# Supplemental material



Figure s1. Location map and topography of Laos.



5 Figure s2. Province map of Laos.











Figure s3. Future flood hazard maps for the 100-year return period under scenarios (a) RCP2.6, (b) RCP4.5, and (c) RCP8.5 and the difference in hazard index between scenarios (d) RCP4.5 and RCP2.6, and between scenarios (e) RCP8.5 and RCP4.5 during the near future.







Figure s4. Future flood hazard maps for the 100-year return period under scenarios (a) RCP2.6, (b) RCP4.5, and (c) RCP8.5 and the difference in hazard index between scenarios (d) RCP4.5 and RCP2.6 and between scenarios (e) RCP8.5 and RCP4.5 during the far future.











15 Figure s5. Comparison of rainfall between 3 scenarios: (a) RCP2.6, (b) RCP4.5, and (c) RCP8.5 and the difference in rainfall between the (d) RCP4.5 and RCP2.6 scenarios and between the (e) RCP8.5 and RCP4.5 scenarios during the near future.







(e)



Figure s6. Comparison of rainfall between 3 scenarios: (a) RCP2.6, (b) RCP4.5, and (c) RCP8.5 and the difference in rainfall between the (d) RCP4.5 and RCP2.6 scenarios and between the (e) RCP8.5 and RCP4.5 scenarios during the far future













Figure s7. Future landslide hazard maps for the 100-year return period under the (a) RCP2.6, (b) RCP4.5, and (c) RCP8.5 scenarios and the difference in the hazard index between the (d) RCP4.5 and RCP2.6 scenarios and between the (e) RCP8.5 and RCP4.5 scenarios during the near future.





Figure s8. Future landslide hazard maps for the 100-year return period under the (a) RCP2.6, (b) RCP4.5, and (c) RCP 8.5 scenarios and the difference in the hazard index between the (d) RCP4.5 and RCP2.6 scenarios and between the (e) RCP8.5 and RCP4.5 scenarios during the far future.

## Table s1. Details of the GCMs.

Model	Institution	Resolution
		(Lon×Lat)
MIROC-	Atmosphere and Ocean Research Institute (the University of Tokyo), National	2.8°×2.8°
ESM	Institute for Environmental Studies and Japan Agency for Marine-Earth Science and	
	Technology, Japan	
MIROC-	Atmosphere and Ocean Research Institute (the University of Tokyo), National	2.8°×2.8°
ESM-	Institute for Environmental Studies and Japan Agency for Marine-Earth Science and	
CHEM	Technology, Japan	
CanESM2	Canadian Center for Climate Modeling and Analysis, Canada	2.8°×2.8°
CNRM-	Center National de Recherches Meteorologiques/Center European de Recherche et	1.4°×1.4°
CM5	Formation Avancees en Calcul Scientifique	
GFDL-	NOAA Geophysical Fluid Dynamics Laboratory	2.5°×2.0°
ESM2 M		
MPI-	Max Planck Institute for Meteorology, Germany	1.87°×1.86°
ESM-LR		
MRI-	Meteorological Research Institute	1.12°×1.12°
CGCM3		

## Table s2. Questionnaire of preference for the AHP approach.

Which respect to damage, using the scale from 1 to 9 (where 9 is extremely and 1 is equally important), please indicate (x) the relative importance of opinions A (left column) to opinions B (right column), here scale value are consider as (9 (A) to 9 (B))

(inght column	<u>ј</u> , п		care	vai	uc a		onsit		as ()	$(\Pi)$	10 2	(D)	<u>n</u>						
Options A	Extremely		Very Strongly		Strongly		Moderately		Equally		Moderately		Strongly		Very Strongly		Extremely	Options B	
Flood	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Land use change	j = 1
Flood	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Landslide	j = 2
Flood	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Climate change to flood	<i>j</i> = 3
Flood	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Climate change to landslide	
Land use change	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Landslide	
Land use change	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Climate change to flood	
Land use change	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Climate change to landslide	
Landslide	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Climate change to flood	
Landslide	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Climate change to landslide	
Climate change to flood	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Climate change to landslide	<i>j</i> = 10

