PART I: REPORT OF THE COMPLETED YEAR

3. Activity report

3.1 Information related to the research plan

WP1 milestone 1: Integration of data
We have successfully integrated over 3500 diverse sensors from SLF, SensorScope, RECORD, TRAMM, BigLink, Permasense and Mountland (Stillberg) real-time and historical data into GSN already. These sensors range from manual temperature loggers, to automated dendrometers, Distributed Temperature Sensors (DTS), the national IMIS network, bespoke meteo stations and the SensorScope stations.

The impact of the real-time data infrastructure so far has been significant. All of these projects are now enjoying the benefits of online data access which has proven to be exceptionally beneficial in the inter-institutional CCES projects., with many projects using it to share data within their widespread teams. Feedback has been excellent. Once the advanced features of the infrastructure start to be integrated, it is expected that the number of users will significantly expand.

APUNCH now have their GSN server, which is presently used by HWRM to collect and process APUNCH field and experimental data, which will then be selectively transferred to the SwissEx platform.

A significant step forward in the integration of national networks for the benefit of the CCES projects was taken when the IMIS database was integrated with GSN and automatically published to SensorMap.

All of these sensors are now available online through various instances of GSN, accessible under the following URLs:

- SLF - http://montblanc.slf.ch:3000/
- CCES public data - http://montblanc.slf.ch:22001/
- CCES private data - http://montblanc.slf.ch:22002/
- IMIS-ENET - http://montblanc.slf.ch:22003/
- PermaSense - http://yosemite.ee.ethz.ch:22001

An instance containing RECORD data also exists, although the public URL was not known at the time of writing.

All of the research data integrated pre-June was also registered into SensorMap (www.sensormap.org). SLF will register all data integrated since then into SensorMap over the coming months.

SLF, Permasense and Mountland have integrated a significant amount of metadata so far. Integration of metadata requires constant interaction by all members of each project for this to reach its full use potential. Though all of the groups have been successful so far at using the infrastructure to access data, only some groups have been successful at recording metadata (though any amount of collaborative metadata recording is better than what most projects have so far). This requires more perseverance by the project teams.

RECORD project (together with University of Twente) have integrated both metadata and data from manually sampled campaigns directly into the wiki and have provided significant training of their personnel to allow them the capability for entering data in this way. The completed development of a wiki-GSN interface means that in future, this data may be accessible from the same interface as the automated sensor data. The data is however currently available through the wiki interface and can be queried and output in many different formats via semantic wiki querying techniques. These querying techniques are being further developed by EPFL LSIR to make them more accessible to non-wiki literate users.

Initial attempts to contact Maiolica and get data integrated have so far been unsuccessful. Further attempts will be made.

The PermaSense team has worked closely with EPFL/SLF on the definition of a suitable data handling architecture to automate data manipulation and make it possible for them to store their data as georeferenced timeseries. To date the concepts have been defined and a prototype implementation headed by EPFL/LSIR is under way. The final system will be advanced beyond the concepts of any other system, allowing e.g. SensorScope data to stream into the system, but be split into georeferenced datasets. E.g. if a logger breaks in the field and is exchanged, based on the metadata, entered by the team, GSN will automatically concatenate the data streams from the two loggers, meaning that far less data interaction/manipulation will be required by the projects in future. Once this system is in place, the separate data streams from Permasense (currently already in GSN) will be available as georeferenced datasets.

WP1 milestone 2: Baseline SwissEx data infrastructure completion

The major goals of this task are twofold; to provide a working version of GSN and to develop a working metadata recording interface.

(1) To make GSN operational for each project partner, LSIR has continued to provide technical support for the partners, by monitoring their requirements and organizing development schedules through weekly GSN meetings. In addition, many demos and workshops describing the benefits of GSN have motivated both new and existing GSN users within SwissEx to increase GSN usage. LSIR will maintain this support over the whole project.

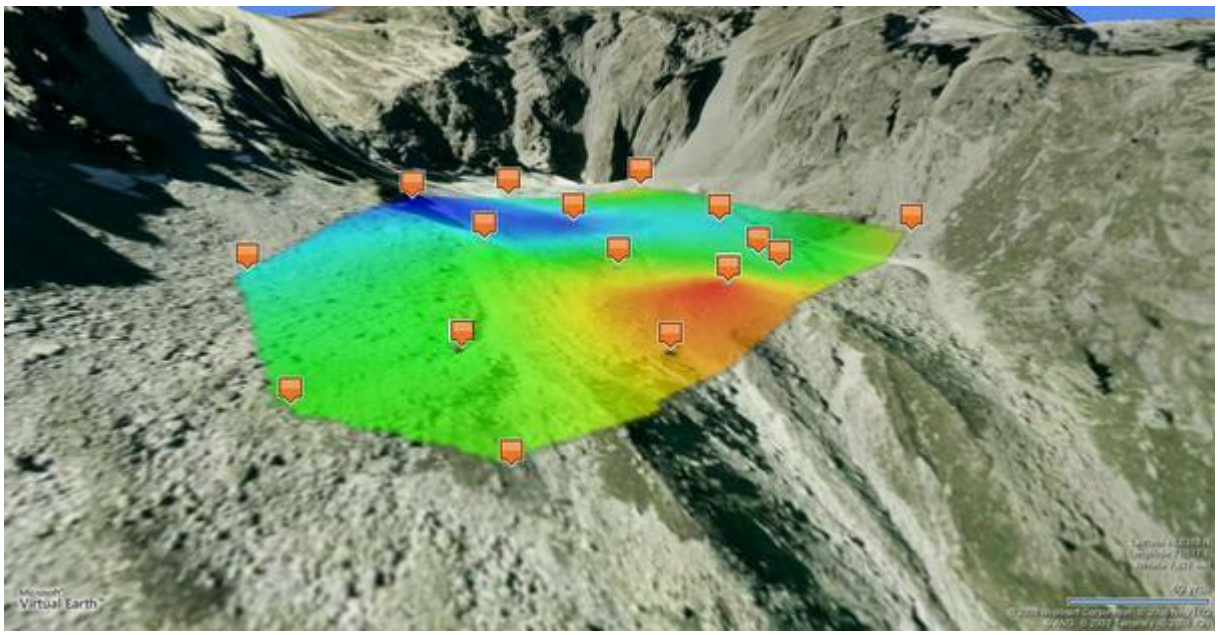
(2) For the metadata management, LSIR has developed a user friendly, easily deployable wiki system based on the collaboration with EAWAG and SLF in order to capture and share knowledge on sensor measurements. SLF made an initial metadata schema in early 2008 that was used among some of project partners in SwissEx and then extended and redefined the schema (with input from other SwissEx partners e.g. PermaSense and EAWAG) in spring 2009. This extension meant that the sensor metadata schema was more widely applicable to all project partners. LSIR implemented the extended metadata schema on the SwissEx wiki system, as well as developed additional functionalities for easy use (e.g., bulk loading and exporting of metadata).

The baseline SwissEx infrastructure, i.e. a working version of GSN, a working metadata recording interface and a working centralized data access system (SensorMap), is now in place.

GSN is a hugely flexible tool, the advantages of which, even the most doubtful of scientists have been convinced by once they begin to use it. The development list of advanced tools requested from this tool has grown rapidly, showing the success of the system. These advanced tools will be integrated for WP1 milestone 3. Baseline functionalities allow the user to browse their data and make quick comparisons between data sets as well as getting some basic statistics on the data sets. The data can then be downloaded in various formats.

Most of the instances of GSN available so far are (unfortunately) protected data sources, but the system has now been developed such that, through SensorMap, protected data sources and their parameters may be discovered without providing data access. This means that the public outreach potential of the system remains as unaffected as possible – users can browse what is available and apply to the registered user for access.

The Microsoft SensorMap collaboration is now complete and no work will take place on this interface during the coming year. The interface allows all sensors registered in GSN instances to be discovered, compared and downloaded in a geospatial interface and even displays the metadata recorded in the wiki whenever a sensor is selected. Data can be spatially interpolated and this interpolation can be replayed over time and/or overlayed on the digital elevation model. This is a highly powerful interface with advanced user permissions: sensors are assigned to groups and individual users can be accepted into these groups e.g. IMIS by the group owner. It was designed to be the ‘Facebook of sensors’ and performs very much along the same principles.



WP1 milestone 3: Advanced infrastructure development completion

A significant amount of work has already been carried out towards the creation of advanced infrastructure tools, even though all of this work was scheduled for post month 12. The integration of hydrological/cryospheric models with GSN is almost complete, having been implemented in a very elegant, generic fashion which means that the integration of further models will be much simplified. The significant and rapid progress in this area has mainly been made possible by the HYDROSYS third party funding. Users can now be notified when a sensor is no longer updating, paving the way for alerts based on data quality. A limited amount of data quality analysis tool development has been carried out so far. Work is also underway in restructuring data based on metadata, so that if multiple sensors are used at a single site over time, the time-series can be automatically created, or if, e.g. a sensorscope station is moved between projects, the datasets can be automatically separated based on the metadata.

WP2 milestone 1: Comparison of SensorMap vs. IKA GIS interface

The collaboration between LSIR and Microsoft Research has been successfully completed, and has made SensorMap an integral part of the SwissEx infrastructure. For this task, LSIR integrated GSN with SensorMap whilst reflecting the needs of environmental scientists for SensorMap visualisations. The resulting system enables the direct submission of GSN data to SensorMap: GSN virtual sensors can be registered into SensorMap either using a very simple form system or directly registered by GSN. This registration system means that all instances of GSN from the various organisations are made available in a single interface and can be queried, downloaded and visualized as if it were a single database. Microsoft Research is now working to make the SensorMap interface into an open source project.

Whilst the GSN/SensorMap integration aimed to provide a generic data infrastructure to be used over many SwissEx partners for sensor data visualisation, the development of the IKA interface began by integrating and visualising metadata and polygon type GIS based data. This development has been continued in association with LSIR so that it is now possible to visualise basic metadata and data from the GSN interface within the IKA interface, as well as the polygon type data which will be integrated into GSN in the coming months. The outcome of this is an interface which is capable of plotting both GIS based information and sensor information simultaneously.

The convergence of these two interfaces must now be considered in detail. Both currently have their own advantages. It is currently envisaged that SensorMap will remain as the outreach product, whereas the IKA interface will provide services only available within the ETH domain. Meetings in year 2 will define the future direction.

WP3 milestone 1: SensorScope 2nd Generation Network

The SensorScope 2nd generation network is now completed and is functioning very reliably. Manufacture of these stations has now been taken over by SensorScope Sàrl and made into a

commercial product. This has meant that the robustness and reliability of the stations has been drastically improved. The possible communication ranges have been increased significantly and experience has shown that attained ranges may actually exceed the claimed inter-station ranges of 1.4km. Only one failure has been experienced (the station consistently lost power) out of the 39 stations (not including those bought by APUNCH) received. This station will be replaced before it is redeployed. SwissEx have provided significant feedback to SensorScope on design improvements which can be made to these stations.

WP3 milestone 2: Setup of Calibration and Measurement Team

A calibration team has been set-up and a workshop was held together with Decagon on calibration and measurement with soil sensors. Calibration of the SensorScope stations has not yet been started due to the late delivery of the stations.

WP3 milestone 3: Long distance communication links

Through the use of external antennae, SensorScope stations are now communicating over distances of at least 1.4km (longer ranges have been attained in the field). A 900MHz, low power radio link is now in development, to allow inter-station ranges of up to 35km. The SwissEx pool of stations currently uses multiple master stations to overcome these limitations. Using a low power radio link may therefore reduce the operating costs to some projects e.g. Biochange, in future years (depending on the unit price).

A WiFi link is in place to receive data from the radar in Davos. Further WiFi links with remote power sources and mobile data connections will be completed by SLF this winter under the HYDROSYS project. Following meetings with SWITCH, this WiFi hardware setup was used as the basis of a technology proving study between SWITCH and UniBern, to prove whether the links can be used to extend the SWITCH networks to the MeteoSwiss meteo stations. No credit has so far been received.

