R150 EGU2015-7813 Parameter identification of a distributed runoff model by the optimization software Colleo

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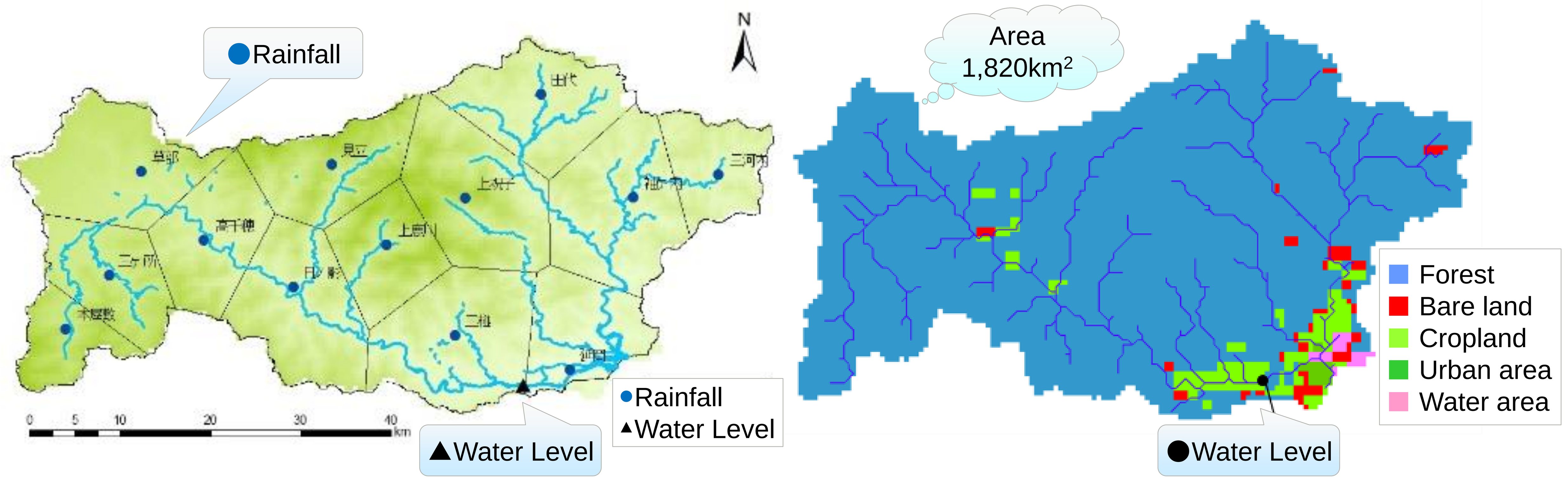
Objective

- To determine suitable optimization algorithms for the parameter identification of the flood simulation