	High hazard	V
Province name	(percentage of whole	very high hazard
	country)	(percentage of whole country)
Attapeu	0.25%	0.19%
Bokeo	0.13%	0.06%
Bolikhamxai	0.73%	0.27%
Champasak	0.45%	0.18%
Houaphan	0.21%	0.20%
Khammouan	0.87%	0.24%
Louang Namtha	0.14%	0.07%
Louang Prabang	0.51%	0.17%
Oudomxai	0.22%	0.11%
Phongsaly	0.25%	0.14%
Salavan	0.16%	0.16%
Savannakhet	0.92%	0.27%
Vientiane	0.59%	0.26%
Vientiane Capital City	0.08%	0.04%
Xaignabouly	0.37%	0.16%
Xekong	0.12%	0.12%
Xiangkouang	0.14%	0.15%
Total percentage of high-		
/very high-hazard area	6.14%	2.78%
across the country		

## Table s3. Percentage of high- and very high-hazard areas from the flood hazard map in each province.

	High hazard	Very high hazard (percentage of whole country)		
Province name	(percentage of whole country)			
Attapeu	0.05%	0.10%		
Bokeo	0.00%	0.00%		
Bolikhamxai	0.48%	2.31%		
Champasak	0.02%	0.07%		
Houaphan	0.02%	0.01%		
Khammouan	0.05%	0.18%		
Louang Namtha	0.00%	0.00%		
Louang Prabang	0.00%	0.00%		
Oudomxai	0.00%	0.00%		
Phongsaly	0.00%	0.00%		
Salavan	0.01%	0.02%		
Savannakhet	0.00%	0.00%		
Vientiane	0.21%	0.92%		
Vientiane Capital City	0.00%	0.00%		
Xaignabouly	0.00%	0.00%		
Xekong	0.02%	0.06%		
Xiangkouang	0.35%	0.60%		
Total percentage of high-				
/very high-hazard area	1.21%	4.28%		
across the country				

## Table s4. Percentage of high- and very high-hazard areas from the landslide hazard map in each province.

Province name	High hazard (percentage area of whole country)	Percentage increase from current flood hazard map
Attapeu	0.30%	19%
Bokeo	0.18%	35%
Bolikhamxai	0.78%	6%
Champasak	0.50%	10%
Houaphan	0.25%	23%
Khammouan	0.92%	5%
Louang Namtha	0.19%	33%
Louang Prabang	0.56%	9%
Oudomxai	0.27%	22%
Phongsaly	0.30%	19%
Salavan	0.21%	30%
Savannakhet	0.96%	5%
Vientiane	0.64%	8%
Vientiane Capital City	0.12%	60%
Xaignabouly	0.42%	13%
Xekong	0.17%	39%
Xiangkouang	0.19%	33%
Total percentage of high-hazard area across the country	6.94%	

70 Table s5. Percentage of high-hazard area from the land use change impact on flood hazard map in each province and the percentage of increase from the current flood hazard map.

Table s6. Percentage of very high-hazard area from the land use change impact on flood hazard map in each province and the percentage of increase from the current flood hazard map.

	Very high hazard	Increase from current
Province name	(percentage area of whole	flood hazard map
	country)	r
Attapeu	0.22%	16%
Bokeo	0.09%	50%
Bolikhamxai	0.30%	11%
Champasak	0.21%	17%
Houaphan	0.23%	16%
Khammouan	0.27%	13%
Louang Namtha	0.10%	45%
Louang Prabang	0.20%	18%
Oudomxai	0.14%	27%
Phongsaly	0.17%	22%
Salavan	0.19%	19%
Savannakhet	0.30%	12%
Vientiane	0.29%	12%
Vientiane Capital City	0.07%	82%
Xaignabouly	0.19%	19%
Xekong	0.15%	25%
Xiangkouang	0.18%	21%
Total percentage of very high-hazard	2.20%	
area across the country	3.30%	

Table s7. Percentage of very high-hazard area from the climate change impact on flood hazard map in each province and the percentage of increase between the RCP4.5 and RCP2.6 scenarios during the near future.

Province name	Percentage of very high-hazard area under RCP2.6	Percentage of very high-hazard area under RCP4.5	Percentage increase in very high-hazard area between RCP4.5 and 2.6
Attapeu	0.25%	0.25%	2%
Bokeo	0.10%	0.10%	1%
Bolikhamxai	0.34%	0.36%	6%
Champasak	0.24%	0.25%	2%
Houaphan	0.26%	0.26%	2%
Khammouan	0.31%	0.32%	3%
Louang Namtha	0.12%	0.15%	23%
Louang Prabang	0.20%	0.23%	12%
Oudomxai	0.17%	0.19%	12%
Phongsaly	0.19%	0.19%	2%
Salavan	0.21%	0.22%	2%
Savannakhet	0.36%	0.43%	21%
Vientiane	0.31%	0.34%	9%
Vientiane Capital City	0.07%	0.08%	14%
Xaignabouly	0.21%	0.21%	2%
Xekong	0.17%	0.17%	1%
Xiangkouang	0.19%	0.20%	2%
Total percentage of very			
high-hazard area across	3.71%	3.97%	
the country			

Table s8. Percentage of very high-hazard area from the climate change impact on flood hazard map in each province and the percentage of increase between the RCP8.5 and RCP4.5 scenarios during the near future.

