The project IMPRINTS represents an integrated effort to establish a coherent, common methodology in Europe oriented to contribute to reduce loss of life and economic damage through the improvement of the preparedness and the operational risk management for flash flood and debris flow (hereafter, referred to as FF/DF) generating events, as well as to contribute to sustainable development through reducing damages to the environment.

The main scope of IMPRINTS is based on the conviction that implementation of active risk management strategies and FF/DF forecasting and warning systems are the most effective way to increase preparedness and mitigate FF/DF risk in the territory. Many previous projects have gone deep into the understanding of the nature and dynamics of FF/DF from the phenomenological point of view, but, unfortunately, the application of the results has up to now not conveniently reached the operational world.

Under this premise, the challenge of IMPRINTS is to improve preparedness and risk management in FF/DF events through the implementation of operational tools, specifically designed to be used for the practitioners responsible for flood risk management and associated effects and damages.

To that end, IMPRINTS is organized in 9 main Sub Projects (SP) aim at achieving 5 main objectives:

1) The improvement of short-term rainfall forecasts as the best way to increase anticipation in front of these FF/DF events (SP1).

2) The development of three methodologies of different complexities to provide FF/DF forecasting and warnings: (i) an early warning FF/DF system based on simplified estimates of the probability exceedence (SP2), (ii) an integrated hydrometeorological probabilistic FF forecasting system (SP3), and (iii) a probabilistic FF/DF rule-based risk forecasting system (SP4).

3) The study of risk management and mitigation strategies by assessing the impact of potential plausible future changes (climate, land use and forest fires) in the test-bed areas and their effects on the hydrological response and their vulnerability in front of FF/DF generating events (SP5).
4) The development of a **prototype of the operational platform including the IMPRINTS tools and methodologies** developed under the project. This prototype will be designed under the premise of its **ultimate commercialisation and use around Europe** (SP7).

5) The **test of the tools and methodologies developed under the project in 6 selected test-bed basins** covering the main characteristics of the areas prone to FF/DF events (SP8).

During the first 18-month period of the project the following achievements have been reached:

**SP1: Improving short-term rainfall forecasting**

1.1: A new **rainfall nowcasting technique for mountainous areas, NORA**, has been fully developed (D1.1) and work is in progress to make it run operationally in real time (D1.5).

1.2: Two methodologies for **probabilistic short-term rainfall forecasting** have been developed (D2.2). Both techniques are ready to be implemented within SP7 in the IMPRINTS tools from the algorithms and specifications to be delivered in D1.4.

1.3: Two alternative approaches for **blending probabilistic (ensemble) forecasts combining radar-based and NWP-model-based precipitation forecasts** have been developed.

**SP2: Developing probabilistic FF/DF early warning systems:**

2.1: Compilation of an **inventory of the flood risk management plans** available in the test-bed regions. From them, **three approaches to identify the areas prone to FF/DF events** have been identified.

2.2: Development of a toolbox for **quick determination of FF/DF risk areas**, allowing potential users to **friendly establish risk maps from generally available input data**. Their applicability either to the verification of existing risk maps or to provide a first regional assessment in regions not yet covered by local risk maps enhance the interest of the obtained results.

2.3: **Pre-operational set-up of the developed early-warning system providing daily flash flood forecasts for the IMPRINTS test-beds.** The results are currently being tested in a daily base by SCHAPI in the Gardon d’Anduze basin, from which experience feedback and comments will be collected.

2.4: **Development of a Probabilistic Flash Flood Guidance System** (PFFGS) using high-resolution radar rainfall maps over regional domains to **produce flash flood early warnings at river scale (1 km²).**

**SP3: Developing an integrated hydrometeorological probabilistic FF forecasting system**

3.1. The available hydrological models have been implemented at the various test basins and a **first draft of the integrated hydrometeorological probabilistic FF forecasting system has been outlined.**

**SP4: Developing a Rule-based Probabilistic FF/DF Forecasting System**
4.1: The Identification of the governing variables to be included in the rule-based system has been achieved and a hierarchy of static and dynamic governing variables has been established in D4.1.

4.2: The methodologies to set up the knowledge base from which to derive the rules to determine if the probability of a FF/DF occurrence is over a certain threshold have been identified and described in D4.2.

4.3: The simulations covering a wide range of possible rainfall scenarios to establish the knowledge base have been completed. The main results have been summarized in D4.2.

**SP5: FF/DF risk management and mitigation in changing environments**

5.1: A compilation of the lessons learnt from past FF/DF events in the test-bed basins has been carried out to propose future strategies on risk management based on such an experience.

5.2: The main potential future changes that are likely to occur in the test-bed areas and may affect the risk level related to FF/DF have been identified and characterized.

5.3: The methodologies to estimate the impact of the potential changes on the governing variables of the FF/DF occurrence (used in the rule-based system developed in SP4) have been developed on the basis of results published in previous studies. Plausible future scenarios have been simulated to adjust the changes in the governing variables characterising the basin. These will be used in the rule-based system to establish the impact of the studied changes.

**SP6: Specifications for the Practitioners’ Tools for the test-beds verification**

6.1 and 6.2: The compilation of the information from the practitioners’ procedures (current practices) and the available data from the test-beds has been completed and the results have been reported in Deliverable D6.1.

**SP7: Development of Practitioner Tools**

7.1. A first version of the planned platform has been developed in Task 7.1 (D7.1). Some tests related to Task 7.2 (implementation of SP1 modules) have been carried out. These tests will be used as a first draft that will help to define generic tools for the integration of the technologies from the rest of SPs (Tasks 7.3 to 7.7).

**SP8: Testing the Practitioners’ Tools on the selected Test-beds**

This SP has not yet started.

**SP9: Dissemination of Project results**


9.2. Organization of the 1st IMPRINTS workshop to support the implementation of the EU Flood directive (Barcelona, June 17th, 2010). The program, the abstracts of
the presentations and the uploaded posters are available at http://www.imprints-fp7.eu/workshop-BCN/.

During the next 24 months of IMPRINTS, the rest of the objectives will be addressed and in particular the proposed methodologies to complete the planned tools will be developed. These tools will be progressively integrated into the IMPRINTS platform, which will be applied in the test-bed basins from November 2011.

During this period 3 additional open Workshops to support the implementation of the EU Flood directive will be held:

- Toulouse (France), on the 3rd February 2011.
- Glarus (Switzerland), on the 23rd June 2011.
- Salerno (Italy), on the 26th January 2012.

A final conference or a Summer School (still to be decided) will be organized in July 2012 as final dissemination event of the project. In all these dissemination activities the partners will present the advancements in the operational platform including the IMPRINTS tools and methodologies developed under the project.

In parallel, 3 additional videos will be produced to cover the 4 selected topics of the dissemination documentary on Flash Floods and Debris Flows Risk Management:

- 1. Living with the risk (Video publicly available at the website of the project)
- 2. Understanding what we can do.
- 3. Adapting us to a changing environment.
- 4. IMPRINTS tools and test-bed verification.

The full documentary will be distributed in a DVD at the end of the project.

The IMPRINTS team.

Barcelona, October 2010