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# Understanding Streamflow Responses to Soil Conservation Measures

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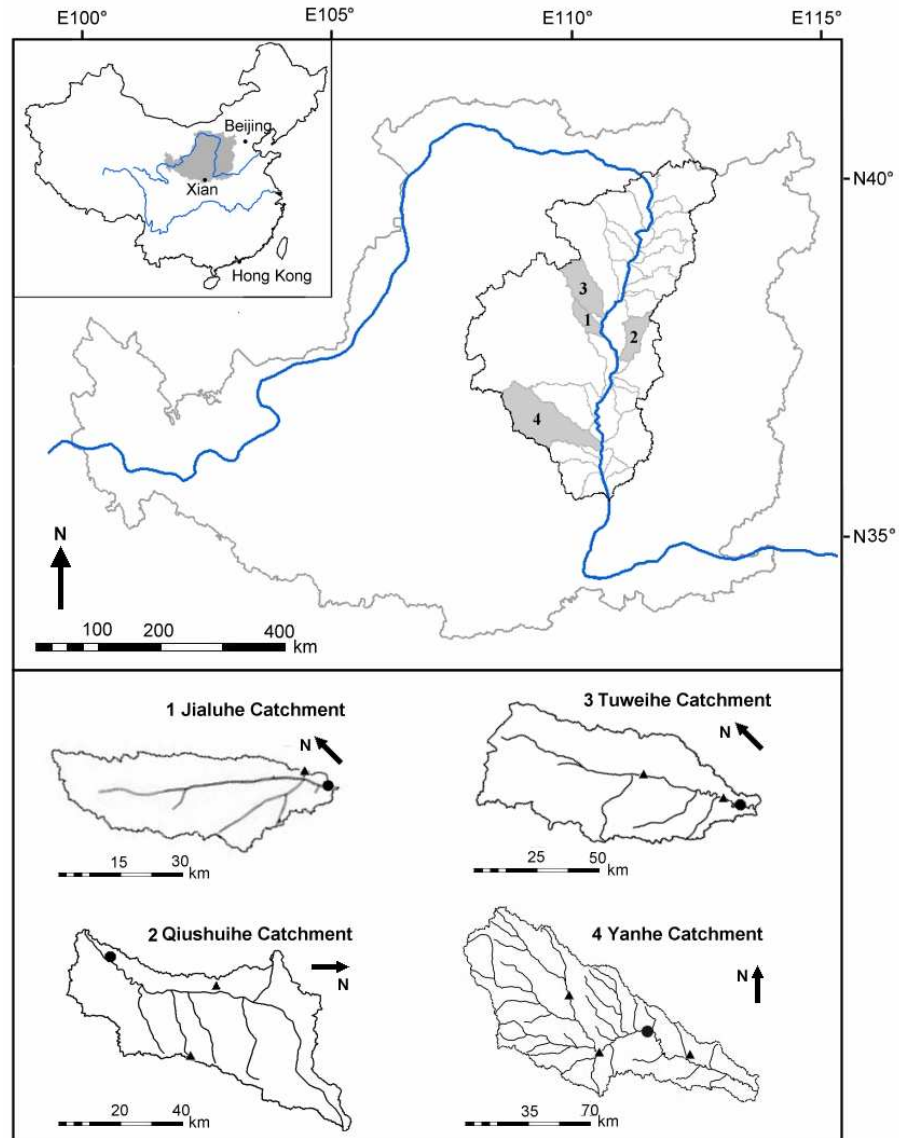




# Study catchments



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ACIAR Final Project Review Meeting - Yangling, China, October 2005



