear. Taking into account the large spectrum of the applications in this field, I developed my studies in the demographic, economic and financial field and, on the other hand, in the physics, chemistry and hydrology. Function of the specific type of the problems, the classical decomposition methods were used (generally for the simple economic time series), Box-Jenkins methods or new methods were elaborated. The testing and the validation of the indeterminist models were made by statistical methods.

- *Significant works* related to the proposed project:

1. A. Barbulescu, *Time series and applications*, Ed. Junimea, Iasi, 2002
2. A. Barbulescu, *A model for the water leakage after a torrential rain*, Bulletin for Applied & Computer

Mathematics, Technical University of Budapest, XCVIII – C, 2003, p. 133 – 138

3. C. Maftei, A. Barbulescu, *Program for the management of the pluviometrical and limnimetrical data*, Conference 2004: Dynamical systems and applications, Antalya, Turkey, 2004, p.508 – 514

4. A. Barbulescu, *Hausdorff h-measure and Box dimension of some sets*, Workshop on Fractal Analysis, Eisenach, Germany, 11 – 17.09.2005, http://www.minet.uni-jena.de/~cfa-ln.html

5. A. Barbulescu, *The estimation of the graph Box dimension of a class of fractals*, The 7th Balkan Conference on Operational Research, Constanta, 25 - 28.05.2005, http://fmi.unibuc.ro/balkan-conf/CD/Section1/index.html

(For a partial list of the published works, see http://www.univ-ovidius.ro/math.)

4.1.1.2. The managerial competence of the project manager

A.Barbulescu is a project manager at Grant CNCSIS 902/2007 – Studies on the materials used in the naval constructions - the modeling of the mass losses in different media. The approved value for 2007 is 39035 lei .

4.1.2. The research team

The list of the research team members:

No.	Name and surname	Birth year	Didactical Scientific title *	PhD **	Signature
1	Maftei Carmen Elena	1965	assoc. prof.	YES	
2	Pelican Elena	1975	lecturer	PhD. Student	
3	Teodorescu Dacian Constantin	1972	researcher	PhD. Student	
4	Buta Constantin	1979	assistant	PhD. Student	

4.1.2.1. Experienced researchers

Maftei Carmen Elena is a PhD in Civil Engineering - Hydrologie Continentale at Ovidius University of Constantza and Academie de Montpelier (2002).

- *The professional experience* of 19 years can be divided in two periods, as follows:

- 1988-1993, when she was an engineer at firms of land amelioration;
- after 1993, since when she has a didactic and research activity Ovidius University of Constantza, The Department of Civil Engineering.

Between 1996 -1998 she followed the Academic post-graduated school courses *The engineering of water resources* at Technical University of Civil Engineering, Bucharest. As a consequence of the obtained results, she obtained a grant at IRD Montpellier – France. In that period of 3 months she worked at the grant HAPEX – Sahel, at the data analysis (hydrological, climatic, pedological, geomorphologic etc.) observed on the hydrographical basin Big -Wankama, in order to fit on and to validate two mathematical hydrological models: one, of black-box type and another of a mechanistic type.

In November 1997 she worked at IRD Montpellier, as a member of the grant CATCH, at the realization of a mathematical model rainfall-debit. As a consequence of a co - tutelage convention she accomplished 2 preparation stages at the University Montpellier II, at the hydrological laboratory of IRD Montpellier. The two preparation stages where financed by the program *Postgraduate Academic Studies and Doctoral Thesis in the Filed of Water Resources*, developed by the Technical University of Civil Engineering, Bucharest. The result of those preparation stages was the PhD Thesis: *Etudes concernant les ecoulements superficiels*. It results that Mrs. Carmen Maftei is a specialist in hydrology and in hydrological modeling.

- *The competence domains* are: the description of the mechanisms of the hydrological cycle on small hydro –

graphic basins (the case study: the hydrographic basin Voinesti), with accent on precipitations, evapo-transpiration and the hidric transfer in the unsaturated zone, the study of the superficial flow by hydrological spatialized modeling, starting from a fine discretization of the natural media, realized using the geographical informatics systems, mathematical modeling of climatic processes that participate at the dimensioning of the irrigation works, the mathematical modeling of the processes in unsaturated zone.

