Are Envelope Curves or Palaeoflood Records Close to the PMFs?

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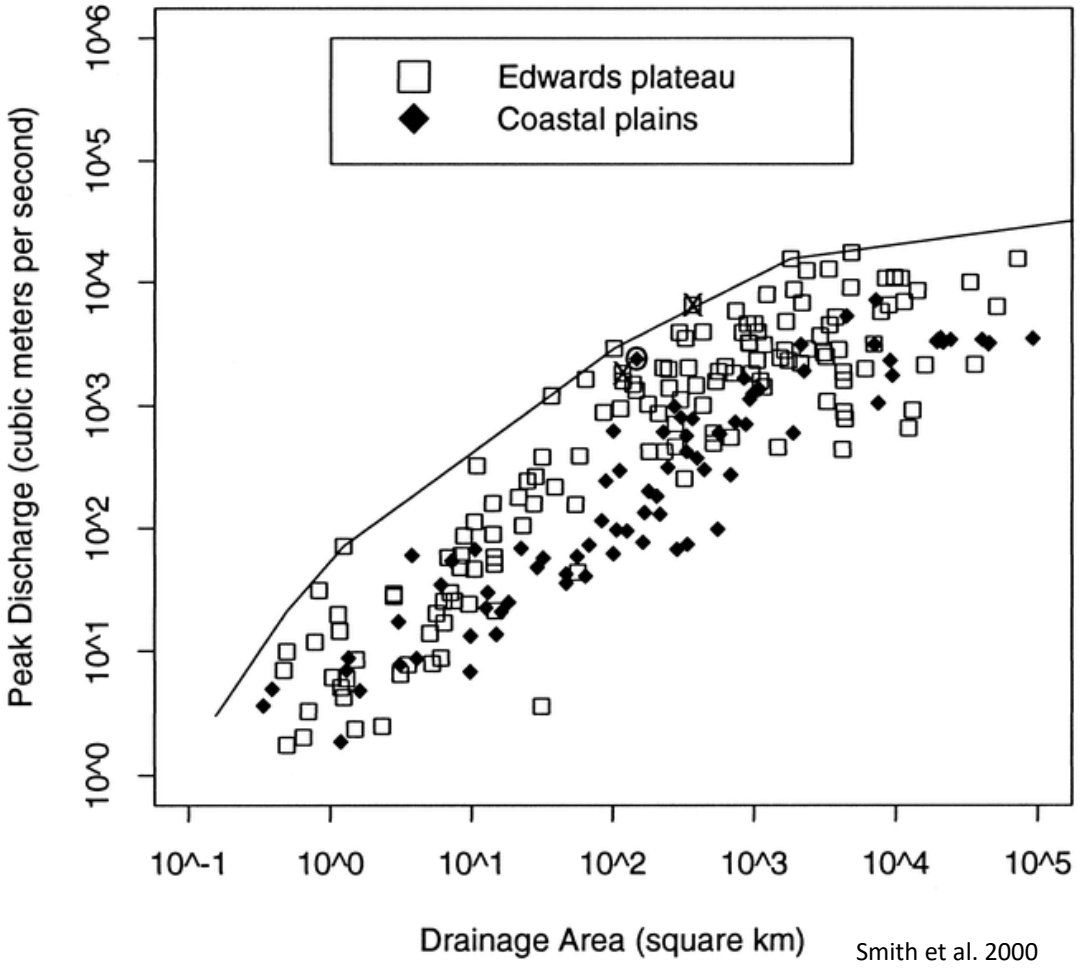
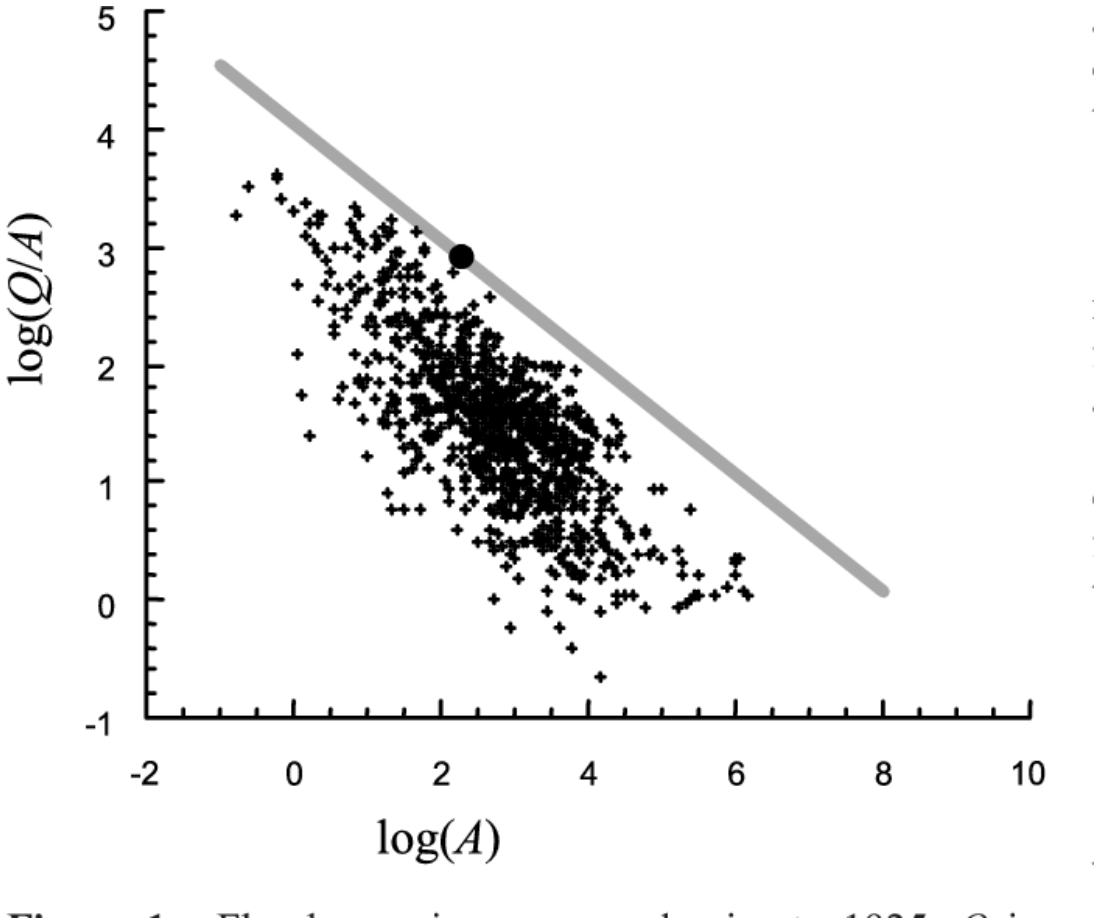
Water Technology

