StartClim.3c

Ereignisdatenbank für meteorologische Extremereignisse

MEDEA

(**M**eteorological extreme **E**vent **D**ata information system for the **E**astern **A**lpine region)

umweltbundesamt

IIASA

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Wien, November 2003

Teilprojekt von StartClim
“Startprojekt Klimaschutz: Erste Analysen extremer Wetterereignisse
und ihrer Auswirkungen in Österreich“

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content:

Kurzfassung

Die Ereignisdatenbank für meteorologische Extremereignisse soll in erster Linie der mittel- und langfristigen Datensicherung für meteorologische Extremereignisse verschiedener Art in Österreich dienen. In zweiter Linie soll in der Perspektive die Möglichkeit geboten werden, der österreichischen Klimaforschungsgemeinde gezielte Auswertungen aus der Datenbank heraus zu ermöglichen.

Der derzeitige Stand der Arbeit an MEDEA kann mit folgenden (Zwischen-)ergebnissen zusammen gefasst werden:

- Das am Umweltbundesamt entwickelte Dateninformationssystem MORIS wurde erfolgreich auf seine Verwendbarkeit hinsichtlich der Anforderungen der Ereignisdatenbank MEDEA getestet. Dabei standen folgende Anforderungen im Mittelpunkt der Evaluierung:
    1. Erfassbarkeit eines weiten Datenspektrums (z. B. georeferenziert – nicht georeferenziert, „harte“ naturwissenschaftliche (Mess-)daten – „weiche“ sozioökonomische Daten)
    2. jederzeitige Erweiterbarkeit in Richtung neuer Forschungsprojekte/-programme der österreichischen Klimaforschungsgemeinde (z.B. ClimRisk, möglicher Nachfolger von StartClim, ProVision)
    3. Integration von Unsicherheitsangaben zu den verschiedenen Daten(sätzen)
- Eine vorläufige Objektklassifizierung für MEDEA wurde durchgeführt.
- Eine erste Sichtung und Beurteilung verschiedener (zu erwartender) Datensätze nach deren Unsicherheit.
- Die ersten uns zur Verfügung gestellten StartClim-Daten wurden erfolgreich in MEDEA eingepflegt.

abstract

The main task of the Meteorological extreme Event Data information system for the Eastern Alpine region (MEDEA) is the long range storing for the various range of meteorological extreme event data in Austria. Perspectively the possibility for specific analysis shall be given.

The state-of-the-art concerning MEDEA can be summarized as follows:

- The MORIS data information system developed at the Umweltbundesamt was tested successfully due to its potential for the requirements of MEDEA. The following needs were in the focus:
    1. Integration of a wide-range data spectrum (e.g. georeferenced – not georeferenced, “hard“ natural science data – “soft” socio-economic data)
    2. flexibility towards new research projects/programmes of the Austrian climate research community (e.g. ClimRisk, possible StartClim-successor, ProVision)
    3. integration of uncertainty specifications belonging to the various data
- A preliminary object classification has been carried out.
- A first evaluation of the anticipated data and their uncertainty has been carried out.
- The first StartClim data sets were imported successfully into MEDEA

3c-1 Introduction

3c-1.1 Scope of the Report

This is the final report of the StartClim Project 3c *Ereignisdatenbank für meteorologische Extremereignisse* (in the following called MEDEA – **M**eteorological extreme **E**vent **D**ata information system for the **E**astern **A**lpine region), jointly carried out by the Austrian Federal Environment Agency (Umweltbundesamt – *Umweltbundesamt*) and the International Institute for Applied Systems Analysis (IIASA). The report describes MEDEA's potentials in meeting a wide range of technical and scientific requirements envisaged under Austrian climate research programmes currently under discussion, including uncertainty and its consideration and representation in the database.

3c-1.2 Background

Collaborative work on the StartClim Project 3c commenced in March 2003. The status of work has been reported intermittently throughout the Project. Documents that summarize the Umweltbundesamt-IIASA meetings were made regularly available to the StartClim community on the FTP server of the University of Agricultural Sciences, Vienna (ftp.boku.ac.at).

3c-1.3 Rationale

The StartClim Project 3c grew from the preparatory work on *ClimRisk – An Integrated Approach Assessing Climate Related Risks: Interdisciplinary Research for Tracing the Impact of Climate Change and Socioeconomic Intervention*, a research program under preparation for submission to the Austrian Science Fund (FWF). The assessment of uncertainties and risks is considered as one key thematic area to ensure successful completion of this integrated research programme. The intention behind the StartClim Project 3c was not to lose sight of this valuable long-term scientific goal and to prepare the basis for Austria's future research on climate-induced impacts. In fact, the StartClim Project 3c can be considered as the only project under StartClim that was requested, and also attempted, to meet future challenges of integration, beyond its own completion.

A typical challenge is the lack of knowledge around extreme events and their risks, for instance, concerning: historical data on occurrence and location, geophysical information, underlying uncertainties, losses, mitigation and adaptation strategies, etc. This information often exists on rather aggregate scales but is typically needed on detailed spatio-temporal scales. Another challenge is the involvement of multiple agents – households, governments, transportation, land use and other local and central authorities, insurers, etc., whose goals, constraints, and limitations need to be taken into account.

These arguments are considered sufficient to motivate the development of a new type of database to support the assessment and management of extreme events. Such a database is needed to facilitate a better understanding of extreme events, their characteristics, causes and scales of consequences. It is also needed to enable appropriate analyses of past events and their uncertainties as well as their prognostic treatment with the help of models.

The grouping of UMWELTBUNDESAMT and IIASA – UMWELTBUNDESAMT with its long-term experiences in building integrated, multi-functional environmental databases (Schentz and Mirtl 2003) and IIASA with its experiences in building databases (including models) focusing on extreme events and their stochastic characteristics, the explicit treatment of losses induced by catastrophes as well as their socioeconomic consequences (Ermoliev *et*

al., 2000; Ermolieva *et al.*, 2001; Jonas *et al.*, 2001, 2004) – was a logical consequence. A request for cooperation was submitted to UMWELTBUNDESAMT and IIASA prior to commencing Project 3c.

3c-1.4 Objectives

The overall objective of the StartClim Project 3c is to establish a new type of data information system for extreme meteorological events that considers uncertainties and permits and supports the assessment of risks. The information system must be able to manage, classify and harmonize heterogeneous data; to record and follow their uncertainties; and to present the data in a way that permits integrated (including prognostic short- as well as long-term) analyses by the StartClim community and other users. The database has to be built in a way that facilitates easy extension defined by the needs of future programmes and activities in the field of climate change, such as ClimRisk and ProVision. To these ends, existing know-how and software expertise developed under the umbrella of integrated environmental assessments have to be used.

Connections to other databases and accessibility via the Internet will be demonstrated in the form of examples.

3c-1.5 Conditional Framework

StartClim Project 3c was requested to meet StartClim-internal integration requirements to the extent possible. In addition, Project 3c was requested to also take future integration challenges into consideration as they are to be expected in connection with Austria's planned environmental research programmes ClimRisk and FORNE *(Forschung für nachhaltige Entwicklung)*.

3c-1.6 Guide Through the Study

While 3c-1 is meant to introduce MEDEA by describing the aims and background, chapter 3c-2 gives an outline of the scientific needs and requirements. Chapter 3c-3 deals with the technical aspects of MEDEA. In chapter 3c-4 we describe the major results within StartClim while chapter 3c-5 gives an abstract about the proposed follow-up since MEDEA doesn't finish within the time frame of StartClim.

3c-2 scientific requirements for MEDEA

3c-2.1 MEDEA in the context of StartClim and AustroClim

Dating from 23 May 2003, the enquiry to build an information system for the storage of the StartClim data was brought to Umweltbundesamt by the Institute of Physics and Meteorology (Prof. Kromp-Kolb) of the University of Agricultural Sciences Vienna. The positive response dated from 20 June was sent by Dr. Karl Kienzl, Umweltbundesamt.

From the start, the intention of MEDEA was to build up an architecture for a data information system that is not only suitable for StartClim, but also for further projects and programmes in the field of climate change research in Austria in the oncoming years (like FORNE, ClimRisk and possible StartClim-successor).

The short time frame of the second half of StartClim was used intensively by Umweltbundesamt and IIASA to provide an adopted system that has the capability to be:

- *suitable* for the requirements of StartClim,
- *flexible* for a possible successor of StartClim, and
- *expandable* for the requirements of ClimRisk and FORNE.

Keeping this in mind, Umweltbundesamt and IIASA can guarantee that MEDEA can accomplish the requirements of AustroClim.