The PermaSense and APUNCH projects have jointly set up an internet link to field sites in Zermatt. This link consists of a leased line from Zermatt to Trockener Steg and Klein Matterhorn as well as a distribution to the weather radar on Klein Matterhorn (APUNCH) and the PermaSense field site on the Hoernliridge (PermaSense, WLAN link). Negotiations with SWITCH to gain access to the Swiss university network are ongoing.

WP3 milestone 4: Permasense 2nd Generation Network

The PermaSense project has been successfully developing a second generation wireless sensor networking system targeted for environmental monitoring in extreme environments. The system is made up of simple, battery powered sensor nodes, a more powerful base station including webcam and weather station as well as a solar power supply. The base station can be connected to the internet using a number of different options (GPRS, WLAN, satellite links). The sensors currently used for monitoring permafrost on two sites in the Swiss Alps are temperatures, crack meters, pressure sensors and a set of resistivity measurements. The system is ideally suited for long term monitoring in hazardous and remote areas and is built for reliability, including disconnected operation in case of a subsystem failure. In case of a failure of part of the network, the base station or the data server, all sensor data is retained on backup memory contained in every node. The key technology is developed in partnership with the NCCR MICS project.

The system has been tested and refined on our testbed and deployment field sites since July 2008. First scientific results will be available shortly based on the data captured over the first 1.5 year period. The sensor nodes are produced through a contract manufacturer (Art of Technology) where they are available for purchase through interested parties. A similar process is foreseen for the other system components in the near future. Current work includes the setup of WLAN links, the development of a high-resolution camera, precision GPS sensors and the integration of GSN and the Swiss Experiment wiki for data management.

A joint deployment of PermaSense sensor network technology has been discussed with the RECORD project on the basis of their Thur field site.

WP3 milestone 5: Hydromon self organising wireless network

The Hydromon wireless network is working successfully and is now in the second stage of development. These networks have been received with interest in the relevant communities and in the press due to recent cases of pollution in water distribution systems in Ticino. The Hydromon concept has been extended thanks to the water distribution enlargement towards the north and the projected water pickup in the Lake of Lugano (Ceresio). The very high cost of the system caused by the expensive sensor technology remains an issue. Work on less expensive solutions is in progress.

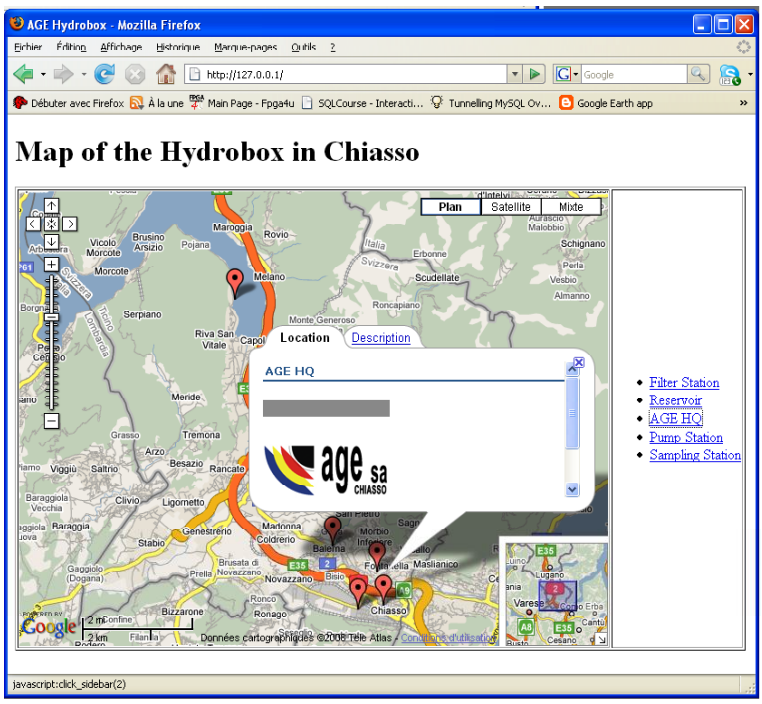


Figure 1. Hydromon web interface.

WP3 milestone 6: SensorScope 3rd Generation Network

Significant work is already underway on energy efficient collaborative routing algorithms. Initial tests of some aspects are being field tested at La Fouly, papers have already been written on model based reduction of transmitted data rates and these are to be implemented in a demonstration network to demonstrate it to the projects and gain experience of how these techniques could be more widely exploited. Long range communication technology is under development to allow SensorScope stations to be deployed as wide area networks. The SensorScope webcam will be demonstrated in about month 18. Snow height sensors have undertaken initial tests and will be tested more thoroughly on Wannengrat this winter and a new anemometer is being tested in collaboration with DISAL.

WP3 milestone 7: SensorScope extreme environment test deployment on Wannengrat

This will take place in winter 2009/10 as the stations were not available in 2008/9.

WP3 milestone 8: Completion of RADAR, LIDAR and Disdrometer and development of DTS

The RADAR is now deployed and has been collecting data in Davos since September for the winter of 2009/10. This data is available to EPFL online through a WiFi link provided by SLF. An outreach product will be available soon. The RADAR will be calibrated using disdrometers located at different altitudes in the Davos area.

Disdrometer development is now in the chip design stage. A demonstration prototype based on an old chip is planned for the end of 2009.

Usage methods for the DTS have been further developed by EAWAG (RECORD) to provide high density measurements of the vertical temperature profile. Together with the University of Twente, they have now made this data available in real-time through GSN.

WP3 Milestone 8: SensorScope deployment

Multiple successful SensorScope deployments are currently in progress in Davos, Damma, the Rhein Valley, Burkina Faso, the Mattertal and the Dranse catchment. For more details, please see the tables below.

WP3 Milestone 8: LIDAR field campaign and development
The LIDAR has undergone significant development this year and has been successfully deployed in the field with some interesting results. A deployment of the LIDAR in Davos is planned this winter. For more information, see the EPFL/LSIR table.

WP4 milestone 1: Integration of CCES projects into the SwissEx infrastructure
The CCES projects who expressed an interest have been/are being integrated as far as practical. This work is to continue.

WP4 milestone 2: Precipitation measurement campaign in alpine terrain
All equipment is available and ready to be deployed in Davos this winter. A press conference regarding this took place on 21st October 2009 and has created significant positive press coverage (Le Temps, Südostschweiz etc.). These reports will be included in the year 2 report.

WP4 milestone 3: Vispa catchment measurement campaign
The APUNCH project proceeded with the installation of the reference raingauge stations in the Vispa catchment, and with the acquisition of 13 SensorScope stations this summer, which are currently being tested for future use in measurement campaigns.
Mountland will receive their SensorScope stations next year (the project decided not to deploy in Valais for August/September 2009, instead, these stations were deployed in Dischma, Davos, for Mountland Stillberg) and COGEAR should have many of their measurements in place next year.

WP4 milestone 4: Wiki and GSN workshops
A Wiki/GSN/SensorScope workshop was held in month 6 as planned.

WP4 milestone 5: Creation of a pool of SensorScope Stations for multiple use in campaigns of the participating CCES projects
The various CCES project were asked for their requirements and 39 SensorScope stations were bought to meet these requirements (12 of these were bought in advance using the year 2 budget and will be retrospectively charged). Some extra sensors will be bought to cover the requirements of the winter deployments.

WP5 Milestone 1: End of each education 'campaign'

The first step of the SwissEx environmental education (EE) program called climAtscope (http://eflum.epfl.ch/climatscope) has been set up successfully by EPFL. More than 1200 children, from 6 to 14 years old, either analyzed and compared SensorScope data or conducted an experiment from the educational notebook designed in conjunction with the climAtscope partners. Based on the analysis of this pilot project, EPFL are now working on the generalization of climAtscope for children, from 15 to 18 years old.
The SwissEx environmental education programs have been involved in the European O3E program (http://o3e.geoazur.eu/). SwissEx will take the lead of the meteorological part of this project. This means that the partners (France and Italy) will buy SensorScope stations, a SwissEx technology.

Change in Project Partners Directly Involved in Swiss Experiment

Olaf Cirpka (RECORD project) received the Professorship for Hydrogeology at the Eberhard-Karls-University of Tübingen (Germany) and left Eawag end of September 2008. The RECORD consortium chose Mario Schirmer to act as PI of the RECORD project starting October 1, 2008 and Eawag Representative/PI in the Swiss Experiment. Until the end of February 2008, Mario Schirmer was Departmental Head Hydrogeology at the Helmholtz-Centre for Environmental Research - UFZ and Professor for Hydrogeology and Modelling at the Martin-Luther-University Halle-Wittenberg. He is head of the research group Hydrogeology at the Eawag since March 2008 and in addition Associate Professor in the Centre for Hydrogeology at the University of Neuchâtel.

Andreas Wombacher (LSIR) received a position as Assistant Professor at the University of Twente (Netherlands), Data Base Group in August 2007. He continues his collaboration with the Swiss Experiment by working on meta data management.

Deliverables:

Deliverables WSL/SLF:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
Infrastructure for retrieving TRAMM and BigLink streaming data	***LSIR***	***Software, Support***	***3***	***WP4.1***	***4***

The infrastructure for receiving TRAMM and BigLink streaming data is in place and functioning reliably.

TRAMM:
TRAMM have been supported with integration of data into GSN from the start. Data on Wannengrat is streaming to GSN and experiments at Ruedlingen have been supported by post-experiment integration of data. More effort will be made in year 2 to expand on the way that TRAMM use the metadata system, integrating some of the more manual measurement data.

The TRAMM projects are successfully using GSN for data sharing.

Currently, TRAMM Rüedlingen/Rufiberg only has one SensorScope station providing streaming data. This station was hired before SwissEx had bought the latest generation of stations and is in use on a regular basis. TRAMM Wannengrat was the first set of streaming data to be integrated and continues to be supported under the SwissEx winter precipitation campaign with the infrastructure and an additional 19 SensorScope stations on Wannengrat and 7 on Dorfberg.

Following developments made by LSIR in the coming months, support will be added to GSN for both the laser scan data and the EPFL radar data, both of which will be of significant value to the TRAMM project.

BigLink:
BigLink have 8 SensorScope stations in use for the summer period. All other BigLink streaming data (meteo and runoff-stations) is streaming directly into GSN and SensorMap.

SwissEx will support (where possible) the transfer of wireless technologies into these projects for streaming data where this is requested and where funding allows.

The initial data from both projects was integrated on time though integrating data will be an ongoing task. http://montblanc.slf.ch:22002 (user: gsn, password: swissex079)

SensorScope data will soon be found at http://montblanc.slf.ch:22001 and will make use of the new GSN/metadata interactivity developed for the permasense project, to provide extra support to BigLink

Year 2 will see the integration of manual measurements from BigLink into the system.

Control and publishing of metadata	LSIR	Publication	6	WP1.2	1

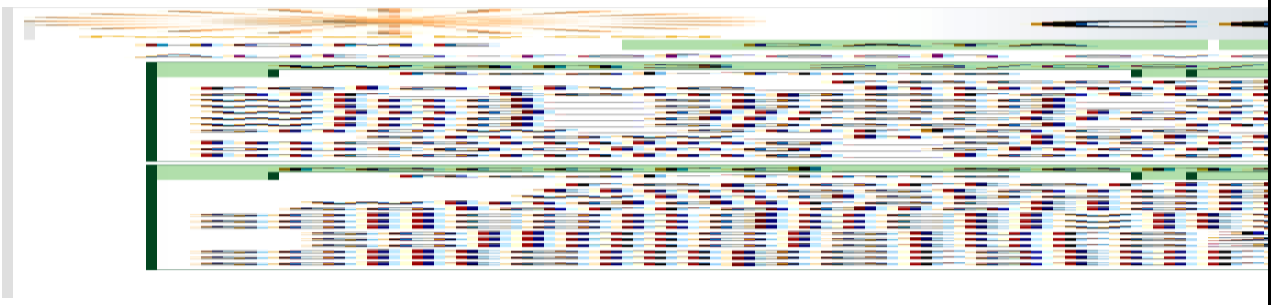
A paper was published in the 4th IEEE eScience (2008) conference proceedings. In association with PermaSense and LSIR and with advice from other CCES projects, the metadata system has been redesigned since the writing of this paper to make it more generic. A bulk upload system has recently been added, reducing the initial workload required by a project to enter previous metadata. Metadata recorded in the wiki may now be synchronised into GSN, and this method is being utilised to reorganise hardware referenced data streams into geospatially referenced data streams, based on the metadata.