Flood Envelope Curves

- Maximum Observed Floods
  - Streamflow records
- Typically in log-log plot



Smith et al. 2000

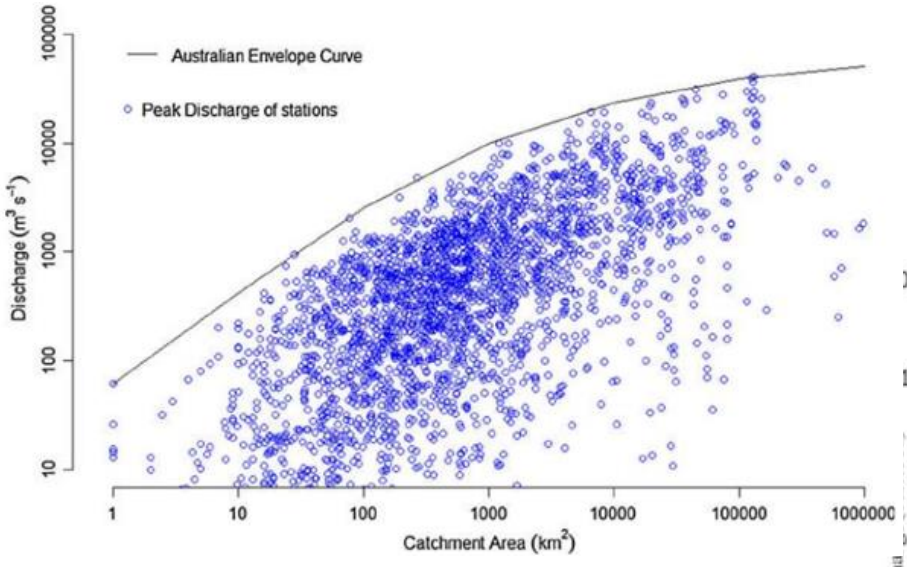


Castellarin et al., 2004

- Quick reference guide to likely maximum flood magnitude
- Basis of comparison to flood magnitude
- Simple comparison with a single variable
- Type of floods you can expect to see based on previous floods

Regional Envelope Curves

Political boundary



Lam et al. 2016

Geographical Region

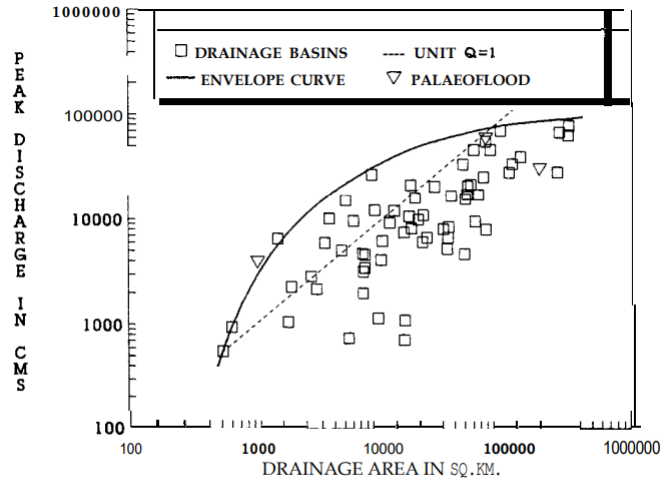


Figure 4. Envelope curve for the Deccan Peninsula, encompassing maximum flood peaks on record [18]. The dashed line represents unit diicharges equal to one $m^3/s/km^2$.

Kale and Hire, 1997

Hydrological boundary

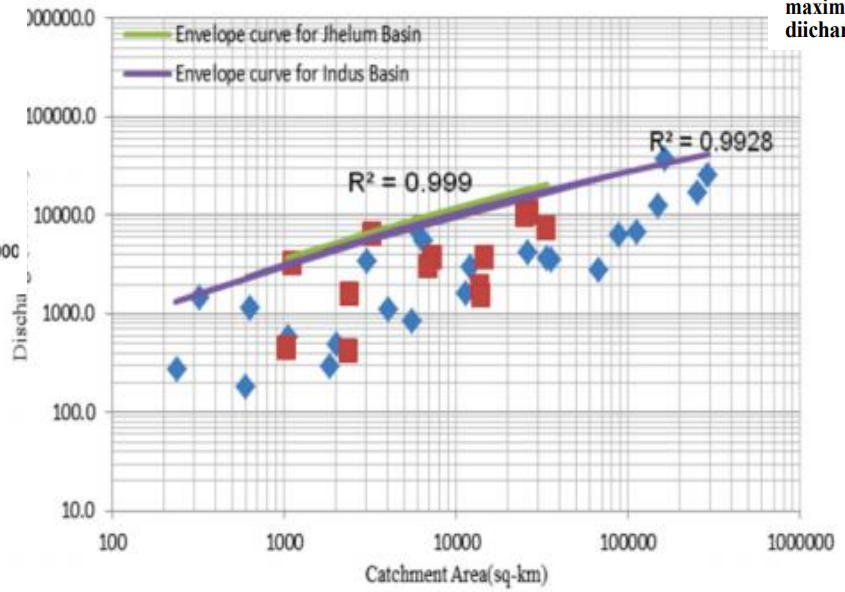


Fig. 5. Envelope curves for Indus and Jhelum river basins.

