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Flood Monitoring and Damage Estimation for Paddy Fields from RADARSAT and Field data

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Abstract: This study discussed the flood area and flood water depth monitoring from integration analysis of the time series of RERSS requested RADARSAT observation data and the field water level gauges date and multi-level corner reflector information. And also, estimating the damaged volume of the yield at the flooded paddy field area from flood depth map from RADARSAT and agricultural field survey information.

1.Back Ground

In the Mekong river basin, the flood damage occurs every year frequently and it has a serious influence on the agriculture production and the social infrastructures. The Japanese Institute of Irrigation & Drainage (JIID) conducts and develops the flood damage monitoring system of remote sensing and G.I.S. as a pilot study project in the Mekong river lower basin with the Mekong river committee secretariat from 1996. The author took part in this study project as the remote sensing expert. This pilot study was sponsored by Ministry of Agriculture, Forestry and Fisheries Japan.

2. The Pilot Site

The place name of the pilot site is Thabok village , which is located in the about 90 km east from Vientiane in Laos beside the Mekong river. The area of the pilot site is 400 square km .

3. The compositions of the study

The compositions and the flow are shown in figure 1. There are three study components as the flood depth analysis, the paddy filed analysis, the crop depth analysis. Final results are the yield estimation map, considering the damage volume. (Fig.1)

4.Flood Depth Information

Two positions of water level gauges station were set at the pilot area. The water level information was observed continuously. The time series satellite data were sorted as the order of water gauge level. (Table.1) R1 data is the most high water level time. The difference from R1 means the water depth for each date. (Fig.2)

5.Paddy Field Extraction

The processing flow is show in Fig.3. The water surface area of trans planting time was extracted by irrigation season water area minus dry season water area. The paddy field area was extracted by the combination analysis of water area (July) , vegetation area (August) and bare soil area (October).

6.Crop Damage Analysis

The agricultural statistics data from 1994 to 1999 was collected in the field survey. The regression analysis was implemented between yield volume and water depth. The regression coefficient is 0.999.

7.Addition of Soil Condition

Using a multiple regression analysis in the relation between unit yield and all the ion substitution quantity, the degree of the base saturation which depends on the soil types. The soil type classification is used the soil map which is surveyed by the soil information center of LAOS.

8.Yield Estimation Map

The unit yield estimation model at the non damaged case is set up by the soil regression model. The damage yield rate is analyzed from the water depth /yield analysis of filed statistics data analysis. The water depth map is analyzed from the multi temporal radar image overlay analysis.

9.Results and Conclusion

The damage map (Fig.5) and the yield map information is checked in the field investigation data. The accuracy of these maps were almost correct in Thabok area. As the system of the crop damage estimation, it is expected that the future utilizes a profit in many countries for the flood damage monitoring.