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# Sediment trapping dam



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# Tree planting



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# Terraces



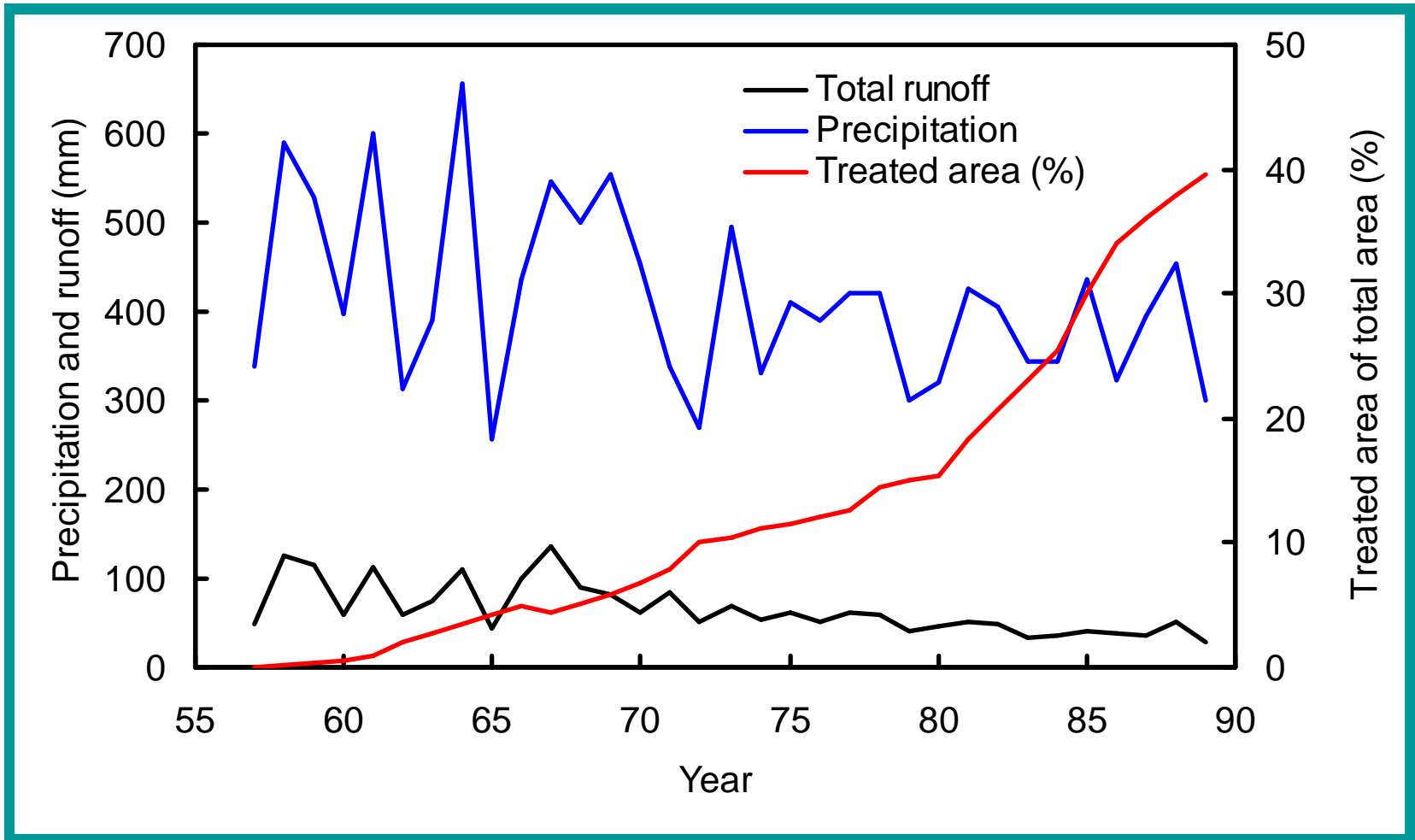
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# Identifying changes