Ahsan et al., 2016

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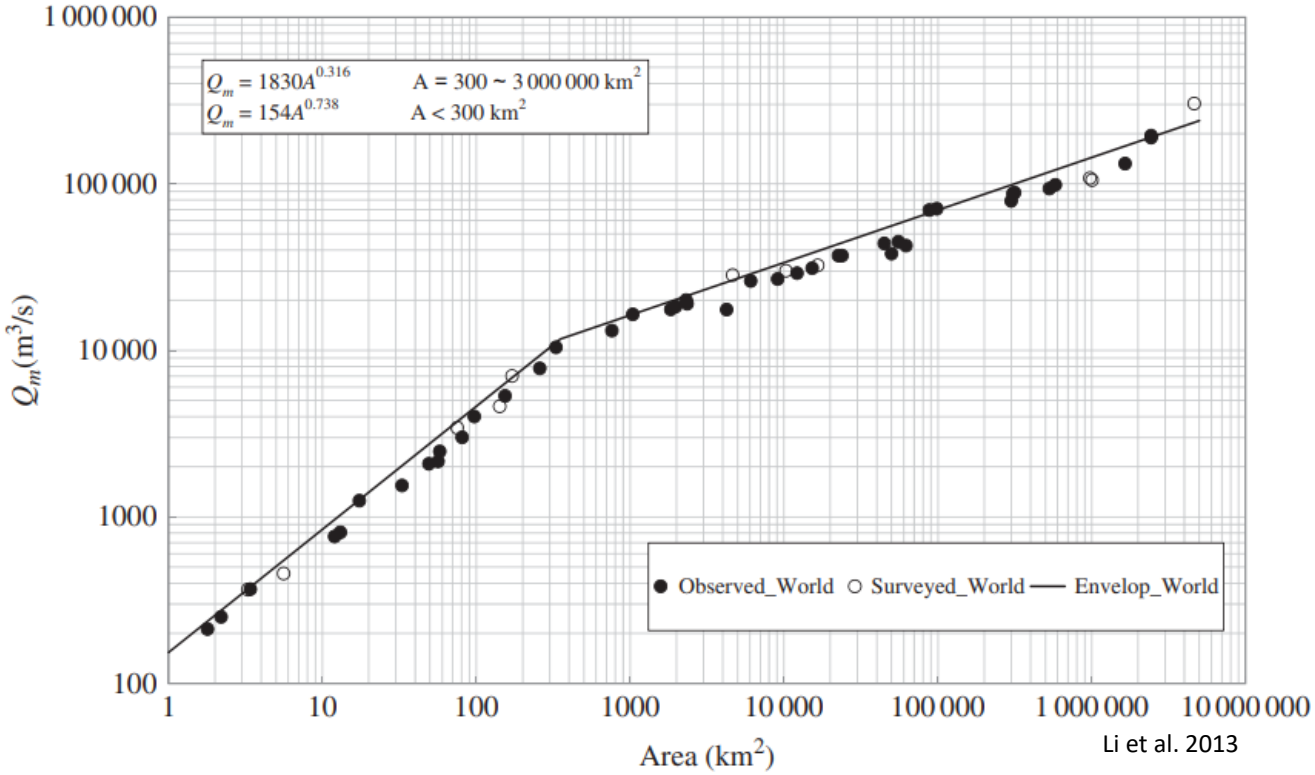
World Envelope Curve

- Francou and Roche (1967)
- Rodier and Roche (1984)
- Herschy (2002)
- Li et al. (2013)



