

## UNESCO Pakistan project

In late July to August 2010, Pakistan experienced unprecedented floods. The interaction of two low pressure systems produced torrential rain over the Indus basin, causing 160,000 km<sup>2</sup> of flooded area, US\$10 billion of direct damage, and 1,985 deaths according to the Annual Flood Report 2010 (MOWP, Pakistan Government).

ICHARM dispatched its researchers to join a UNESCO field investigation team at the end of August, while also studying ways of technical assistance for the mitigation of future disaster damage. At the end of June 2011, the Japanese government approved JICA's financial contribution to UNESCO to start the Project on Strategic Strengthening of Flood Warning and Management Capacity of Pakistan. In response to the request from UNESCO, ICHARM concluded a contract with UNESCO, in which the centre was assigned to provide technical assistance in Pakistan in the following three tasks (Phase 1: 2012-2014):

- 1) Development of a flood forecasting system covering a large part of the Indus River basin,
- 2) Implementation of floodplain hazard mapping for the lower Indus River, and
- 3) Provision of capacity building training for Pakistani personnel.

ICHARM worked on the first task in cooperation with Pakistan Meteorological Department (PMD), and developed Indus-IFAS, a flood forecasting and early warning system that uses global data and covers the upper Indus and Kabul rivers. Indus-IFAS was then tested for its capabilities, its parameters were tuned, and its accuracy was verified through the simulation of several flood events. The Indus-IFAS system is uniquely designed to have two advanced simulation models: the IFAS model for quick runoff simulation of the upstream and midstream parts of a basin and the RRI model for flood simulation of the midstream and downstream parts. With these two models set to cover a basin from upstream to downstream, they can relay the flow rate for simulation from one to the other efficiently. The system was also equipped with several technological ingenuities currently available. It allows users to use either ground or satellite rainfall data, and to use the flow rate observed upstream as the boundary condition to minimize errors caused by the uncertainty of rainfall data due to the insufficient density of ground observation points and the influence of snowmelt and glaciers melt in high mountains upstream.

