



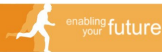
Geo-information for Disaster Management

Delft, The Netherlands - March 21-23, 2005



An integrated system for Flood Forecasting and Emergency Management

Dr. Federico Rossi
Environment Business Director



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Outline

- ✓ DATAMAT Profile
 - Figures
 - Fields of excellence in ICT for environment
- ✓ Dimension of Flood problem
 - World
 - Europe
- ✓ M3Flood solution
 - History
 - Main principles / functions
 - ✓ Data acquisition
 - ✓ Forecasting
 - ✓ Evaluation
 - ✓ Risk analysis
 - ✓ Intervention Support
 - ✓ User configurability: GIS set-up
- ✓ M3 Flood installations / trials
- ✓ Conclusions



Florence, 1966



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DATAMAT Profile

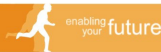


- ✓ Italian **leading group** in the supply of **ICT solutions**, established in **1971**
- ✓ Listing onto the Italian Stock Exchange in 2000
 - Now included in TechSTAR "excellence" segment
- ✓ Continuous growth of core activities
 - Sales (FY 2004): 170,9 M€
 - EBITDA (FY2004): 28,3 M€ (+20,5%)
- ✓ High value **human resources**:
 - **1,366 employees** on December 31, 2004
 - Highly skilled (51% graduated) and receiving constant training
- ✓ Supply ICT solutions for **end users** in **specific segments of our vertical reference markets** through the delivery of: **products, systems and integrated services**, leveraging on:
 - Strong **application expertise** (knowledge of client primary processes)
 - Strong **technical and technological competencies** ("state-of-the-art" solutions)
 - **Management and organizational capabilities** in managing complex and high economic value contractual responsibilities

with a proven **capability** to deploy on **international** scenarios.



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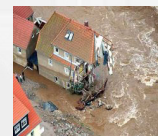
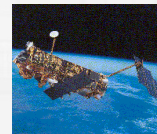


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Our fields of excellence in ICT for environment

- ✓ Earth Observation from Space
 - DATAMAT has implemented and is currently operating, on behalf of the **European Space Agency** and of the **National Space Agencies** (UK, IT, DE, ES, ...)the European distributed information system providing user access to Earth Observation products and services (ENVISAT + Multi-Mission User Services)
- ✓ Meteorology
 - DATAMAT has a long record of experience (since early 80's) in the provision of systems for meteorological applications to national **met and civil protection services** and **international organisations** (Meteorological Satellite Ground Stations, Meteorological and Climatological Centres, Weather Radar Networks)
- ✓ Natural Risk Management
 - DATAMAT experience in this field ranges from vertical **thematic** applications, generally in partnership with scientific institutions, to horizontal architecture and **interoperability** projects (in line with EU geo-spatial directives).
- ✓ Emergency Management
 - DATAMAT started cooperating at the end of nineties with **Civil Protection Authorities** at National, Regional and District level to upgrade their level of ICT awareness and exploitation focusing on CPA Operation Control Centres, **on-field** intervention, Emergency communications network.



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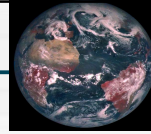


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The dimension of Flood problem in the World



- ✓ Looking at 1992-2001 decade, at least 1/3 of all losses due to nature's forces can be attributed to flooding.
- ✓ In this period losses amounted to more than 200 Billion Euro.
- ✓ Recently societies have considerably improved warning methods based on better weather forecast models and this has led to a reduction in the number of victims.

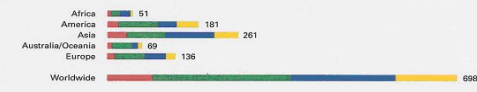
Statistics of natural catastrophes in 2002

Loss events and fatalities

Percentage distribution worldwide



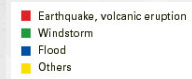
Number of loss events



Number of fatalities



Source: Munich Re



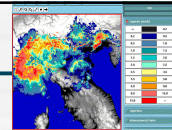
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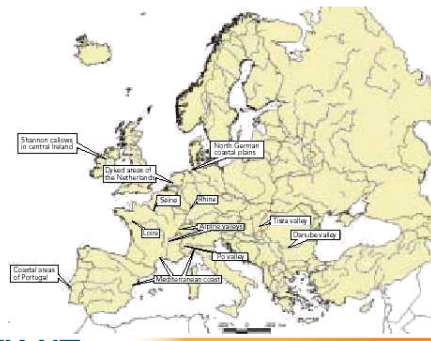
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... and in Europe



- ✓ In the last two decades the greatest number of floods occurred in France (22%), Italy (17%) and the UK (12%)
- ✓ Flood damages for the period 1980-2002:
 - The highest number of fatalities occurred in Italy (38 %), followed by Spain (20 %) and France (17 %).
 - The greatest economic losses occurred in Germany and Italy (both €11 billion), followed by Spain and the UK (both around €6 billion).
- ✓ Need of structural (reservoirs, river canalisation, dikes, floodways for water courses, etc.) and non-structural measures (flood warning and prevention systems, management of flood areas, insurance, etc.) for Flood prevention



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M3Flood Solution

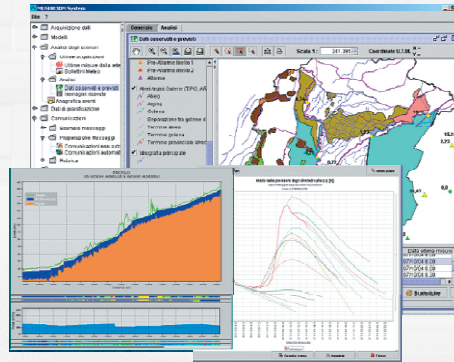


✓ Purpose

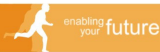
- Fully integrated system for flood forecasting and related emergency management

✓ Target users

- All organisations involved in flood management at local, regional and national level including:
 - ✓ civil protection agencies
 - ✓ river basin authorities
 - ✓ hydro-meteorological services
 - ✓ water authorities
 - ✓ navigation services
 - ✓ emergency operations centres
 - ✓ environmental protection agencies



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Where does M3Flood come from?