Li et al. 2013

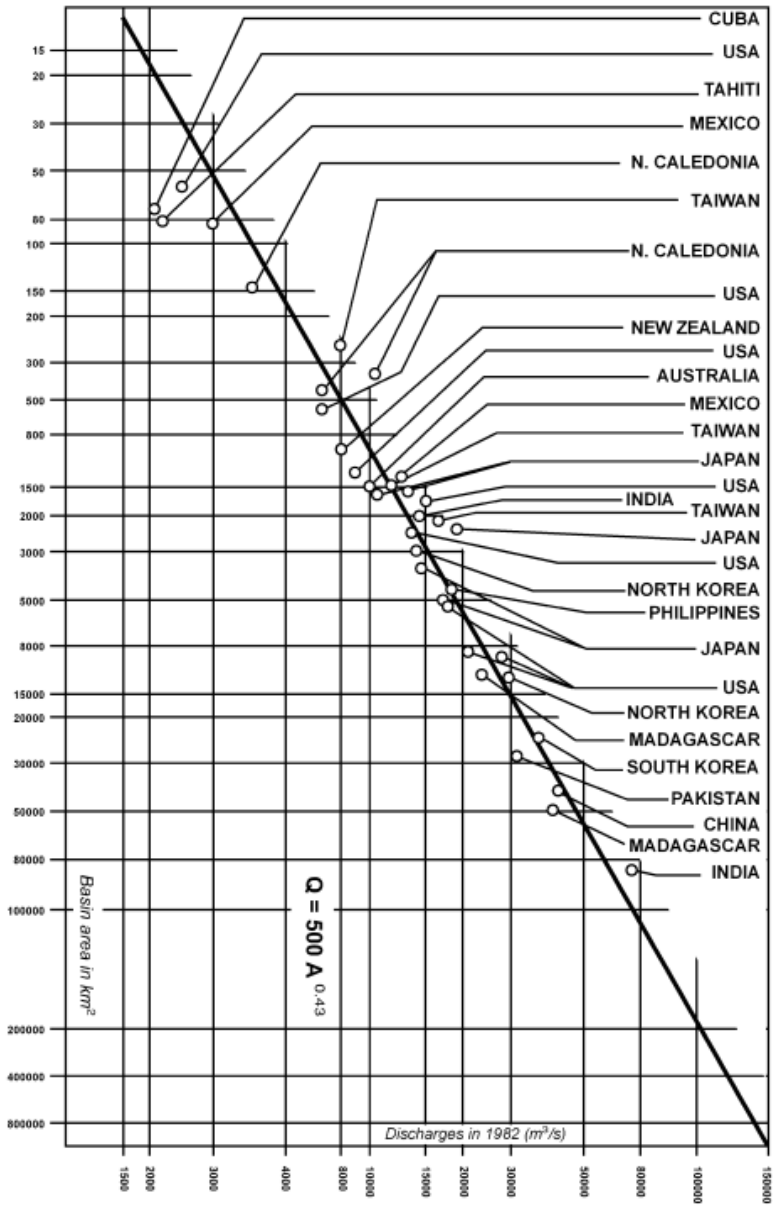


Fig. 1. Envelope curve of the world's maximum measured floods.

Herschy, 2002

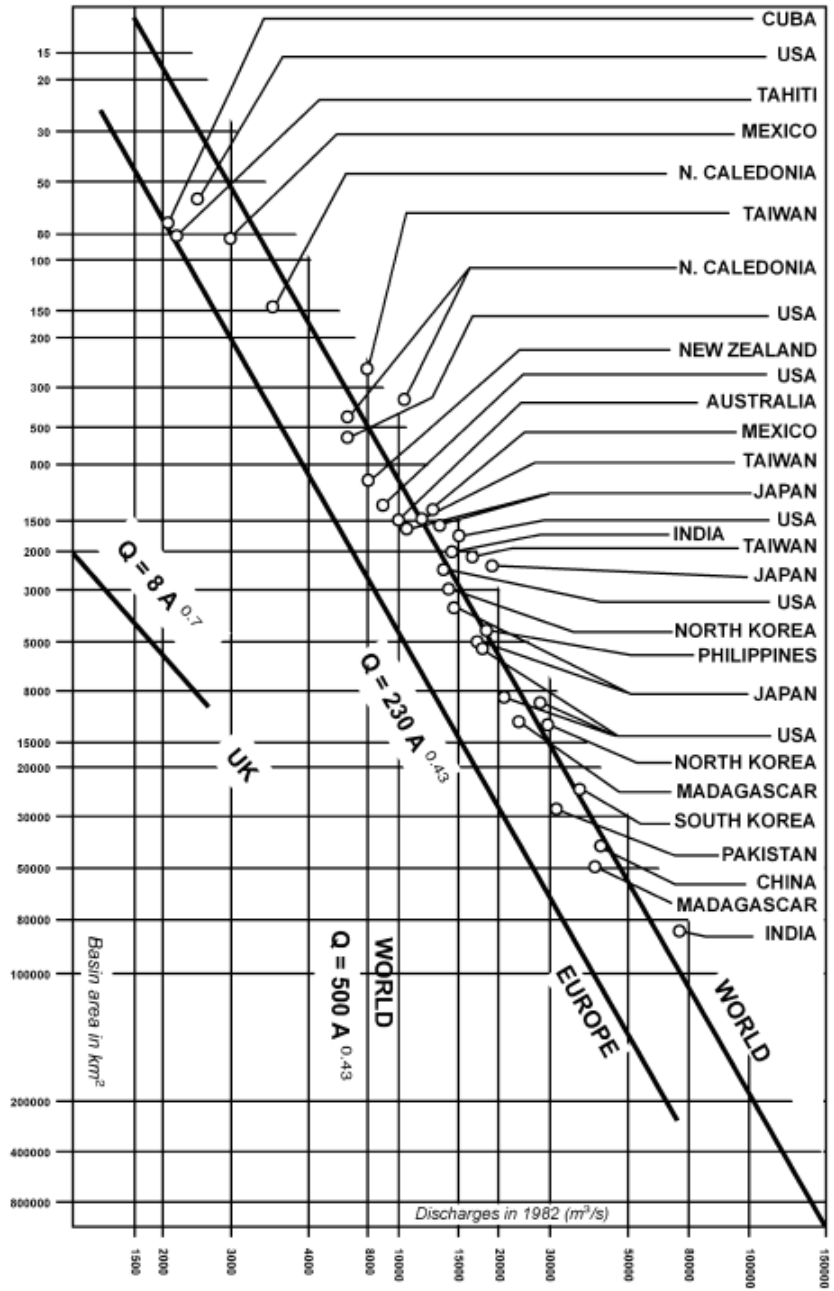
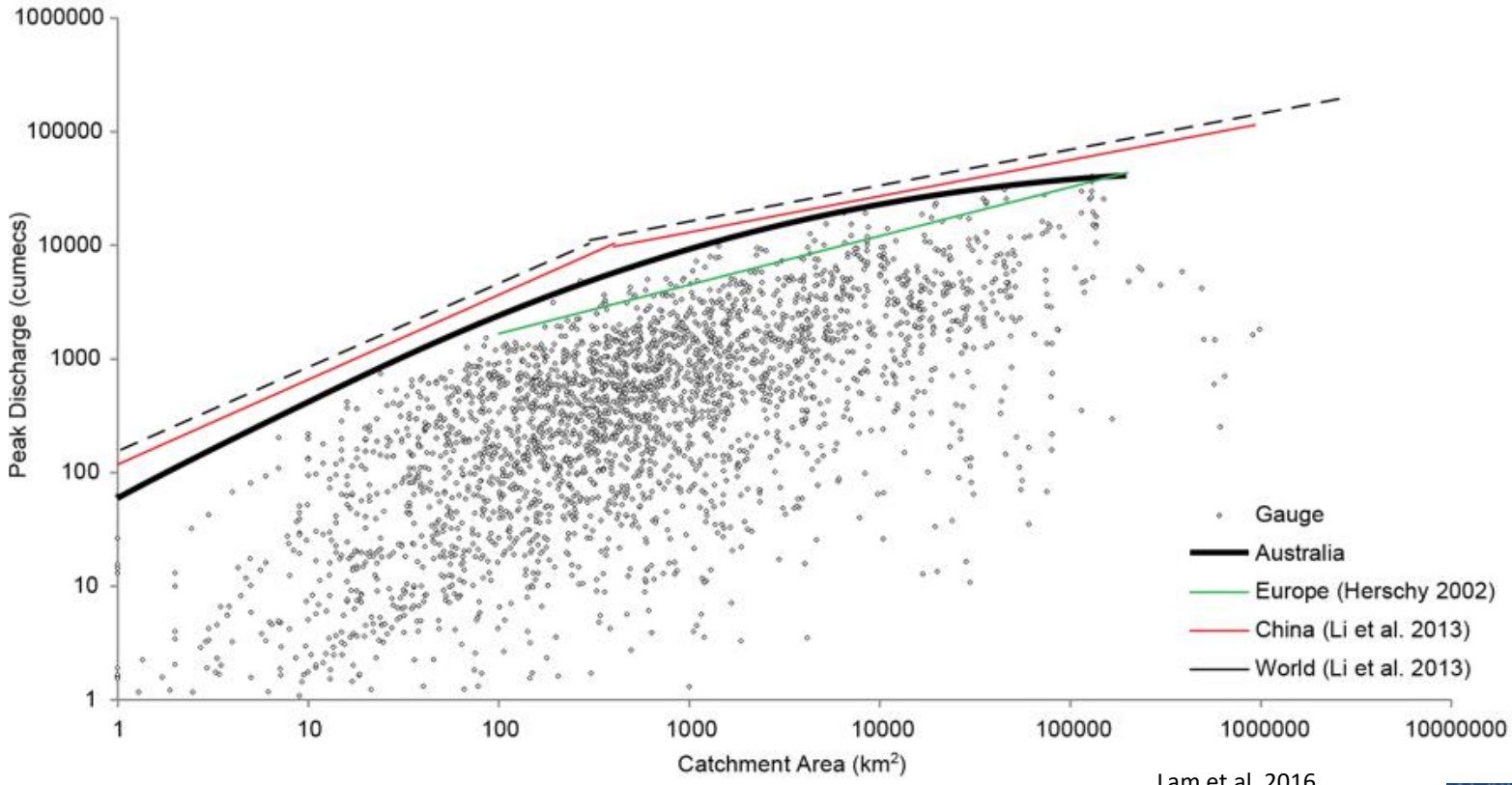