Sensorscope Station for Davos Schools	***LCAV***	***Hardware***	***8***	***WP5.1***	***5***
This was delayed to wait for the 2nd generation of SensorScope stations and to ensure that sufficient SwissEx infrastructure was in place. This is now possible, though the summer period has been detrimental to initial meetings. Assistance in organizing the school outreach activities is now available via the O3E project. In exchange, SwissEx is providing the infrastructure to make these outreach activities possible.					
Data infrastructure for Mountland, Maiolica and APUNCH streaming data	***LSIR***	***Software, Support***	***12 - 36***	***WP4.1***	***4***
Mountland: Mountland Stillberg is already significantly integrated into the SwissEx infrastructure and are using all of the SensorScope stations initially assigned to Mountland Valais for the summer (these will be used in Valais next year). Integration of the other Mountland sites will follow in early 2010. Data from Stillberg is available on the SLF GSN site http://montblanc.slf.ch:3000 and can be made available on the CCES GSN site (http://montblanc.slf.ch:22002) or on SensorMap on application to the data owners (not all data on Stillberg is paid for by CCES). Much of the sensor data on Stillberg is acquired via logger and manually collected. This data is also already integrated into GSN. A significant effort will take place next year to integrate the remaining Mountland fieldsites. **Maiolica:** Initial contact has been made for integrating Maiolica. **APUNCH:** Assistance is being provided to the APUNCH postdoc, who is making significant steps forward in integrating the APUNCH data. SwissEx will support the transfer of wireless technologies into these projects for streaming data where this is requested and where funding and time allows.					
Generic model interface	***LSIR***	***Software***	***24***	***WP1.3***	***1***
This has been funded entirely using 3rd party funding, hence Hydrosys need this to be seen as their own task, however the interface is now almost complete. This generic model interface consists of a generic input/output library, written in C++ and open source. The library may be integrated into any model and provides the web-service interface to query data from distributed GSN instances.					
Paper on dense spatially and temporally distributed measurements from Wannengrat	***EFLUM, LCAV***	***Publication***	***24***	***WP3.7***	***3***
The measurement infrastructure is currently being built on Wannengrat. Initial studies based on a test SensorScope deployment in 2008 show great benefits.					
Calibration of SensorScope meteorological instruments	***LCAV, EFLUM***	***Web Publication***	***24***	***WP3.2***	***3***
Initial investigations will take place in October. EFLUM have one paper in review/press which will form part of the real-time corrections/calibrations that will be carried out on the data.					
Paper on characterisation of annotations on a data model	***LSIR***	***Publication***	***36***	***WP1.3***	***1***
No work yet carried out.					
Meteoswiss and BAFU data	***LSIR***	***Data online***	***48***	***WP1.1***	***1***
Initial contacts are currently being made.					
Infrastructure workshops	***LSIR,***	***Workshop***	***6, 18, 36***	***WP4.4***	***4***

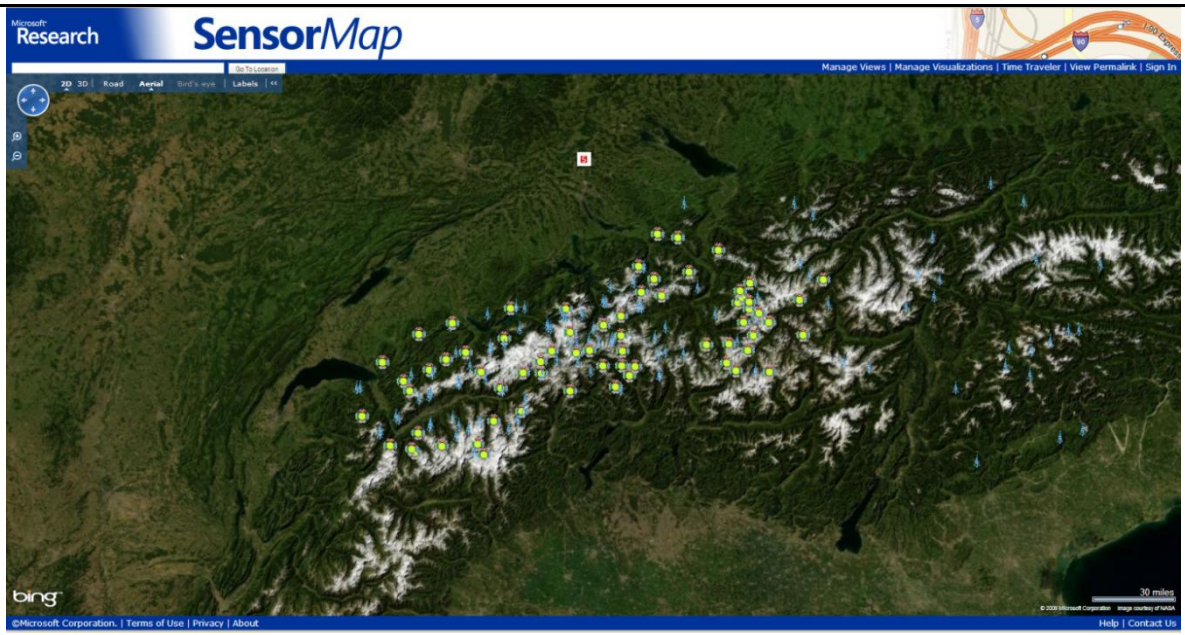
	EAWAG				
An infrastructure workshop was successfully held in month 6. Maximum attendance was attained.					
Integration of all data into the infrastructure	***All***	***Data online***	***48***	***WP1.1***	***1***

Integration of streaming data:
Integration of streaming data is proceeding steadily. We have begun with the projects which have shown significant interest in integrating data and we are now moving to more complex scenarios such as the Permasense data (which relies on reorganizing acquired data into time series according to the metadata). Integration of streaming data and manually collected time-series logger data provides the bulk of the acquired data so far. Projects are becoming more excited by the capabilities of the infrastructure as they use it. The largest users so far are SLF (Wannengrat, which includes TRAMM), Mountland (Stillberg), RECORD, BigLink, TRAMM and PermaSense. APUNCH is currently working to integrate its data.

GSN provides the capability for integrating many different types of sensor, from SensorScope networks to CSV files downloaded from simple loggers. The more this is used, the more requests SLF get for integrating new data sources. We now have sources ranging from IMIS automated stations to the DTS, SensorScope stations and raingauges in Ruedlingen. For a list of the sensors it is possible to integrate so far, see: http://sourceforge.net/apps/trac/gsn/wiki/Documentation.



The IMIS cryospheric sensing network was integrated into GSN and SensorMap in February. Usage of the SensorMap portal as a real-time download system for IMIS data is being granted to specific individuals where they would normally have to regularly request data from the IMIS administrators. An automated system has been developed to register sensors in GSN, directly into SensorMap. As all of the IMIS stations are the same, this tool has been used to register them into SensorMap. This tool could be used to register all other sensors, though registering them separately has been the preferred method so that parameters referred to as acronyms in the database could be given a descriptive name in SensorMap. Significant effort was put in to manually register these sensors earlier in the year, although this now requires a second attempt for the additional sensors.



Integrated data can be found at:

GSN:

SLF -	http://montblanc.slf.ch:3000/
CCES public data -	http://montblanc.slf.ch:22001/
CCES private data -	http://montblanc.slf.ch:22002/
IMIS-ENET -	http://montblanc.slf.ch:22003/
PermaSense -	http://yosemite.ee.ethz.ch:22001

An instance containing RECORD data also exists, although the public URL was not known at the time of writing.

SensorMap: http://www.sensormap.org

Metadata:
A fully functional metadata system has is now on its 2nd generation design and implementation and many projects (e.g. Wannengrat,Stillberg, PermaSense, RECORD) have been trying to store as much metadata as possible. This is to continue over years to come and is now facilitated by a bulk upload system. The minimum requirements for metadata (field sites, their positions and the research that goes on there) has been completed for all CCES projects. The projects above are using the system to store sensor information and field site observations.

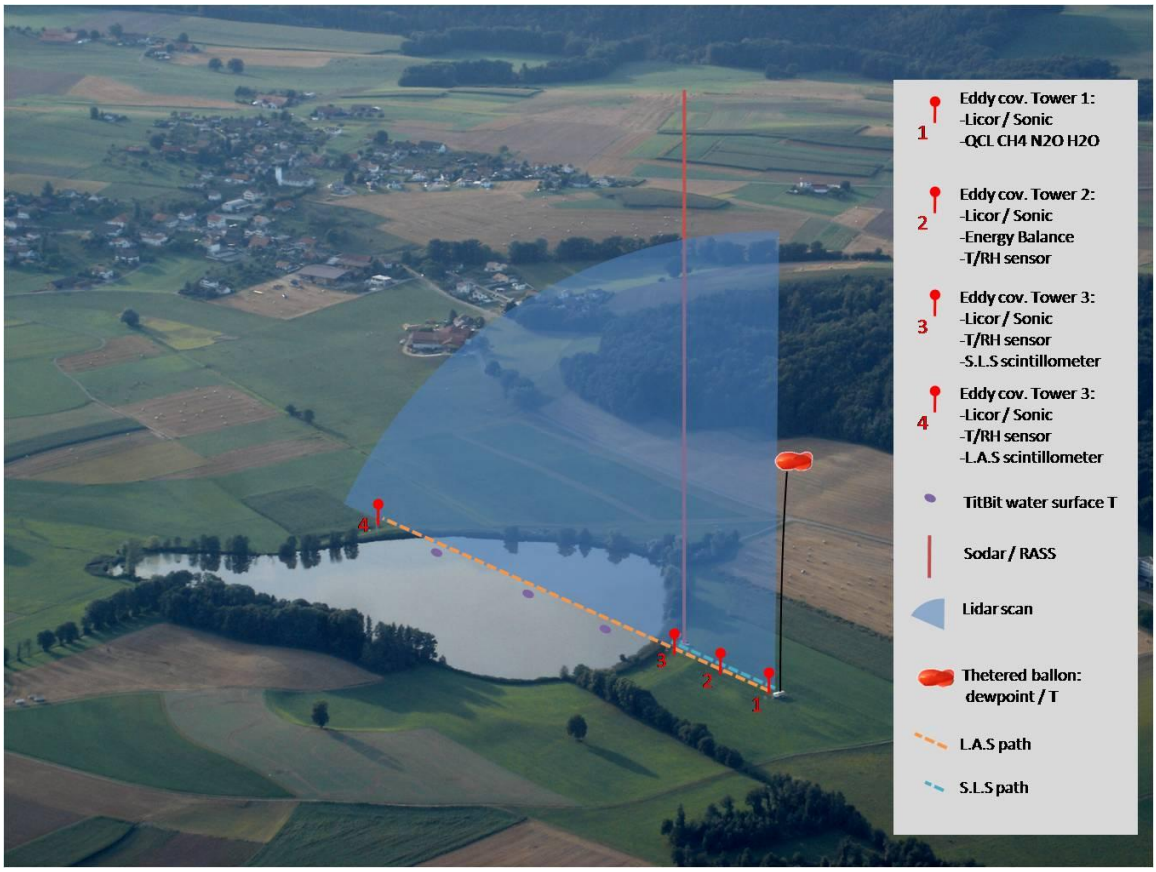
Some re-education of users is required so that this metadata is recorded, and this is an area of development for SwissEx.

Metadata can be found at:
http://www.swiss-experiment.ch/index.php/Fieldsite:Home

Manually Sampled Data:
RECORD project have created a wiki based manually sampled data storage system and are using it to great effect. It is planned that this will be introduced to further projects over the next year. This system can be queried through semantic web query language and LSIR are working to provide tools to create these queries, such that the data is accessible to a wider, non-wiki literate audience. RECORD project have provided significant training and support to their team to enable the entering and querying of their data through the wiki.