- ✓ M3Flood is the result of the MUSHROOM initiative, a “market validation” project co-funded by the EC e-TEN Programme (Mar 2003 - Oct 2004), coordinated by DATAMAT and with the direct and effective involvement of users, based on the integration of existing specialised components into a unique scalable solution.

NUWATER Consulting Service Ltd.



DATAMAT S.p.A.
Project Coordinator

ARPA SIM - Emilia-Romagna -
Servizio Idro-Meteo Regionale

PDM - Provincia di Modena

STBR - Regione Emilia Romagna -
Servizio Tecnico Bacino Reno

PROGEA S.r.l.

GEOSYS S.L.

IMIDA - Instituto Murciano de Investigación y Desarrollo Agroalimentario

CHS - Confederación Hidrográfica del Segura

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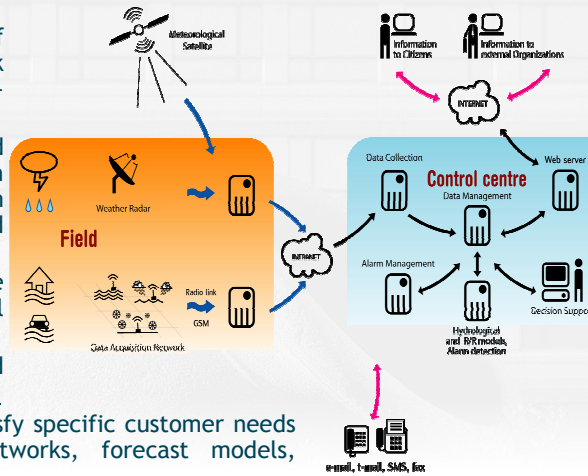


M3Flood: Main principles



✓ Complete, modular, integrated, scalable, distributed and interoperable solution for:

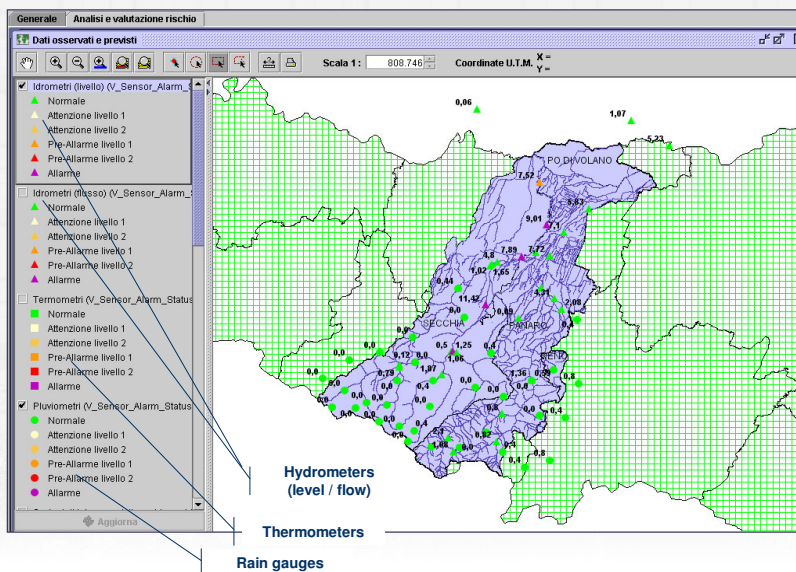
- Real-time monitoring of river basins and flood risk areas acquiring hydro-meteorological observation
- Generation of flood forecasts and/or acquisition of such forecasts from external sources (R/R and hydraulic models)
- Risk analysis to issue warnings in case of critical event forecasts
- Intervention support and dissemination of information



✓ Strongly **customisable** to satisfy specific customer needs and constraints (sensor networks, forecast models, existing infrastructures, ...)



Data acquisition: Real-time sensors network read-out



Data acquisition: Real-time sensors network read-out

Stazioni	Data	Frassinoro	ro (intensità)
2	2003-10-31 08:30:00	0.00	0.04
3	2003-10-31 09:00:00	0.00	0.04
4	2003-10-31 09:30:00	0.00	9.8
5	2003-10-31 10:00:00	0.04	22.8
6	2003-10-31 10:30:00	1.06	11103.7.00
7	2003-10-31 11:00:00	1.02	11103.7.00
8	2003-10-31 11:30:00	1.02	11103.7.00
9	2003-10-31 12:00:00	2.00	
10	2003-10-31 12:30:00	3.06	
11	2003-10-31 13:00:00	0.08	10.0
12	2003-10-31		
13	2003-10-31		
14	2003-10-31		
15	2003-10-31		
16	2003-10-31		
17	2003-10-31		
18	2003-10-31		
Pioppa	5.22		
Polinago	01/11/03 7.0		
Ponte Alto	4.79		
Ponte Bacchello	7.04		
Ponte Cavola	0.99		
Ponte Dolo	7.81		
Ponte Samone	0.1		
Ponte Samone SIAP	0.92		
Ponte Val di Sasso	11.15		
Ponte Veggia	0.57		
Porretta			
Ramiseto			
Rifugio Bargetana			

Andamento dei dati misurati dai pluviometri (intensità di pioggia) [mmh]

Andamento dei dati cumulati misurati dai pluviometri [mm]

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M3Flood
M3 Flood

Data acquisition: Weather radar maps

MUSHROOM System

File ?

- Acquisizione dati
- Modelli
- Analisi e valutazione rischio
 - Ultime acquisizioni
 - Dati osservati e previsti
 - Bollettini Meteo
 - Immagini ricevute
 - Anagrafica eventi
- Casi di pianificazione
- Comunicazioni
- Intervento
- Risorse
- Amministrazione del sist