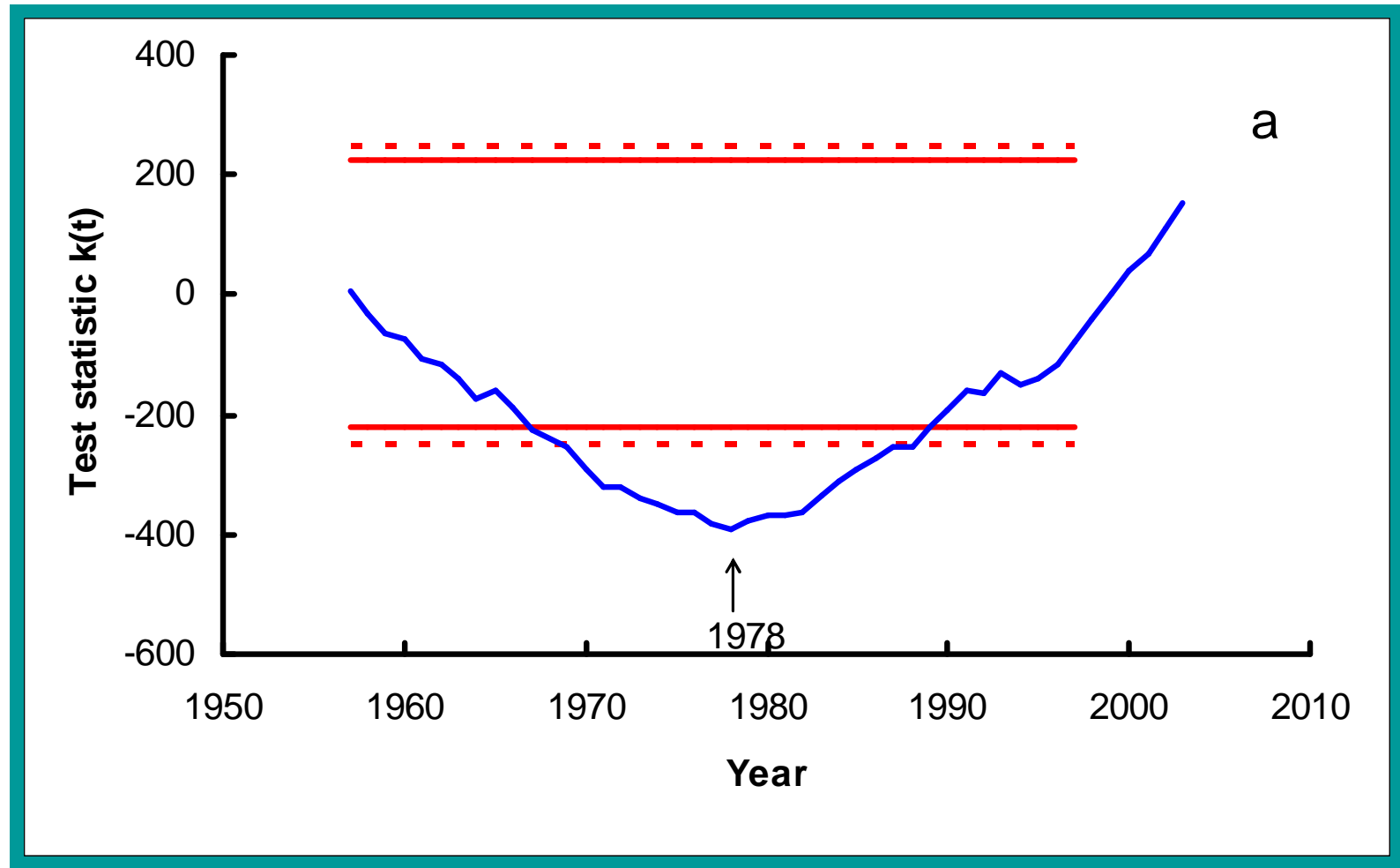
# Complex soil conservation measures

Catchment	Year	Terrace		Dams		Afforestation		Pasture		Total	RPC
		km <sup>2</sup>	RA(%)	km <sup>2</sup>	RA(%)	km <sup>2</sup>	RA(%)	km <sup>2</sup>	RA(%)	km <sup>2</sup>	%
Jialu (1,134 km <sup>2</sup> )	1959	4.3	<b>26</b>	0.8	5	9.2	<b>55</b>	2.3	14	16.7	<b>1.5</b>
	1969	27.3	<b>36</b>	4.1	5	41.7	<b>56</b>	1.7	2	74.7	<b>6.7</b>
	1979	67.1	<b>36</b>	9.7	5	97.5	<b>53</b>	10.2	6	184.6	<b>16.5</b>
	1989	104.3	<b>25</b>	12.9	3	293.9	<b>69</b>	12.8	3	423.9	<b>37.8</b>
	1996	141.4	<b>30</b>	16.3	3	295.3	<b>63</b>	15.5	3	468.5	<b>41.8</b>
Qiushui (1,989 km <sup>2</sup> )	1959	21.3	<b>50</b>	2.8	7	15.1	<b>35</b>	3.4	8	42.6	<b>2.3</b>
	1969	72.4	<b>59</b>	4.6	4	37.3	<b>30</b>	8.3	7	122.6	<b>6.5</b>
	1979	141.9	<b>51</b>	12.7	5	113.6	<b>41</b>	12.1	4	280.3	<b>15.0</b>