Between the remarkable results obtained we mention two original applications of hydrological modeling on spatialized base, starting with the description of the natural media, intermediated by a geographical informatics system. The data were geo - referee and assembled on Arc View format. The model TOPOG was used to simulate

the events averse/flow (being the second application made in Europe). ANSWERS model gave an information on the soil loss, significant for a basin with big angle of fall.

- *Representative scientific works*: 5 lecture notes and a monograph, 40 article, 17 research grants (11 obtained

in competition, at 4 – project manager) and an invention brevet (RO 103211/1993).

1. A. Barbulescu, C. Maftei, C. Dumitriu, *The modeling of the climatical process that participates at the sizing of an irrigation system*, Bull. For Applied & Computer Mathematics (XCVII – D), Technical University of Budapest, 2002, p.11 – 20

2. C. Maftei, *Hydrology – Applications*, Ed. ExPonto, 2004

3. C. Maftei, *Modelisation spatialisee de l'ecoulement sur des petits bassins versants*, Ed. Cermi, Iasi, 2004

4. C. Maftei, C. Buta, *Evaluation of the Mathematical Models for Quantifying the Unsaturated Hydraulic Conductivity*, Lucrari Stiintifice, XLIX, Vol 1(49), seria Horticultura, 2006, p.951-957

5. C. Maftei, C. Gherghina, S. Gelmambet, C. Buta, *ETREF un logiciel qui calcule l'evapotranspiration de reference*, Annals of Oradea University, Fascicle of Management and Technological Engineering, 2006, p. 86-93

- *Research contracts* in the last 5 years:

1. Contract no. 58/2002, Beneficiary The National Society of the land Amelioration, Constantza Branch: *Research about the optimization of technical elements of the irrigations by aspersion – Theoretical and experimental studies on the water circulation and storage in the soil active layer*, 2003: *The realization of the project for the experimental stand* - coauthor.

2. Grant CNCSIS 1071/2005, the themes 1/2005, 2/2006, 3/2007: *The modeling and optimization of the water circulation and the storage in the active soil layer* – proiect manager

3. Grant CEEX - MENER (cod MEC 1914), 2006-2008: *Advanced technologies for the modernization and management of the exploitation of the natural resources with high degree of vulnerability at natural disasters* - project manager for Ovidius University partner; value: 77200 lei, for Ovidius University.

- *Participation at conferences:* (11 in the last 5 years); between them:

- microCAD 2004 International Scientific Conference, Miskolc, Hungary, 2001, 2004;
- XIX Congreso Nacional del Aqua, Argentina, 2002;
- 6th International Congress on Advances in Civil Engineering, Istanbul, Turkey, 2004;
- The 5th International Conference MTC 2007, Alexandropoulos, Greece, 2007

- Member in scientific and professional societies: IAHS (International Association of Hydrological Scientists), WASWC (World Association of Soil and Water Conservation), ANEVAR, AGIR, AIFCR.

Pelican Elena graduated the courses of the Department of Mathematics and Computer Sciences (1998) and the Master courses on *Nonlinear Analysis* (1999) at the same Faculty of Ovidius University of Constanta
She is a PhD. Student at the Institute of Mathematical Statistics and Applied Mathematics of Romanian Academy. She will present his doctoral dissertation in public session in October 2007, when his PhD. Supervisor (Prof. dr. Dorel Homentcovschi, Polytechnics University Bucharest, Research Professor at Binghamton University, New York, SUA, homentc@yahoo.com) will return from USA.

Till 1999 she was an assistant and from February 2005 she is a lecturer in the Department of Mathematics and Computer Sciences, Ovidius University of Constanta.

She teaches courses, seminars and laboratories of: Numerical Analysis, Iterative Methods, Algorithms and Approximating Schemes.

- *Research stages*:

- Friederich - Alexander University, Erlangen - Nürnberg, Germany, 1.09.2002 – 28.02.2003;
- The 5th edition of the courses on numerical parallel simulation, 1 -7.10.2006, Belgrad, Serbia
- She is the winners of a grant for the period 23.07-3.08, 6-9.09.2007 at the Summer School *Advance Training for Women in Scientific* Research, Kerms, Austria.