Deliverables EPFL/EFLUM:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
SensorScope station for climate EE programme	***LCAV***	***Hardware***	***6***	***WP5.1***	***5***
From April to November 2008, 10 Sensorscope stations were set up around schools in the Dranses watershed (Valais, Switzerland). More than 1200 children, from 6 to 14 years olds were involved. On the website (http://eflum.epfl.ch/climatscope), an educational notebook, report and data can be directly downloaded. We are currently planning the installation of the second generation of SensorScope stations in Valais, Lausanne and Zurich.					
LIDAR, SODAR, SensorScope field campaign	***LCAV***	***Data and publication***	***12***	***WP3.8***	***3***
The basic configuration of the LIDAR was completed. The LIDAR, together with other equipment (SODAR, tethered balloon, 3 eddy covariance towers and SensorScope stations), was used in a field campaign aimed at studying air/complex terrain interactions carried out in Seedorf (FR) in Autumn 2008.					



Picture 2: LIDAR deployment, Seedorf

The Seedorf LIDAR deployment data are being processed and analyzed. The most interesting results are the horizontal LIDAR measurements. During cloudy days, the water vapor concentration above the lake was lower than above ground, due certainly to evapo-transpiration from plants. The presence of consistent coherent structures in the water vapor measurements advected by the mean wind, and passing through the all profiles, has been found. It is the first time that such structures have been observed in time and space over such scales and could lead to new answers about the organization of packet structures already observed or modeled at smaller scales by others groups.

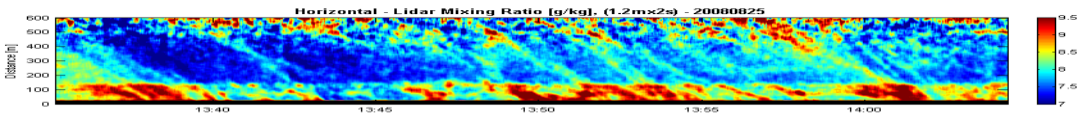


Figure 3: Horizontal LIDAR mixing ratio, Seedorf deployment

Upgrade of the LIDAR to provide automatic control of the harmonic generation of its laser is ongoing. A study aiming at enhancement of the laser energy was completed in July 09. A microprocessor based system for automatic control of the elevation and azimuth scanning of the LIDAR is in progress. Intercomparison of the temperature channel of the LIDAR and DTS is in preparation.

Testing of SensorScope stations (part of calibration programme)	***LCAV, WSL/SLF, EAWAG***	***Web publication***	***24***	***WP3.2***	***3***
Work not started					
Precipitation measurement campaign	***LCAV, HWRM, WSL/SLF, LSIR***	***Publication***	***24***	***WP4.2***	***4***

The 2009 La Fouly (VS) campaign was designed to study the spatial variability of meteorological variables and soil properties; data and metadata collected from the 10 SensorScope stations were published on the web and made available to the public (http://sensorscope.epfl.ch/climaps/). Theses sensors will be integrated into GSN and SensorMap as soon as testing is complete. In this context metadata plays a very important role in that it allows users (scientists, students, decision makers, etc) to picture the data source in terms of location and sensor type. The ongoing data analysis show significant spatial differences for any given variable. The ongoing campaign will provide data from several locations within the catchment for application in a 3D hydrological model.

The Burkina Faso deployment is ongoing. 15 second generation SensorScope stations have been installed in a small semi-arid West African catchment. Further information can be found under this link: http://eflum.epfl.ch/research/burkina.en.php.

The LIDAR will be incorporated into the WSL/SLF 2009/10 winter precipitation campaign at Wannengrat. This deployment will also incorporate SensorScope measurements, Radar, permanent meteo stations, a runoff station, laser scans and disdrometer measurements.

La Fouly deployment

The La Fouly (VS, Dranses catchment) deployment was set up to provide a comprehensive dataset pertaining to hydrologic response in a steep alpine watershed. Following on from the pilot project deployment (summer and autumn 2008), the 2009 campaign (May to November) is composed of 10 second generation SensorScope stations that collect meteorological and soil data and a river water level sensor. In addition to this, discharge measurements were carried out on a weekly basis, using the salt dilution method to derive a stage-discharge relationship for this alpine catchment. The ongoing campaign will provide data from several locations within the catchment, to be used in a 3D hydrological model (GeoTop). The river flow modeling is important in water budget calculations as well as in evaluating whether the catchment is dominated by surface or subsurface flow. This study is mainly relevant for flood, debris-flow and landslide warning.

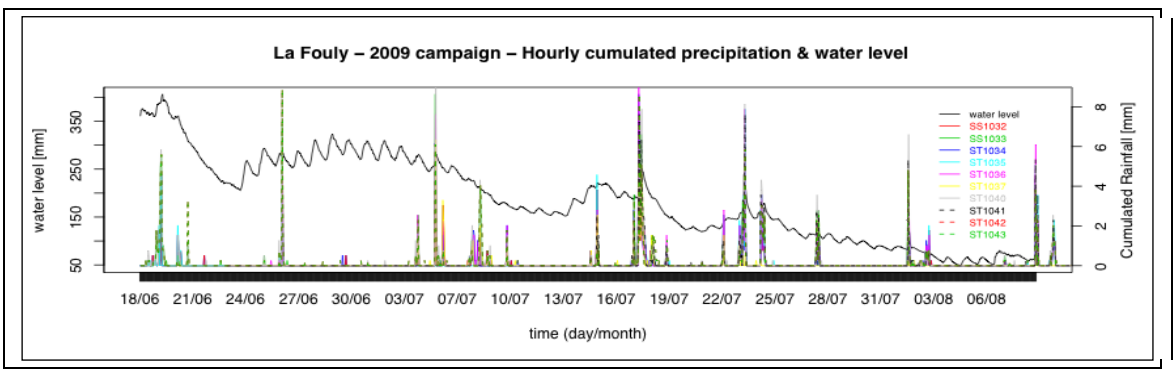


Figure 1: Water level (black) and precipitation from 10 Sensorscope stations from the 2009 ongoing campaign.

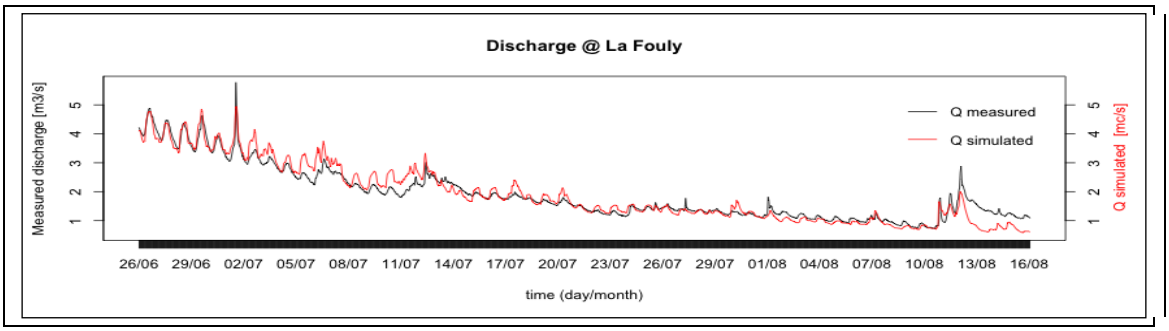


Figure 2: Plot of the modeled discharge against measures taken at La Fouly during the 2008 campaign

Burkina Faso deployment

15 second generation SensorScope stations have been installed in a small watershed near the village of Tambarga (Burkina Faso). Stations were installed in April 2009 and will remain installed a minimum of a year and a half. Studies in this field campaign will address the increasingly prevalent phenomenon in semi-arid West Africa of more irregular rains accompanied by a flashier or more quickly responding drainage system. Up until now, we have had tremendous support from local residents regarding our research and the stations. Both rural farmers and local technicians show interest in incorporating the information we produce into their activities.

Picture 1: **SensorScope station in Burkina Faso**

Mobile radar field campaign	***LTE, WSL/SLF***	***Hardware***	***6-48***	***WP3.8***	***3***

The mobile radar is currently installed in Davos. This data will be integrated in the SwissEx infrastructure with the SensorScope station data and permanent meteo station data and will be used primarily by snow scientists performing preferential deposition analysis. The data will however also be used in various other projects from hydrology to biodiversity. The mobile radar will be supplemented by a gradient of disdrometers (to be used for interpretation of the radar data) and the 3D scanning LIDAR. Initial logistics for the positioning and deployment of the LIDAR are just beginning. EFLUM's main role in this task will be LIDAR deployment and data analysis as well as SensorScope support. For more information on this deployment, see the LTE section.

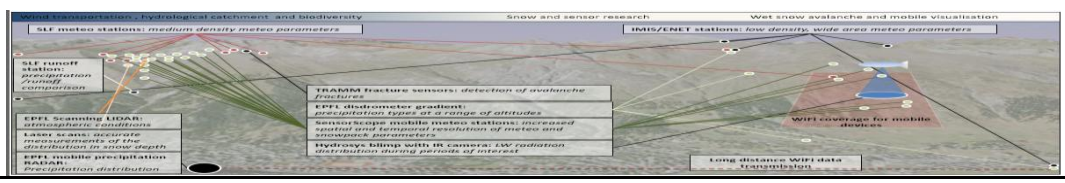


Diagram of the sensors available in Davos this winter. These will all be integrated into the SwissEx infrastructure					
Disdrometer prototype deployment	***LTE, ISIM***	***Hardware***	***18***	***WP3.8***	***3***
The disdrometer is currently in development (see ISIM section) and the first prototype will be deployed around month 18.					
Generalized climate EE programme in Valais	***LSIR, GLOBE, LCAV, SED***	***Common website***	***48***	***WP5.1***	***5***
We are currently planning the installation of the second generation of SensorScope stations in Valais, Lausanne and Zurich. Based on the first step of climAtscope, we, in conjunctions with our partners, are currently working on the generalization (development of educational notebook, finding news partners, development on continuous education for teachers,…) of this EE project for children from 15 to 18 year old at national scale. These educational tools are available on the climAtscope website: http://www.swiss-experiment.ch/index.php/SwisScope:Home					
SwissEx EE programme	***LSIR, GLOBE, LCAV, SED***	***Common website***	***48***	***WP5.1***	***5***
Over the first year, the excellent collaboration between the SwissEx EE programs (SISMO at school, GLOBE…) have been developed and reinforced.During this first year, several collaborations and coordination meetings have been conducted through the SwissEx EE partners (GLOBE, SED, SLF, …) in order to set up common goal. More information : http://www.swiss-experiment.ch/index.php/SwisScope:Home					
Paper on large scale interdisciplinary deployment in Valais	***All institutions***	***Publication***	***48***	***WP1.3***	***1***
Not yet started					
Coordination and development of international network for Environmental Education.	***SED, GLOBE, LCAV***	***International network***	***12***	***WP5.1***	***5***
ClimAtscope, SISMO at school and GLOBE are now part of a European Environmental Education project (O3E). O3E (http://o3e.geoazur.eu/) will develop synergies between Switzerland, France and Italy in the area of environmental education (seismology, hydrology and climate). The aim of this project is to build an international EE network by sharing environmental monitoring data, experiences and by writing educational books for children.					