Generale | Analisi e valutazione rischio

Mappa di pioggia prevista

Fotogramma 1 di 16

Scala 1: 971.222

Coordinate U.T.M. X = Y =

Mappa di pioggia radar

Fotogramma 86 di 97

Pre-Allarme livello 2

Aggiorna

Viste

Query

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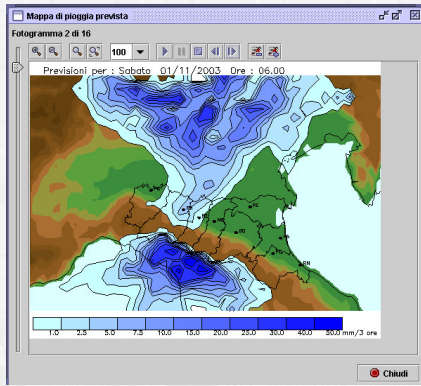
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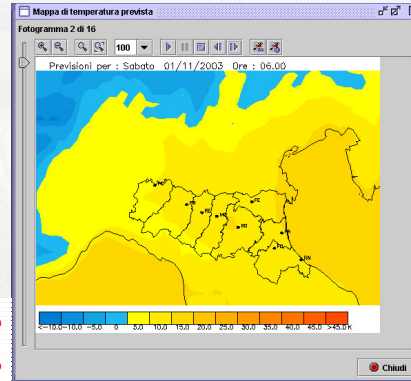
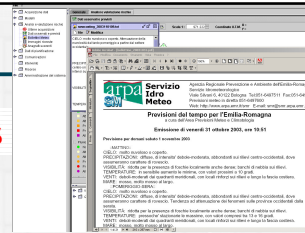
M3Flood
M3 Flood

GI4 DM Data acquisition:
Results of weather forecast model



Rainfall maps

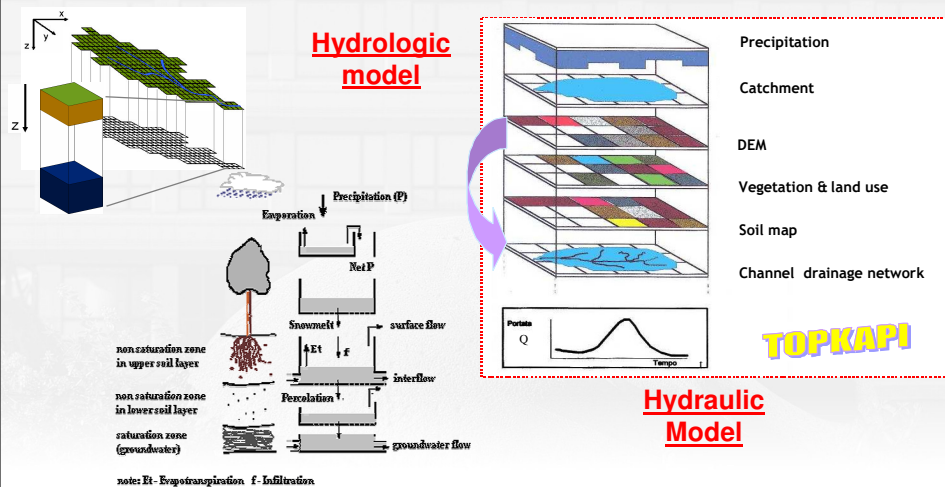
Bulletins



Temperature maps

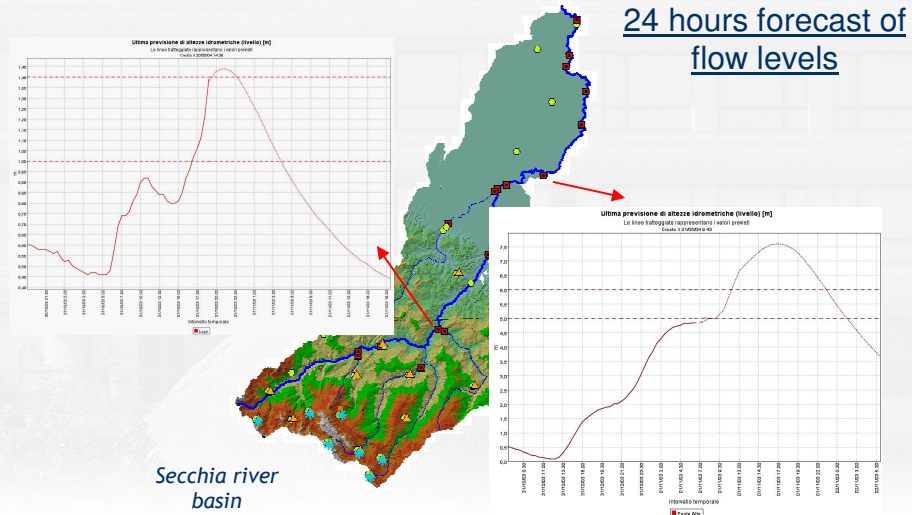
GI4 DM Forecasting:
Hydrologic and hydraulic models

✓ Capability to integrate third-party models as well as availability of internal models:





Forecasting: Flow evaluation in specific river section



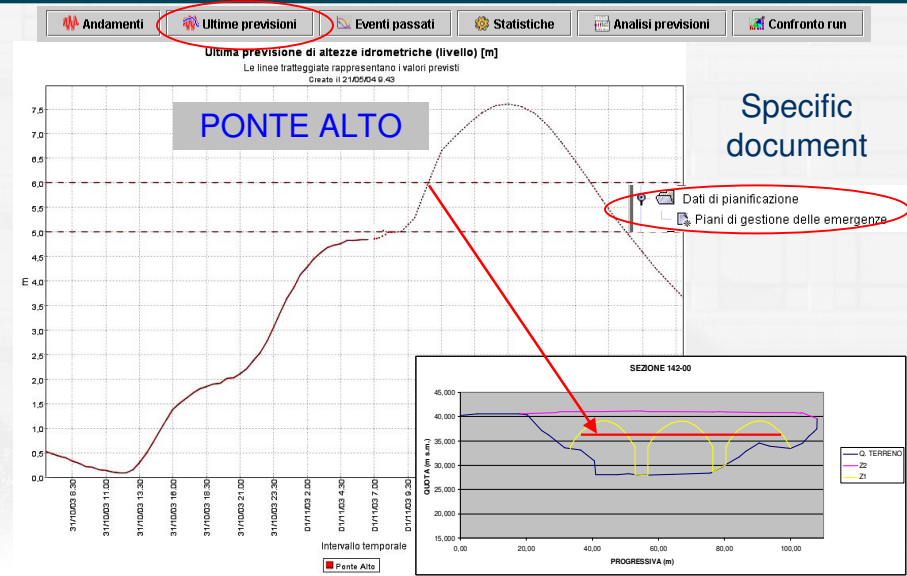
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Evaluation: Thresholds and emergency actions

