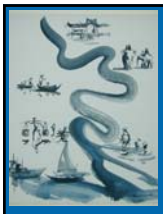

Adaptive Disaster Management Using Flood Prevention Functions of Paddies and Irrigation/Drainage Facilities in Monsoon Asia

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Background

① 7.13 Niigata-Fukushima Storm occurred in July 2004 (→ June 2011, again)
② Dike Breaches of Igarashi and Kariyata Rivers of 2 respective regions (Southern Part of the flat plain, Niigata Pref., Japan)
→ Tremendous flood damage
③ Different types of inundation and depths after the disaster due to different drainage systems

Contents

i) In case of serious disaster of that time,
ii) Effects of drainage facilities installed or strengthened (1/15-year Return Period for Agriculture) on the reduction of flood disaster

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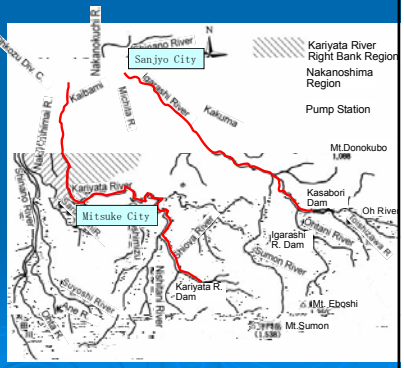
Outline of the Basin and Target Region

i) Low-lying paddy-dominant regions surrounded by Shinano, Kariyata and Igarashi Rivers (1/1,500 ~ 1/5,000)
ii) Kariyata R. right bank region(Ag. P.)
Pump Dra.(67km^2)
Natur. Dra.(16km^2)
iii) Nakanoshima reg.



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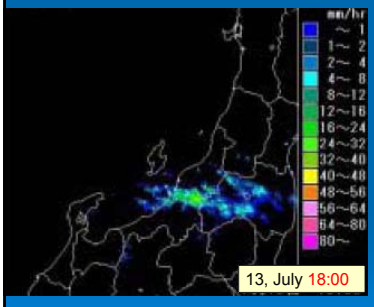
Overview of Heavy Storm



i) Torrential rainfall occurred on July 13, 2004 in the central part of Niigata Pref.

ii) A record rainfall amount as 421mm/d (400 ~ 500 years probability) in

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Magnitude of the Observed Rainfall Events

Category	Return Period	Irrigation Preriod (1 May -- 31 August) Daily Max. Rainfall	2-day Max. Rainfall	3-day Max. Rainfall	Max. Contin. Rainfall
Exceeded	2-year	77.7	106.4	116.8	150.0
	3-year	95.8	131.6	146.2	816.1
	5-year	119.1	162.7	184.3	920.8
	7-year	135.1	183.5	210.5	982.7
	10-year	152.1	205.9	239.8	1044.7
	15-year	173.9	232.3	274.9	1115.0
	20-year	189.7	251.5	301.1	1157.2
	25-year	202.3	266.8	322.2	1191.9
	30-year	213.0	279.6	340.1	1219.9
	40-year	230.3	300.2	369.0	1263.0
	50-year	244.3	316.5	392.4	1296.1
	100-year	290.6	369.9	470.3	1396.4
	200-year	341.5	427.1	556.4	1494.2
	500-year	416.5	509.2	683.8	1620.4

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Overview of Inundation

i) Water level of the rivers exceeded the risky level, resulting in dike breaching and overflowing
→ Flood and inundat.