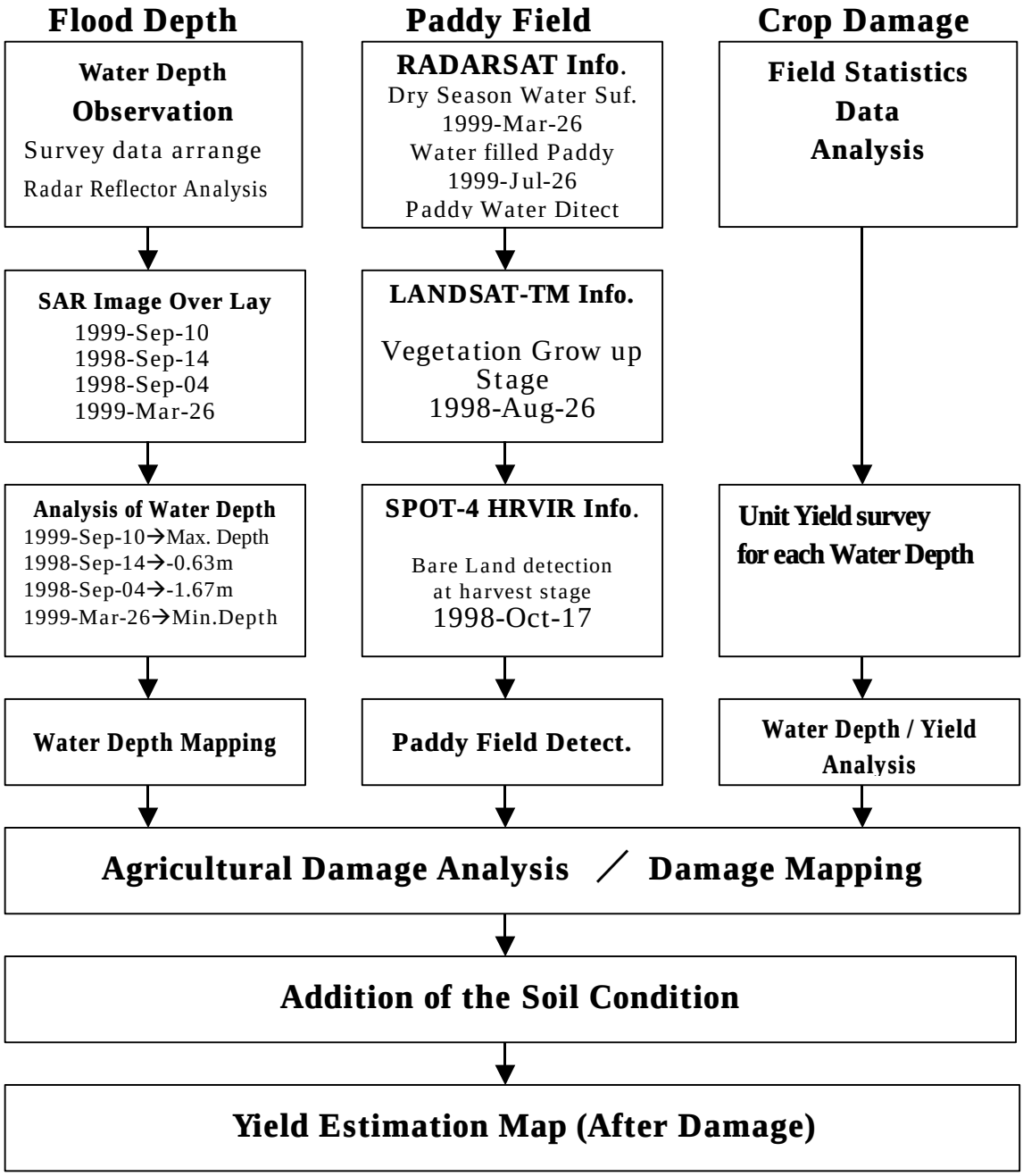


Fig.1 Flow of Flood Monitoring and Damage Estimation for Paddy Fields

Table1. Difference of Water Depth at each Satellite Observed Date

Data ID	Observed Date	Satellite Sensor	Water Gauge A	Diff. from A	Water Gauge B	Diff. from B
R1	**99-Sep-10***	Radarsat	**157.09**	0	**157.09**	0
R2	98-Sep-14	Radarsat	156.46	-0.63	156.42	-0.67
L1	98-Aug-26	Landsat-TM	155.70	-1.39	155.66	-1.43
R3	98-Sep-04	Radarsat	155.43	-1.66	155.42	-1.67
L2	98-Sep-27	Landsat-TM	154.63	-2.46	155.02	-2.07
S1	98-Oct-17	SPOT-4HRV	154.44	-2.65	154.81	-2.28
R4	99-Jul-12	Radarsat	152.08	-5.01	-	-
R5	99-Mar-26	Radarsat	-	-	-	-

* = Reflector No.02 (Top Ave.- 0.33m)