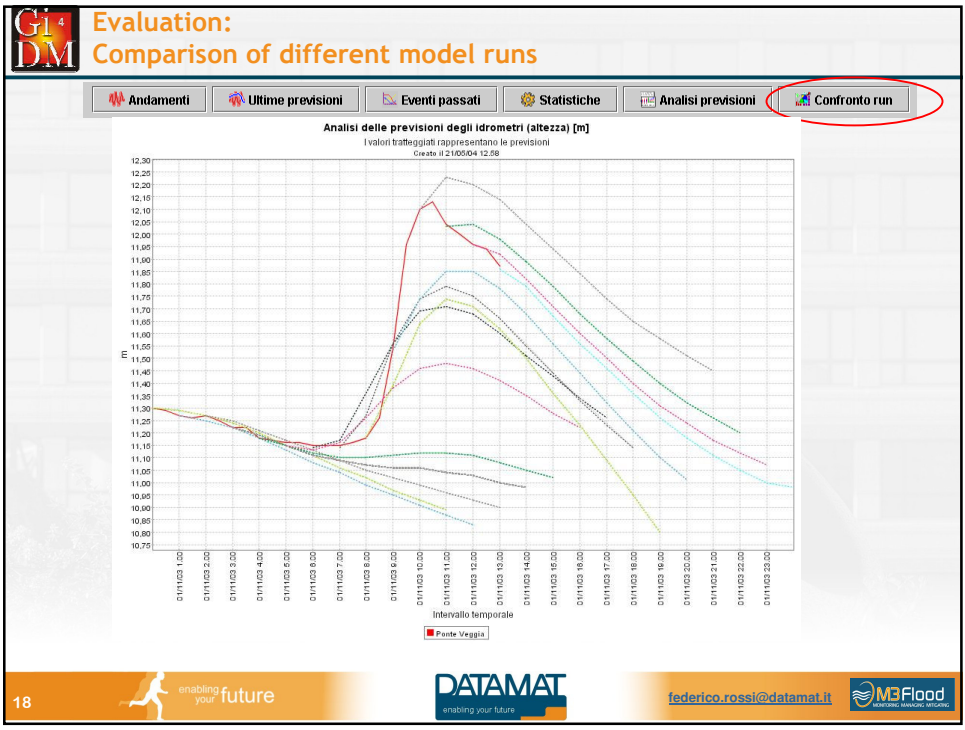
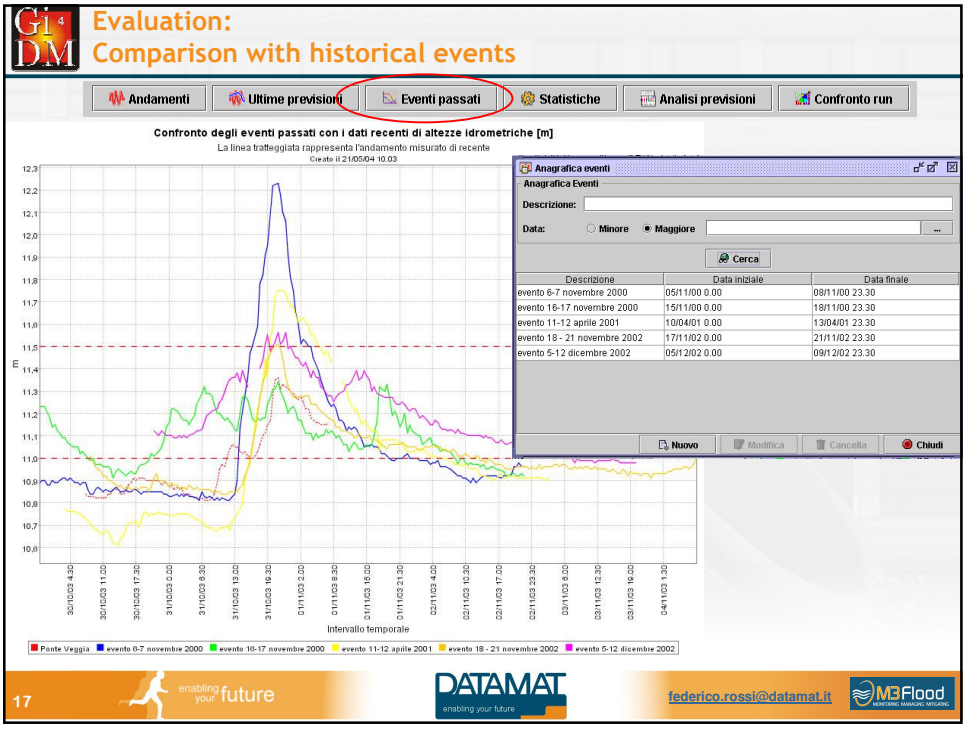


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Risk analysis: Risk levels definition

Stato del rischio

Data analisi	Tipo di sito	Sito	Livello rischio	Tipo rischio	Data allarme	Trend
26/10/04 1	Idrometro (livello)	Ponte Bacchetto	Pre-Allarme livello 1	Rischio esondazione	27/11/03 20	
26/10/04 1	Idrometro (livello)	DOLO	Pre-Allarme livello 1	Evento meteorologico av.	27/11/03 19	
26/10/04 1	Idrometro (livello)	Lugo	Atterramento livello 2	Rischio esondazione	27/11/03 20	
26/10/04 1	Idrometro (livello)	Ponte Veggia	Atterramento livello 2	Rischio esondazione	27/11/03 23	
26/10/04 1	Sotto bacino	ROSSIGNA	Atterramento livello 2	Evento meteorologico av.	27/11/03 19	
26/10/04 1	Sotto bacino	TRESINARO	Atterramento livello 2	Evento meteorologico av.	27/11/03 19	
26/10/04 1	Sotto bacino	DRAONE	Atterramento livello 2	Evento meteorologico av.	27/11/03 17	
26/10/04 1	Sotto bacino	SECCHIA	Atterramento livello 2	Evento meteorologico av.	27/11/03 12	
22/10/04 1	Idrometro (livello)	Fonte Alto	Normale	Rischio esondazione	08/11/03 12	