	1989	167.2	<b>42</b>	17.5	4	200.7	<b>50</b>	14.8	4	400.2	<b>21.4</b>
	1996	263.4	<b>42</b>	24.2	4	318.5	<b>51</b>	19.8	3	625.8	<b>33.4</b>
Tuiwei (3,294 km <sup>2</sup> )	1959	1.0	<b>4</b>	0.2	1	25.4	<b>91</b>	1.4	5	28.0	<b>0.9</b>
	1969	10.8	<b>11</b>	1.7	2	77.1	<b>81</b>	6.1	6	95.7	<b>2.9</b>
	1979	31.3	<b>14</b>	7.1	3	174.7	<b>76</b>	16.1	7	229.2	<b>7.0</b>
	1989	45.5	<b>5</b>	11.1	1	754.5	<b>90</b>	28.8	3	839.9	<b>25.8</b>
	1996	66.5	<b>6</b>	15.5	1	1021.6	<b>90</b>	37.4	3	1140.9	<b>35.1</b>
Yanhe (7,725 km <sup>2</sup> )	1959	4.1	<b>8</b>	4.6	9	41.3	<b>82</b>	0.3	1	50.4	<b>0.9</b>
	1969	47.2	<b>21</b>	15.8	7	161.3	<b>71</b>	3.7	2	228.0	<b>3.9</b>
	1979	97.5	<b>23</b>	28.7	7	286.9	<b>67</b>	17.5	4	430.7	<b>7.3</b>
	1989	174.3	<b>15</b>	37.8	3	840.7	<b>70</b>	145.2	12	1198.1	<b>20.3</b>
	1996	275.6	<b>16</b>	41.7	2	1100.2	<b>66</b>	259.9	15	1677.3	<b>28.5</b>