3c-2.2 Collaboration between Umweltbundesamt and IIASA

In addition to numerous informal contacts, a number of formal meetings took place between Umweltbundesamt and IIASA to monitor and document the progress of work (see table 3c- 1 below and Appendix 1 and 2). The core question repeatedly posed was how MEDEA can serve as an integrated data information system for the StartClim community (and other users) that considers uncertainty and meets the interests and demands of different stakeholders. The StartClim Project 3c offers two answers to appropriately overcome the addressed issue: 1) To make use of MORIS as a basis, Umweltbundesamt's Monitoring and Research Information System, which already offers many of the required characteristics (see chapter 3c-3); and 2) to introduce a solid uncertainty concept that meets the criteria of data heterogeneity and permits following uncertainty during data integration (see chapter 3c4.1.6).

Documented Meetings		
When	**Where**	**Available Document**
09 April 2003	Umweltbundesamt, Vienna	*Provision of Assistance*, dated 23 April 2003
24 April 2003	IMP, Vienna*)	*Provision of Assistance*, dated 07 May 2003
22 May 2003	Umweltbundesamt, Vienna	*Provision of Assistance*, dated 27 May 2003
23 June 2003	Umweltbundesamt, Vienna	Joint Presentation at 2nd StartClim Workshop, Vienna, 24 June 2003
11 July 2003	IIASA, Laxenburg	*Provision of Assistance*, dated 17 July 2003
14 August 2003	Umweltbundesamt, Vienna	*Provision of Assistance*, dated 20 August 2003
18 September 2003	Umweltbundesamt, Vienna	Joint Presentation at 3rd StartClim Workshop, Vienna, 29-30 September 2003
No separate meeting; joint preparations via email etc.		Joint Presentation at 4th StartClim Workshop, Vienna, 10 November 2003

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table 3c- 1: Documented Meetings.

3c-2.3 quality assurance

(Test-)data of as many subprojects of StartClim as possible have been imported to test how the integration model of the heterogenous data performs in practical work.

In a second step also some selections of the data were made to find out, if they will be well accessible in the future.

The third quality test was to export primary data and selected datasets to EXCEL and SPSS to see if the possibility for special investigations is given.

The classification of the uncertainties has been mapped to the polyhierarchies of MEDEA.

All tests showed that the structuring work was done in a manner which fits the demands.

3c-2.4 innovation potentials: end-user-defined classes and the integration of uncertainties

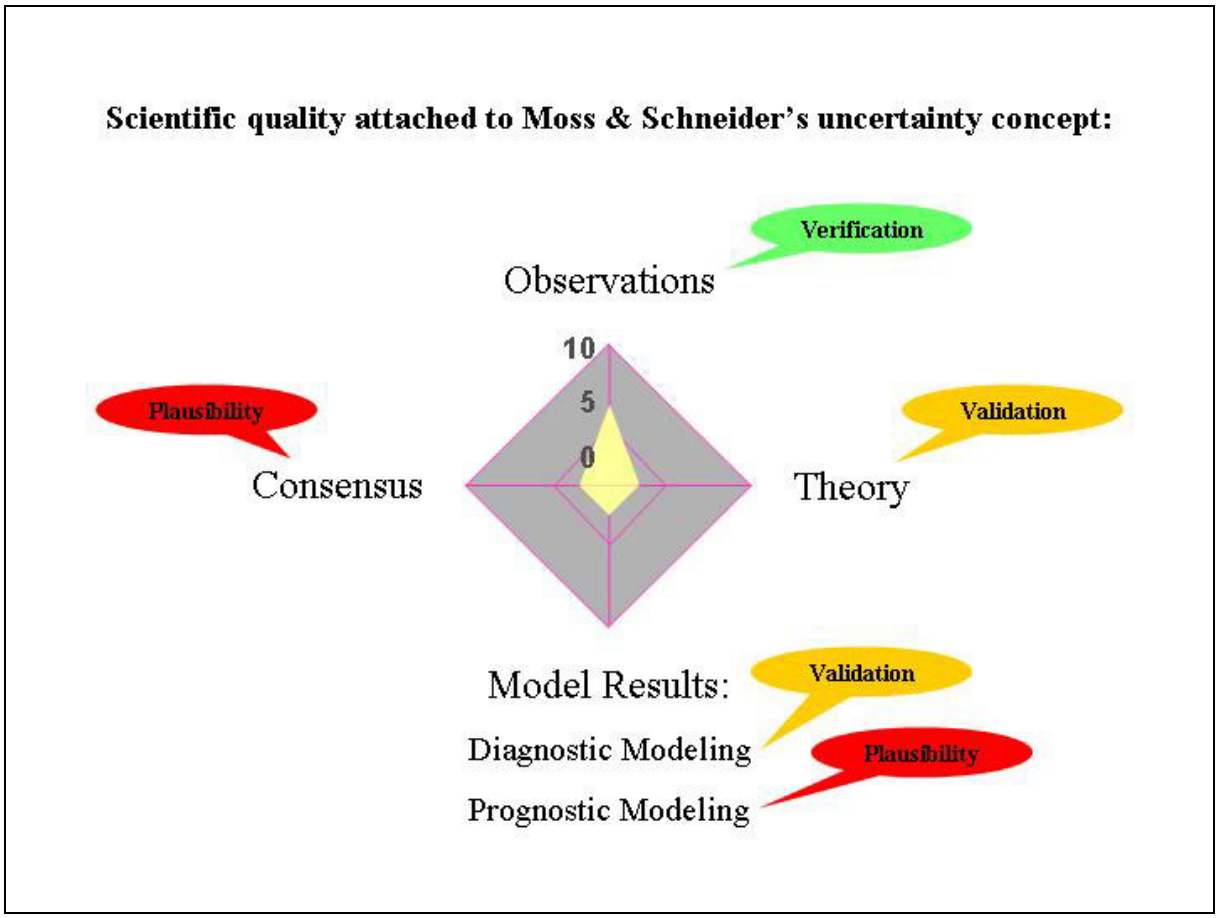
The common IT model of classes is expanded to end-user definable ones which produces a very flexible and extensible information system, the base for long term monitoring of meteorological, socio-economic, ecological and different other data.

We refer to Moss and Schneider (2000; see also Giles, 2002), who categorize uncertainties and espouse the use of a straightforward concept within the Intergovernmental Panel on Climate Change (IPCC) to illustrate where scientific uncertainties come from. Their concept reveals the advantage of fundamental structure. It considers four main categories – corresponding to confidence in the theory, the observations, the models and the consensus within or across disciplines – to which we attach scientific quality labels to indicate whether plausibility, validation or verification (ascending order of strictness) can be achieved (see Fig. 3c-1).

In accordance with this concept, only observations (measurements) – uncertain per se – can be verified, but none of the other categories.

To justify theory as a self-standing uncertainty category, reference can be made, e.g., to the famous Michelson-Morley experiment performed by Albert Michelson (1852–1931) and Edward Morley (1838–1923) in 1887. It was motivated by the search for an absolute reference frame, within which absolute motion can be measured. This experiment can serve as a classical and illustrative example that theory and observation – although individually "solid" – did not match, simply because the current physical understanding at that time was insufficient. However, theories – like diagnostic models – are our reflection of reality and can never be considered complete; final truth cannot be achieved. Therefore, theories and diagnostic models can only be validated or, alternatively, falsified (which is a controversially discussed issue on its own).

Consensus (soft knowledge) as well as prognostic modeling also give rise to uncertainty. However, these two categories can, at best, only be judged as plausible; they can neither be validated nor verified.



figur 3c- 1: The four-axis concept of Moss and Schneider (2000; see also Giles, 2002) to trace where uncertainty comes from, modified to show which scientific quality in terms of plausibility, validation and verification can be achieved.

3c-3 technical requirements for MEDEA

3c-3.1 requirements

The information system has to be able to map following data:

- meteorological sites and their describing attributes , meteorological parameters and time series measured at those sites.
- meteorological events, classified by an extensible system, and a collection of several meteorological parameters.
- geomorphological impacts as e.g. floods, mudflows, avalanches, …. and all the parameters measured along with them.
- Economical impacts of meteorological events, e.g. distructions of buildings, agricultural land, and the influence on plant growth and harvests.
- Observations of meteorological events and their impacts by common people.
- Geographical, political, hydrological and other a regions or structures (e.g. rasters) describing the surroundings of sites and places of observations
- Data Classification according to the system of Schneider Moss
- Detailed data on the methods of observation, measurement, calculation, … to enable valid interpretation of data even later on.
- Data about the projects, subprojects, initiatives tasks to make the data management easier.
- Data on actors as they are relevant for projects, to make questions possible when further facts about the data should be required.
- All kinds of important notes like scratches, photos, articles, documents.