Visualizzazione dei criteri

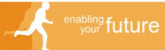
Criterio di allarme: Superamento soglia osservata criticità elevata (h)

Tipo di sito	Sito	Bacino	Osservato	Previsto	Soglia	Misura/Previsione
Sotto bacino	DOLO	SECCHIA	18	1	20,00	20,25 THR351

Superamento soglie

Tipo di sito	Sito	Bacino	Osservato	Previsto	Soglia	Misura/Previsione	Tipo
Idrometro (livello)	Lugo				1,40	1,56	THR1P102 (Soglia di pr...
Idrometro (livello)	Proppa				7,70	7,83	THR1P102 (Soglia di pr...
Idrometro (livello)	Ponte Alto				6,00	6,51	THR1P102 (Soglia di pr...
Idrometro (livello)	Ponte Veggia				11,50	11,75	THR1P102 (Soglia di pr...
Idrometro (livello)	Rubiera				6,00	6,96	THR1P102 (Soglia di pr...
Idrometro (livello)	Ponte Bacchetto				7,60	7,92	THR1P102 (Soglia di pr...
Idrometro (livello)	Lugo				2,00	2,01	THR1P202 (Soglia di all...
Idrometro (livello)	Rubiera				7,30	8,29	THR1P202 (Soglia di all...
Idrometro (livello)	Ponte Bacchetto				9,00	9,12	THR1P202 (Soglia di all...
Idrometro (livello)	Ponte Bacchetto				6,50	6,62	THR1S102 (Soglia di pr...
Sotto bacino	DRAONE	SECCHIA			5,00	5,68	THR1S0A3 (Soglia per pi...
Sotto bacino	DOLO	SECCHIA			5,00	6,12	THR1S0A3 (Soglia per pi...
Sotto bacino	SECCHIA	SECCHIA			5,00	6,25	THR1S0A3 (Soglia per pi...
Sotto bacino	SOA TENNA	PANARO			5,00	5,28	THR1S0A3 (Soglia per pi...
Sotto bacino	DRAONE	SECCHIA			10,00	15,87	THR2S1A3 (Soglia 1 per...
Sotto bacino	DOLO	SECCHIA			10,00	16,84	THR2S1A3 (Soglia 1 per...
Sotto bacino	ROSSIGNA	SECCHIA			10,00	18,45	THR2S1A3 (Soglia 1 per...
Sotto bacino	SECCHIA	SECCHIA			10,00	13,91	THR2S1A3 (Soglia 1 per...

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Risk analysis: Hydraulic conditions

Detailed scale

5,5

20

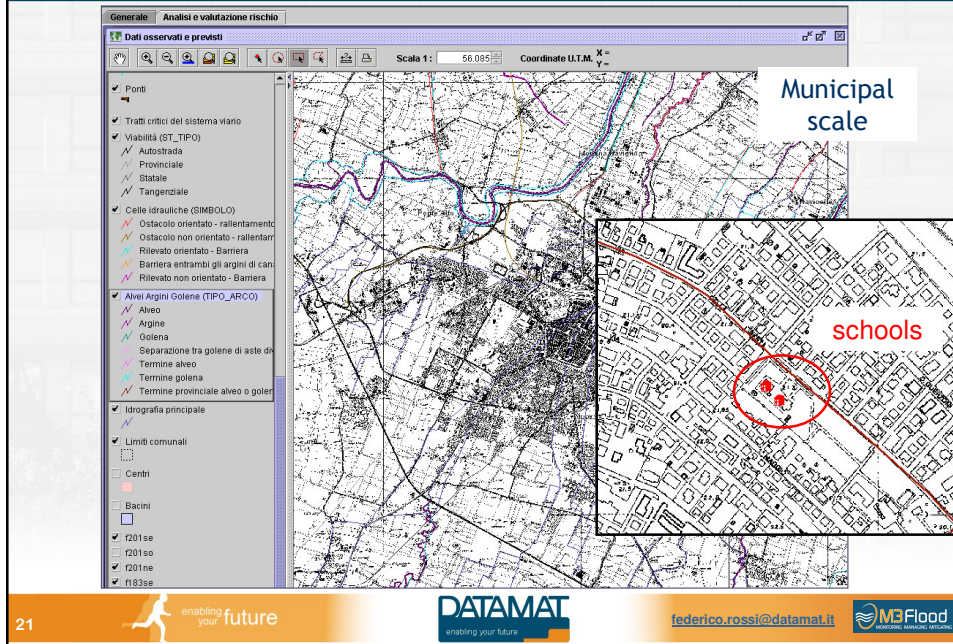


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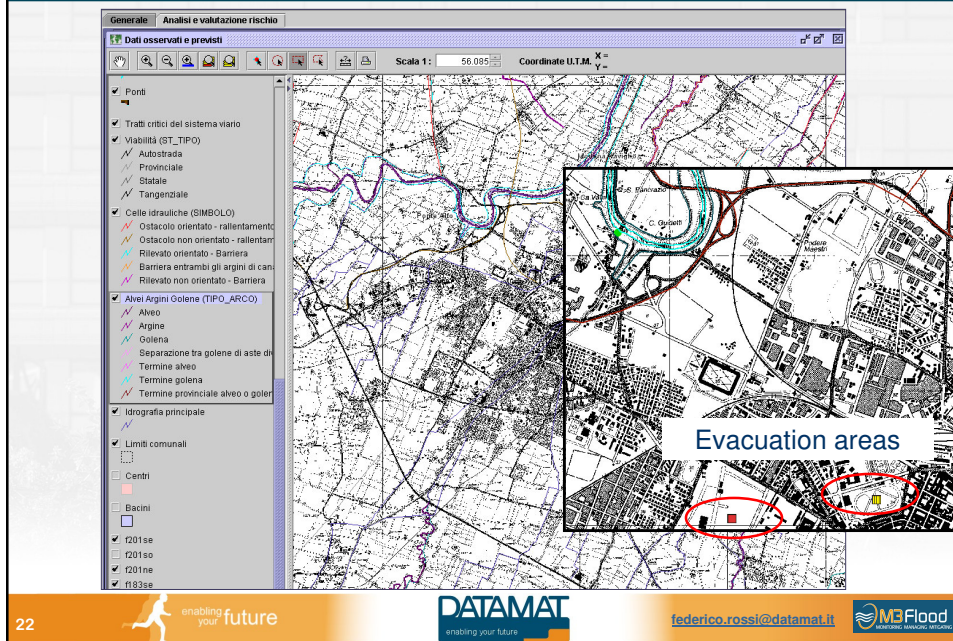