Deliverables EPFL/LSIR:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
GSN operation	***SLF***	***Software, Support***	***1- 48***	***WP1.2***	***1***
Software: The GSN software has been continually developed based on project requests over the past year and a full-time engineer has been employed to fulfil both development and support. The software has been made significantly more stable, new sensor types have been integrated (e.g. SensorScope), metadata synchronisation has been made possible, a model interface has been added and the software development has been made fully trackable, with its own bug tracking, request and documentation system (http://sourceforge.net/apps/trac/gsn/). This is only some of the many developments which have been made, which are listed throughout this document. Support: We have successfully made GSN operational for several SwissEx partners; In 2008, data from the sensors deployed by SLF, TIK, and EAWAG were already being collected through GSN. Since spring 2009, HWRM has been using GSN for obtaining their data. Many other organizations (e.g., belonging to HYDROSYS and COGEAR projects) also use GSN. All projects currently integrated plan to extend the use of GSN for more sensors that will be deployed in the following years. All projects are provided with as much support as possible.					
Control and publishing of metadata	***SLF, EAWAG***	***Software, Support***	***18***	***WP1.2***	***1***
The main development of SwissEx wiki system was completed, and the metadata store in the system is currently being used by SwissEx partners (http://www.swiss-experiment.ch/index.php/Metadata:Home). The metadata schema was created by the collaboration among EAWAG, SLF, and LSIR, through a chain of discussions with the other partners. To ease the workload of adding metadata, we also developed a bulk-loading system of the metadata (http://www.swiss-experiment.ch/index.php/BulkloadInstruction, user-id:cces_swiss, password:experiment) , and an exporting system (http://lsir-swissex.epfl.ch/exportMetadata/exportMetadata.html). Further developments on the metadata management system will be carried out, e.g., real-time joint processing of the metadata and sensor data.					
Operational data exploitation software	***SLF***	***Software***	***18***	***WP2.1***	***2***
The integration of SensorMap with GSN has been completed (http://www.sensormap.org). SensorMap is now showing not only sensor data through GSN at SwissEx partners, but also associated metadata from the wiki server. This allows users to query the sensor and retrieve real time sensor information through interaction with the map.					
Long term data and metadata management	***All institutions***	***Publication***	***48***	***WP4.3***	***4***
In June 2009, we made a concrete plan for managing long-term sensor and meta data, targeting the system at both SwissEx and MICS projects. This includes model-based sensor data compression, efficient data access, optimization in data-stream processing and storage, and controlling data quality using complex model-based data representation. For long-term metadata management, we have provided two dedicated servers for managing the metadata in the SwissEx wiki system as well as one full-time developer for this task. We will keep these resources for the metadata management until at least the end of SwissEx project.					

Deliverables ETHZ/IKA:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
GIS based interface: Collection of proprietary GIS specific schemas and database domains, provided by the project partners	***All partners***	***Schema pool***	***1-6***	***WP2.3, 4.1***	***1, 4***

In SwissExperiment, the majority of project partners have the time-consuming task of integrating their sensor-data in the GSN (Global Sensor Network) environment. With the development of the GML-export plugin for GSN by IKA, it is now possible to extract and integrate the required schemas and datasets directly from GSN instances.

So far, although WSL/SLF has 4 working and accessible GSN instances for TRAMM, Mountland, BigLink and all SLF data, the other partners are still in the process of making their data available with the GSN framework, therefore, a higher number of accessible data can be expected in the next year, depending on the collaboration and data of the other project partners. The IKA is in contact with a number of other project partners and will be informed of every increase in the number of the available data sources.

IKA have collected, organized and provided support for the generation of data and database schemas of the project partners as required. Currently, we have collected abstract schemas mainly from WSL/SLF (Wannengrat sensor data), SED (seismic stations, event data), and IKA (swisstopo pixel maps, DTM25). Due to the close collaboration with the COGEAR project we possess the database schemas from a number of COGEAR partners (IGT (boreholes), EngGeol (cracks, soil temperature sensors at Randa), PRS (LiDAR data, aerial images, DTM-AV), LMS (boreholes) and IMAC (vibration records, survey Visp)). These schemas are still in development and might be modified by the responsible partners.

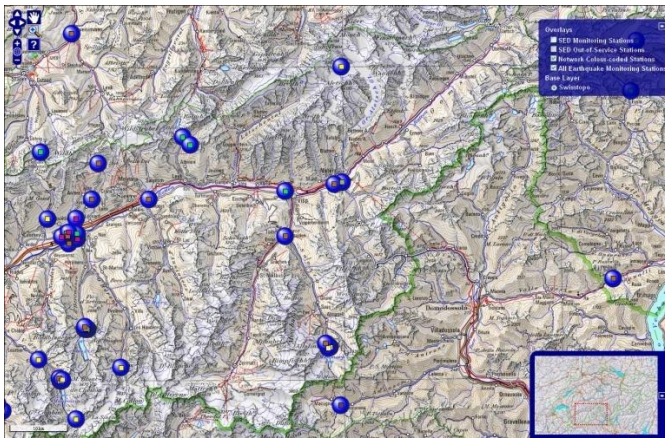
The schemas for the sensor data are provided by each project partner via their individual GSN instances. Additionally, the schemas collected in cooperation with the COGEAR project can be found at: http://ikapc4.ethz.ch/swissexperiment/deliverables/schemapool

GIS based interface: Unification of the schemas and database domains, planning a distributed GIS model using Web Services		***Support***	***6-12***	***WP1.2 , 4.1***	***1, 4***

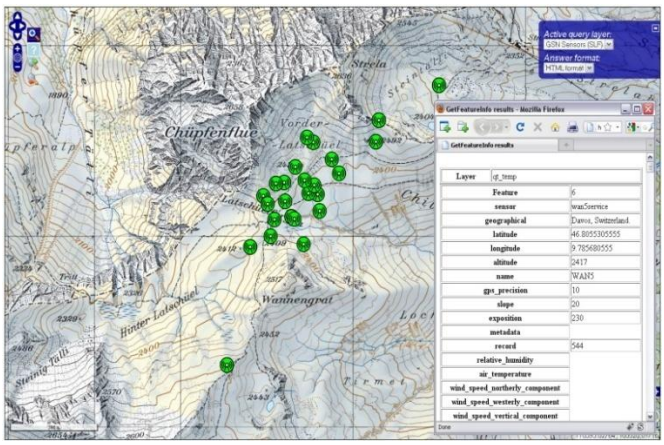
The schemas collected in Task 1 were analysed for the integration process. The result of the analysis was that the schemas were highly heterogeneous and a common schema is not practical for use by all project partners. On one hand, a common schema would be too complex to be useful for the individual domains covered by project partners and as consequence they will use only a very small subset. On the other hand, the project partners need to have the freedom for schema extensibility and schema evolution, which is hardly possible with a fixed common schema.

Based on the above analysis, IKA proposed an unification at the GIS application level. Therefore IKA created testbeds for the project partners and combined them in an additional testbed as proof of concept for the interinstitutional interoperability (see figures of testbed examples below). The unification of the schemas and database domains is performed visually in this testbed, and allows project partners to manage and evolve their schemas according to their needs.

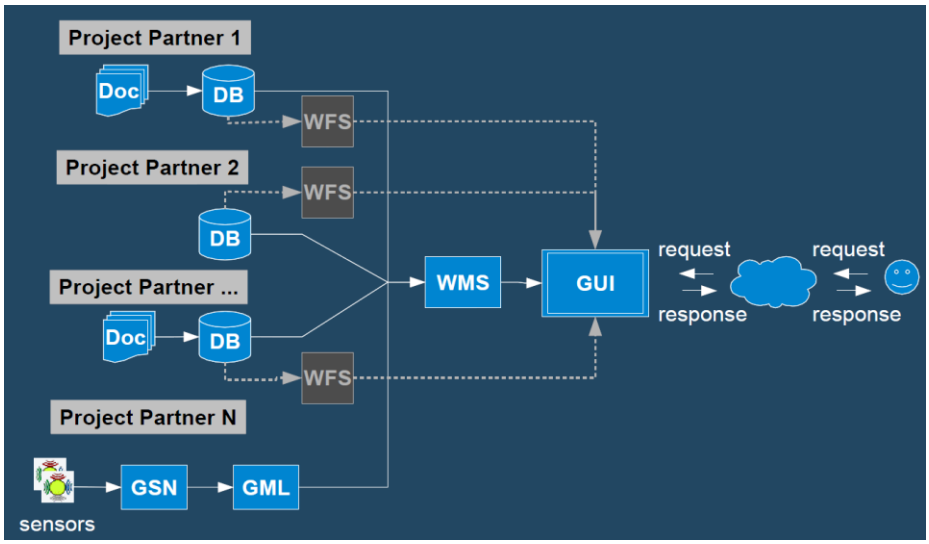
SED data combined with swisstopo data (provided by IKA)



WSL/SLF data combined with swisstopo data (provided by IKA)



Additionally, a distributed unified GIS-based model was developed to share the metadata of the sensor stations. This model is based on the COGEAR Web Service Infrastructure (see figure below) and allows the integration of both SwissEx and COGEAR data in a common environment.



Support for project partners was provided on request. In addition due to the efforts of task 4, a testbed is available. Access to this testbed can be granted on-demand.

GIS based interface: Description of a Web Service Interface for sensor metadata		***Report***	***12***	***WP1.2, 4.1***	***1, 4***
As discussed in task 2, GML allows the interoperability and exchange of data and metadata. The metadata can be extracted from GSN instances and therefore no additional effort is required from the project partners except for providing this metadata in the GSN framework. Therefore, for SwissExperiment, the Web Service Interface for sensor data and metadata is GML (Geographic Markup Language) as described in the corresponding deliverable. GML is an XML-based geospatial standard that is widely accepted for spatial data exchange and can be easily used to create web services. Report available at: http://ikapc4.ethz.ch/swissexperiment/deliverables/InterfaceDescription/report/					
GIS based interface: Implementation of a Web Service Interface for available sensor metadata of the project partners		***Software***	***12-18***	***WP1.2, 4.1***	***1, 4***
Task 4 was started ahead of plan due to the close interconnection with the other tasks, once it was clear that only a GML based interface can provide the unification and interoperability amongst the partners. In order to enable interoperability with GSN instances, IKA developed an export functionality for GSN allowing export of dynamic sensor data on demand as GML. The implementation work performed in this task was required to support the proof-of-concept (testbed) for task 2. Therefore considerable development efforts were invested in developing sensor data visualization functionality as the core component for the IKA GIS platform. These efforts are visible in the development of the QGIS mapserver and in the set-up of the geodatabase for the swisstopo geodata provided by IKA, and finally in the GeoVITe graphical user interface that will be used in the future as front-end for the SwissExperiment Web application. These early development effort accounts also for the increased funding required in the first year.					
GIS based interface: Alignment of the Web Service Interface with the general SwissEx Metadata Model, Adaptations of the Web Service Interface	***WSL/SLF, LSIR***	***Software***	***18-20***	***WP4.1***	***4***
Not yet started					
GIS based interface: GUI Web Interface prototype for metadata		***Software***	***22***	***WP1.2***	***1***
Not yet started					
GIS based interface: Interface description for accessing available sensor data of the project partners using Web Services		***Documentation***	***24***	***WP1.2***	***1***
Not yet started					
GIS based interface: Implementation of the Web Service Interface for first incoming sensor data of the project partners		***Software***	***20-24***	***WP1.2***	***1***
Not yet started					
GIS based interface: Web		***Report***	***24***	***WP1.2***	***1***

Service Interface implementation progress report for available sensor data of the project partners					
Not yet started					
GIS based interface: Implementation of cartographic tools for visual data mining		***Software***	***24***	***WP1.2***	***1***
Not yet started					
GIS based interface: Final version of the GUI Web Interface, Bug fixing		***Software, Support***	***36***	***WP2.1***	***1***
Not yet started					
GIS based interface: Maintenance		***Software, support***	***12-48***	***WP1.3***	***1***
Not yet started					

Deliverables EAWAG:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
Control and publishing of non-streaming data	***WSL/SLF, LSIR***	***Software, Publication***	***18***	***WP1.2***	***1***
Due to the close collaboration with SwissEx partners, new approaches to data acquisition and data management were jointly developed, implemented and adapted to Record's specific needs. A generic data model was developed, which allows data and metadata to be queried and combined. The Wiki platform was further developed as the interface for this. Most of Record's non-streaming data is now stored in the Wiki, e.g. sensor data from piezometers and soil data. Publishing of this data is subject to a delay as manual data correction is required. Additionally, manually sampled data (mostly analysed in the lab) has been published in the Wiki, e.g. water quality data such as inorganic hydrochemistry, organic hydrochemistry, micropollutants, and ecological data.					
Fusion of streaming data with sampled data	***LSIR, WSL/SLF***	***Publication***	***36***	***WP1.3***	***1***
To be able to jointly query sensor data with sampled data, a subproject was started to allow us to query over various data bases within the wiki (using the SPARQL query language), combining data and meta data.					
Development of distributed temperature sensing (DTS) applications for groundwater systems		***Software, Publication***	***24***	***WP3.8***	***3***

The goals for the first year have been reached. The main activity of the first year was data collection. After the installation of instrumentation, wells, loggers and field sites were maintained and data were downloaded at regular intervals. The geological and hydrogeological characterisation of the test sites is finished, resulting in a hydrogeological model. The hydraulic conductivity distribution was determined by sieve analysis, slug tests, flowmeter tests, and pumping tests. For the detailed investigation of infiltration rates in the river bed a high-resolution vertical temperature profiler was developed based on Distributed Temperature Sensing (DTS). Bank filtration in the channelised and restored river corridor was determined by preliminary analysis of travel times (Rn-222, time series of electrical conductivity (EC) and temperature). Tracer tests in the hyporheic groundwater have been started to identify flow paths and to verify travel times. After one year of sampling in regular campaigns hydrochemical characterisation is complete. Sampling is now focused on special conditions such as floods. Groundwater exfiltration areas in the side channels were investigated by lateral DTS measurements combined with other temperature methods yielding detailed exchange rates.
 	