Fig. 2. World, Europe and UK maximum flood envelope curves.

Herschy, 2002



Lam et al. 2016

Envelope Curve	Discharge for 1000km² Area (m³/s)
World (Li et al. 2013)	16,000
China (Li et al. 2013)	13,000
Australia (Lam et al. 2016)	9,900
Europe (Herschy, 2002)	4,500

Peak Discharges in context to PMF

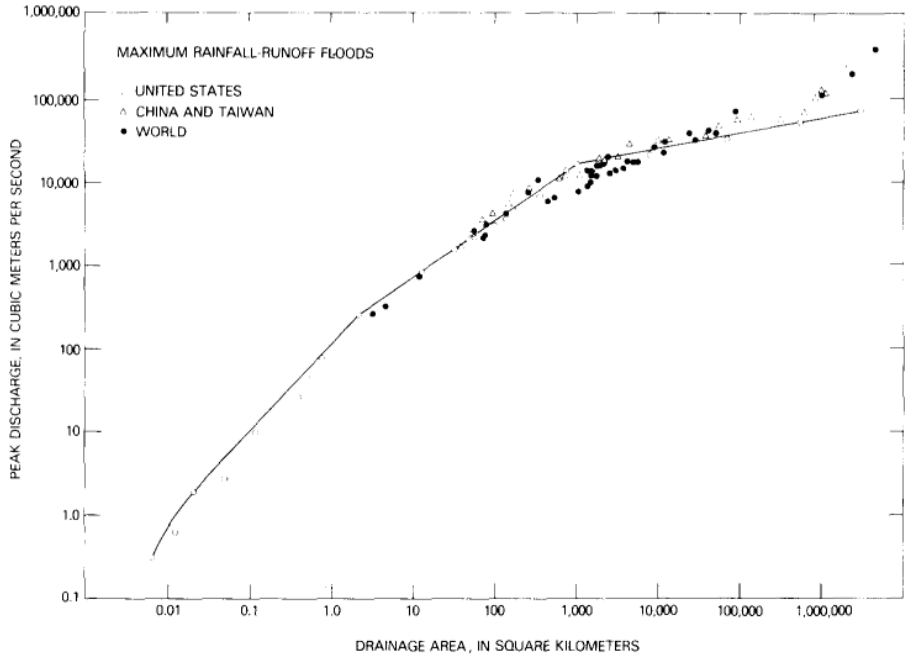


Fig. 2. Envelope curve of the maximum rainfall–runoff floods measured in the United States, compared with the maximum rainfall–runoff floods from China and from the world. Data are from Tables 1–3.