- *Interest domains*:

- Iterative algorithms, methods of finite element type, schemes with finite differences;
- Optical flow, Image processing;
- Integral equations of first type, numerical methods for the approximation of these equations; genetic algorithms with applications in inverse problems, generalized inverse for linear operators;

- *Competence domains*

- Operating systems: Windows 9x/2000/XP, Linux;
- Programming languages: C/C++, C#, Java;
- Programming media: Visual C++, Visual Studio .Net, Jawa Pro, Borland C, Dev-C++, Netbeans;
- Systems of relational data bases: MySQL, Access, Visual Foxpro;
- Web: XML, XHTML, CSS, PHP, ASP;
- Publishing: Microsoft Office (and MS Project), Corel Draw, Adobe Photoshop, Macromedia Studio MX;
- Mathematic Software: MATLAB 7.3, Maple 10.0, Mathematica 5.0, Scientific WorkPlace 5.0 , Latex.

- *Representative scientific works*: 2 lecture notes and a monograph, 3 articles published in journals CNCSIS B quoted, 6 articles in proceedings of conferences with referees, 2 preprints, 7 articles in others journals;

between them:

1. E. Pelican, C. Popa, *Introduction in Numerical Analysis*, Ed. MatrixRom, Bucharest , 2005

2. E. Pelican *Complements of numerical analysis, Exercises and Problems. Calculus Programs* (*MATLAB*), Ed. MatrixRom, Bucharest, 2006

3. E. Pelican, E. Bautu**,** *Discretization Techniques and Numerical Treatment for First Kind Integral Equations***,** Proceedings of the 4-th Workshop on Mathematical Modeling of Environmental and Life Sciences Problems, Academy Publishing House, Bucharest, Romania, p.171-180

4. E. Pelican, *Extensions of Projections and Collocation Methods for First Kind Integral Equations*, Revue Roumaine de Mathematiques Pures et Appliquees, 3(51), 2006, p. 365-377

5. E. Bautu, E. Pelican, *Numerical Solution for First Kind Integral Equations Occurring in Synthesis of Electromagnetic Field*, Romanian Journal of Physics, No. 3-4 (52), 2007, p. 225-236

- *Member in the research grants*:

- PNCDI INFOSOC No. 131/20.08.2004 (finished): *Informatics system of high performance for the simulation of the complex phenomena of nanofluids that pass through multiphase porous media and with chemical reactions*: member: http://csam.univ-ovidius.ro/sistemnano; value: 125000 ron

- CEEX-05-D11-25/05.10.2005 (actual): *Mathematical modeling in diffusion processes.* – member: value: 80000 ron.

- *Participation at conferences* (13); between them*:*

- The 4-th and The 5-th Workshop on Mathematical Modeling of Environmental and Life Sciences Problems, Constanta, 2005, 2006
- The 13-th Conference on Applied and Industrial Mathematics, 14-16.10.2005, Pitesti
- National Conference *Caius Iacob*, 25-26.11.2005, Bucharest
- The 6th Balkan Workshop on Applied Physics, IBWAP, Constanta, Romania, 3-5.07.2006

- 5-th International Conference on Applied Mathematics, ICAM5, Baia Mare, oct.2006

- Member in scientific societies: SSMR, ROMAI (Romania), GAMM (Germany).

Teodorescu Dacian Constantin graduated in 1995 the courses of the Department of Civil Engineering, Ovidius University of Constanta and the Master courses at Hebrew University of Jerusalem, Israel, in 1997, in the domain of *The exploration, exploitation and management of the groundwater resources.* He is a PhD student at the Romanian Institute of Geography (Romanian Academy).

He is hydrologist engineer at the National Company Apele Romane. The current research activities are: hydro technical measurements, evaporation measurements and alluvial discharge measurement, water balance.

- collaboration with JICA Association, B.EN.A. Association, Romanian Institute of Geography.
- *Works* (6); between them:

1. D.C. Teodorescu, *Information flux and high floods in Dobrogea*, Hydrological Session, Calimanesti, 2003

2. D.C. Teodorescu, *Influence of aforestation degree for mountain sides and high floods rivers of Dobrogea*, Proceedings of Annual Session of Spiru Haret University, may 2003, p.49

3. D.C. Teodorescu, *Considerations about climatic factors which determined runoff in Dobrogea*, Proceedings of Annual Session of Spiru Haret University, no.8, 2005, p.87-90

4. D.C. Teodorescu, *Specific features which generated the high floods runoff in Dobrogea hydrographic basins*, Proceedings of Annual Session of Spiru Haret University, may 2006, p.20

5. D.C. Teodorescu, *Considerations about the risk phenomena which are registered in 2005-2006 in south Dobrogea. Case study: hydrographic basin Urluia*, Proceedings of Annual Session of Spiru Haret University, may 2007, p.23

Buta Constantin graduated in 2003 the courses of the Department of Civil Engineering of Ovidius University of Constanta and the Master courses at the same Faculty (2004). He graduated the Master courses in Naval Engineering in 2006. He is a PhD. student at Technical University Gh. Asachi, Iasi and assistant at Department of Civil Engineering of Ovidius University of Constanta.