The information system has to provide the following functionalities:

- Import and Export routines for data and metadata
- Tools for structuring data according to different, sometimes contradicting systems.
- Tools for surfing through the data
- Simple reporting
- Simple time series display
- Interfaces for Statistics Tools like SPSS and MS EXCEL
- Standard TXT and CSV Interfaces

3c-3.2 solutions so far

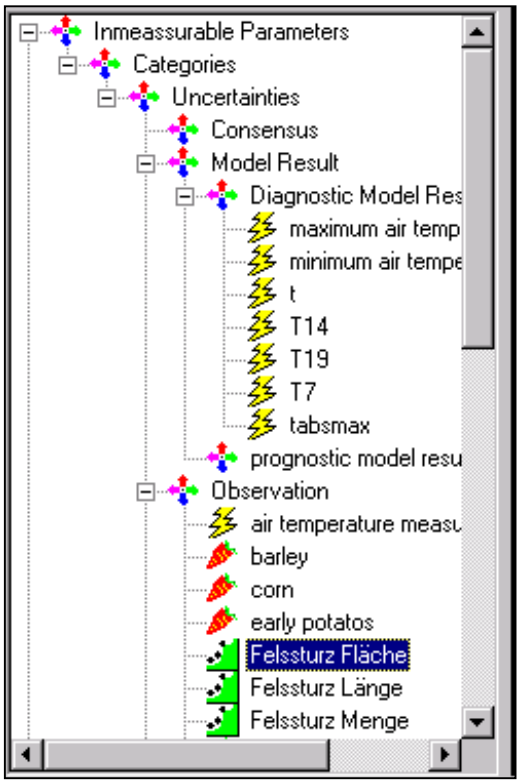
So the Solution had to have at least the following features:

- Adaptability for heterogenous data (a single set of attributes would not match for events, sites, regions, ….)
- Extensibility (the future will certainly bring new kinds of data)

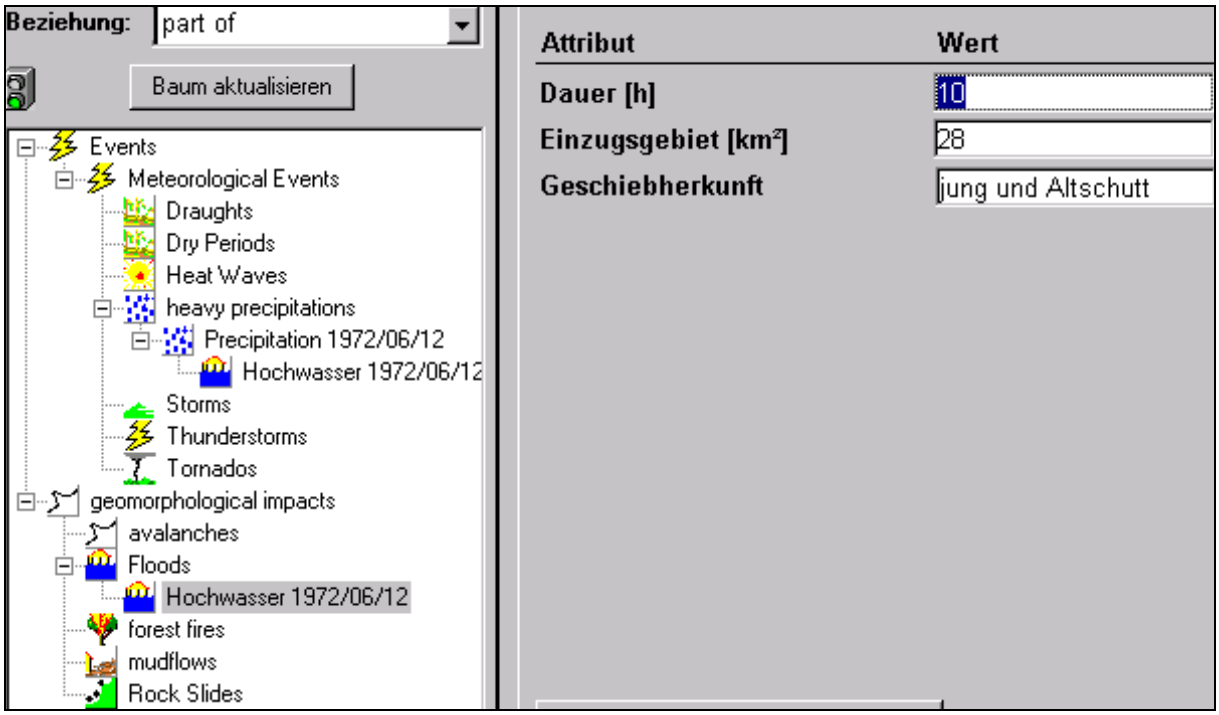
So only a generic system with all the other features described above could meet the task. Fortunately the Umweltbundesamt had developed an information system for the Austrian part of the UN ECE project “Integrated Monitoring” which had to meet nearly the same tasks. So the experts made successful tests with testing data supported by the different projects and

found out that the information system fits for the requirements of StartClim and the following projects if the additional features described in 3c-2.3 can be installed.

3c-3.3 Screenshots



figur 3c- 2: Treeview showing Uncertainties in the polyhierarchy of Parameters



figur 3c- 3: Polyhierarchy of events showing a specific flood in 2 Positions:

(1) In the tree of meteorological events, since it is the impact following a certain meteorological event.

(2) In the structuring tree of geomorphological impacts.

3c-4 outcome within StartClim

3c-4.1 Mapping of the supported Data

All supported data and all metadata and data management data could be mapped into MORIS without major problems.

3c-4.1.1 Meteorological extreme events

The possibility to map all data around meteorological extreme events was tested with an extract of the Austrian flood and avalanche database of the BFW. Not only that all recorded data could easily be mapped to MORIS, it was also possible to structure the events according to different categories using the built-in feature of polyhierarchie

3c-4.1.2 Impacts of the meteorological extreme events

The descriptions of extreme events and extreme periodes as well as the regions, villages and districts that were effected and all meteorological, economical and geomorphological parameters exactly fit into the package “specimen”, “object” and “parameter”. With the possibility to establish polyhierarchies the relation to the meteorological extreme events could be mapped as well as categorization of those events.

3c-4.1.3 Data of meteorological monitoring

Since MORIS was built for any kind of ecological monitoring data it is not difficult to record meteorological data.

3c-4.1.4 Data of observations of common people

Whenever observations of common people have to be recorded you have to store all the data about the “Umfrage”. The methode used, the person(s) who observed, the method used to verify the data, and sometimes photos and scratches that were made during the observation or during the “Befragung”. Those data are stored in the Packages “Methodes” , “Archive” and “Actors”

3c-4.1.5 Descriptions of the methods of observations and measurements

Even though scientific observations are done with more precise and distinct methods than those of common people it is always useful to precisely describe the methods used. MORIS had no difficulty to record any of those descriptions.

3c-4.1.6 Uncertainties

As mentioned above the categorization of all observations and other data according to the model of Schneider Moss was an outstanding scientific need for the information system. This categorization could be management with the use of polyhierarchies amongst the parameters observed.

3c-4.1.7 Different metadata

Of course meteorological, geomorphological, economical and agricultural parameters have different so called primary metadata as e.g. upper limit, lower limit, resolution, etc. Since this is a fact for all outcommings of observations and measurements, MORIS has been built to serve those needs and we did not have any problem to map different metadata to MEDEA.

3c-4.2 Functionalities available

- Import and export routines for data and metadata are standard features of MORIS and proved to fit all the demands that arose during StartClim. Of course the possibilities to import classes which are just in the process of implementation will be of great use, whenever data which are already well structured according to categories. (e.g. the tornado monitoring data)
- Hierarchies as auxiliary structures are very common in the whole IT-world. Polyhierarchies are wide spread in the scientific world as our world can not be described in 1 homogenous mono-hierarchical system. So there are two effects: Users are not so aquainted with the IT part of polyhierarchies but once they have got accustomed to them, they are really widely using them.
- Overviews over complex, heterogenous data are, no doubt, always difficult, and so it is with the data of StartClim. But the built-in tools of MORIS are of great help for the users:
    - The treeview to show the polyhierarchies
    - The drill – into function which allows the user to surf along any way of relations amongst the data
    - The built-in index
- MEDEA has no built-in tool for complex reporting, it is much more thought to use the generic interfaces for adding a standard reporting tool to meet reporting needs.
- The built-in tool of MORIS can be used to display time series but can not display frequencies or interdependencies or any other statistic facts. Those tasks have to be accomplished by external tools or may be implemented in the future, if the permanent need makes more comfort necessary
- The Interfaces for Statistics Tools like SPSS and MS EXCEL are very comfortable and in combination with the selection tool they can serve various purposes.
- The standard TXT and CSV Interfaces work according to the state of the art and proved useful when importing data.