Costa, 1987

Table 2: Comparison of maximum measured discharge for a given basin size in the United States with simulated PMF (Costa, 1987b and Bullard, 1986)

Location	Date	Drainage Basin Area (km^2)	Peak Measured Discharge in U.S. for Basin in this Size Range (m^3/sec)	Estimated PMF Peak Discharge (m^3/sec)	Measured Discharge as a Percentage of PMF
Little Pinto Creek, Newcastle UT	8-11-64	0.78	74.5	84.7	88
Lane Canyon near Echo OR	7-26-65	13.1	807.1	883.6	91
Bronco Creek, Wikieup AZ	8-18-71	49.2	2,080	2,795	74
Eldorado Canyon, Nelson Landing NV	9-14-74	59.3	2,152	3,135	69
N. Fork Hubbard Creek, Albany TX	8-4-78	102	2,920	4,579	65
Jimmy Camp Creek, Fountain CO	6-17-65	141	3,510	5,409	65
Seco Creek near D'Hanis TX	5-31-35	368	6,510	9,901	66
W. Nueces River, Kickapoo Springs TX	6-14-35	1,041	16,425	19,569	84
Eel River, Scotia CA	12-23-64	8,063	21,300	28,151	76

USACE 2003

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Palaeofloods

- Extreme floods prior to historical and systematic observation
- Sedimentary flood Evidence
- Derive timing and magnitude of past flood events

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Palaeofloods vs Envelope Curves

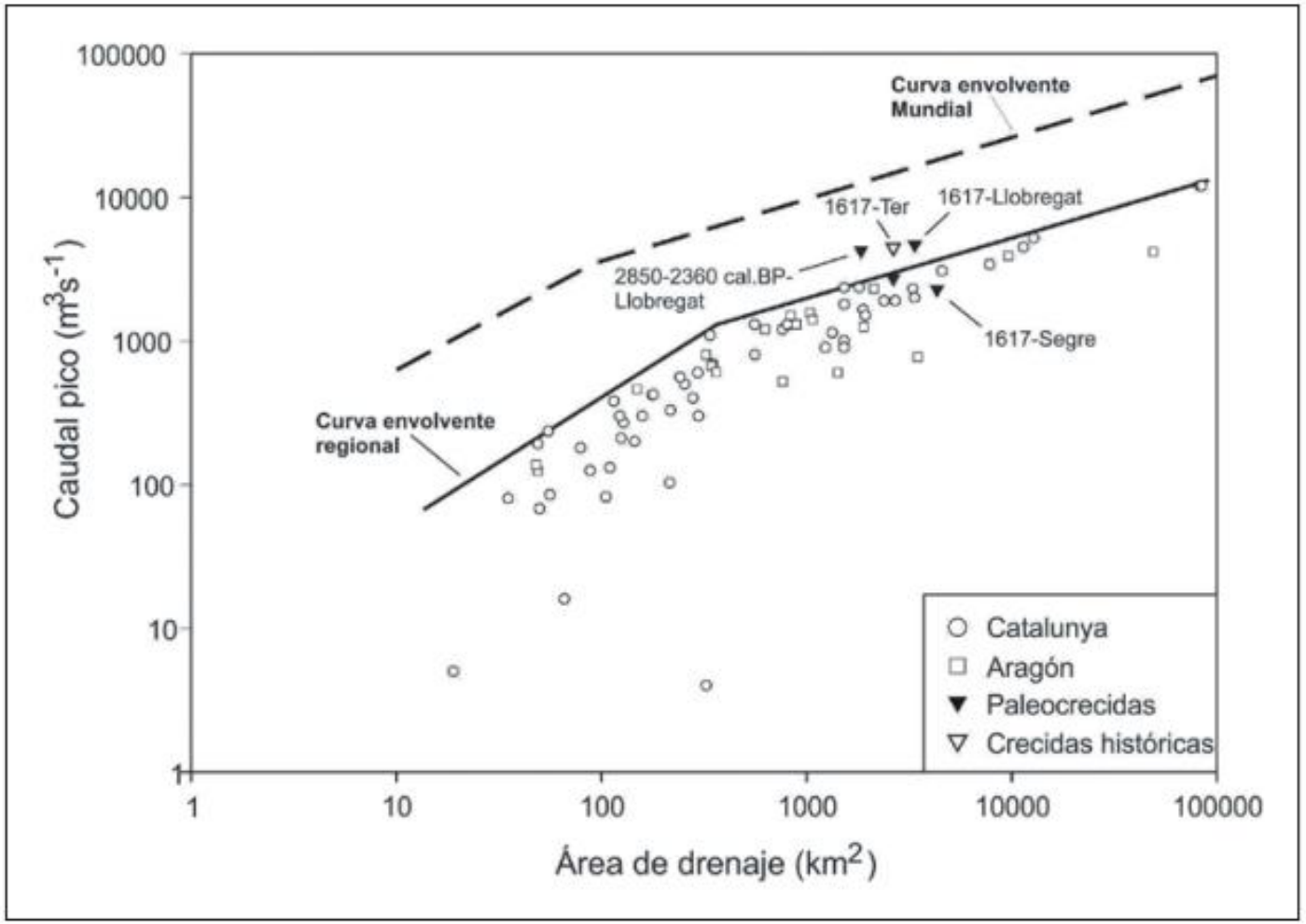

Figura 3. Curva envolvente regional de caudales máximos registrados en estaciones de aforos del NE de España, sobrepasada por los caudales estimados para las paleocrecidas en los ríos Llobregat y Ter, mientras que en el Segre los registros de paleocrecidas correspodientes a los últimos dos milenios tendrían una magnitud similar a la inundación de 1982 (Modificado de Thorndycraft et al., 2006).