# Identifying trends in annual streamflow

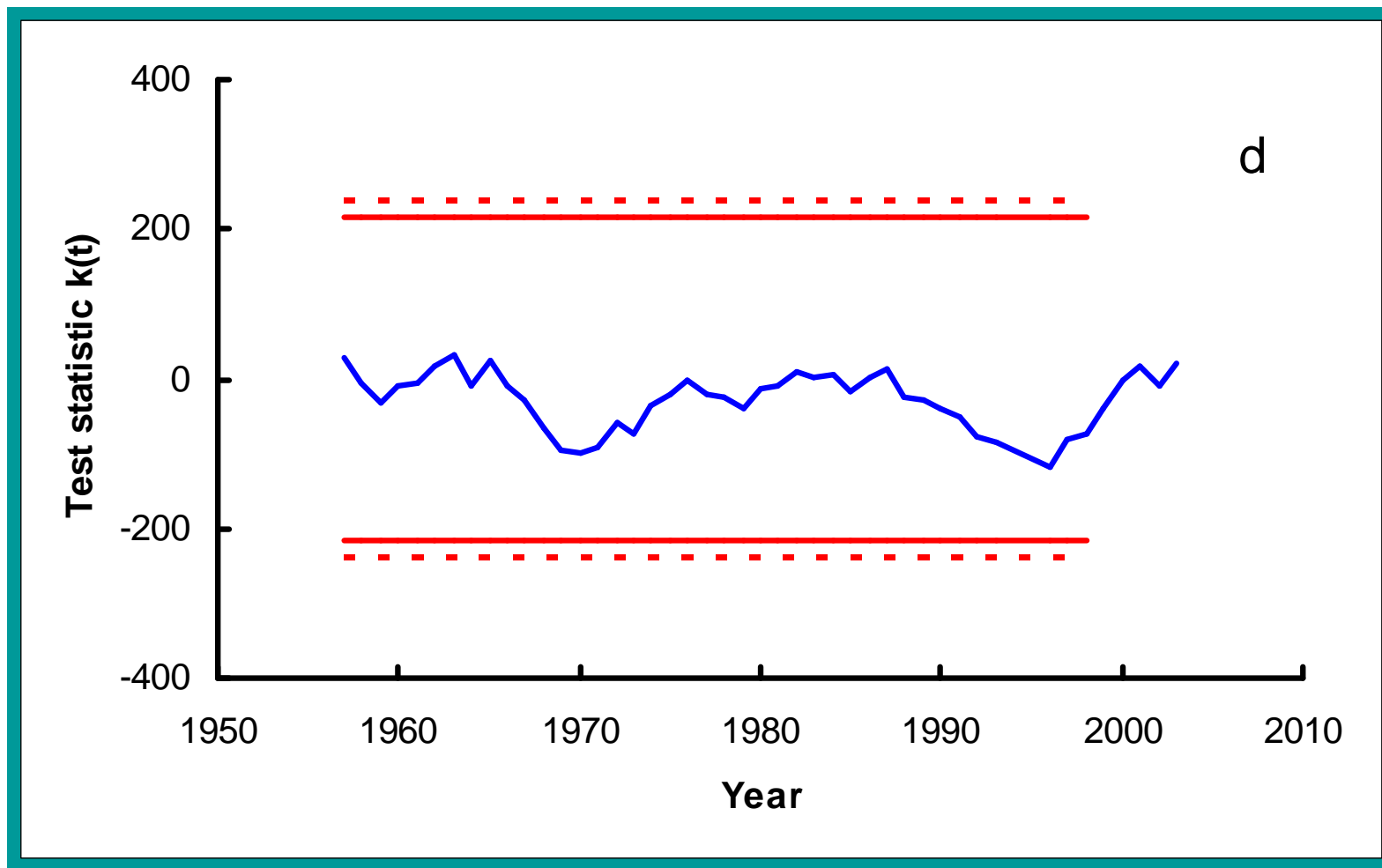
## Jialu River





# Identifying trends in annual streamflow

## Yanhe River