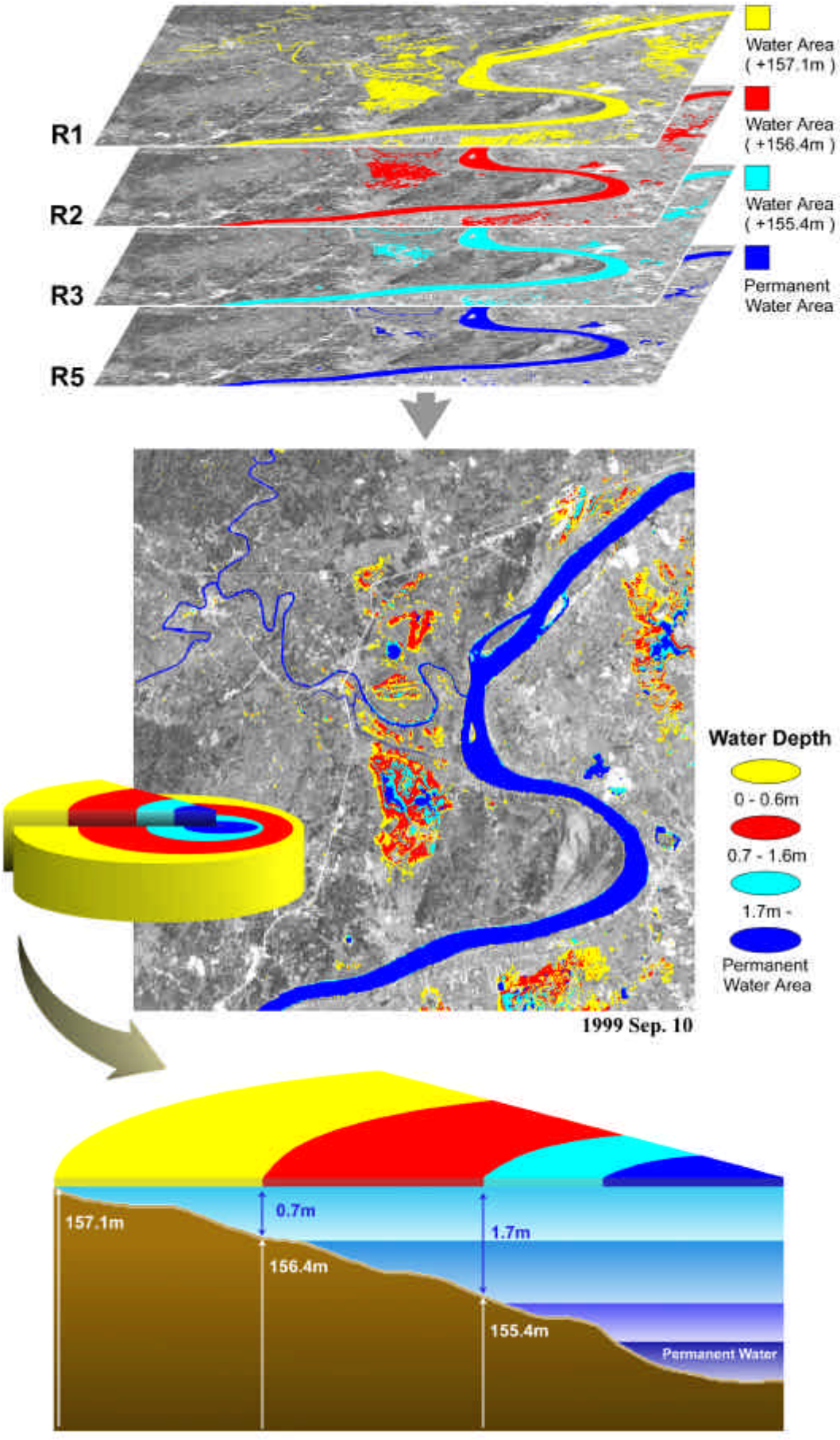


Fig.2 Analysis Procedure of Inundation Depth Map

JIID-MRC 1999

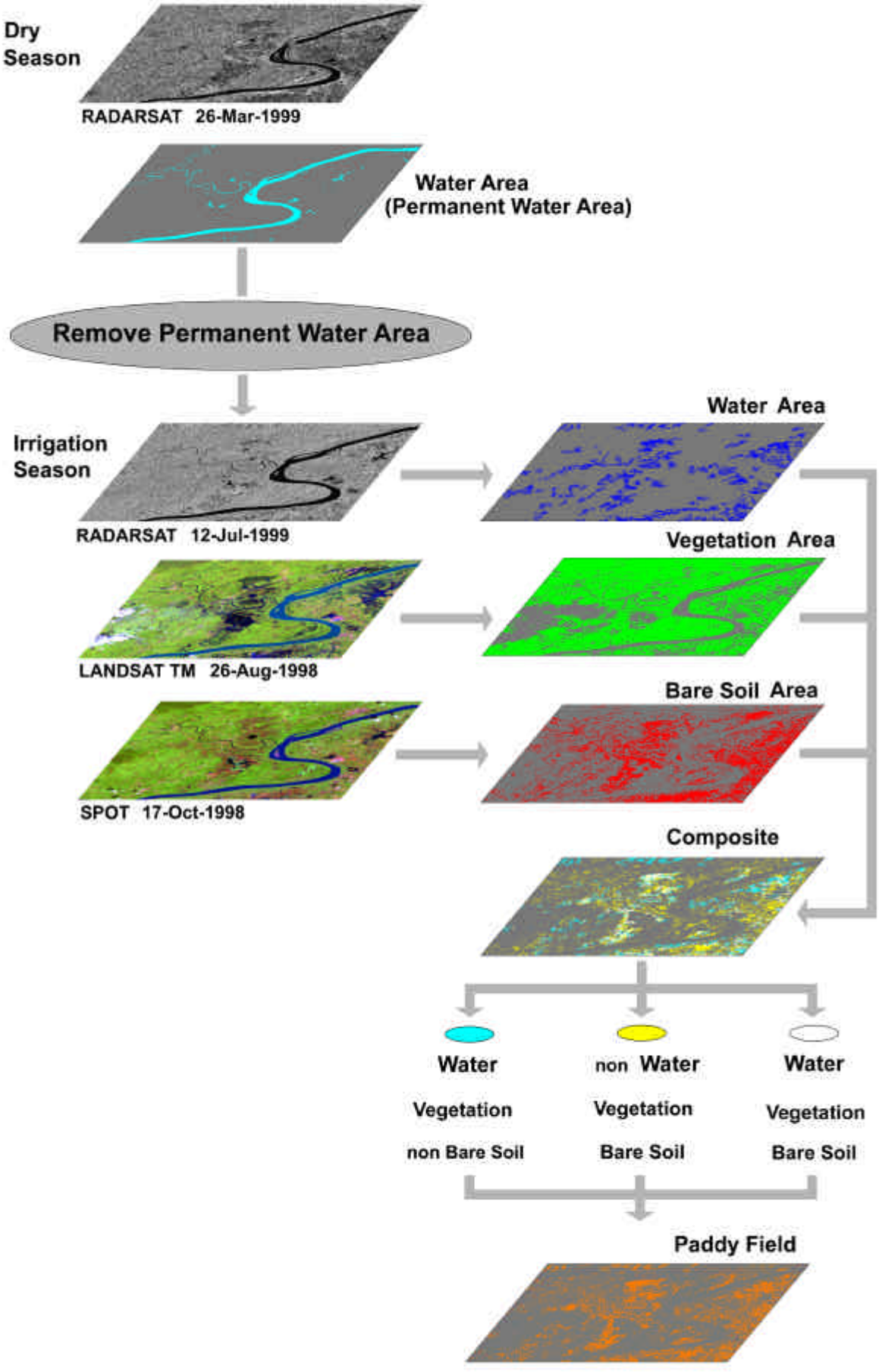


Fig.3 Extraction of Paddy Field