Benito, 2014

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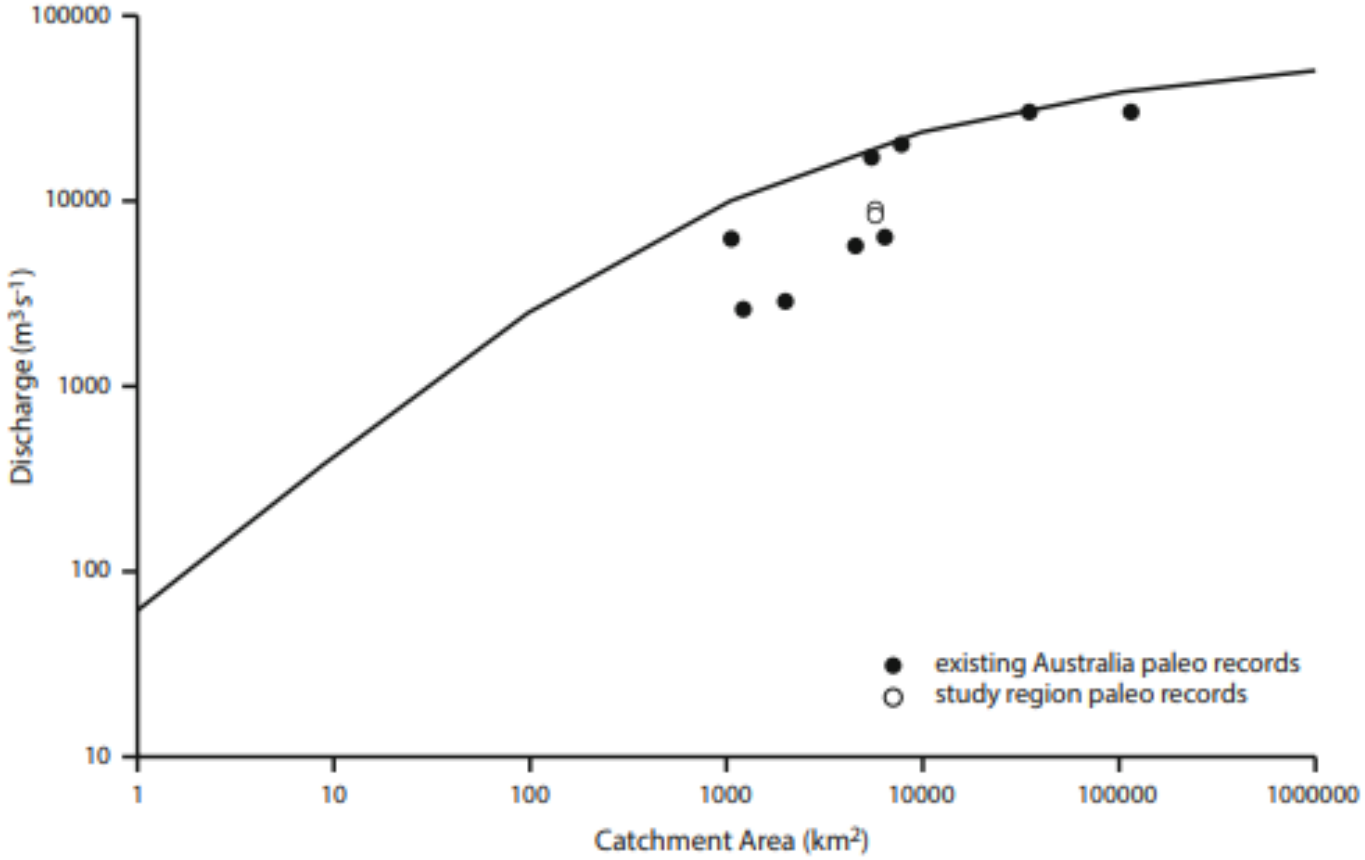
Palaeofloods vs Envelope Curve



Lam et al. 2016

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Palaeoflood in context to PMF

LOCALIZACIÓN	ÁREA DE LA CUENCA DE DRENAJE (KM²)	CRECIDA INSTRUMEN-TAL MÁXIMA (M³/S)	PERIODO DEL REGISTRO DE PALEOCRECIDAS (YEARS)	CAUDAL DE PALEOCRECIDA MÁXIMA (M³/S)	Q PARA T= 10.000 AÑOS BASADO EN PALEOCRECI-DAS (M³/S)	MÁXIMA CRECIDA PROBABLE (PMF) (M³/S)
Río Santa Ynez California (USA)[1]	1080	2265	2900	2550	2690	13,060
Río Ochoco, Oregon (USA)[2]	764	-	10,000-15,000	285	285	4785
Río Crooked, Oregon (USA)[3]	6825	-	8000-10,000	<1100	1100	7225
Río South Fork Ogden, Utah (USA)[3]	210	53	400	70	<215	3075
Río Llobregat[4]	3370	2,500	2800	4680	6921**	18,985*
Río Caramel[5] (Guadalentín)	372	170	1985	1616	3450	5786

Benito, 2014

Cuenca de la Rambla de la Viuda (Reservoir of María Cristina)

Flows in m^3s^{-1}

Return Periods (years)	100	500	1000	5000	10 000
Gauging station	1300	1975	2250	2895	3100
Gauging + Palaeoflood	1570	2305	2615	3310	3560
	PMF** 10700				

Source: Hydrology and Climate Change Laboratory

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Are Envelope Curves or Palaeofloods Records close to PMF ?