Highlights:
• Installation and instrumentation of the wells
  • transect towards pumping station Niederneunforn, 18 wells
  • transect in alluvial forest Schäffäuli, 12 wells
  • transect on South side of the restored-reach site, 6 wells
  • grid of observation wells at the canalized-reach site, 17 wells
  • individual wells in alluvial forest, on gravel-bar island, and on overbanks, 25 wells
• Continuous operation of loggers					

- Preliminary analysis of point-like observations
  - travel times from Rn-222 analysis
  - deconvolution and cross-correlation of EC and temperature time series
  - relation to hydrochemistry (ongoing)
- Operation and preliminary analysis of DTS data
  - velocity of river water infiltration from vertical temperature profiles of the river bed
  - identification of exfiltration areas in the side channels from lateral measurements

Setup of calibration and measurement team – development of test calibration and validation procedures (EAWAG competence: soil and groundwater sensors)	***HWRM, EFLUM, WSL/SLF, LCAV***	***Guidelines, report***	***12, 24***	***WP3.2***	***3***

A team for calibration and measurement has been formed. The group responsible for soil and groundwater sensors organized a Workshop with focus on soil- and groundwater sensors (details see WP 3.2a). During this workshop, presentations and discussions focused on (i) evaluation of calibration procedures and its dependency on soil types, (ii) adapting calibration curves for selected soil types, (iii) developing manuals and protocols for sensor installation and calibration, and (iv) using soil sensors in groundwater environment.

The calibration studies have been delayed according to the workplan as the production and delivery of SensorScope stations took more time than expected. Deployment of test and development stations has therefore been postponed. The interplay of Decagons soil and groundwater sensors with SensorScope loggers and transmitters has not been investigated in detail due to delayed delivery.

Soil and groundwater sensor installation, calibration and maintenance workshops	***WSL/SLF***	***Workshop, manual***	***12, 24***	***WP3.2, 4.4***	***3, 4***

(i) Sensor metadata and data recording was a specific subject at Wiki workshops in May 2008, October 2008 and May 2009.
(ii) Data Model workshops for manual sampling campaigns were held in September 2008 and February 2009.
(iii) A workshop together with Decagon was held at WSL in March 2009 with focus on installation and calibration of soil and groundwater sensors.

Development, calibration and test of water quality sensors, total-dissolved gas pressure probes and on-site mass spectrometers		***Sensor development***	***18***	***WP3.2, 4.4***	***4***

An inlet membrane mass spectrometer system was constructed with the inlet membrane placed outside the gas analysing system, at the end of a several meter long tube. We intend to measure dissolved gases in groundwater by in situ extraction of the gases, therefore avoiding any mixing of the water by pumping. So far we have managed to detect gas concentration changes (under well defined laboratory conditions) with a response time of less than a minute, using a 5 m tube between the analysing system and inlet membrane.

Highlights:

- Construction of a prototype inlet membrane mass spectrometer with the inlet membrane head placed several meters outside the gas analysing system.
- First laboratory experiments successfully showed the main functionality for the intended purpose of measuring Ar, N2, O2 and other atmospheric gases.

Data infrastructure for RECORD	***LSIR***	***Software, support***	***3***	***WP4.1***	***4***

A data model has been developed and implemented to provide:

(i) data streaming into GSN (e.g. DTS and SensorScope)

(ii) traceable linkage of manually sampled data and metadata, manually retrieved sensor data and meta-data, wirelessly retrieved sensor data and its metadata, and automated data upload into the database for manual sampling and manually/wirelessly retrieved sensor data. This results in 600+ Wiki pages providing views and access to the data by location, time and type. Additionally a data graph tool (software) is under development in cooperation with Uni Twente database group and first steps towards automated picture analysis have been promising.

Currently, the following sensors can feed streaming data into project databases:

GSN:

- Sensorscope stations (2 meteo stations, 1 soil monitoring station, 1 groundwater monitoring station)
- 1 DTS
- 27 STS sensors.

Other project databases (soon to be converted to use GSN):

The number of online sensors will be continuously increased by implementing, testing and adapting strategies developed together with our SwissEx partners (see www.swiss-experiment.ch and http://lsir-swissex.epfl.ch/index.php/Record:Home).

The coordination with the cantons of Thurgau and Zürich regarding technical details has lead to a close co-operation. Data and infrastructure sharing will be continued in the future.

- Monitoring-well field installed at the restored and canalised-river site
- Full-scale system deployed in summer 2008
- Full-scale measurements begun
- Individually adapted sensors deployed

SensorScope station deployment and soil sensor calibration for APUNCH	***HWRM, LCAV, WSL/SLF***	***Deployment***	***48***	***WP4.1***	***4***

The APUNCH project did not need support from Eawag for the deployment of the sensorscope stations at the APUNCH site. Instead, Eawag and HWRM-ETHZ will compare different soil sensors in a joint test campaign this winter. Sensorscope stations will therefore be deployed, tested and cross-calibrated at the ETHZ campus.

Calibrate SensorScope non-meteorological sensors	***LCAV, WSL-SLF***	***Web publication***	***24***	***WP3.2***	***3***

A workshop focused on Decagons' soil- and groundwater sensors was held at WSL in March 2009. During this workshop, presentations and discussions focused on

(i) evaluation of calibration procedures and its dependency on soil types.

(ii) adaptation of calibration curves for selected soil types.

(iii) development of manuals and protocols for sensor installation and calibration.

(iv) using soil sensors in groundwater environment.

50% of the designated online soil and groundwater sensors have been deployed this summer. In order to proceed with calibration manuals and protocols (whilst SensorScope loggers were unavailable), these sensors were deployed using other loggers e.g. from Campbell and Decagon.

A guideline for soil sensor installation and a field installation protocol was developed.

The interplay of Decagons soil and groundwater sensors with SensorScope loggers and transmitters has not been investigated in detail due to delayed delivery.

Deliverables ETHZ/HWRM:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
Data infrastructure for APUNCH data	***LSIR***	***Software, Report***	***48***	***WP4.1***	***4***
In order to integrate pre-processed HWRM-APUNCH data into the Swiss Experiment platform a Celsius W370 PC (Dual core CPU3.16GHz, 4GB Ram, 1 terabyte) was bought and installed at HWRM localities. The device meets the requirements to make selected HWRM-APUNCH data available to Swiss Experiment for the entire project duration. Data integration has not yet been implemented for the following reasons: • Sensors were only received by June 2009 • Measurements with sensors are currently in calibration phase • Automatic data streaming from the sensors to a local hard disc located at HWRM is currently undergoing testing. • Software for preprocessing of raw data is currently being developed.					
Prototypes of sensors for embedded measurements of sediment transport	***ISIM***	***Hardware, Publication***	***24***	***WP4.1***	***4***
A new optical imaging technique is being developed and tested to measure both the channel bed topography and the water surface at the experimental field sites. The partner AQUA-EPFL developed a video camera with an integrated near infrared light source and an image sensor that measures the time of arrival of the reflected light at each pixel, producing a per pixel measurement. The technology is novel and its use in this context is also new.					
Calibration of X-Band radar	***LTE***	***Methodology Publication***	***18-24, 24-30***	***WP4.1 WP4.2***	***4***
A PhD candidate was employed by the APUNCH project on 1 April 2008 to investigate this topic. The X-Band radar is deployed on Klein Matterhorn. Due to damages caused to the computers and to the hardware of the X-Band radar by 3rd party building work, the calibration phase had to be delayed.					
Rainfall field estimation from combination of radar and raingauge observations	***LTE***	***Methodology Publication***	***24-30, 30 - 36***	***WP4.1 WP4.2***	***4***
A PhD candidate was employed on 1 April 2008 to investigate this topic during the next three years. Rain gauges have been deployed but calibration measurements are still ongoing.					
Installation of GPS station for water vapor tomography	***LSIR, WSL/SLF***	***Hardware***	***18-24***	***WP4.1 WP4.2***	***4***
Fabian Hurter (PhD student) is refining the tomographic software package AWATOS2, which extracts atmospheric water vapour distribution form GPS measurements. AWATOS2 has been developed at GGL (ETHZ) and is based on the Kalman Filter technique. Simulations and validations using the AWATOS2 have been carried out on a regional scale using the Swiss AGNES stations (GGL ETH Zürich). Ideas as to how GPS data and weather radar data can be coupled have been gathered and first testing of a direct coupling will soon be carried out.					
Deployment of APUNCH reference raingauges		***Hardware***	***12***	***WP4.1 WP4.2***	***4***
Within the HWRM-APUNCH project 6 Reference stations were bought. All 6 stations have been deployed and are currently being tested and calibrated. The locations of the 6 deployments are as follows: 1) Saas-Balen 2) Stalden 3) St. Niklausen 4) Zermatt 5) Randa and 6) Trockener Steg (the sensor at Trockener Steg will be deployed in mid September) Furthermore, 13 SensorScope stations were bought and deployed at locations near the Randa reference station. The 13 SensorScope stations will be deployed according to project requirements at different locations.					

Procedure for inference and scaling properties of precipitation data		***Methodology Publication***	***18-24 24-30***	***WP1.1, WP4.1***	***1,4***
A PhD candidate was employed on 1 September 2009 to investigate this topic over the next three years.					
Installation of sediment transport experimental site (Riedbach)		***Test site***	***18***	***WP4.1***	***4***
At the field site Riedbach in the Matter valley (canton Valais) an array of geophone sensors was installed in autumn 2008 at a water intake in cooperation with the hydropower company "Mattmark AG".					
Sediment transport experiments		***Methodology Publication***	***18, 24***	***WP4.1, WP4.3***	***4***
The technical equipment necessary for the RFID (Radio Frequency Identification) tracers for sediment particle monitoring has been purchased. Natural sediment particles from the Riedbach stream were prepared with RFID tags inserted into the particles. These tagged particles were put into the streambeds in summer 2009, and their position will be monitored regularly.					
Rainfall data disaggregation techniques		***Methodology Publication***	***18-24, 24-30***	***WP4.1, WP4.2***	***4***
A PhD candidate started on 1 September 2009 to investigate this topic over the next three years (same candidate as for "*procedure for inference and scaling properties of precipitation data"*).					