Province name	Percentage of very high-hazard area under RCP4.5	Percentage of very high-hazard area under RCP8.5	Percentage increase in very high-hazard area between RCP8.5 and 4.5
Attapeu	0.25%	0.25%	0%
Bokeo	0.10%	0.10%	0%
Bolikhamxai	0.36%	0.38%	5%
Champasak	0.25%	0.25%	2%
Houaphan	0.26%	0.26%	0%
Khammouan	0.32%	0.34%	5%
Louang Namtha	0.15%	0.15%	1%
Louang Prabang	0.23%	0.23%	0%
Oudomxai	0.19%	0.19%	0%
Phongsaly	0.19%	0.19%	0%
Salavan	0.22%	0.22%	2%
Savannakhet	0.44%	0.46%	3%
Vientiane	0.34%	0.35%	3%
Vientiane Capital City	0.08%	0.08%	1%
Xaignabouly	0.21%	0.21%	0%
Xekong	0.17%	0.17%	1%
Xiangkouang	0.20%	0.20%	2%
Total percentage of very			
high-hazard area across	3.97%	4.05%	
the country			

0.26%		2.6
0.2070	0.27%	5%
0.10%	0.10%	2%
0.37%	0.40%	7%
0.25%	0.26%	5%
0.26%	0.28%	5%
0.32%	0.35%	7%
0.15%	0.16%	3%
0.23%	0.24%	5%
0.19%	0.20%	4%
0.19%	0.20%	4%
0.22%	0.23%	4%
0.45%	0.49%	9%
0.35%	0.37%	7%
0.08%	0.08%	2%
0.21%	0.22%	4%
0.17%	0.17%	3%
0.20%	0.21%	4%
4.0%	4.22%	
	0.26% 0.10% 0.37% 0.25% 0.26% 0.32% 0.15% 0.23% 0.19% 0.23% 0.19% 0.22% 0.45% 0.35% 0.08% 0.21% 0.17% 0.20%	0.26%0.27%0.10%0.10%0.37%0.40%0.25%0.26%0.26%0.28%0.32%0.35%0.15%0.16%0.23%0.24%0.19%0.20%0.19%0.20%0.22%0.23%0.45%0.49%0.35%0.37%0.08%0.08%0.21%0.17%0.20%0.21%4.0%4.22%

Table s10. Percentage of very high-hazard area from the climate change impact on flood hazard map in each province and the percentage of increase between the RCP8.5 and RCP4.5 scenarios during the far future.

Province name	Percentage of very	Percentage of very	Percentage increase in very high-hazard area	
	under RCP4.5	under RCP8.5	between RCP8.5 and	
Attapeu	0.27%	0.31%	14%	
Bokeo	0.10%	0.10%	5%	
Bolikhamxai	0.40%	0.48%	21%	
Champasak	0.26%	0.30%	14%	
Houaphan	0.28%	0.32%	15%	
Khammouan	0.35%	0.41%	19%	
Louang Namtha	0.16%	0.17%	8%	
Louang Prabang	0.24%	0.27%	13%	
Oudomxai	0.20%	0.22%	11%	
Phongsaly	0.20%	0.22%	11%	
Salavan	0.23%	0.26%	12%	
Savannakhet	0.49%	0.62%	26%	
Vientiane	0.37%	0.45%	20%	
Vientiane Capital City	0.08%	0.08%	4%	
Xaignabouly	0.22%	0.25%	12%	
Xekong	0.17%	0.19%	9%	
Xiangkouang	0.21%	0.23%	11%	
Total percentage of very				
high-hazard area across	4.22%	4.88%		
the country				

Table s11. Percentage of very high-hazard area from the climate change impact on landslide hazard map in each province and the percentage of increase between the RCP4.5 and RCP2.6 scenarios during the near future.