Risk analysis: Elements exposed to risk



Intervention support: Civil protection resources



GI⁴ DM Intervention support: Communication procedures definition based on Emergency Plan

Data analisi	Tipo localita	Localita	Livello rischio
01/11/03 8...	Idrometro (livello)	Lugo	Allertamento
01/11/03 9...	Idrometro (livello)	Ponte Veggia	Allertamento
01/11/03 1...	Idrometro (livello)	Ponte Alto	Allertamento
01/11/03 1...	Idrometro (livello)	Ponte Bacchello	Allertamento
01/11/03 1...	Idrometro (livello)	Pioppa	Pre-Allarme livello 1
01/11/03 2...	Idrometro (livello)	Rubiera SS9	Normale
01/11/03 2...	Idrometro (livello)	MISSANO	Normale

Overcoming of different risk level

Address-book

Message sending

VOICE SMS FAX E-MAIL

Civil Protection

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M3Flood

GI⁴ DM Intervention support: The Web component

- ✓ The WEB component provides a set of reduced but very useful information, for the required evaluations to be done during flood management. Key benefit is the availability everywhere (including palm and laptop devices), with no specific installation.
- ✓ It was conceived, in particular, to provide flood managers with the full possibility to remotely monitor basin conditions and event evolution, allowing to support decisions in terms of:
 - ✓ personnel organisation (availability, shift, etc.)
 - ✓ banks and critical sites surveillance activity organisation
 - ✓ increasing of controls
 - ✓ volunteers support
 - ✓ alert of companies to support possible emergency hydraulic works
 - ✓ provision of information to external entities working in risky conditions in the river (e.g. bridge construction, river crossing with pipelines)

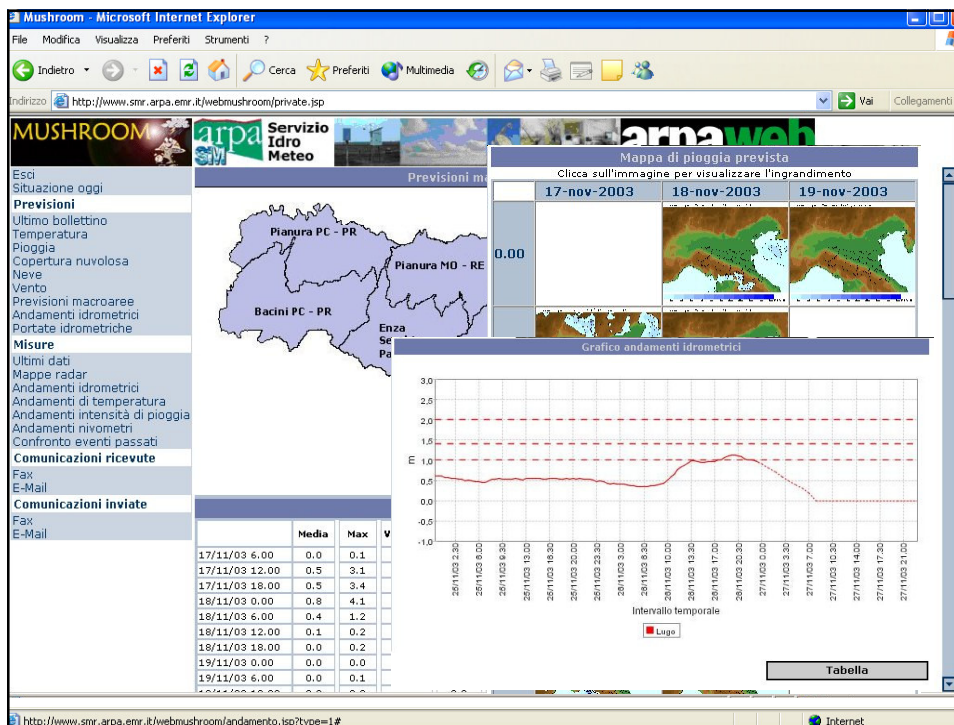
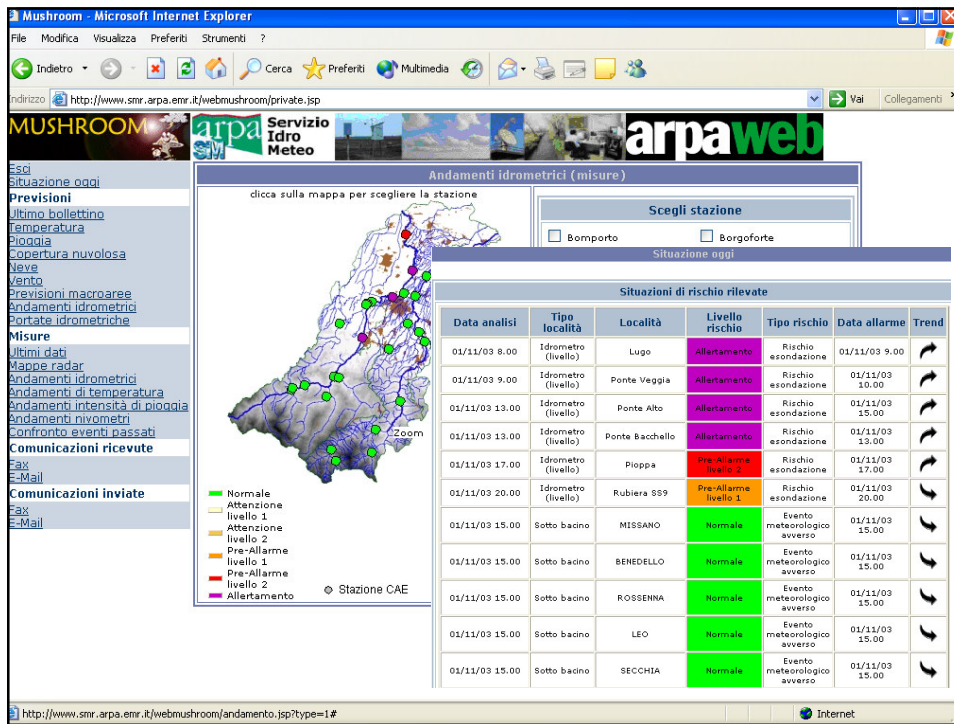
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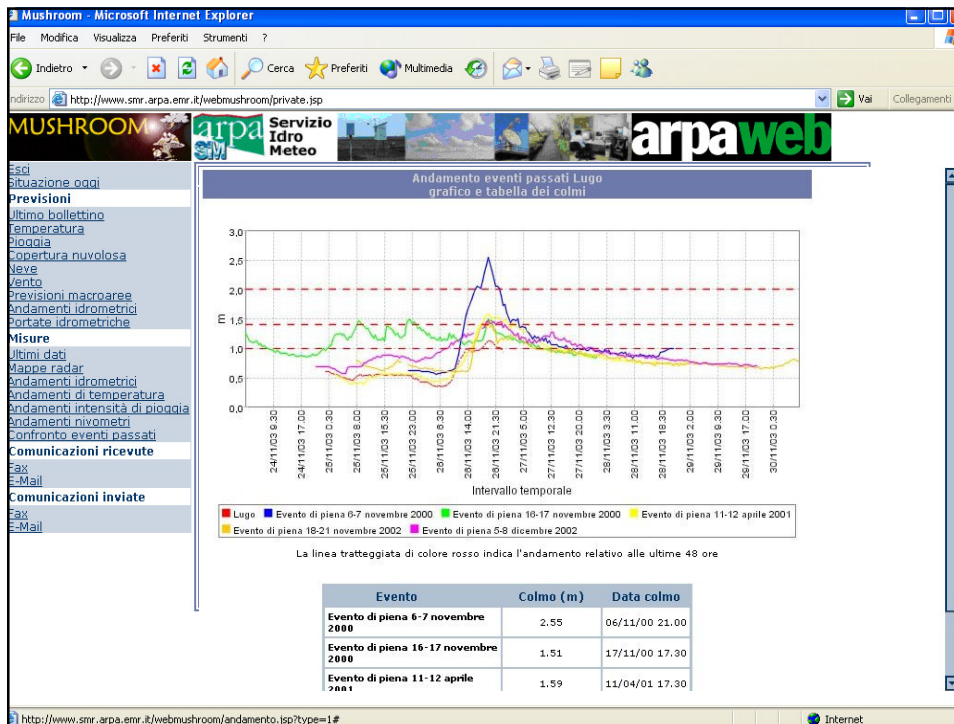
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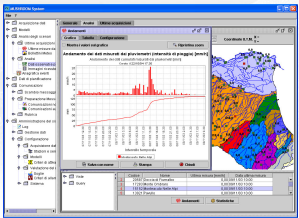