3c-5 Future Perspectives

During the project it became that the following extensions would enhance the usability and utilisation of MEDEA:

- WEB Interface would allow project partners to view, extract and access data over the internet
    - There is at this point no need to perform administrator tasks like class definition over the internet. However, visualisation of data stored in MEDEA with an WEB browser seems a basic necessity. Since nearly all functionalities of the user Interface of MEDEA are already implemented once in one or another application of the environment agency its clear that this is no technical but only a financial question.
- GIS Integration for selection, presentation and statistical calculation of data.
    - A low level GIS Integration for data stored in MORIS is already available. This integration is semistatic, that is to say it has to be extended for every new class defined. This could be automated by procedures on any level between database and GIS (stored procedure, web service, GIS Macro, ….). A more adequate solution would be an interactive interface which can easily handle time series, class dependend attributes, related parameters, statistic output, ….. a very versatile GIS interface should be implemented. Previous tests in other projects with tools like WEB GIS and disy Cadenza clearly demonstrate the benefits of this approach.It also became apparent, that a real universal GIS interface implies a lot of effort.
- Integration of existing dislocated databases as e.g. the flood and avalanche database of the BFW.

  Ecological monitoring in general and StartClim in particular involve access of data sources of various institutions situated at different geographical locations. Integrating systems need to access already existing topic databases independent of the geographic location, database vendor, etc. As a consequence the following tasks have to be accomplished to integrate data:

  (1) data aggregation: most of the time data are not needed in the best granulation available

  (2) access control: No Integration can be done without it

  (3) data transportation: a lot of techniques are ready for use

  (4) data mapping: joining, merging, adding, translating the semantic. A common ontology has to be established, better the process of establishing it has to be defined.

  (5) data presentation: (graphical, alphanumeric, multimedia) display, export, ….

  A common data exchange method between partners is export – transport - import. This can be quite useful for small amounts of data are to be transferred and if the data are static.

  Higher level exchange methods require a different approach. Upcoming technologies like GRID Technology will eventually offer tools to help accomplish the mentioned tasks.

Depending on the detailed requirements and the funding various stages of extensions are possible. To ensure the active cooperation of all project partners in the future, it is recommended to implement the Web interface.

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Figures and tables

figures

tables

Appendix 1:

Provision of assistance to Umweltbundesamt in carrying out StartClim Project 3c: *Ereignis-Datenbank* (*Db Project* hereafter)

Meeting at Umweltbundesamt, 9 April 2003: JB, MK, HS, JW (Umweltbundesamt); TE, MJ (IIASA)

Note: The purpose of this document is to provide assistance to Umweltbundesamt in carrying out the Db Project and to generate value-added benefit by addressing scientific and other issues of concern during this process. This document is not meant to serve as a protocol. However, it reflects major points of discussion and can, therefore, be used to make them transparent to the StartClim community.

I. Discussed Issues:

1. StartClim ↔ ClimRisk

   The Db Project is exposed, more than other projects under StartClim, to the need that it will also be of use to the follow-up ClimRisk program. Toward this end, key issues that need to be kept in mind are *integration*, *uncertainty*, *risk*, *prognostic modeling* (see also Issue I.5 below) and others.

2. Transparency and Provision

   The StartClim Db is meant to serve as a tool that aims at integrating Austria's climate change related research. It will not replace existing, officially agreed and widely accepted, Austrian databases. It will also be made accessible to the interested public. The Umweltbundesamt will kindly consider these issues as it is also within its mandatory regulations.

3. Getting Started: Bottom-up ↔ Top-down

   (a) Bottom-up: A questionnaire on which data are available within and/or will be generated by the StartClim community has already been sent out. A good overview of data providers and customers is not yet available, as many replies have not been received so far. This feedback will drive the building of the Db from a thematic point of view.

   (b) Top-down: Key questions concerning the purposes of the Db, its technical and functional capabilities, etc., need to be identified and addressed in parallel.

   (c) Bottom-up ↔ Top-down: After merging, the two approaches are suited to serve as the basis for a 'list of obligations'.

4. Structure of Data

   Our thinking, when driven by uncertainties, implies structuring the data (and thus the Db) to an extent that goes beyond our current thinking, which is determined by mean values only. Moss and Schneider (2000; see also Giles, 2002) espouse the use of a straightforward concept within the Intergovernmental Panel on Climate Change (IPCC) to illustrate where scientific uncertainties come from. It involves four main categories, corresponding to confidence in the theory, the observations, the models and the consensus within or across disciplines.

5. Diagnostic ↔ Prognostic

   This issue is mentioned although it is implicitly included in Issue I.4.

   The understanding so far is that StartClim will mainly focus on historical data, with the main focus on the last five decades. In contrast, ClimRisk will also foresee prognostic modeling (with scenarios until 2020/2050), which is why historical data need to be compiled for much longer periods.

II. Endorsed Issues:

1. To I.3

   (a) To continue the effort of identifying the data providers and customers of the Db, their data contributions and requirements, etc., (bottom-up approach).

   b) To commence, in parallel, with identifying and answering the key questions that underlie building this Db (top-down approach). To these ends, to establish contact with H. Kromp-Kolb and other relevant colleagues and seek their input as soon as possible.

   c) To complete the 'list of obligations' as soon as possible. (This will also serve as the basis for a limited call for tenders to explore the competitiveness of the Umweltbundesamt/IIASA-cooperation in building the Db).

2. To I.4

   To follow up the IPCC discussion on uncertainty and explore its relevance and consequences for the Db Project.

3. To I.5

   See Issue II.2 above.

III. Recommendations:

1. It is suggested that the scientific bottom up–top down approach, which will serve as the basis for the still-to-do 'list of obligations' is overlaid with a critical time path that resolves tasks by weeks. The Umweltbundesamt team may use this critical time path to identify crucial bottlenecks. After the 'list of obligations' and the critical time path have been balanced, it is suggested that a summary document is forwarded to all other StartClim teams, providing them with the necessary information that are key to their interaction with the Db Project.
2. It is suggested that great caution is shown when the purposes of the Db, its technical and functional capabilities, etc., are identified. This discussion should not only be driven from a purely technical point of view (that is, by promises on what the Db will be capable of doing). It is suggested that equal, if not greater, emphasis is given to an adequate (internal as well as external) documentation of the Db so it can be easily understood and operated and is broadly accepted among scientists.
3. It is anticipated that running the top-down approach (see Issue I.3b), in combination with discussing uncertainty (see Issues I.4 and I.5), will require more time than expected. Therefore, it is suggested to pay early attention to these tasks.

Provision of assistance to Umweltbundesamt in carrying out StartClim Project 3c: *Ereignis-Datenbank* (*Db Project* hereafter)

Meeting at IMP, 24 April 2003:
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T. Ermolieva, M. Jonas (IIASA)
H. Formayer, H. Kromb-Kolb, I. Schwarzl (IMP/BOKU)
D. Rickenmann (ANFI)
A. Soja, G. Soja (ARCS)

Note: The purpose of this document is to provide assistance to Umweltbundesamt in carrying out the Db Project and to generate value-added benefit by addressing scientific and other issues of concern during this process. This document is not meant to serve as a protocol. However, it reflects major points of discussion and can, therefore, be used to make them transparent to the StartClim community.

I. Discussed Issues:

1. Role of Umweltbundesamt

(a) as a contractor, contract allocator, etc.

(b) as the administrator of the Db (and guarantor of its unlimited and long-term accessibility)

has still to be clarified.

2. Questionnaires

A questionnaire on which data are available within and/or will be generated by the StartClim community was sent out on 25 March 2003. The questionnaire will form the mainstay of the still-to-do 'list of obligations' (see next issue). The IMP (HKK and IS) kindly agreed to send out a reminder to return the still missing questionnaires as soon as possible.

3. List of Obligations

The finalization of this list, in a bottom up–top down fashion, has been identified (see *StartClim 3c IIASA 23apr03*: Issues I.3c, II.1c and III.1). Additional remarks:

(a) Bottom-up: The Db Project crucially depends, in particular, on the timely realization of the StartClim Projects 3a and 3b.

(b) Top-down: After their identification, the top-down requirements that are essential for carrying out the Db Project (see *StartClim 3c IIASA 23apr03*: Issue I.3b) will be shared with the StartClim community.

(c) Basis: The list of obligations will serve as a basis for (1) a limited call for tenders to explore the competitiveness of the Umweltbundesamt/IIASA-cooperation in building the Db (see *StartClim 3c IIASA 23apr03*: Issue II.1c); and (2) for communication with the StartClim community, the BMLFUW and other institutions to further clarify and maximize the usefulness of the Db.

4. Checking of Data

Current thinking is that the data will be checked twice, namely prior to implementation in the Db by the individual StartClim projects and after implementation by Umweltbundesamt.