JIID-MRC 1999

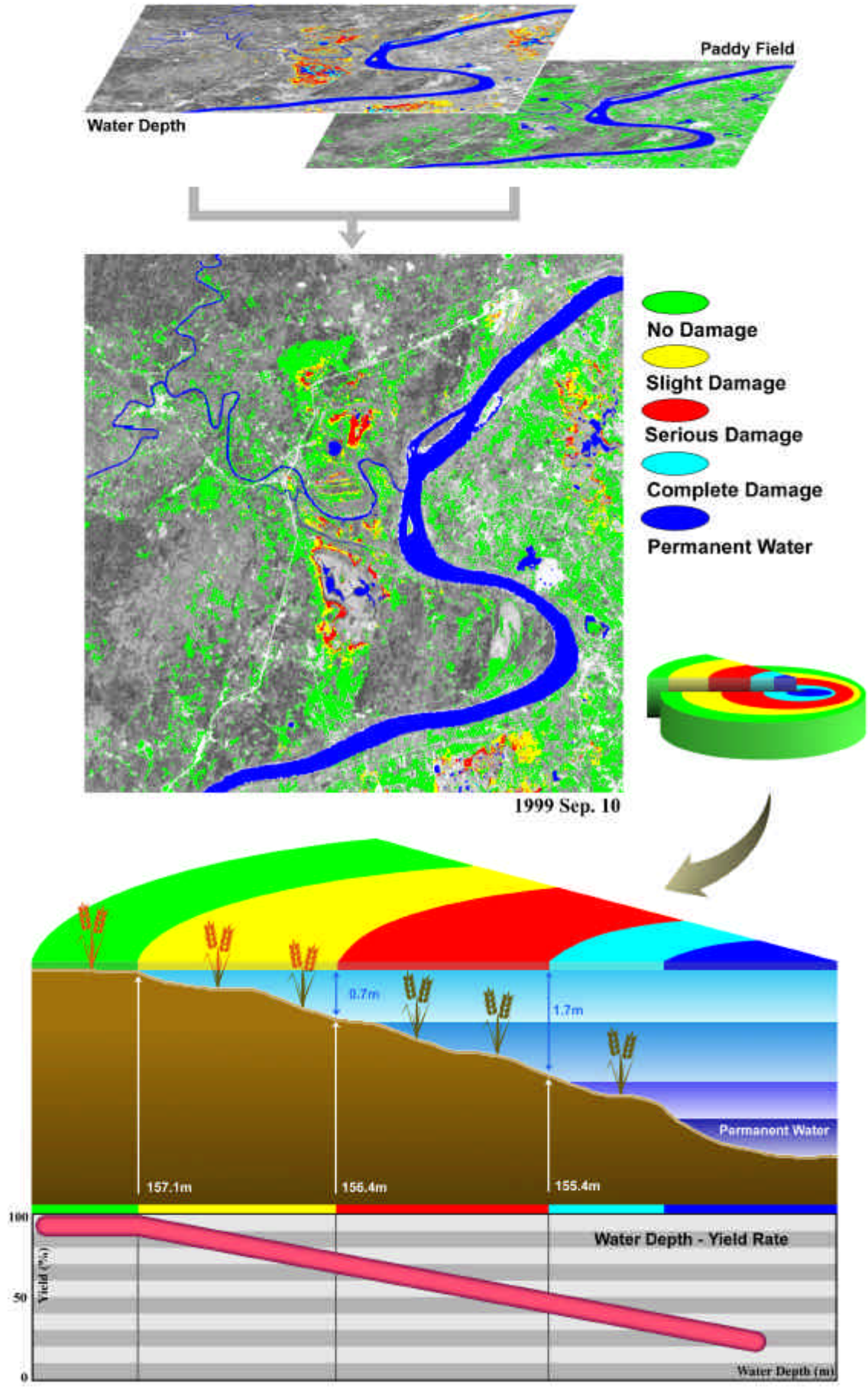
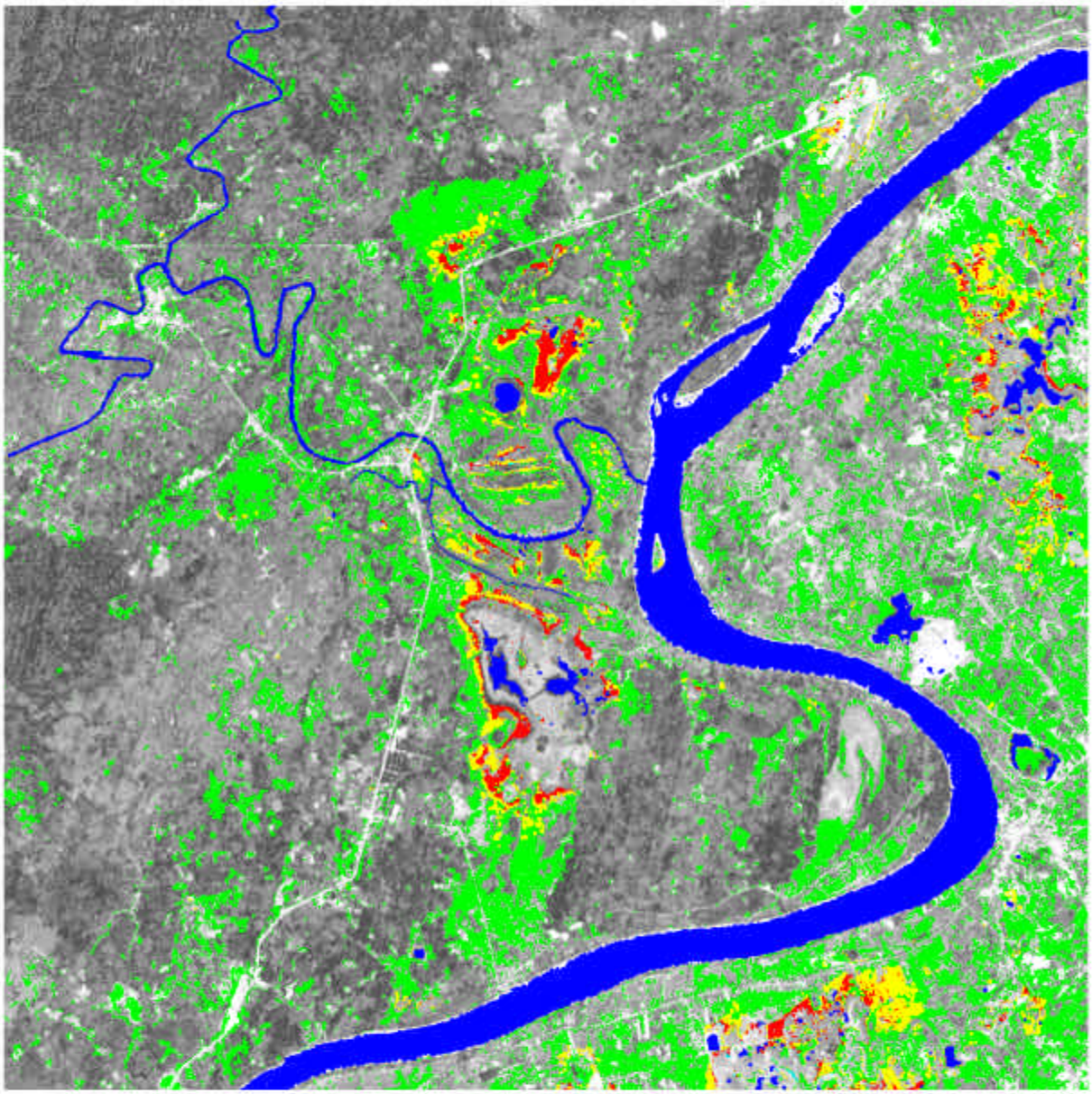


Fig.4 Analysis Procedure of Agricultural Damage Map

JIID-MRC 1999



Agricultural Damage Map

0 5 km

1999 Sep. 10
Thabok (Lao P.D.R.)

		Water Depth	Area (ha)	Area (%)
Paddy Field			7976.86	100.00
	Non Damage		6845.12	85.82
	Slight Damage	0.0 ~ 0.6m	777.87	9.75
	Serious Damage	0.7 ~ 1.6m	332.09	4.16
	Complete Damage	1.7m ~	21.78	0.27
Whole Area			40000.00	

Fig.5 Inundation Mapping in the Lower Mekong Basin

JIID-MRC 1999