GI4 User configurability: GIS Set-up


- ✓ The user is able to pre-define how to retrieve and display geographical information through an ad-hoc developed GIS Set-up tool.
- ✓ The following information:
 - Basic cartographic layers
 - Event scenario for hydraulic risk
 - Damage scenario
 - ...

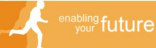



can be combined to operationally support the decision maker during the emergency.



→ VIEWS

→ QUERIES



GIS Set-up: Views definition

Seup GIS - Italian_trial - C:\Projects\Setup_GIS\Projects\

Progetto Creazione SIT Modifica SIT Aiuto

Definizione specifiche Metadati

Cataloghi File grafici Tabelle Temi Viste Query Esci

Generale Temi Applicazioni

Nome* Stazioni di Monitoraggio

Analisi

VIEWS

Temi selezionabili

Nome	Descrizione base
Stazioni	Stazioni
Arete inondate 1952	Arete inondate 1952
Arete inondate 1956	Arete inondate 1956
Arete inondate 1960	Arete inondate 1960
Arete inondate 1966	Arete inondate 1966
Arete inondate 1972	Arete inondate 1972
Arete inondate 1973-a	Arete inondate 1973-a
Arete inondate 1973	Arete inondate 1973
Arete inondate 1976	Arete inondate 1976
Arete inondate 1979	Arete inondate 1979
Arete inondate 1982	Arete inondate 1982
Arete inondate 1992	Arete inondate 1992
Celle idrauliche	Celle idrauliche
Idrografia - b	Idrografia secondaria
Bacini_oltd	Bacini_oltd
Secchia-Panaro	Fiumi Secchia - Panaro
f201se	f201se
f201so	f201so
f201ne	f201ne
f183se	f183se
f184so	f184so
f202se	f202se

Aggiungi...> <-Rimuovi

Temi selezionati

Nome	Descrizione b...	Selezionato	Posizione
Limiti comunali	Limiti comunali	<input checked="" type="checkbox"/>	110
Alvei Argini Go...	Alvei Argini Go...	<input checked="" type="checkbox"/>	15
Viabilità	Viabilità	<input type="checkbox"/>	13
Tratti critici del...	Tratti critici del...	<input type="checkbox"/>	12
Ponti	Ponti	<input checked="" type="checkbox"/>	11
Centri	Centri	<input checked="" type="checkbox"/>	19
Ferrovie	Ferrovie	<input checked="" type="checkbox"/>	14
Limite provinci...	Limite provinci...	<input checked="" type="checkbox"/>	11
Idrometri (livell...	Idrometri (livell...	<input type="checkbox"/>	1
Pluviometri	Pluviometri	<input checked="" type="checkbox"/>	2
Termometri	Termometri	<input type="checkbox"/>	3
Sezioni di inter...	Sezioni di inte...	<input type="checkbox"/>	4
Sezioni di inter...	Sezioni di inte...	<input type="checkbox"/>	5
Idrometri (flus...	Idrometri (flus...	<input type="checkbox"/>	1
Idrografia - a	Idrografia pnn...	<input checked="" type="checkbox"/>	17