Deliverables ETHZ/SED:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
Seismic instrumentation in the Valais	***COGEAR partners***	***Report***	***24***	***WP4.6***	***4***
Plans for densification of the high gain seismic network in the region are at an advanced stage. Several new stations will be fully integrated into the Swiss Digital Seismic Network (SDSNet) by SED (ETHZ), with real time continuous communication, and will provide a significant reduction in the threshold magnitude for in earthquake detection throughout the upper Valais region. Future seismic events occurring in the target region of Visp / St. Niklaus will have excellent azimuthal station coverage at close distances to produce extremely reliable event locations and depths. Preferred locations have been identified for 4 semi-broadband stations, and currently site permissions are being negotiated. It is expected that the installation of these stations will be completed in the second year. If possible, GPS stations will be co-located at some of these sites. Additionally, the SED will provide matching funds for the purchase and installation of a broadband sensor in the region. A site has been identified in a tunnel near Fiescheralp, and the instrument will be installed in the second year.					
GPS instrumentation in the Valais	***COGEAR partners***	***Report***	***30***	***WP4.6***	***4***
During 2008, a pilot project was successfully finalized by GGL (ETHZ), showing the feasibility of GPS monitoring of tectonic movements in the area of Valais. This test network, TECVAL, consisting of 5 permanent stations was third-party financed by SNF and Haznet and has now been transferred to COGEAR. The search for sites for seismological stations has been pushed further and special emphasis has been put on the co-location of GPS receivers and seismological stations. A completed example is the seismological station 'Sanetsch' (SENIN) where both instruments could be co-located. Since the major financing of the GPS equipment is foreseen in the next two years and, in addition, will depend on the decision on the equipment-oriented proposals, no GPS stations have been acquired yet in project COGEAR. This is except for the TECVAL receivers, which have been financed by other sources.					
Instruments for short-term earthquake precursors	***COGEAR partners***	***Report***	***30***	***WP4.6***	***4***
Magneto-Telluric Sensors The selection of instruments to be purchased has been advanced by analyzing similar projects in other parts of the world, and by comparing different sensors. The final selection and acquisition of the best equipment is planned in the second year. Previously, some magneto-telluric surveys were carried out by the Group of Geomagnetism of the University of Neuchâtel in the area limited (to the north) by the Rhone River and (to the south) by the Swiss-Italian border. This study will be used to establish potential sites for test measurements and installations. **Geochemical sensors** Geo-chemical sensors for possible earthquake indicators (T, pH, Eh, EC, CO2, CH4, H2, Rn, He) are planned at spring sites in Valais. We require geothermal springs that are not influenced by superficial ground water. The selection of the sites is therefore not easy because most of the springs in the Valais area are in use, and therefore the pumping "shadows" the possible effects of earthquakes on the geo-chemical parameters. We have searched for possible sites and are presently exploring the possibility of equipping a geothermal spring in the Brigerbad area. No equipment has been purchased yet. Continued in the next two items….					
Multi-sensor monitoring system in the Visp area	***COGEAR partners***	***Report***	***30***	***WP4.6***	***4***
Geotechnical and strong-motion sensors at the Visp site Instrument evaluation and site selection are in progress by the SED (ETHZ), IGT (ETHZ) and IMAC (ETHZ). A semi-permanent array consisting of 12 stations was deployed in Visp and Mattertal during the winters 07/08 and 08/09. The analysis of the recorded earthquake data allowed for a selection of some potential sites for the surface strong motion installation. The planning of the borehole installations including strong-motion instruments and geotechnical sensors is scheduled for the second year.					

Multi-sensor monitoring system in the Matter Valley	***COGEAR partners***	***Report***	***30***	***WP4.6***	***4***

Geotechnical sensors at the Randa rock slope site
A prototype dynamic measurement system was installed at the Randa in-situ laboratory by EngGeo (ETHZ). Fiber optic strain gauges were installed at three measurement intervals within an existing 120 m deep research borehole. These down-hole sensors are currently expected to record data for 3 to 6 years. Additionally, two surface cracks with a long history of continued movements were also instrumented with the new strain gauges. Two temporary short-period seismometers were placed at the Randa site in June 2009 by SED (ETHZ) and are expected to operate until October 2009. One sensor is located on the instable part of the rock slope, whilst the second sensor is placed on the stable part and serves as a reference site. Special installations were necessary for power supply. All sensors are presently operating off-line with local data storage.

Data infrastructure for COGEAR data	***IKA, LSIR***	***Software, Report***	***48***	***WP4.6***	***4***

Database and Instrumentation in COGEAR:

The IKA (ETHZ) provided support for the generation of database schemas of the project partners. Currently, schemas from the SED (ETHZ), PRS (ETHZ) and IMAC (EPFL) are available. They are still in development and might be modified. The IKA is in contact with the other project partners to increase the available data sources progressively. As a next step, the IKA created two COGEAR test-beds for static data and combined them in a third test-bed as proof of concept for the inter-institutional interoperability. The unification of the schemas and database domains is performed visually in the COGEAR test-bed. With the test-bed, project COGEAR provided the general technology and the proof of concept for a distributed Web Service Interface (enhanced WMS + HTTP download links). The general workflow is simple and efficient. Further efforts need to be taken for the Swisstopo geodata management (a very large dataset, > 1.5 TB) and the integration of the Geovite GUI.
Additional efforts were made to unify both COGEAR and SwissExperiment data in a common environment with the help of the COGEAR Web Service Infrastructure. IKA developed a workflow to integrate real time sensor data in this Web Service Infrastructure by using a GML interface for GSN. With this interface, access to the metadata and data of GSN-based sensors is now possible. Further tests and developments need to be done to improve the GML interface.
In order to homogenize and modernize its data storage, and to make spatial data web-accessible, the SED plans to migrate or link its entire databases to a system of postgreSQL databases. In 2008, a feasibility study was carried out on seismic station information. The information has been linked to the COGEAR webGIS test-bed. Whilst the connection of the new database is relatively easy, the current displays on the COGEAR GUI still rely on secondary data storages that are disconnected from the automatic seismic data analysis tool chain.
The SED plans to interface the postgreSQL databases presently in development at the SED with the COGEAR web front-end. This goes hand-in-hand with significant changes in many processes of the automatic earthquake data acquisition and analysis. For the near future, the storage of primary waveform data from the seismic instruments (velocity- or acceleration time-series) will remain file-based, using well established standards such as GSE2 and miniseed. Format-free storage in databases is currently not viable, due to the high sampling rates, and the context-sensitive meaning of single measurement values. However, derived values, such as peak accelerations or velocities in an interval, as well as data from non-seismic sensors (geochemical, magneto-telluric, and others) could be stored as timestamp-value pairs in databases, and distributed over the planned SwissExperiment GSN framework. The experiences from these tests and experiments will be used for the integration of the different sensor types.

Project Workshops:
The technical discussion regarding the integration of the sensors in the GSN system has advanced. Two joint workshops of COGEAR and SwissExperiment partners were held, the first one in Visp on January 28, 2009, the second on July 1, 2009, in Lausanne. A further workshop between COGEAR and SwissEx partners is scheduled during the yearly meeting of project COGEAR in Visp, January 27-29, 2010.

Processing strategies and tools for real-time systems related to earthquake observations	***COGEAR partners***	***Software, Report***	***48***	***WP4.1***	***4***
This item has not yet been started					
Education in Seismology: Description of products		***Report***	***24***	***WP5.1***	***5***
The environmental education components of SwissEx consist of 3 components: Climate (EFLUM), Seismology (SED) and Energy Balance (WSL/SLF). The first step of the seismology program called "Seismo-at-School" (http://www.seismoatschool.ethz.ch/) led by the SED has been set up successfully. Five Schools are involved in this program with a total of 150 students (14-18 year old), and 10 Matura-works were initiated that are related to earthquakes and wave propagation. This work will be defended during this year. The work was presented to the children and to the wider public during the Basecamp09 event, as part of the Focus-Terra museum events at ETH Zürich in May 2009. About 150 classes from different schools in Switzerland were present at this event. The "school earthquake database" has been developed and is now open for schools and the public. The "cookbook" concerning the experiments for teachers related to earthquakes is in preparation. We are also working on the "Seismo-at-School" books for teachers and student with an age between 15 and 18 years. "Seismo at school", "ClimAtscope", and "GLOBE" have been involved in an European Environmental Education project (O3E). O3E (http://o3e.geoazur.eu/) wants to develop synergies between Switzerland, France and Italy in the area of environmental education (seismology, hydrology and climate). The aim of this project is to build an international EE platform network by sharing environmental monitoring data, experiments, lessons, information and E-learning for teachers at schools.					
Education in Seismology: Final report		***Report***	***48***	***WP5.1***	***5***
See progress in previous item					

Deliverables EPFL/LCAV:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
Paper on Sensorscope 1st Generation Experiences and Results	***EFLUM***	***Publication***	***4***	***WP3.1***	***3***
Several papers were published last year in the proceedings of major communication conferences such as IPSN, EWSN, and Sensys (see bibliography section). A journal paper describing the Sensorscope system has recently been accepted for publication in the ACM Transactions of Sensor Networks.					
SensorScope 2nd Generation		***Harware / Software***	***3***	***WP3.1***	***3***
Sensorscope 2nd generation has already been fully developed and is currently being used in multiple Swiss Experiment deployments. This 2nd generation considerably outperforms Sensorscope 1st generation in flexibility, reliability, and installation complexity. Main features / enhancements include: i) Low energy consumption: powered by four rechargeable AA batteries ii) Long communication range: up to 1.5 Km with a clear line of sight iii) Easy installation in different types of terrain iv) High sensor versatility: sensors are plug-and-play, and can be directly connected to a station without the need for a priori configuration v) Self-Organized network: Sensorscope uses communication protocols that allow stations to self-organize into multi-hop ad-hoc networks, which are able to adapt themselves to topology modifications without any manual configuration. This allows the user to arbitrarily place, move, or remove stations. vi) Time synchronization: stations are globally synchronized on the Coordinated Universal Time and measurements are therefore taken with a common time stamp even amongst different deployments. vii) Local backup: stations can be equipped with a memory card of up to 2GB for local backup. viii) Real time data-access: stations can be equipped with a GPRS module which regularly transmits sensor data from the network.					
Develop sensor communication protocol (sensor bus)		***Software***	***1-6***	***WP3.1***	***3***
To increase station flexibility, a new station-to-sensor protocol has been successfully integrated in the Sensorscope system. This protocol allows plug-and-play sensors: that is, sensors can be directly connected to any station without the need for a-priori configuration. To add a sensor to a station, you simply plug the sensor into the chain of previously installed sensors. Stations can be equipped with up to 16 of the same sensor model, for a total of up to 50 sensors connected simultaneously to a station. This protocol has been developed keeping flexibility in mind: new sensors need to be integrated into the system (see deliverables) whilst remaining compatible with previous sensors. When new sensors are made available they can be immediately plugged into a previously installed station without any further modification.					
New mechanical design for SensorScope (including housing, connectors, frame)		***Hardware***	***1-6***	***WP3.6***	***3***
Stations have been re-designed from the ground up to be deployed quickly and easily by two persons on all types of terrains. They are built around an aluminum pole anchored into a base, such that they can be installed on slopes while still standing up straight. All sensors include a watertight connection box so that different sensors can be daisy chained on a single station.					
Energy Efficient Collaborative Routing Algorithms	***DISAL***	***Software***	***3-24***	***WP3.6***	***3***
Efficient multi-hop communication protocols have already been developed to reduce the power consumption of sensing stations. A multi-hop protocol allows stations to be placed further away from a GPRS enabled station and communicate over a low-power radio chip. Data packets are then forwarded along a chain of					

stations, from the stations to the GPRS, enabling data gathering over a wide area with only one GPRS connection.
This protocol is currently being tested in some Sensorscope deployments (EPFL, La Fouly).

We are currently starting a project to exploit environmental data correlation to reduce the amount of data sent through the network by using a model-driven data acquisition system: stations compute a statistical model of the collected data (in-network) and transmit only the parameters of this model (only once) and the difference between the measured value the value predicted by the model. In addition to compression, these models can also provide important indications about the quality of the measurement data (a great difference between the predicted value and the real measurement is likely to be due to a sensor malfunction) and protection against packet loss (we can always use the predicted value if the real measurement was lost).