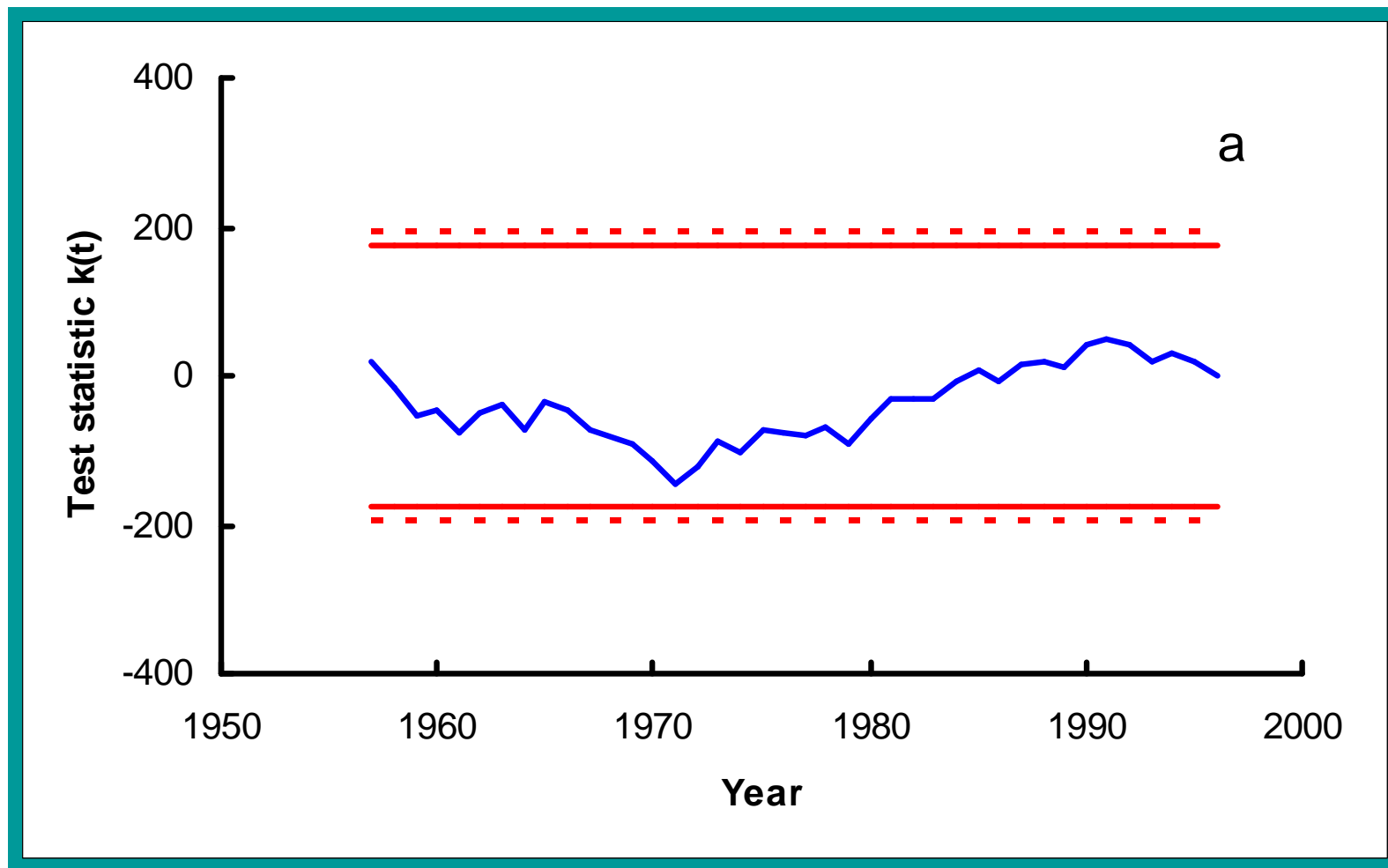




# Identifying trends in annual rainfall



## Jialu River

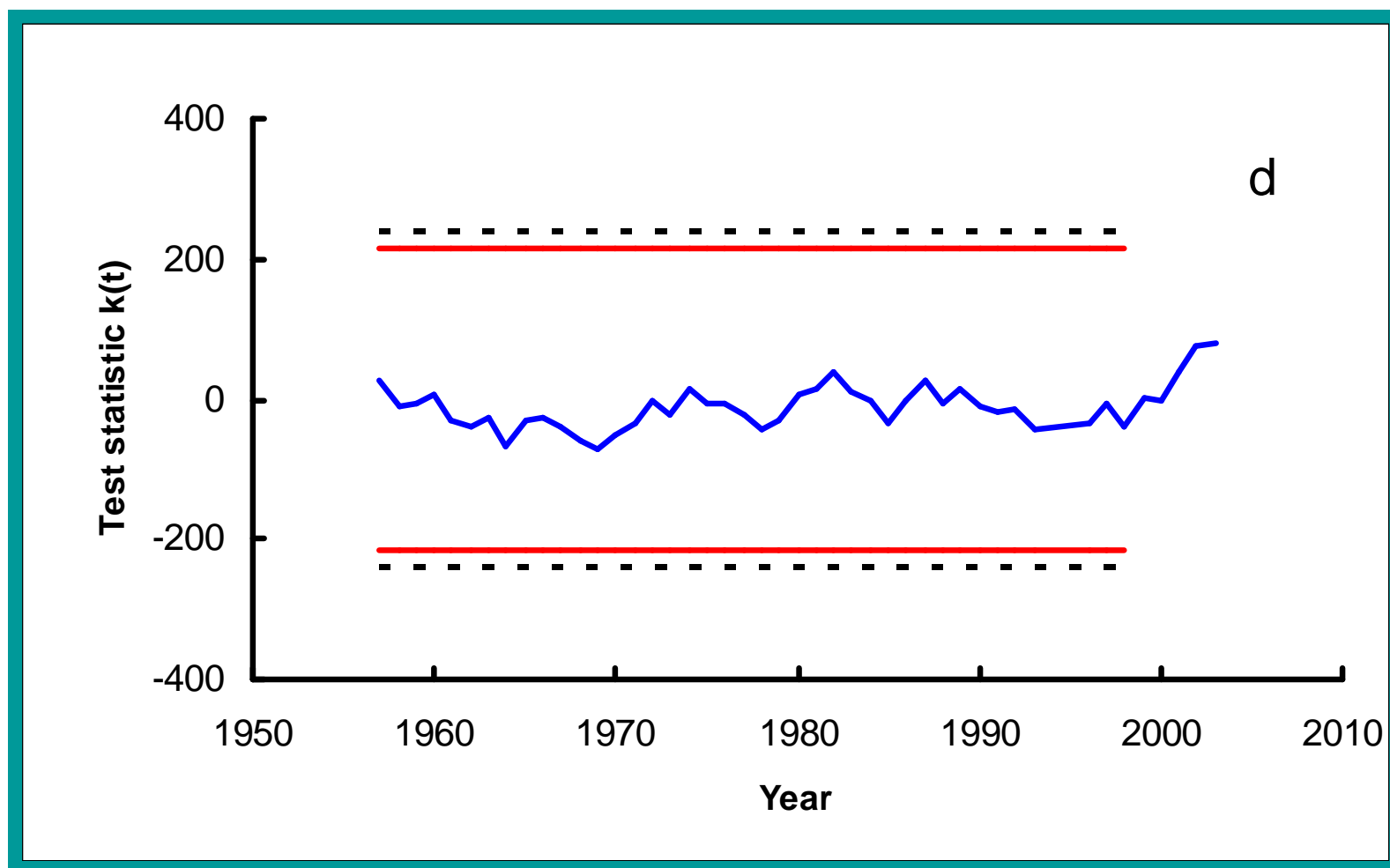




# Identifying trends in