Colleo – Collection of Optimization software

- Enables the use of 4 optimization software and 75 optimization algorithms

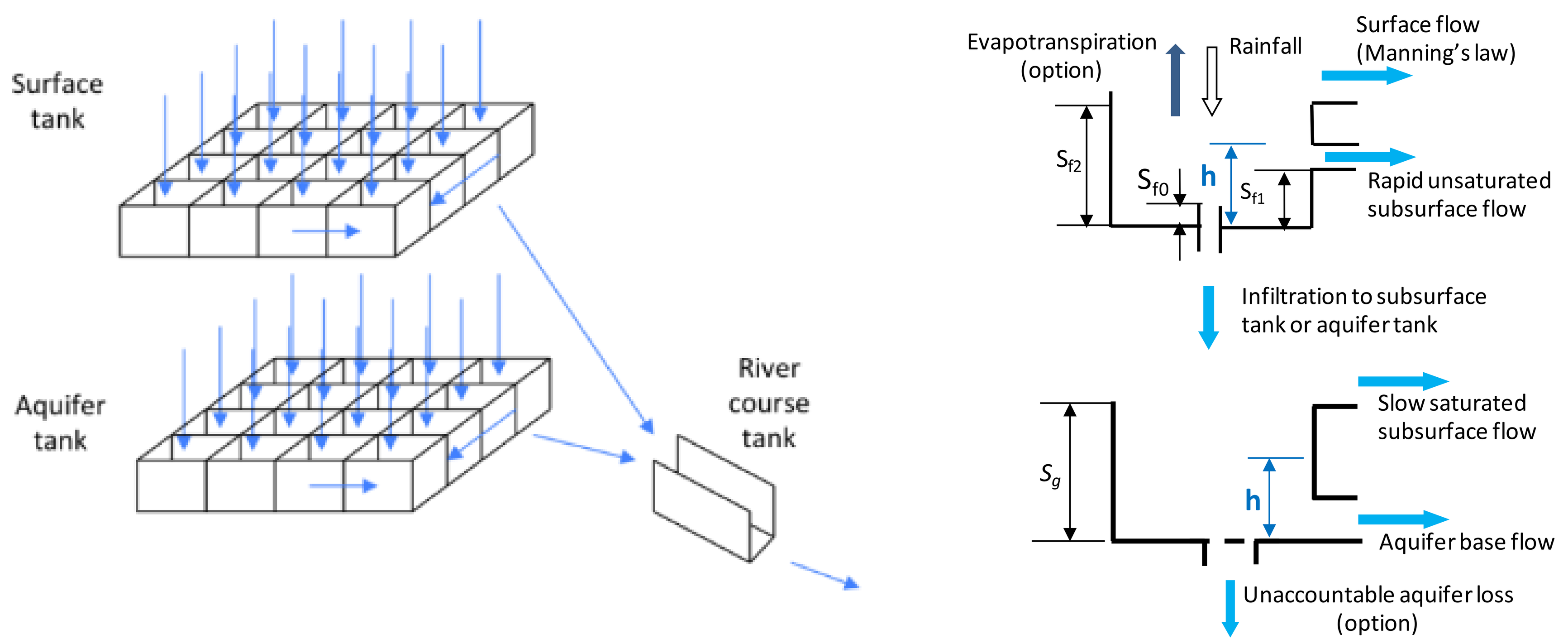
Gokase River basin



Flood cases

No	Year	Start	End	Days	Rainfall types	Max discharge
1	2004	8/28	9/1	4	Typhoon 16	6,116
2	2007	8/1	8/4	3	Typhoon 5	5,287
3	2007	7/2	7/17	15	Typhoon 4	4,435
4	2004	9/4	9/9	5	Typhoon 18	3,563
5	2006	8/17	8/20	3	Typhoon 10	2,795
6	2003	8/6	8/10	4	Typhoon 10	2,484
7	2004	10/18	10/22	4	Typhoon 23	2,482
8	2004	9/28	10/1	3	Typhoon 21	2,247
9	2002	7/25	7/29	4	Frontal	2,013
10	2003	5/26	6/2	7	Typhoon 4	1,956
11	2002	8/29	9/2	4	Frontal	1,708
12	2002	7/5	7/8	3	Frontal	1,694
13	2004	6/19	6/23	4	Typhoon 6	1,678
14	2006	6/23	6/29	6	Frontal	1,374
15	2003	9/10	9/14	4	Typhoon 14	1,350

The PWRI distributed hydrological model



$$Q_{sf} = L\frac{1}{N}(h - S_{f2})^{\frac{5}{3}}\sqrt{i}$$

$$Q_{ri} = \alpha_n \cdot A \cdot f_0 \frac{(h - S_{f1})}{(S_{f2} - S_{f1})}$$

$$Q_o = A \cdot f_0 \frac{(h - S_{f0})}{(S_{f2} - S_{f0})}$$

$$Q_{g1} = A_u^2 \cdot (h - S_g)^2 \cdot A$$

$$Q_{g2} = A_g \cdot h \cdot A$$

Parameters and objective functions

	Parameters	Lower bound	Upper bound	Starting values
f_0	SKF_1	-5.301030	-1.301030	-3.301030
	SKF_2	-6.698970	-2.698970	-4.698970
	SKF_3	-7.000000	-3.000000	-5.000000
	SKF_4	-8.000000	-4.000000	-6.000000
	SKF_5	-7.000000	-3.000000	-5.000000
N	SNF_1	0.000100	2.000000	0.700000
	SNF_2	0.000100	2.000000	2.000000
	SNF_3	0.000100	2.000000	2.000000
	SNF_4	0.000100	2.000000	0.000100
	SNF_5	0.000100	2.000000	2.000000
A_u	AUD	0.050000	0.600000	0.100000
A_g	AGD	0.001000	0.050000	0.003000

$$E_{ms} = \frac{1}{N}\sum_{i=1}^{N}(meas(i) - sim(i))^2$$

$$E_{rel} = \frac{1}{N}\sum_{i=1}^{N}\frac{(meas(i) - sim(i))^2}{meas(i)^2}$$

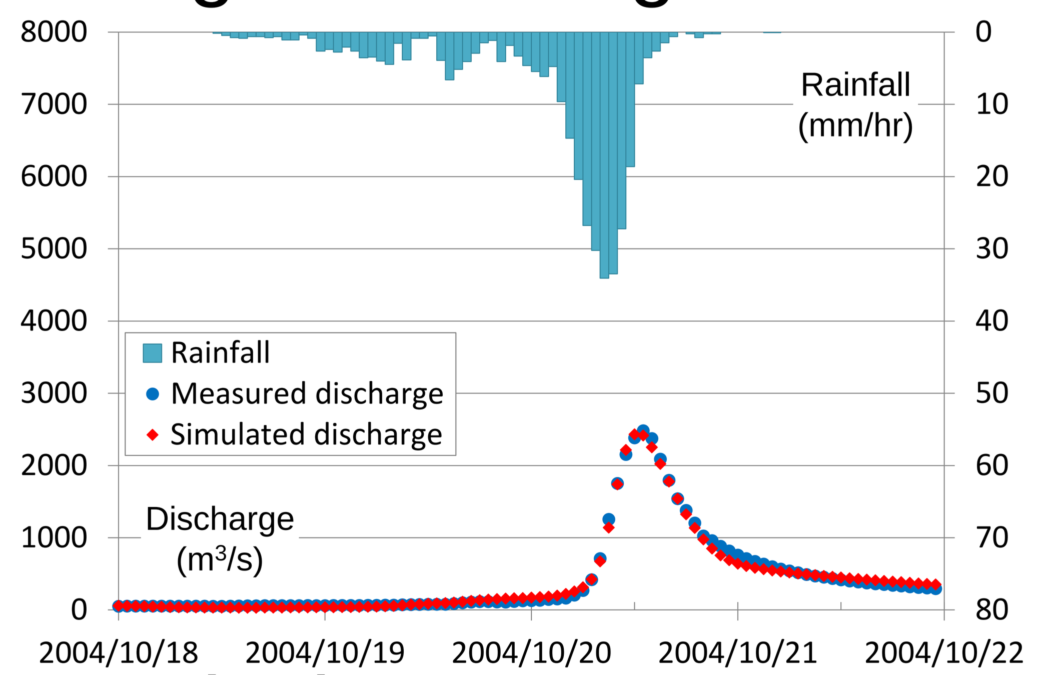
$$E_{log} = \frac{1}{N}\sum_{i=1}^{N}(\log(meas(i)) - \log(sim(i)))^2$$