Province name	Percentage of very high-hazard area under RCP2.6	Percentage of very high-hazard area under RCP4.5	Percentage increase in very high-hazard area between RCP4.5 and 2.6
Attapeu	0.10%	0.10%	0.06%
Bokeo	0.00%	0.00%	0.00%
Bolikhamxai	2.85%	2.86%	0.20%
Champasak	0.07%	0.07%	0.04%
Houaphan	0.01%	0.01%	0.01%
Khammouan	0.18%	0.18%	0.12%
Louang Namtha	0.00%	0.00%	0.00%
Louang Prabang	0.00%	0.00%	0.00%
Oudomxai	0.00%	0.00%	0.00%
Phongsaly	0.00%	0.00%	0.00%
Salavan	0.02%	0.02%	8.32%
Savannakhet	0.00%	0.00%	0.00%
Vientiane	0.92%	0.93%	1.64%
Vientiane Capital City	0.00%	0.00%	0.00%
Xaignabouly	0.00%	0.00%	0.00%
Xekong	0.06%	0.07%	7.46%
Xiangkouang	0.64%	0.68%	5.84%
Total percentage of very			
high-hazard area across	4.86%	4.92%	
the country			

120 Table s12. Percentage of very high-hazard area from the climate change impact on landslide hazard map in each province and the percentage of increase between the RCP8.5 and RCP4.5 scenarios during the near future.

Province name	Percentage of very high-hazard area under RCP4.5	Percentage of very high-hazard area under RCP8.5	Percentage increase in very high-hazard area between RCP8.5 and 4 5
Attapeu	0.10%	0.10%	4 69%
Bokeo	0.00%	0.00%	0.00%
Bolikhamxai	2.86%	2.87%	0.55%
Champasak	0.07%	0.07%	0.03%
Houaphan	0.01%	0.01%	0.01%
Khammouan	0.18%	0.18%	0.07%
Louang Namtha	0.00%	0.00%	0.00%
Louang Prabang	0.00%	0.00%	0.00%
Oudomxai	0.00%	0.00%	0.00%
Phongsaly	0.00%	0.00%	0.00%
Salavan	0.02%	0.02%	0.01%
Savannakhet	0.00%	0.00%	0.00%
Vientiane	0.93%	0.94%	0.35%
Vientiane Capital City	0.00%	0.00%	0.00%
Xaignabouly	0.00%	0.00%	0.00%
Xekong	0.07%	0.07%	6.93%
Xiangkouang	0.68%	0.69%	1.62%
Total percentage of very			
high-hazard area across	4.92%	4.96%	
the country			

Table s13. Percentage of very high-hazard area from the climate change impact on landslide hazard map in each province and the percentage of increase between the RCP4.5 and RCP2.6 scenarios during the far future.

Province name	Percentage of very high-hazard area under RCP2.6	Percentage of very high-hazard area under RCP4.5	Percentage increase in very high-hazard area between RCP4.5 and 2.6
Bokeo	0.00%	0.00%	0.00%
Bolikhamxai	2.93%	3.20%	8.98%
Champasak	0.07%	0.07%	0.21%
Houaphan	0.01%	0.01%	0.04%
Khammouan	0.18%	0.18%	0.56%
Louang Namtha	0.00%	0.00%	0.00%
Louang Prabang	0.00%	0.00%	0.00%
Oudomxai	0.00%	0.00%	0.00%
Phongsaly	0.00%	0.00%	0.00%
Salavan	0.02%	0.02%	0.05%
Savannakhet	0.00%	0.00%	0.00%
Vientiane	0.93%	0.95%	2.84%
Vientiane Capital City	0.00%	0.00%	0.00%
Xaignabouly	0.00%	0.00%	0.01%
Xekong	0.06%	0.06%	0.19%
Xiangkouang	0.66%	0.67%	2.01%
Total percentage of very			
high-hazard area across	4.89%	4.98%	
the country			

Province name	Percentage of very high-hazard area under RCP4.5	Percentage of very high-hazard area under RCP8.5	Percentage increase in very high-hazard area between RCP8.5 and 4.5
Attapeu	0.25%	0.25%	0%
Bokeo	0.10%	0.10%	0%
Bolikhamxai	0.36%	0.38%	5%
Champasak	0.25%	0.25%	2%
Houaphan	0.26%	0.26%	0%
Khammouan	0.32%	0.34%	5%
Louang Namtha	0.15%	0.15%	1%
Louang Prabang	0.23%	0.23%	0%
Oudomxai	0.19%	0.19%	0%
Phongsaly	0.19%	0.19%	0%
Salavan	0.22%	0.22%	2%
Savannakhet	0.44%	0.46%	3%
Vientiane	0.34%	0.35%	3%
Vientiane Capital City	0.08%	0.08%	1%
Xaignabouly	0.21%	0.21%	0%
Xekong	0.17%	0.17%	1%
Xiangkouang	0.20%	0.20%	2%
Total percentage of very			
high-hazard area across	4.98%	5.28%	
the country			