annual rainfall



## Yanhe River

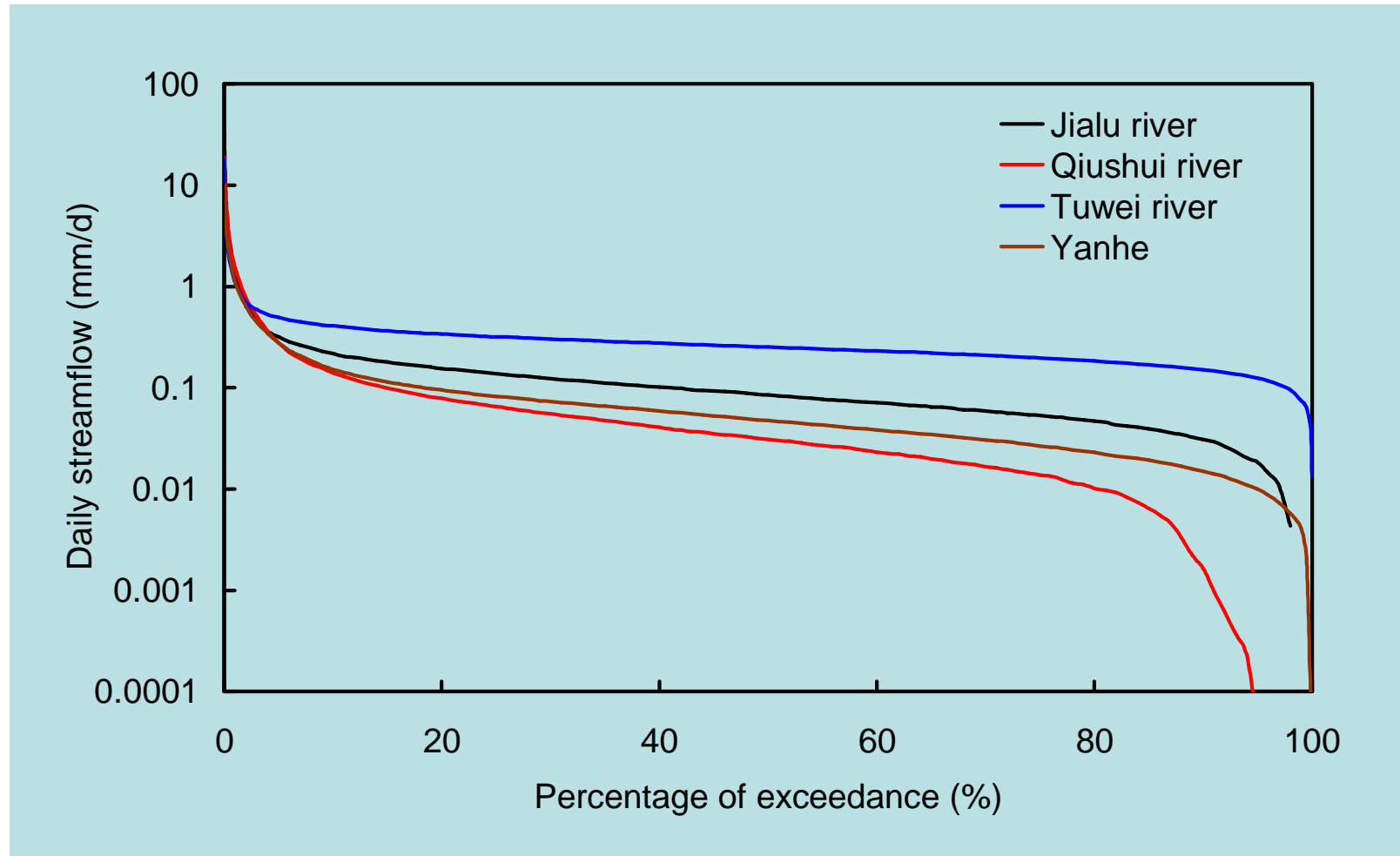




# Characteristics of flow duration curves (FDCs)



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