5. Interaction with the Db

The need to make the Db interactive in 'one way or another' (e.g., in connection with StartClim Project 11) will be appropriately addressed after finalizing the list of obligations.

To be considered in this context:

(a) The Db Project will also go through a research phase. Key issues to be kept in mind are *integration*, *uncertainty*, *risk*, *prognostic modeling* and others (see *StartClim 3c IIASA 23apr03*: Issue I.1). Thus, a balance between Db related research requirements and requirements of the StartClim community has to be sought.

(b) Umweltbundesamt's experience shows that it is still difficult to communicate complex data linkages and interrelations through the Internet. This will be even more difficult if the Db is still under construction and, therefore, not fully commented.

6. Linkage with Other Databases

The need to interlink the Db (with its focus on rare events) with other databases that focus on vulnerabilities, damages, etc. (e.g., BUWAL/CH, WLV/AT) will be appropriately addressed after finalizing the list of obligations. Current thinking is that this is a long-term issue to be fully addressed later (under ClimRisk), while the Db Project will look into this issue from an illustrative point of view.

II. Endorsed Issues:

1. To I.2 and I.3

To continue the effort of getting the still missing questionnaires returned as soon as possible and to put high priority on their evaluation as well on finalizing the list of obligations. See also *StartClim 3c IIASA 23apr03*: Issue II.1.

2. To I.5

To appropriately address this issue, in a balanced fashion, after the list of obligations has been finalized.

3. To I.6

To appropriately address this issue, in a balanced fashion, after the list of obligations has been finalized.

III. Recommendations:

1. It is suggested that finalizing the list of obligations should have the highest priority. Recommendation III.1 (*StartClim 3c IIASA 23apr03*) is still valid and continues to stay important.
2. It is suggested that the issues 'Interaction with the Db' and 'Linkage with Other Databases' are dealt with on a provisional and illustrative, yet practical, basis and do not distract from the Db Project. Recommendation III.2 (*StartClim 3c IIASA 23apr03*) is still valid and continues to stay important. However, we strongly support the idea of providing, at the end of the Db Project, a list of recommendations that can serve as a guideline for the ClimRisk community as to how to address the aforementioned issues in a solid manner.

Provision of assistance to Umweltbundesamt in carrying out StartClim Project 3c: *Ereignis-Datenbank* (*Db Project* hereafter)

Meeting at Umweltbundesamt, 22 Mai 2003: MK, HS, JW (Umweltbundesamt); TE, MJ (IIASA)

Note: The purpose of this document is to provide assistance to Umweltbundesamt in carrying out the Db Project and to generate value-added benefit by addressing scientific and other issues of concern during this process. This document is not meant to serve as a protocol. However, it reflects major points of discussion and can, therefore, be used to make them transparent to the StartClim community.

I. Discussed Issues:

1. The issues of the discussion were related to the list of Umweltbundesamt obligations to fulfill the requirements to the StartClim Information System (Db Project). The list of obligations summarizes goals that the InfoSystem pursues and the steps that have to be undertaken in order to reach the goals.

2. One of the main goals is to fulfill the requirements of the ClimRisk project on data flexibility, completeness, reliability, and integrity across thematic areas.

   Flexibility of data: Within the InfoSystem the data has to be integrated on some initial “level zero” resolution, and it should allow for various other resolution levels/scales.

   Questions: What may be meaningful resolution scales for the StartClim partners, as well as potential partners of the ClimRisk project? What can be meaningful resolution scales for policy oriented treatment of uncertainties and risks within and across the ClimRisk thematic areas? What are the resolution scales in which data of the StartClim projects exist or can be efficiently stored; How can higher/lower than initial data levels be store or accessed?

3. For ClimRisk it is vital that the InfoSystem addresses issues related to the treatment of uncertainties and risks in the thematic areas and represents in appropriate form.

   For this, key characteristics of the uncertainties across thematic areas of the StartClim subprojects have to be identified and structured.

   Explicit representation/references to the uncertainties and risks in the InfoSystem.

4. Types and sources of data across the StartClim projects:

   Structures of the currently existing data bases/sets provided by the StartClim partners. Data availability.

Structure that would be appropriate for the InfoSystem project, i.e., satisfy the requirements and the list of obligations (also, see 2.2.).

II. Endorsed Issues:

To I.1., it was agreed that the InfoSystem should allow for integrated model-based analysis and policy–relevant treatment of climatic events, particularly, those of extreme nature.

To 2.1., to the flexibility of data it was supported that the InfoSystem should have initial scale "zero" representation of data. Upon the reasonable "zero" scale the partners of the StartClim should agree. The agreement can be reached after the analysis of already existing databases of the StartClim partners.

To 3.1., to the issues of uncertainties: for various thematic areas the representation of uncertainties will be agreed upon within and across the thematic areas of the StartClim partners. As an example of uncertainties representation, the uncertainties regarding the occurrences of climate related catastrophes can be represented in terms of return periods (e.g., 100 year flood) and the uncertainty bounds around the return period, vulnerability curves (vulnerability of different crop structures towards particular catastrophes, vulnerability of structures/infrastructures), and uncertainty bounds around the vulnerabilities.

To 3.2., the references to the uncertainties within the thematic areas should, to the extent possible, have a clear form and representation.

III. Recommendations:

The InfoSystem should have short and long-term goals. The short-term goal is to satisfy the list of obligations integrating the data of StartClim partners. The "zero scale" resolution of the InfoSystem will correspond to meaningful resolution scales of the thematic areas and the resolution of the data available within the StartClim partners. The InfoSystem will suppose/allow to work on other levels of resolution. As a longer-term goal, the InfoSystem should satisfy the requirements of the ClimRisk subprojects, in particular, it should be suitable for model-based integrated policy-oriented uncertainties and risks management. A potential long-term goal is that the InfoSystem should be used by broader communities, e.g., address global change problems induced by anthropogenic activities on international scales.

Representation of uncertainties and risks in the InfoSystem should find an explicit place. In particular, across the thematic areas the uncertainties and risks have to be identified, structured, and adequately represented. For example, representation of risks in terms of losses/damages (to crops, structures/infrastructures) due to a catastrophe is not sufficient for a policy-oriented analysis. In addition to the losses, the initial property values (crops, structures, infrastructures) should be included. Another recommendation is to include in the InfoSystem policies implemented after or before a catastrophe, since these change reoccurrence periods, loss and vulnerability profiles.

Although some of the StartClim partners have still not provided their data sets, because of time constraints and availability of resources it was recommended to start the work on the InfoSystem with the data sets available. To still account for the data of the partners/thematic areas that have not yet responded, the option of using imaginary test data should be discussed.

Provision of assistance to Umweltbundesamt in carrying out StartClim Project 3c: *Ereignis-Datenbank* (*Db Project* hereafter)

Meeting at IIASA, 11 July 2003: TE, MJ (IIASA); MK (Umweltbundesamt)

Note: The purpose of this document is to provide assistance to Umweltbundesamt in carrying out the Db Project and to generate value-added benefit by addressing scientific and other issues of concern during this process. This document is not meant to serve as a protocol. However, it reflects major points of discussion and can, therefore, be used to make them transparent to the StartClim community.

I. Discussed Issue:

1. Classifying StartClim Data According to Uncertainty

by using the four-axis uncertainty concept of Moss and Schneider (2000; see also Giles, 2002)[1]:

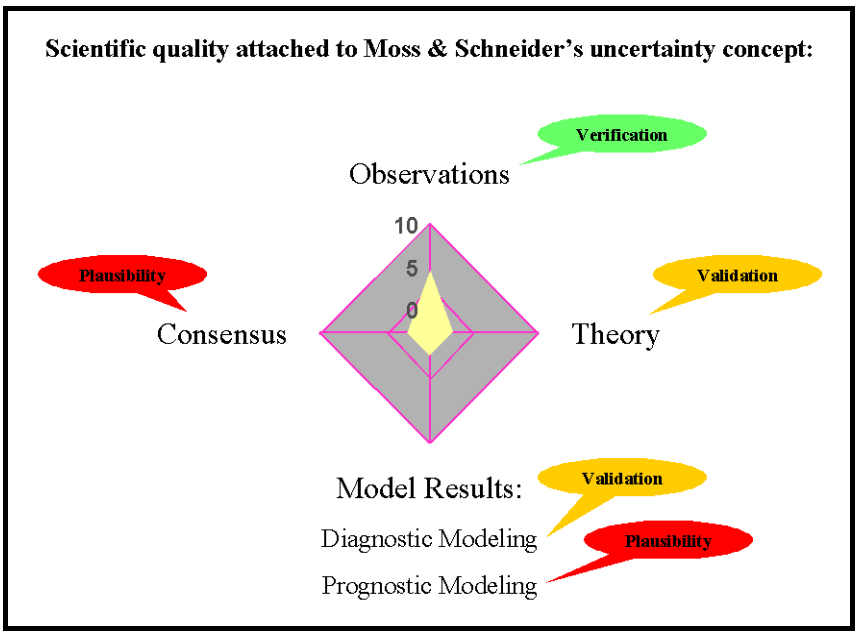


Figure 1: The four-axis concept of Moss and Schneider (2000; see also Giles, 2002) to trace where scientific uncertainties come from, modified to show which scientific quality in terms of plausibility, validation and verification can be achieved.