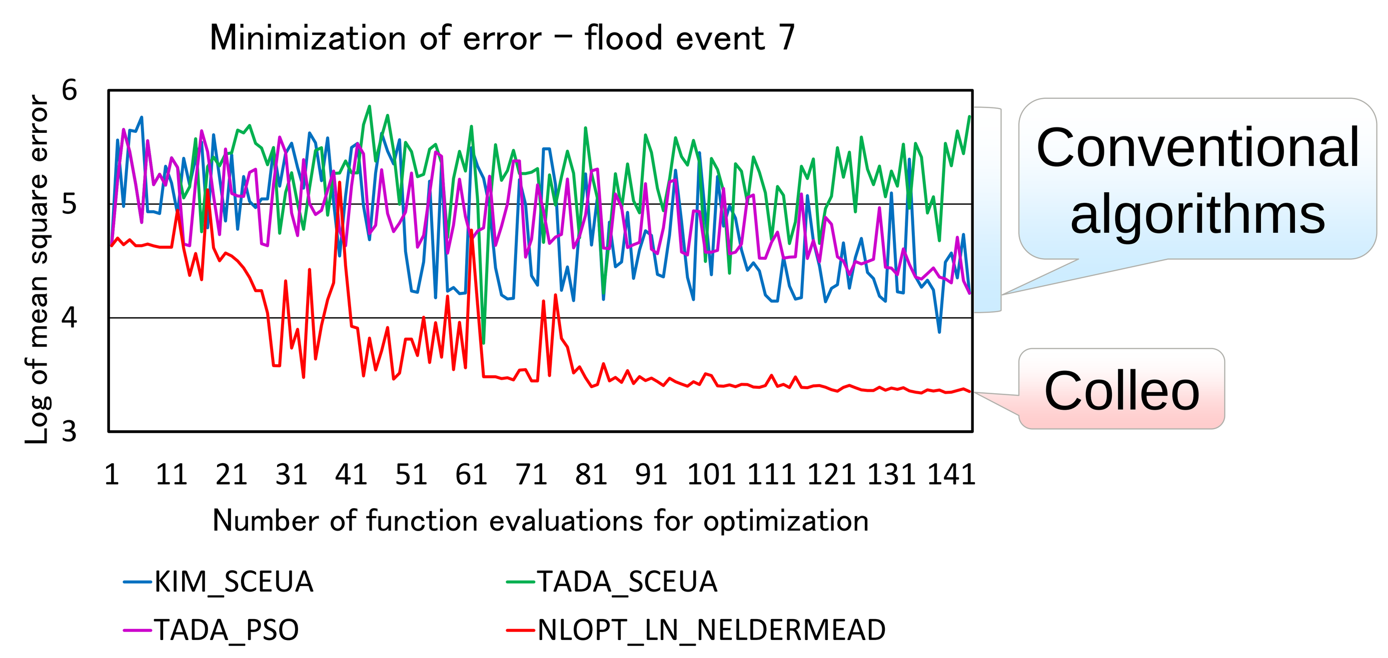
Suitable optimization algorithms for the distributed hydrological model

No	Software	Algorithm	Number of optimization cases
1	pyOpt	NSGA2	2
2		SDPEN	14
3	NLopt	GN_MLSL	4
4		GN_MLSL_LDS	2
5		LN_AUGLAG	1
6		LN_NELDERMEAD	3
7		LN_SBPLX	2
8	inspyred	DEA	2
9		PSO	5
10	R	BBO	2
11		MCO_NSGA2	5
12		PSO_PSOPTIM	1
13		RMALSCHAINS	2

Resulted in the smallest error for each of 45 optimization cases of 15 flood cases x 3 objective functions

Fitting of discharge data and Optimization Performance





Conclusion

- 13 suitable optimization algorithms are presented for the parameter identification of the flood simulation
- Good fitting of discharge data is illustrated in Gokase River basin
- Optimization algorithms of Colleo outperform the conventional ones with a small number of convergent calculation