Location	Data	Specific instantaneous peak Q ($m^3s^{-1}km^2$)
E Alligator	Palaeoflood	25.4 +/- 3
Magela Creek	PMF	24.4
Koolpin Gorge	PMF	19.9

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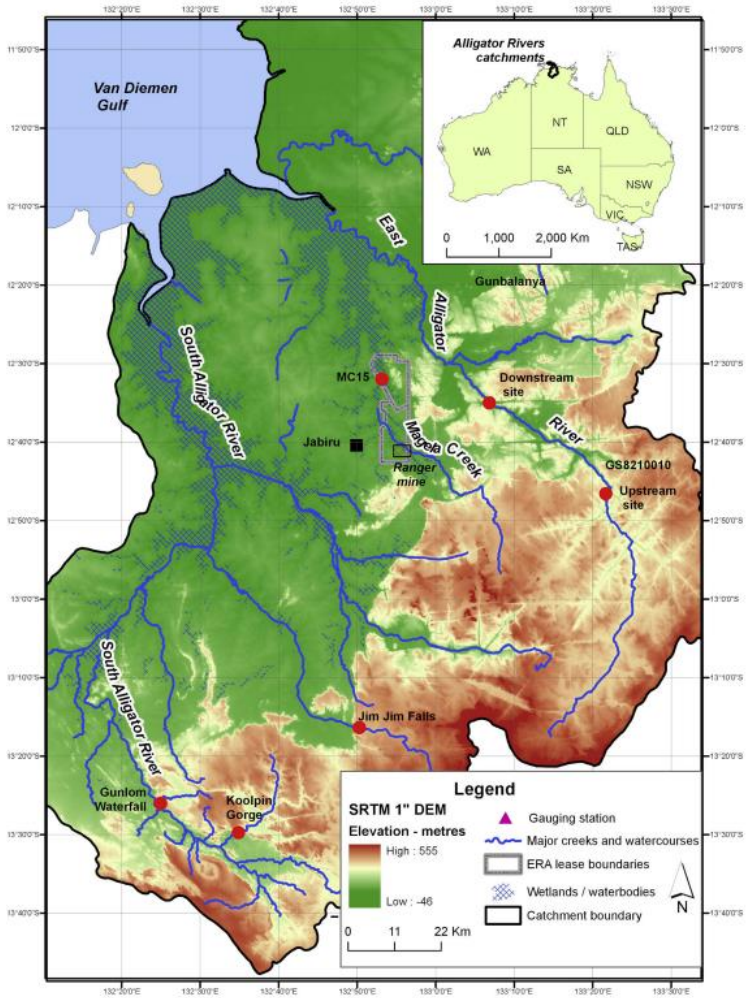
Holocene palaeohydrology of the East Alligator River, for application to mine site rehabilitation, Northern Australia

Mike Saynor [a, *], Robert Wasson [b, d], Wayne Erskine [a, c, 1], Daryl Lam [e]



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Palaeoflood Records

World Envelope Curve

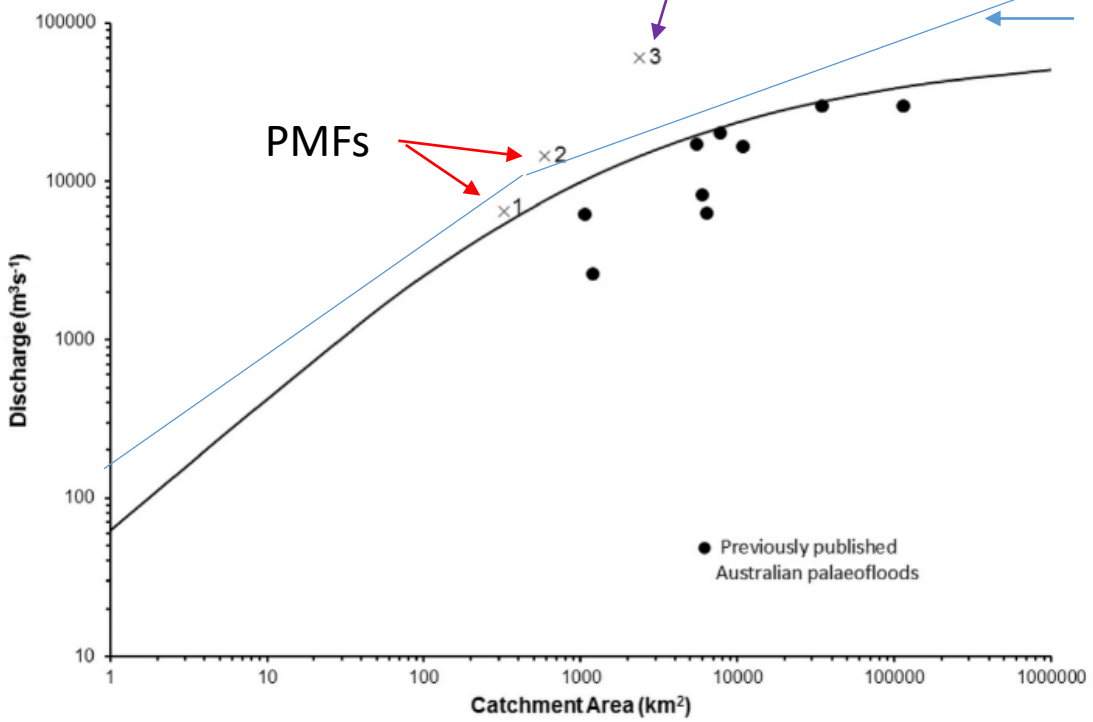

Fig. 6. Palaeofloods and PMFs in relation to the Australian Envelope Curve of Lam et al. (2017) from which were also taken the 'Previously Published Australian palaeofloods'. The crosses denote the following sites: 1, Koolpin gorge PMF; 2, Magela Creek PMF; 3, East Alligator gorge palaeofloods.