Between the research results we mention the participation at the realization of:

- a mathematical model used in the didactic activities at Irrigation courses. It realizes a minimum balance precipitation – real evapo-transpiration, in order to determine the necessary water supply for irrigation;
- a program (ETREF) that calculates the reference evapo-transpiration and is used in didactic activities.

- *Works* (6); between them:

1. C. Maftei, L. Serban, C. Buta, *Meteorology*, Ed. Valinex, Chisinau, 2004 (in Romanian)

2. C. Buta, C. Maftei, L. Rosu, *The drain spacing determination in the Calmatui catchment*, Proceedings of International Scientific Conference microCAD 2004, Miskolc, Hungary, p. 15-20

3. C. Maftei, P. Chevallier, L.Rosu, C. Buta, G.Adam, *Mathematical modeling of the relation suction – moisture*, Scientific symposium: Conceptii moderne in ingineria amenajarilor hidrotehnice, Timisoara, 2005

4. C. Maftei, C. Buta, *Evaluation of the mathematical models for quantifying the unsaturated hydraulic conductivity*, Lucrari stiintifice, XLIX, vol. I, Seria Horticultura, Iasi 2006, p.951-957

5. C. Maftei, C. Gherghina, S. Gelmambet, C. Buta, *ETREF un logiciel qui calcule l'evapotranspiration de reference*, Annals of Oradea University, Fascicle of Management and Technological Engineering, 2006, p. 86-93

- Member of the profesional associations: AGIR, AIFCR
- Member in 4 research grants; between them:

1. Grant CNCSIS 1071/2005, the themes 2/2006, 3/2007: *The modeling and optimization of the water circulation and the storage in the active soil layer*.

2. Grant CEEX - MENER (cod MEC 1914), 2006-2008: *Advanced technologies for the modernization and management of the exploitation of the natural resources with high degree of vulnerability at natural disasters.*

4.1.2.2. Young researchers

The role of the PhD students in project:

Pelican Elena:

2007: The calculus of the statistical indices of data series (expectance, variance, variation coefficients, asymmetry coefficients etc.)
2008: The study of the errors in the prediction models and the parameters optimization in order to obtain the minimum of the errors.
2009: The realization of some programs that detect the long range dependence and the stationarity of the rainfall series.
2010: The realization of some programs that calculate the Hurst coefficient.
The title of the PhD. Thesis is: *Contributions of the inverse problems in mathematical physics.*

Buta Constantin:

2007: The construction of the data series.
2008: The choosing and the fit of the freqvential models for the maximum rainfall in 24 hours.
2009: The prediction of the monthly rainfall using Holt and Winters methods.
2010: The interpretation of the results of the fractal model and the comparison with the results from the scientific literature.
The title of the PhD. Thesis is: *The technique and the technology of the horizontal drainage verifiable with the use of the land appliance.*

Teodorescu Dacian Constantin:

2007: The initial analysis of the values series.
2008: The choosing and the adjustment of the freqvential models for the annual precipitations.
2009: The annual rainfall prediction using Holt and Winter methods.
2010: The prediction of the extreme events using the multifractal model and the comparison with the results from the scientific literature.
The title of the PhD. Thesis is: *The water resources of the continental Dobrogea space. Genesis, hydrological regime and exploitation degree*.

4.2 Other resources

4.2.1. The available infrastructure

- Calculus technique: P.C. Pentium IV, programs for the data processing: SPSS, MATEMATICA, Matlab, Maple
- Access at the libraries of Ovidius University, The Faculty of Mathematics and Informatics, Romanian Academy Institutes Bucharest, Al. I. Cuza University, Iasi.
- Access at the data base: INMH and National Company Apele Romane Dobrogea.
- Internet access