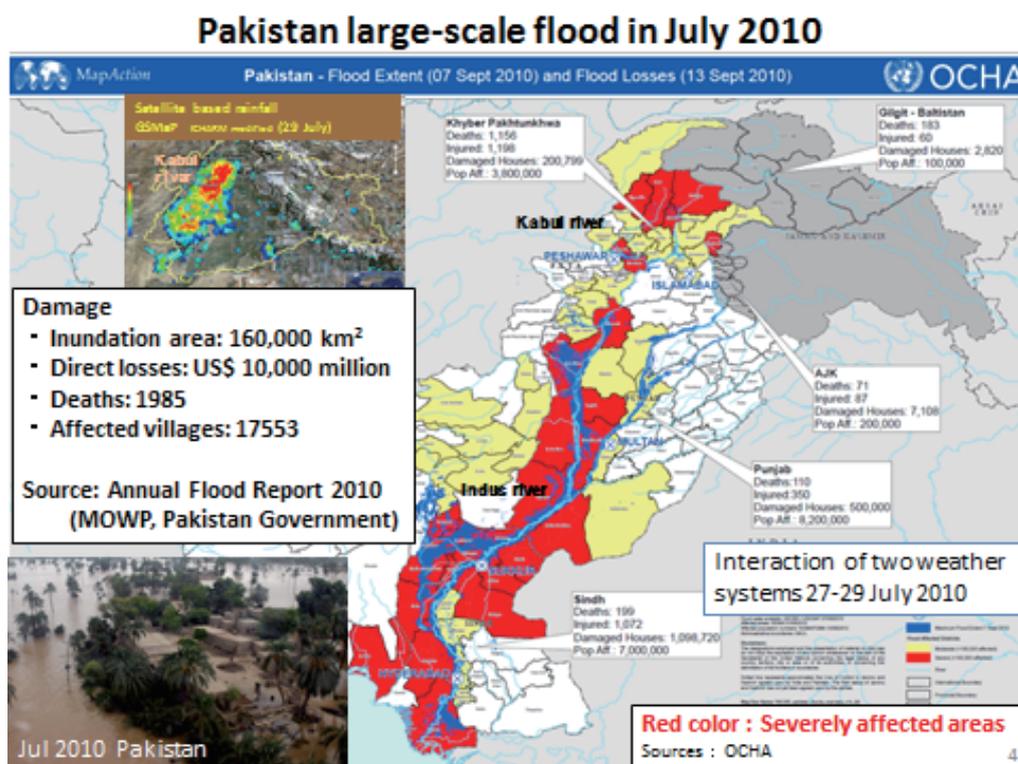


Figure 1 Overview of the 2010 Pakistan flood

## User friendly display of Indus-IFAS

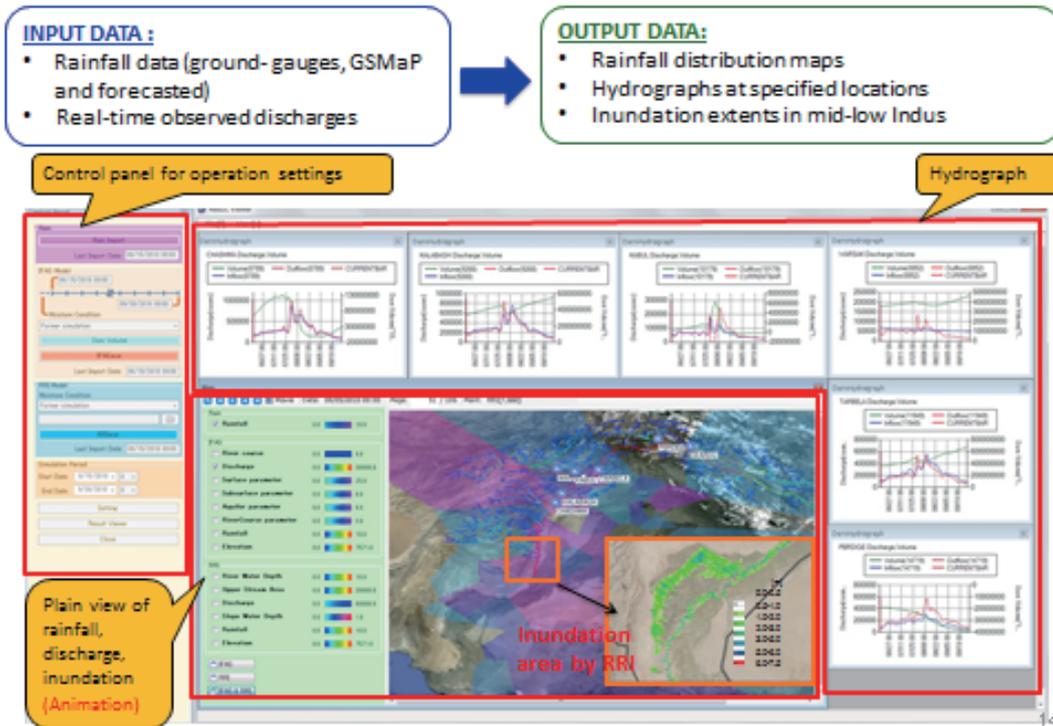


Figure 2 Sample screen of Indus-IFAS

The second task was performed by ICHARM and the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO). The joint effort made it

possible to display flooded areas simulated by the RRI model on the GIS of SUPARCO.

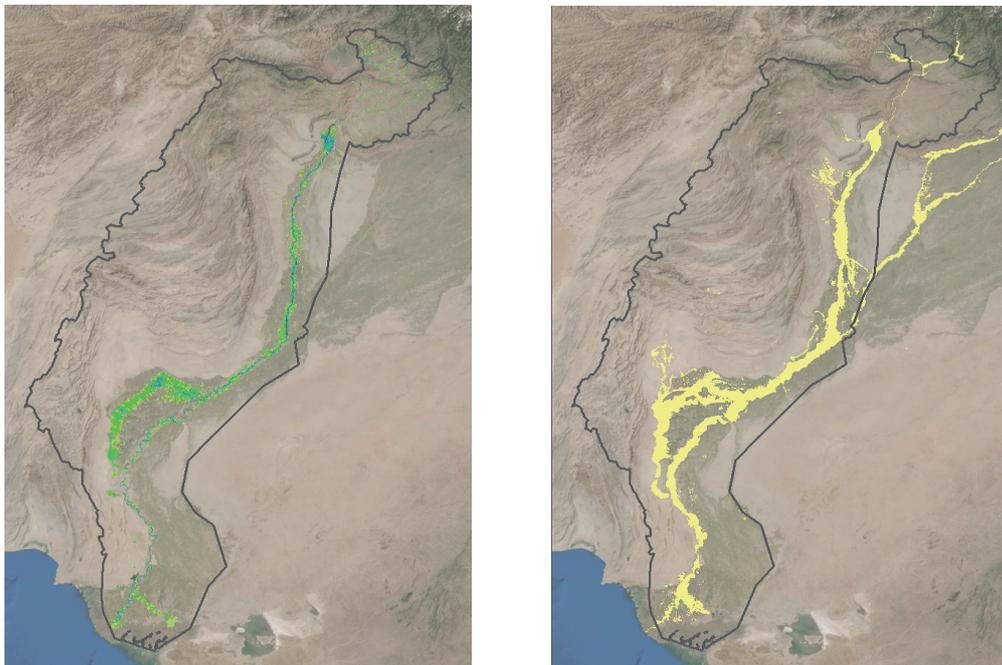


Figure 3 Peak flood inundation by RRI (green) and MODIS image (yellow)

To achieve the third task, ICHARM accepted six trainees from Pakistani governmental agencies to the master's course managed by ICHARM in collaboration with GRIPS. The participants studied practical techniques needed to mitigate flood disaster damage and acquired

master's degrees. ICHARM also provided managerial training in Japan by inviting 11 government officials from Pakistan. ICHARM provided many other workshops and local training to strengthen knowledge and skill required for the operation of Indus-IFAS.



Photo 1 International workshop in Pakistan

Consequently, PMD has become able to provide flood forecast information based on Indus-IFAS simulation on their website. This project is regarded as a successful case of effective technical transfer in that it provided essential support not only for the development of a simulation model, but also for the development of capacity needed to deepen the understanding of the model and the operation of the system.

Since 2015, the project has started Phase 2 operations. Phase 2 includes the following tasks:

**a) Improvement of Indus-IFAS through:**

- 1) Integration of the eastern rivers of Indus (Punjab region), part of which has been using old models, into the coverage of Indus-IFAS,
- 2) Development of a calculation module for snowmelt in upstream mountains,

- 3) Development of a rainfall data input function that allows users to selectively use different sets of rainfall data acquired in different methods when performing simulation for a river basin, and
- 4) Introduction of new correction methods for satellite-based rainfall data.

**b) Capacity development through:**

- 1) Provision of technical training for flow rate observation using acoustic Doppler current profilers, and
- 2) Provision of training necessary for flood forecasting of the Indus River.

ICHARM hopes for further enhancement of flood management capacity of Pakistan through this project.



Photo 2 Indus-IFAS training at PMD