See **Attachment** for the outcome of the discussion.

[1] Giles, J. (2002). When doubt is a sure thing. *Nature*, **418**, 476–478.

Moss, R.H. and S.H. Schneider (2000). Uncertainties in the IPCC TAR: Recommendations to lead authors for more consistent assessment and reporting. In: R. Pachauri, T. Taniguchi and K. Tanaka (eds.) *Guidance Papers on the Cross Cutting Issues of the Third Assessment Report of the IPCC.* Intergovernmental Panel on Climate Change (IPCC), c/o World Meteorological Organization, Geneva, Switzerland, 33–51.

II. Endorsed Issue:

1. To *I*.1

   It was agreed to make use of the Moss and Schneider concept because (1) it exhibits the advantage of fundamental structure, and (2) it is suited to address scientific quality, i.e., to separate between plausibility, validation and verification. Nevertheless, the need of going beyond Moss and Schneider's first structural layer (defined by observations, theory, model results/output, consensus) became obvious – which is also what the authors themselves find necessary, if there is growing interest in this approach among scientists.[2]

III. Recommendations:

1. It is suggested that Moss and Schneider's uncertainty classifiers as well as the comments, questions and/or requests identified in Table A.1 (see **Attachment**) are scrutinized and followed up. This is expected to be an ongoing process. Nevertheless, the StartClim data can already be implemented into the StartClim Db, applying Moss and Schneider's uncertainty classifiers. Current knowledge is considered to be sufficient to also address future (possibly altered) classifying requirements with respect to uncertainty.

2 At this stage of discussing the Moss and Schneider concept, the classifier *Consensus* was understood to be equivalent to *Soft Knowledge*. To justify *Theory* as a self-standing classifier, reference is made, e.g., to the famous Michelson-Morley experiment performed by Albert Michelson (1852–1931) and Edward Morley (1838–1923) in 1887. It was motivated by the search for an absolute reference frame, within which absolute motion can be measured (see, e.g., http://wwwgalileoandeinstein.physics.virginia.edu/lectures/ michelson.html or http://scienceworld.wolfram.com/physics/Michelson-MorleyExperiment.html). This experiment can serve as a classical and illustrative example that *Theory* and *Observation* – although individually solid – do not match, simply because the current physical understanding at that time was insufficient.

Attachment: Outcome of the Discussion

Table A.1: The classified StartClim data available at Umweltbundesamt according to uncertainty.

Project/Data	Identified to Fall Under the Uncertainty Classifier …	Comments, Questions and/or Requests
StartClim 7: *Material-/Energiedaten, Fluss-/ Bestandsgrössen einer Gemeinde*	**O:** ✔ **T:** **D:** ✔ **P:** **C:**	Which data (including surveys) fall under **O**, which under **D**? Can the raw data **(O)** be accessed?
StartClim 2: T, P, etc.	**O:** ✔ **T:** **D:** ✔ **P:** **C:**	The data processing **(D)** needs to exactly described, including the post-processing statistical characteristics (if possible). In this context, it also needs to be made clear how measurement errors can be distinguished from local extreme events (e.g., thunderstorms)? Can the raw data **(O)** be accessed?
StartClim 13: *Flächige Niederschlagswerte*	**O:** ✔ **T:** **D:** ✔ **P:** **C:** ✔ (???)	Can we talk, with respect to **D**, about a fully tested and solid diagnostic technique? How much soft knowledge **(C)** is involved in deriving areal information from point related information? The soft knowledge (including its uncertainty) needs to be clearly specified. Can the raw data **(O)** be accessed?
StartClim 6: *Ökonomische Daten* (not specified)	**O:** ✔ **T:** **D:** ✔ **P:** ✔ **C:** ✔	Data related to **D** and **P** need to be strictly separated? The soft knowledge **(C)** (including its uncertainty) needs to be clearly specified. Can the raw **(O)** data be accessed?
StartClim 3b: *Ertragsdaten ausgewählter landwirtschaftlicher Kulturen von ausgewähltenRegionen*	**O:** ✔ **T:** **D:** ✔ **P:** **C:** ✔	The processing of the surveyed data **(D)** needs to be exactly described, including the post-processing statistical characteristics (if possible). The soft knowledge **(C)** (including its uncertainty) needs to be clearly specified. Can the raw data be accessed?
***BFW* (former *FBVA*):** *Hochwassermeldungen*	**O:** ✔ **T:** **D:** ✔ **P:** **C:** ✔	Typically data related to **O**. With respect to the probability of re-occurring events, it must be made clear to which extent this value is based on **D** and/or on **C**. Can the raw data **(O)** be accessed?

O: observations; **T:** theory; **D:** diagnosis/diagnostic modeling, including data processing; **P:** prognosis/ prognostic modeling; **C:** consensus.

Provision of assistance to Umweltbundesamt in carrying out StartClim Project 3c: *Extreme Event Data Information System for Austria* (*Db Project* hereafter)

Meeting at Umweltbundesamt, 14 August 2003: MK, HS (Umweltbundesamt); MJ (IIASA)

Note: The purpose of this document is to provide assistance to Umweltbundesamt in carrying out the Db Project and to generate value-added benefit by addressing scientific and other issues of concern during this process. This document is not meant to serve as a protocol. However, it reflects major points of discussion and can, therefore, be used to make them transparent to the StartClim community.

I. Discussed Issue:

1. Umweltbundesamt's Monitoring and Research Information System (MORIS)

with respect to its suitability for and adaptability to the needs of StartClim.

II. Endorsed Issue:

1. To *I.*1

   Based on the information provided by HS, backed up by a PowerPoint presentation on MORIS (see **Attachment 1**), it could be concluded that MORIS is well suited for and can be easily adapted to the needs of StartClim, foremost the classification of input data/information according to uncertainty (see *StartClim 3c IIASA 17jul03*: Issues I–III).

   MORIS' current structural approach (see **Attachment 2**) permits to address this need in several ways. The most straightforward solution takes advantage of MORIS' potential of permitting poly-hierarchies (see **Attachment 3**) that can be easily modified and/or extended by the introduction of a new data/information classification scheme (see **Attachment 4**). Typically, uncertainties (in any form, i.e., soft or hard) will be dealt with in the form of attributes (see **Attachment 5**).

III. Recommendations:

2. Based on the presented information, there is no reason not to suggest using MORIS within StartClim and its successor project (ClimRisk). From an information technological point of view, MORIS appears fully capable to adequately deal with identified needs, foremost the classification of input data/information according to uncertainty. It is strongly recommended to demonstrate this strength of MORIS in the form of a few examples (using StartClim input data/information) to the StartClim community at the 3rd StartClim Workshop (29–30 September 2003).

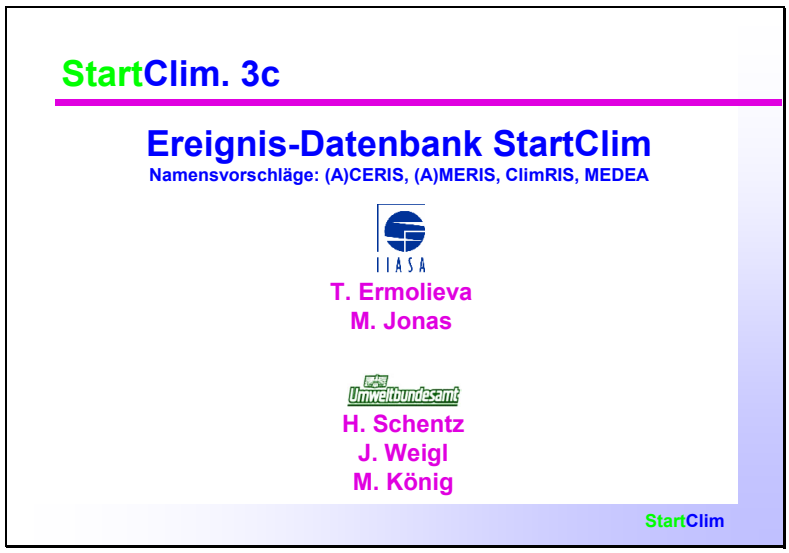
3. However, it is felt that the Umweltbundesamt management also needs to give a clear signal with respect to the future integrated use of MORIS as a standard tool within Umweltbundesamt. Currently, MORIS is already used for a number of individual tasks such as integrated monitoring, deposition surveys of heavy metals, etc. (see **Attachment 6**). That is, MORIS' potential of integrating existing databases Umweltbundesamt internally (see **Attachment 7**) has not yet officially been supported – which would also be a strong signal for Austria's StartClim community (including clients, users, etc.).