Long-Range Communication Module		***Hardware / Software***	***6-18***	***WP3.3***	***3***
Stations have been equipped with external radio antennae which provide a communication range of up to 1.5 km with a clear line of sight. In the presence of obstacles (e.g. buildings, trees, rocks), the typical range is around a few hundred meters. In combination with a multi-hop routing protocol, this allows a small network to cover a wide area. These external antennae could be complemented with a long-range mid-power radio module (such as the DIGI XBee pro) that allows up to a 35Km transmission range (line of sight). However, these radio modules considerably increase power consumption and require specific routing algorithms. A prototype including such a long-range radio is currently under development.					
Routing Algorithms for Long Range Communication	***DISAL***	***Software***	***6-18***	***WP3.3***	***3***
See previous deliverable.					
Develop Camera System for SensorScope		***Hardware / Software***	***6-48***	***WP3.6***	***3***
A hardware engineer was employed to develop the autonomous camera system. We have started the design of an autonomous operation camera for remote sensing that can be integrated into Sensorscope stations. This stand-alone, low-power camera for environmental monitoring is subject to rather demanding challenges: potentially harsh environmental conditions, low data rate for communication (a maximum of 53.6 Kbits/s can be achieved with GPRS), and severe energy limitations (rechargeable battery coupled to a solar panel). The first autonomous camera module is expected December 2009.					
New Sensors in SensorScope (Disdrometer, Snow Depth)	***EFLUM, EAWAG, WSL/SLF***	***Hardware / Software***	***6-48***	***WP3.6***	***3***
Two different snow depth sensors have already been integrated into the system: a high-end mid-consumption sensor (SR50A from Campbell Scientific) and a low-end low-consumption sensor (MaxSonar from MaxBotix). Initial performance tests have already been conducted between these two sensors. A more exhaustive test will be carried out during the Wannengrat deployment this winter. In collaboration with EPFL/DISAL, we are currently working on the integration of a hot wire anemometer. This new sensor will allow high accuracy wind speed measurements at high temporal resolution, whilst maintaining a low power consumption.					
SensorScope Stations for all CCES projects	***WSL/SLF***	***Hardware, Support***	***8***	***WP4.5***	***4***
The manufacturing of Sensorscope stations has been transferred to an external company (Sensorscope SARL) under EPFL license. This company has already provided the stations to create the pool used in multiple campaigns of the participating projects. All CCES projects involved wanted the SensorScope stations for the entire summer, every summer, not for intense, short dense deployments as was planned, so the pool has been significantly dissipated for the summer periods. A small pool has however been bought for the Dranse precipitation campaign and all of the dissipated summer pool will be returned to Davos in October for the winter period.					
SensorScope Testbed	***WSL/SLF***	***Support***	***8-20***	***WP3.7***	***3***

in Wannengrat					
This is to be deployed on Wannengrat in month 12. All stations (now significantly tested) are to be returned from the summer deployments for the Wannengrat winter deployment.					

Deliverables EPFL/DISAL

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
A series of distributed, power-aware, intelligent algorithms for Sensorscope stations to capture environmental events of interest by modifying the local activity patterns of a node and exploiting inter-node information sharing.	***LCAV***	***Software/firmware, test data***	***24***	***WP3.6***	***3***
		Publications (2 conference papers)	***24, 36***		
We are developing a showcase scenario where multiple SensorScope stations will sample and transmit temperature measurements. By using adaptive sampling algorithms through in-network processing they will generate data of the same quality as through the conventional sampling approach used at the moment while requiring less energy and communication bandwidth. This demonstration will show the capabilities of this approach and encourage the other Swiss Experiment participants to adapt it to their specific problems.					
Active control algorithms of the stations based on the annotations of an environmental model, e.g. to adapt the sampling rates of a sensor station based on a model based characterization of an event	***LCAV***	***Software/firmware***	***36***	***WP3.6***	***3***
		1 publication (journal paper)	***48***		
Not yet started					
Multihop routing, in-network processing (data compression, verification, tagging)	***LCAV***	***Software, test data***	***24***	***WP3.6***	***3***
Not yet started					
Anemometer development	***LCAV***	***(possible design and 1 redesign phases), design considerations***	***36***	***WP3.6***	***3***
After developing and debugging an initial prototype, a batch of 22 multi-thermistor-based anemometric units have been fabricated, tested and assembled in the framework of the NCCR-MICS project on Distributed Odor Localization (fund matching project). A set of 10 units has been thoroughly tested in the wind tunnel and the resulting software changes have improved the anemometer's angular resolution. We have negotiated with LCAV and SensorScope Sarl the access to SensorScope's hardware and software to enable an integration of the anemometer which is compliant with the existing hardware and code structure. In cooperation with EFLUM, we have started to investigate the use of the very same thermistor-based technology to enable heat flux measurements. This extremely cheap sensory module needs high sampling rates (20 to 100 Hz) in order to be competitive with traditional ultrasound-based heat flux measurement but it requires only simple preprocessing in the node. It can therefore possibly serve as a showcase for both in-node processing and intelligent sampling schemes. A series of experiments has been carried out to evaluate the performance of this sensory module in the field compared to the standard ultrasound-based methods involving much more expensive equipment. The results are very promising.					
Anemometer development, refinement and integration	***LCAV***	***Optimised prototype (2nd redesign) interfaced to the SensorScope stations, test data***	***36***	***WP3.6***	***3***
		1 publication (conference)	***48***		
We are in the process of setting up the wind tunnel to serve as a testbed for calibration under different fluid dynamic conditions (wind speed, different degree of turbulence, etc.). Systematic tests using commercial ultrasound and hotwire anemometers have started and will continue in the next months. They will allow us					

to accumulate experience with wind tunnel measurements as well as create a solid baseline for comparison for our own anemometric developments.					
Automated, event-driven sampling schemes for water-quality issues	***EAWAG***	***Soft-ware/firmware, test data, 1 publi-cation (peer-reviewed confe-rence paper)***	***48***	***WP3.6***	***3***
Item not started.					
Intelligent sampling schemes, power manage-ment algorithms and model-based active control algo-rithms	***SLF***	***Soft-ware/firmware, test data, 1 publi-cation (peer-reviewed confe-rence paper)***	***30***	***WP3.6***	***3***
We are developing a showcase scenario where multiple SensorScope stations will sample and transmit temperature measurements. By using adaptive sampling algorithms through in-network processing they will generate data of the same quality as through the conventional sampling approach used at the moment while requiring less energy and communication bandwidth. This demonstration will show the capabilities of this approach and encourage the other Swiss Experiment participants to adapt it to their specific problems.					

Deliverables ETHZ/TIK:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
PermaSense 2nd Generation Network	***Uni Basel, Uni Zurich***	***Hardware, Software***	***12***	***WP3.4***	***3***
A second generation sensor network hard- and software is currently being designed. The sensor nodes are currently in series production and the base station is available as prototype. Details are available on request. http://www.permasense.ch					
Deployment andoperation of high alpine field sites	***Uni Basel, Uni Zurich***	***Deployment, Support, Operation***	***1-48***	***WP3.4***	***3***
The field deployments have been operational since July 2008. The data is currently only available on an ETHZ internal platform due to technical issues. It is expected to be able to publish all raw data on an open, public platform at a later date.					
Integration of PermaSense into the Swiss Experiment Data Infrastructure	***SLF, LSIR, Uni Zurich***	***Hardware***	***24***	***WP4.1***	***4***
Work on the integration is currently under way. The necessary concepts have been defined and a prototype is currently implemented at EPFL.					
Tech transfer of Perma-Sense technology to other Swiss Experiment projects	***Uni Basel, Uni Zurich***	***Software, Support***	***24***	***WP3.4***	***3***
Initial negotioations to use PermaSense systems in other projects have been made with APUNCH and RECORD. A joint effort with APUNCH to set up and maintain an internet infrastructure in Zermatt has been especially successful so far.					
Organization of a summer research institute in conjunction with a technical workshop on long-term remote sensing	***Uni Zurich***	***Workshop***	***24***	***WP5***	***5***
This activity has not yet started.					

Deliverables EPFL/ISIM:

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
Hydromon sensor network	***AGE, VonRoll***	***Working sensor network***	***6***	***WP3.5***	***3***
The sensor network was completed and the sensor nodes installed. The web interface was completed.					
Prototype disdrometer software	***LTE***	***Software, support***	***24***	***WP3.8***	***3***
We have designed a software package that is capable of running the current RH2 chip in real-time with programmable frame rates. This software, combined with dedicated firmware, has been successfully tested on a raindrop emulator with a frame integration time as low as 20us (http://www.swiss-experiment.ch/index.php/Isim:Disdrometer). By the end of 2009 we have a milestone for the creation of a prototype based on the existing RH2 chip.					
Prototype disdrometer hardware	***LTE***	***Hardware, support***	***24***	***WP3.5***	***3***
A new chip is being designed. We have reduced the size of the RH2 pixel from 30 to 23um thanks to the use of a low-power NMOS design of the in-pixel memory. We have also started the design of microlenses to be used on the chip for photon capture maximization. We are planning a tape-out early next year.					
Hydromon data analysis package	***AGE, VonRoll***	***Software for data analysis***	***18***	***WP3.5***	***3***
We have begun collaboration with a new hire at AGE who is in charge of data management there. We plan to continue working with him on the data privacy issue as well.					

Deliverables EPFL/LTE (these were not included in the SwissEx workplan) :

Deliverable	Collaborating institutions	Deliverable type	Due month	Milestone	WP
Mobile radar field campaign	***LSIR***	***Hardware***	***6-48***	***WP3.8***	***3***
The mobile X-band polarimetric radar was deployed in Davos in September 2009 for the winter 2009/2010, together with optical and video disdrometers deployed at Weissfluhjoch.					
Disdrometer prototype deployment	***ISIM***	***Hardware***	***18***	***WP3.8***	***3***
A first prototype based on an existing chip (32x32) is planned for the end of 2009, to demonstrate the feasibility of the proposed approach. A new chip is being designed and will be taped-out early next year.					

Timeline:

WSL/SLF:

Most tasks are on-time if not ahead of time.

Due to the non-availability of SensorScope stations last winter, no winter deployment took place and summer deployments were late in starting. With the performance that the stations have demonstrated this summer, we are however confident that we can get the results required for the winter precipitation paper within a single winter campaign. Unfortunately, the CCES projects did not get the SensorScope stations until late this summer. It should be stressed however that these stations were always intended to be additional measurements for the CCES projects and not an essential part of the infrastructure.

The provision of stations for the Davos schools did not take place earlier this year due to the lack of availability of stations and waiting for the infrastructure to mature. We are confident however that this delay will not affect the overall outcome of the educational module. Work will start anew now that the new school term has begun.

EPFL/EFLUM:

All tasks are on time if not ahead of time.

EPFL/LSIR:

All tasks are on time.

ETHZ/IKA:

The project is on schedule (for IKA even slightly ahead of schedule).

The following minor changes were made for IKA:

- task 4 (implementation) was started ahead of schedule, in order to meet the overall project requirements and to demonstrate the workflow to the project partners
- collection of data from project partners will continue in year 2, subject to the finalization of data schemas and of implementation of the GSN framework by each partner.

ETHZ/HWRM:

All tasks are on time.

EAWAG:

Most of the tasks are on time, however the set-up of the calibration team has been set back by the late delivery of the SensorScope stations.

The next steps are to develop a measuring procedure suitable for field work before the end of 2009 and to start the first field campaign in 2010.

ETHZ/SED:

All tasks on time.

EPFL/LCAV:

The 2nd Generation of SensorScope stations was significantly delayed due to the formation of a commercial firm, however all further tasks are now on-time.

EPFL/LTE:

The mobile radar was procured on time and is now deployed in Davos. The disdrometer development is on time and deployment is planned for month 18.

EPFL/DISAL:

No main deviation from the planned objectives although, for clarity, we have merged two objectives related to distributed intelligent algorithms and intelligent sampling schemes into one. Moreover, for the distributed intelligent algorithms contribution applied to water quality, we have identified EAWAG as an interested environmental engineering partner. In terms of timeline, some delay has been accumulated because of a late start of the main collaborator (Dr. Alexander Bahr, joined only mid January 2009), his

adaptation to our working environment, some unpredicted departures among the core people in our laboratory, and some delays in getting our infrastructure adapted to the SwissEx project (wind tunnel facilities renovation, deployment of Sensorscope stations with corresponding software developing tools, etc.). In order to compensate for this slower starting phase, after discussion with the project PI and the CCES executive director Nikolaus Götsch, we have extended our involvement in the project (reaching into the fourth year) and changed correspondingly the deliverable milestones without any cost extension.

EPFL/ISIM:

All tasks are on time.

ETHZ/TIK:

Due to the slow progress with respect to data integration the project is somewhat behind schedule on providing an operational system based on Swiss Ex technology. For now this is not hindering any activities, but the longer development times are currently binding a number of resources.

Publications:

Journal Publications:

Couach, O., Luyet, V., Ristori, P., Parlange, M., Barrenetxea, G., Ingelrest, F., Vetterli, M., Aberer, K.: ***SensorScope: a New Environmental Monitoring System. Example of Application in an Alpine Environment***, Environmental Modelling & Software Special Issue "Sensors and Environment", submitted.

Ingelrest F., Barrenetxea G., Schaefer G., Vetterli M., Couach O., Parlange M.; ***SensorScope: Application-Specific Sensor Network for Environmental Monitoring***: accepted to ACM Transactions on Sensor Networks, Vol. 6, Nr. 2, 2009.

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