Lesson 33: Flood Peak Discharge
Instantaneous Peak Discharge

Fuller [1914] Approach

Fuller's equation for peak discharge

$$\frac{Q_{\max}}{Q_m} = 1 + 2.A^{-0.3}$$

Q_{max}	instantaneous peak discharge
Q_m	maximum mean daily flow
A	drainage area (mi^2)

Others relations for different regions [Fill and Steiner 2003]

Table 1. Relation between Then Ratio of Peak Flow and Mean Daily Flow as Function of Drainage Area in Literature

Author	Region	Expression
Gray (1973)	Rocky Mountains	$Q_{\max}/Q_d = 3.90A^{*-0.22}$
Gray (1973)	Cypress Hills	$Q_{\max}/Q_d = 10A^{*-0.46}$
Gray (1973)	Central Plains	$Q_{\max}/Q_d = 11A^{*-0.26}$
Gray (1973)	Manitoba Encarp.	$Q_{\max}/Q_d = 3.70A^{*-0.38}$
Correia (1983)	Portugal	$Q_{\max}/Q_d = 1 + 1.20A^{-0.036}$
Tonini (1939)[a]	Italy	$Q_{\max}/Q_m = 1 + 68A^{-0.50}$
Cottechia (1965)[a]	Italy ($A < 120\ km^2$)	$Q_{\max}/Q_m = 32A^{-0.313}$
Cottechia (1965)[a]	Italy ($A > 120\ km^2$)	$Q_{\max}/Q_m = 16A^{-0.190}$
Tonini (1969)[a]	Italy	$Q_{\max}/Q_m = 2.39A^{-0.112}$
Tucci (1991)	Brazil	$Q_{\max}/Q_d = 1 + 15.03A^{-0.59}$

Note: A=drainage area (km^2); A^*=drainage area (mi^2); $Q_{\max}$=peak flow; Q_d=highest observed flow; Q_m=maximum mean daily flow. Source: Adapted from Silva and Tucci (1998) (with permission).

[a]Reported in Canuti and Moisello (1981).

Lesson 33: Flood Peak Discharge
Instantaneous Peak Discharge

Langbein [1944] Approach

Langbein's graphical relation

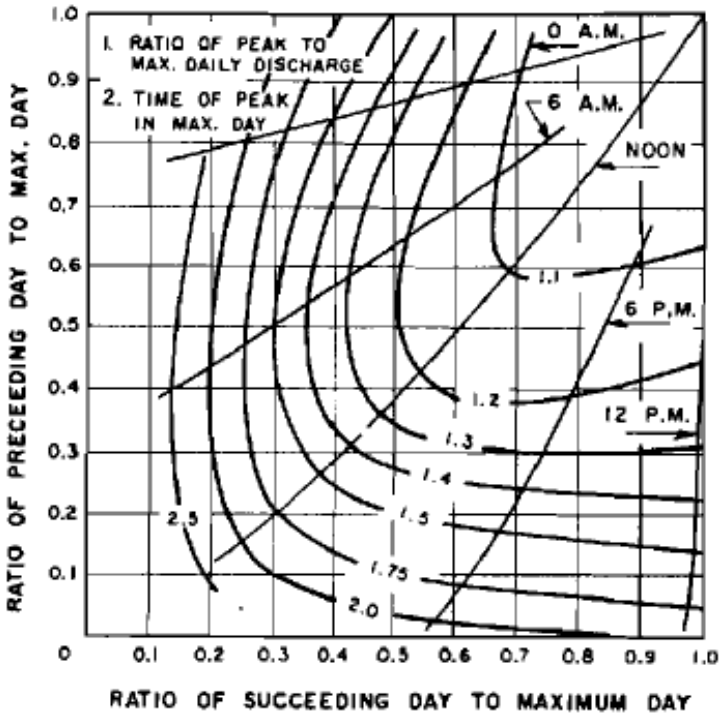

Figure 1. Discharge at and the time of crest, in relation to daily mean discharges (redrawn from Langbein)

Sangal [1983] formula for peak discharge

$$Q_{\max} = (4Q_2 - Q_1 - Q_3)/2$$

Q_{max} instantaneous peak discharge
Q_i mean daily flow on day preceding maximum (Q_1), the maximum day (Q_2), and the subsequent day (Q_3)

Fill and Steiner [2003] formula for peak discharge

$$Q_{\max} = \left[0.8Q_2 + 0.25(Q_1 + Q_3)\right]/k$$

$$k = 0.9123x + 0.362$$

$$x = \frac{Q_1 + Q_3}{2Q_2}$$

Lesson 33: Flood Peak Discharge
Instantaneous Peak Discharge

Examples (Iowa Floods of Record)

Ralston Creek (3.01 mi^2): Peak discharge on 17 July 1972 Q_{max} = 1720 cfs

Date	Daily *Q* (cfs)
7/15/1972	4.3
7/16/1972	2.6
7/17/1972	146
7/18/1972	9.2
7/19/1972	12

Clear Creek @ Coralville (98.1 mi^2): Peak discharge on 17 June 1990 Q_{max} = 10,200 cfs

Date	Daily *Q* (cfs)
6/15/1990	96
6/16/1990	2070
6/17/1990	7310
6/18/1990	1390
6/19/1990	614

Iowa River @ Marengo (2794 mi^2): Peak discharge on 12 June 2008 Q_{max} = 51,000 cfs

Date	Daily *Q* (cfs)
6/11/2008	36500
6/12/2008	44000
6/13/2008	48200
6/14/2008	38900
6/15/2008	34900