So far, a number of other StartClim relevant issues (that up-follow the decision of using MORIS within StartClim) – such as the (restricted) accessibility of MORIS via the Internet, the (restricted) potential of MORIS for statistical evaluations within StartClim, etc. – have been discussed between Umweltbundesamt and IIASA at several occasions, but their mutual understanding concerning these issues has not yet been documented. It is suggested that this be done as soon as possible and that these issues are addressed in the form of a technical summary/overview and presented to the StartClim community at the 3rd StartClim Workshop (29–30 September 2003).

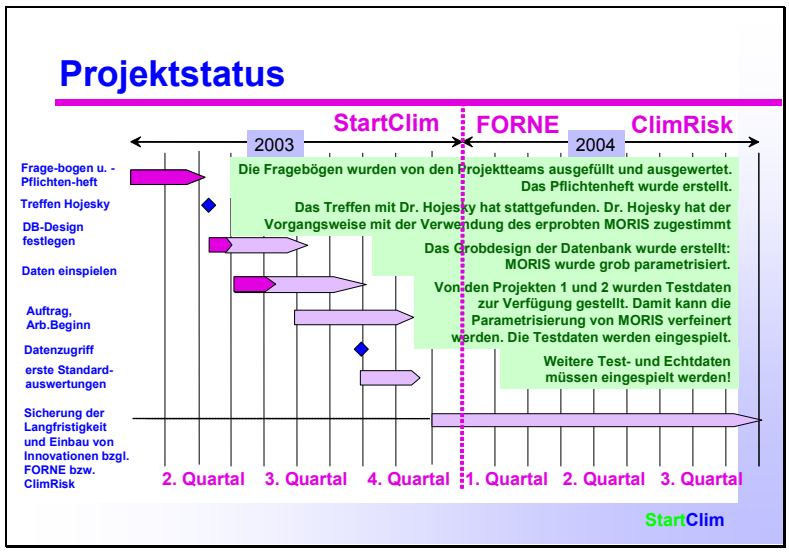
Appendix 2:

Workshop II:

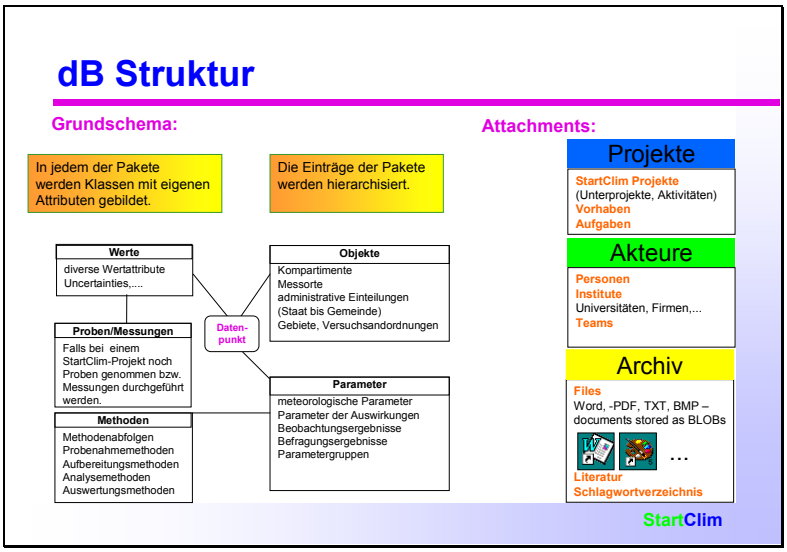
Folie 1



Folie 2

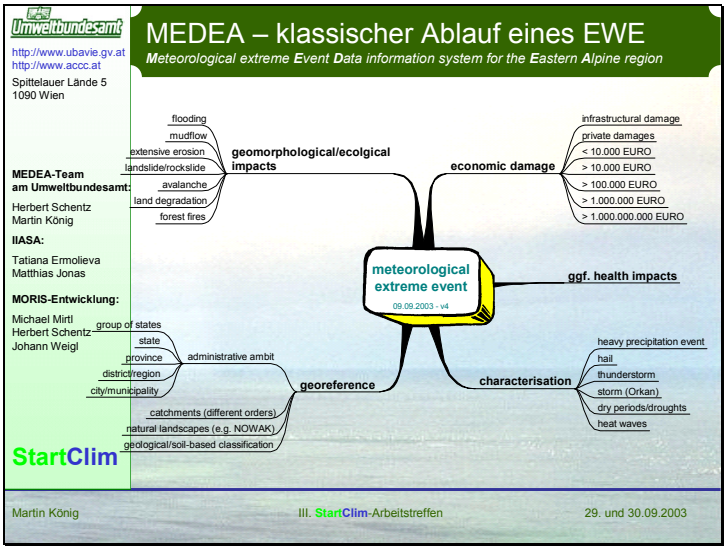


Folie 3

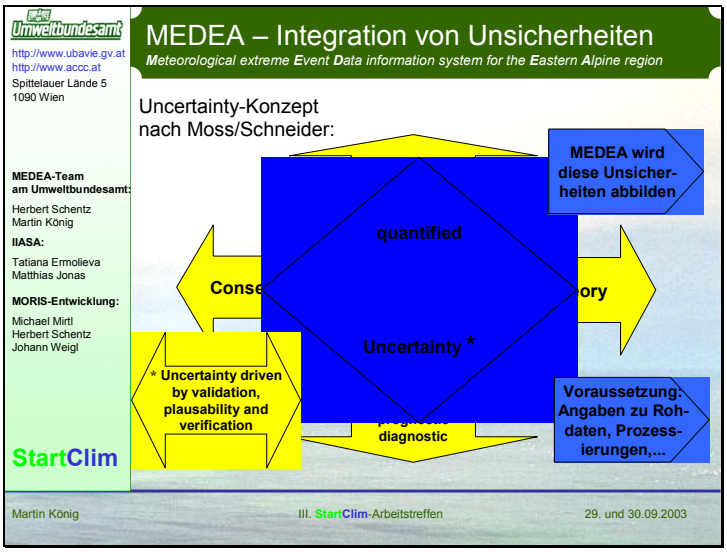


Workshop III:

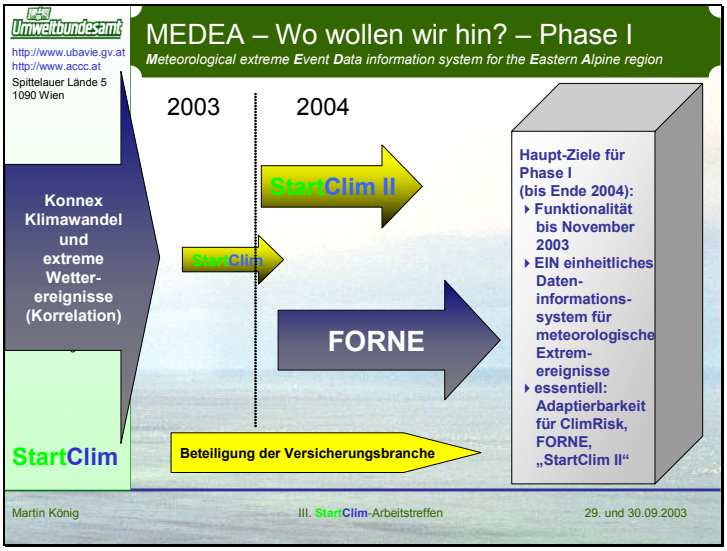
Folie 1



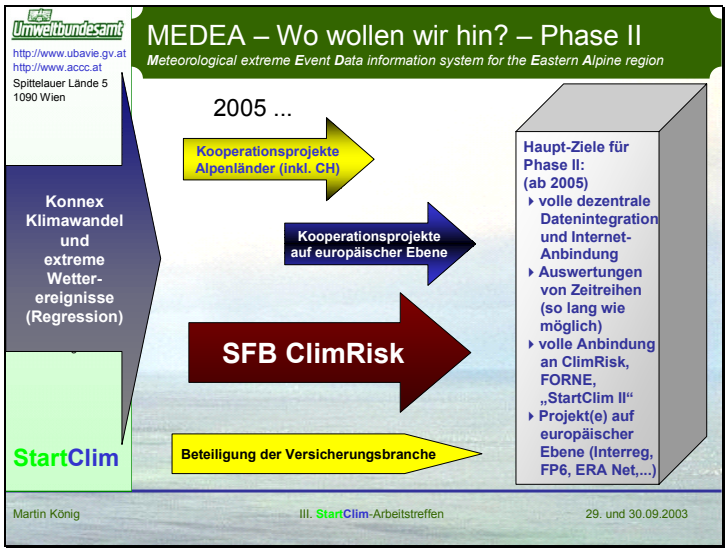
Folie 2



Folie 3

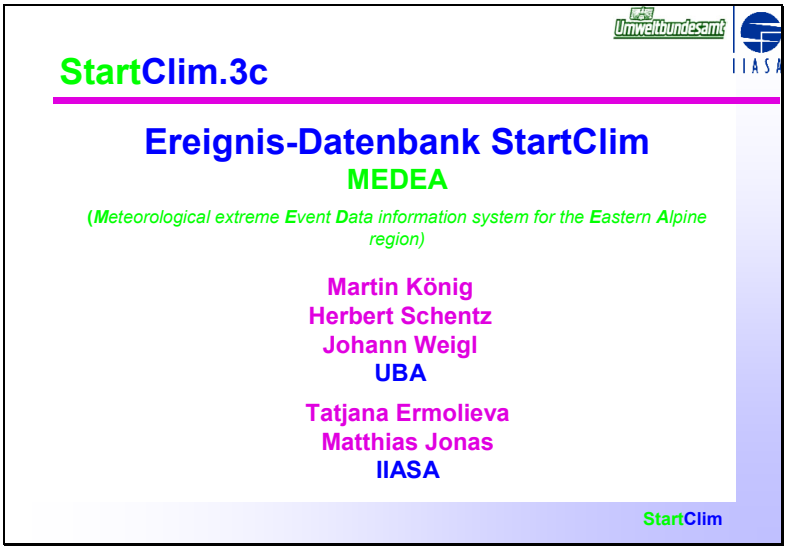


Folie 4

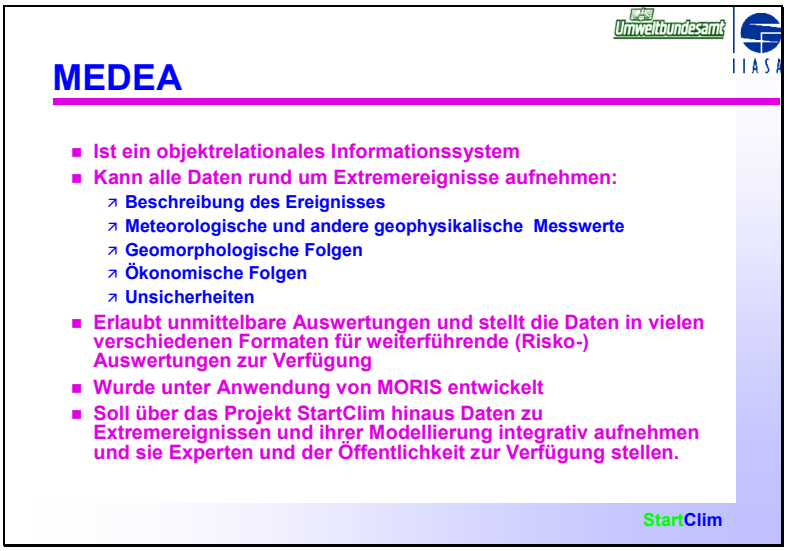

Umweltbundesamt
http://www.ubavie.gv.at
http://www.accc.at
Spittelauer Lände 5
1090 Wien
MEDEA – Wo wollen wir hin? – Phase II
Meteorological extreme Event Data information system for the Eastern Alpine region
2005 ...
Konnex Klimawandel und extreme Wetter-ereignisse (Regression)
StartClim
Kooperationsprojekte Alpenländer (inkl. CH)
Kooperationsprojekte auf europäischer Ebene
SFB ClimRisk
Beteiligung der Versicherungsbranche
Haupt-Ziele für Phase II: (ab 2005)
volle dezentrale Datenintegration und Internet-Anbindung
Auswertungen von Zeitreihen (so lang wie möglich)
volle Anbindung an ClimRisk, FORNE, „StartClim II“
Projekt(e) auf europäischer Ebene (Interreg, FP6, ERA Net,...)
Martin König
III. StartClim-Arbeitstreffen
29. und 30.09.2003

Workshop IV:

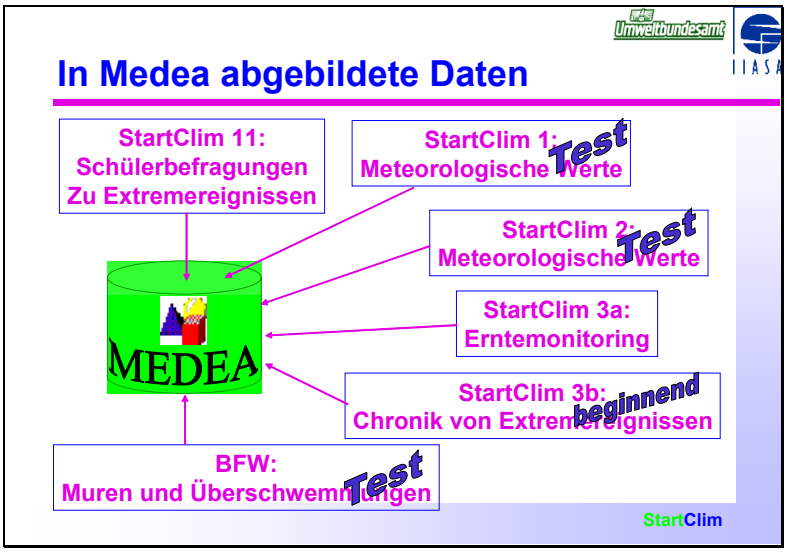
Folie 1



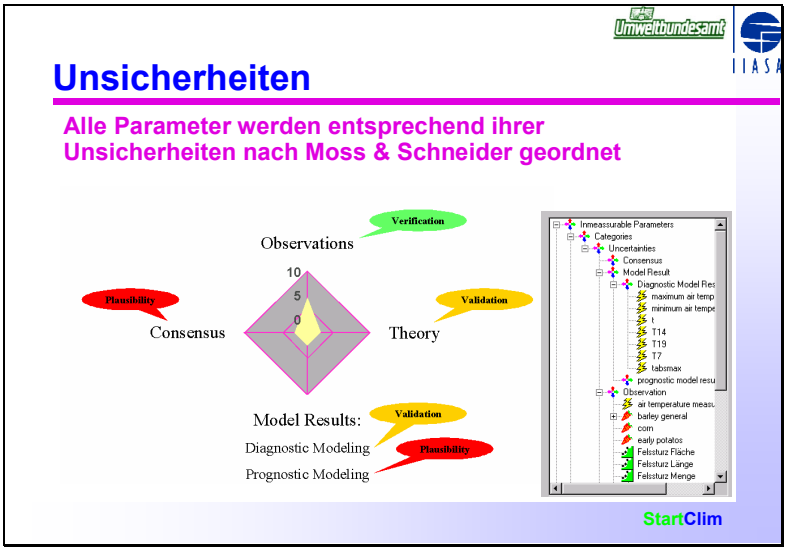
Folie 2



Folie 3



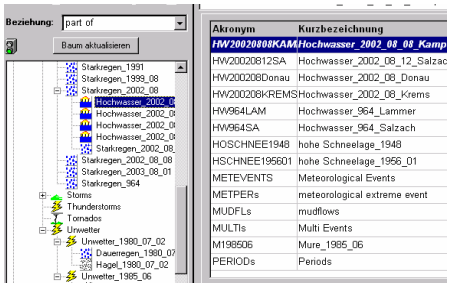
Folie 4



Folie 5

Beispiel Ereignisse

- MORIS ermöglicht die Erstellung unterschiedlicher Ereignisklassen
- Die Polyhierarchie erlaubt deren wechselseitige Zuordnungen



StartClim

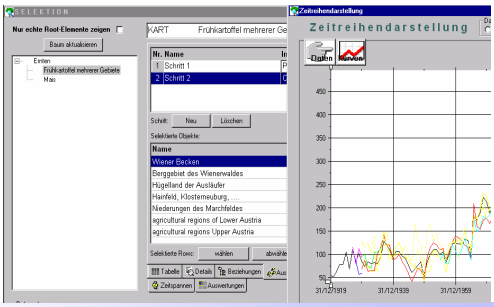
Folie 6

Beispiel Selektion

- MEDEA erlaubt die zusammenstellung von Datenselektionen in beliebig vielen Schritten ohne SQL Kenntnisse

Ausgewählte Daten können:

- in Zeitreiehen dargestellt
- In SPSS und EXCEL bearbeitet
- In bestimmten Formaten exportiert werden



StartClim