Cancella

29 enabling your future DATAMAT federico.rossi@datamat.it M3Flood

GIS Set-up: Queries definition

Seup GIS - Italian_trial - C:\Projects\Setup_GIS\Projects\

Progetto Creazione SIT Modifica SIT Aiuto

Definizione specifiche Metadati

Cataloghi File grafici Tabelle Temi Viste Query Esci

Generale Temi Applicazioni

Nome* Stazioni di Monitoraggio

Analisi

Arete storicamente inondate

Vista raster

Previsione Macroaree

Definizione

Query

Argomento*	Nome*	Tema*	Script sql*	Descrizione*
Allarmi	Idrometri in allarme	Idrometri (livello)	SELECT * FROM V_Hydrom...	Seleziona tutti gli idrometri c...
Allarmi	Pluviometri in allarme	Pluviometri	SELECT * FROM V_Rain_Int...	Seleziona tutti i pluviometri c...
Misure	Ultime misure di Pioggia	Pluviometri	select * from V_Rain_Intensi...	Seleziona tutti i pluviometri c...
Misure	Ultime misure Idrometriche	Idrometri (livello)	select * from V_Hydrometer...	Seleziona tutti gli idrometri c...
Misure	Ultime misure di Temperatura	Termometri	select * from V_Termometer...	Seleziona tutti i termometri c...
Localizzazioni	Idrometro (codice)	Idrometri (livello)	select * from V_Hydrometer...	Seleziona l'idrometro con c...
Localizzazioni	Pluviometro (codice)	Pluviometri	select * from V_Rain_Intensi...	Seleziona il pluviometro con...
Localizzazioni	Termometro (codice)	Termometri	select * from V_Termometer...	Seleziona il termometro con...
Stato rete di misura	Termometri che non trasmet...	Termometri	select * from V_Termometer...	Seleziona tutti i termometri c...
Stato rete di misura	Idrometri che non trasmettono	Idrometri (livello)	select * from V_Hydrometer...	Seleziona tutti gli idrometri c...
Stato rete di misura	Pluviometri che non trasmett...	Pluviometri	select * from V_Rain_Intensi...	Seleziona tutti i pluviometri c...
Localizzazioni	Rilevati orientati	Celle idrauliche	SELECT * FROM LAYER_C...	Seleziona i rilevati orientati c...
Localizzazioni	Ponti - strade provinciali	Ponti	SELECT * FROM LAYER_P...	Seleziona i ponti che si trova...
Localizzazioni	Ponti che attraversano un flu...	Ponti	SELECT * FROM LAYER_P...	Seleziona i ponti che attrave...

Cancella

30 enabling your future DATAMAT federico.rossi@datamat.it M3Flood

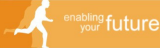


The Trials

- ✓ Spanish trial was undertaken in the Mula river basin which is a sub basin of the Segura basin, located in the south east of the Iberian peninsula. The basin presents fertile flood plains broken by intermittent mountains reaching over 1,000 meters high
- ✓ Two installations are operational:
 - IMIDA H.Q.
 - CHS H.Q.
- ✓ Italian trial was performed on Secchia River basin, a tributary of Po River, mainly located in the Province of Modena. The basin includes both mountain and plain areas.
- ✓ Two installations are operational:
 - ARPA-SIM Hydro-meteorological control room
 - ✓ STBR (using M3Flood web component)
 - PDM Civil Protection office headquarter



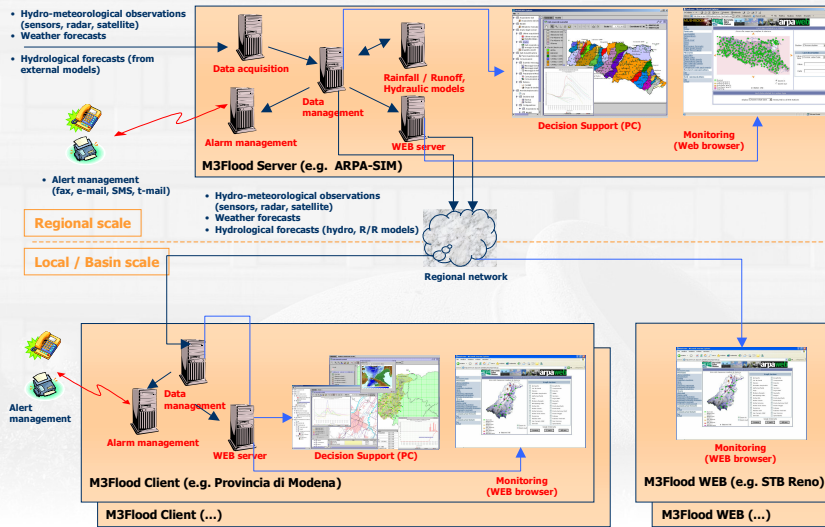
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M3Flood Configuration: Regional / Basin / Local scale operations



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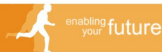


Conclusions



- ✓ M3Flood has proven its ability of being deployed at operational sites showing, according to the feedback we have been receiving from users:
 - The **holistic** approach is proving its effectiveness
 - ✓ Centralisation of information acquisition, processing and display in several formats on a unique platform
 - The high level of **configurability** drastically improve friendliness
 - ✓ Importance of off-line preparation activity (e.g. views, queries,...)
 - **Scalability** favours interoperations between regional and local administrations
 - ✓ "Reduced" set of information available also through web
 - **Integration** saves past investments and guarantees evolution
 - ✓ Full connection to existing sensor networks and data sources, use of existing R/R and Hydraulic models,
 - The availability of typical **"emergency management"** functions is a key discriminating factor with existing solutions
 - ✓ Support of typical Civil Protection tasks includes Alert management, communication support, intervention support

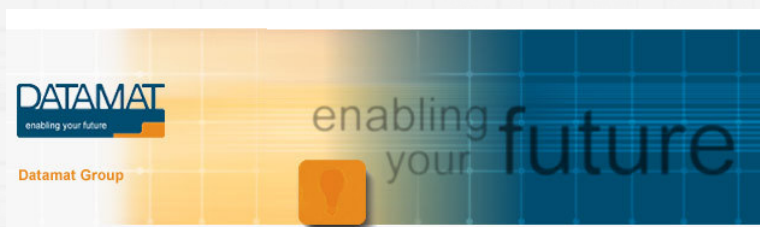
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Many thanks for your attention!



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