Water Balance in Each Region (1)

- During inundation in the area (July 12-20)

(a) Kariyata R. (right) bank region (*Ag. Pump Region*)

		Inflow ($\times10^3m^3$)	Area ($\times10^3m^3$)	Inflow (mm)
Rain	Paddy	16,580	43,817	378.4
	Upland Crop Fields	489	1,293	
	Urban	2,510	6,634	
	Mountain	2,238	5,915	
	Others	3,571	9,436	
Inflow at the dike breach pnt. from the Igarashi R.*		14,063	67,100	209.6
Total		39,500	67,100	588.0
		Drainage ($\times10^3m^3$)	Area ($\times10^3m^3$)	Outflow (mm)
Kariyata R. Right Pump Station **		30,654	67,100	456.8
Drainage pumps in Sanjo City ***		6,423		95.7
Total		37,100	67,100	552.5

* Estimation by Prefectural Committee=$14,078\times10^3m^3$

** Only for pump drainage area

Water Balance in Each Region (2)

(b) Nakanoshima Region by the same procedure (*Natural Drain. Region*)

		Inflow ($\times10^3m^3$)	Area* ($\times10^3m^3$)	Inflow (mm)
Rain	Paddy	11,000	28,070	392.0
	Upland Crop Fields	170	440	
	Urban	590	1,500	
	Mountain	0	0	
	Others	1,300	3,320	
Inflow at the dike breach pnt.from the Kariyata R.**		8,840	33,320	265.3
Total		21,900	33,320	657.3
		Drainage ($\times10^3m^3$)	Area* ($\times10^3m^3$)	Outflow (mm)
Oonuma Pump Station		6,780	33,320	203.5
Natural drainage (Nakanoshima R.)***		10,861		326.0
Natural drainage (Nakano-shima R. with improved cross section) ****		2,999		90.0
Toral		20,700	33,320	619.5

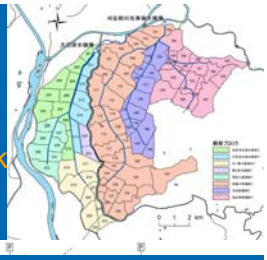
* Estimated by GIS data

** Estimation by Prefectural Committee=$8,804\times10^3m^3$(Reference)

Numerical Model and Areal Model

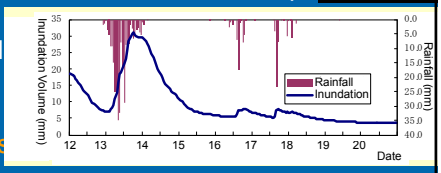
Analysis of runoff and inundation applied Diffusive Tank Model

(Bound. Con.: inflow by dike breach and Pump. &



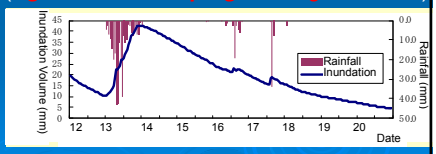
Discussion (Temporal Process of Inundation Volume on Paddies)

To drain out flooded water
K.R.B.R: 4days
N.R.. 7days



Kariyata River Right Bank Region
(*Agricultural Pumping Drainage* oriented)

Around and after max. flood stage,
- Most of flooded water stored in low-paddy areas
- Pump drainage for agriculture purpose in full operation



Nakanoshima Region
(*Natural Drainage* Oriented) 13

Integrated basin management in Future

- Basin-wide flood manag.during abnormal floods
  → To make use of a different design standard
  (Urban: 1/100-1/200 years Return Period,
  Agriculture: 1/10-1/20 ys)
- (*EX.*) 2 Rivers in Niigata (Q_{river}>$Cap_{riv.}$) in 2004, (2011)
  → Flooded by bank overflows and/or breaches of dikes
  → Most of flooded water = Stored in Paddies
  → Drainage Facil. (1/15y) for Ag. = Effective

Decrease of flood damage in the lower reach (urban areas) 14

Conclusion

- i) Inflow magnitudes into the areas by the river dike breaches were beyond the design standard (1/15-year Capacity) as irrigation and drainage facilities.
- ii) Even the project to carry out the internal agricultural drainage only by pumps proved to be effective on decreasing the damage even by big floods.
- iii) Toward future basin management to make use of paddy dominant areas (different drainage standard from urban areas)

→ Adaptive Flood Management 15

The End