# Flood modelling in mega-cities using a coupled drainage-surface flow model: Kolkata, India

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### Kolkata



#### Terrain model

#### 30m RST interpolation from land survey points



#### Kolkata's drainage model



#### Kolkata's monitoring network



Shttp://weatherkolkata.in/

#### Rainfall event: 2015-07-31 to 2015-08-01



#### IDW → raster time-series of rainfall

### Police waterlogging reports

(	Kolkata Traffic Police added 2 new photos.												
	D	2 62		1 Comment									
		Like 💭 Commen	Share										
Water Logging Report on 01.09.2017 at 19:30 Hrs													
				STATUS									
SL NO.	TP GRD	PLACE AND STRETCHES	FLANK	ANKLE	ABOVE ANKLE DEEP	KNEE DEEP							
1	TA	ON LALBAZAR STREET	SOUTH	Y									
2	TA	RABINDRA SARANI NEAR PODDAR COURT		Y									
3	тв	I/F/O. NPPS	WEST		Y								
4	TB	STRAND ROAD & M G ROAD CROSSING		v									

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4	TB	STRAND ROAD & M G ROAD CROSSING				Y					

Observed water depth class Above ankle deep Knee deep Estimated water depth (m)<sup>1</sup>

p 0.10 < h < 0.47p  $0.47 \pm 0.05$ 

<sup>&</sup>lt;sup>1</sup> David J. Hunter et al. (2005). "Knee height, knee pain, and knee osteoarthritis: The Beijing Osteoarthritis Study". Arthritis & Rheumatism 52.5, pp. 1418–1423; Raja Sriswan Mamidi et al. (2011). "Secular Trends in Height in Different States of India in Relation to Socioeconomic Characteristics and Dietary Intakes". Food and Nutrition Bulletin 32.1, pp. 23–34.

### Observed flooding (2015-07-31 to 2015-08-01)



### **Computer model**

### itzï, a GIS-integrated, open-source partial inertia model<sup>2</sup> Swww.itzi.org

Coupled to SWMM with weir and orifice equations<sup>3</sup> Coefficients obtained from experimental results<sup>4</sup>

<sup>2</sup>Laurent Guillaume Courty et al. (2017). "Itzï (version 17.1): an open-source, distributed GIS model for dynamic flood simulation". Geoscientific Model Development 10.4, pp. 1835–1847.

<sup>3</sup>A.S. Chen et al. (2007). "The urban inundation model with bidirectional flow interaction between 2D overland surface and 1D sewer networks". Novatech 2007. Lyon, France, pp. 465–472.

<sup>4</sup>Matteo Rubinato et al. (2017). "Experimental calibration and validation of sewer/surface flow exchange equations in steady and unsteady flow conditions". Journal of Hydrology 552, pp. 421–432.

#### Computed water depth



#### Conclusion / way forward

- Data scarcity / quality is a challenge
- Tides data?
- Building blockage effect?
- Hopes of a better DEM

Other events (more recent -> more measuring points)

## Thank you

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✓ @LaurentCourty

Shttp://weatherkolkata.in Swww.itzi.org