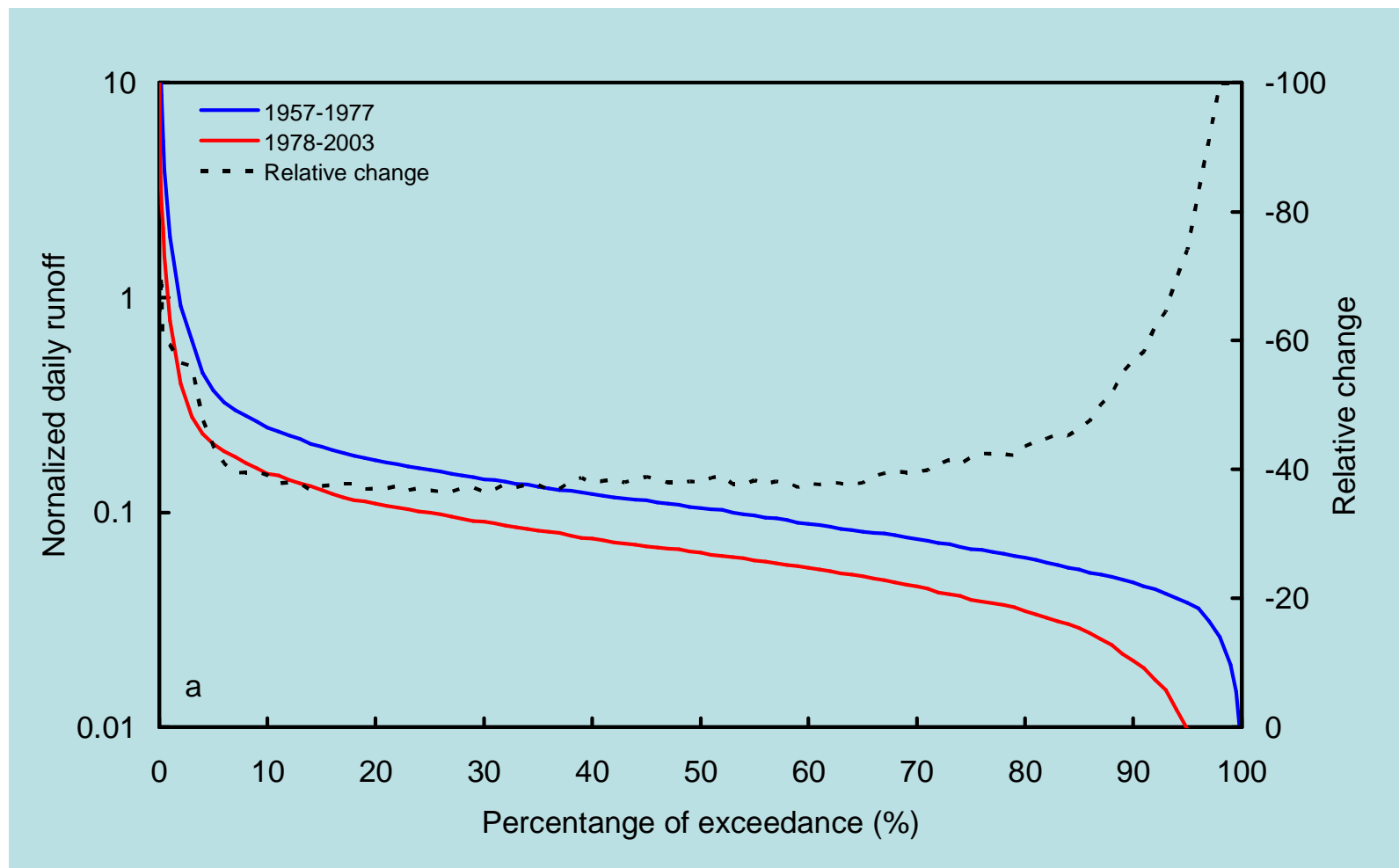


# Changes in flow duration curves (FDCs)

## Jialu River



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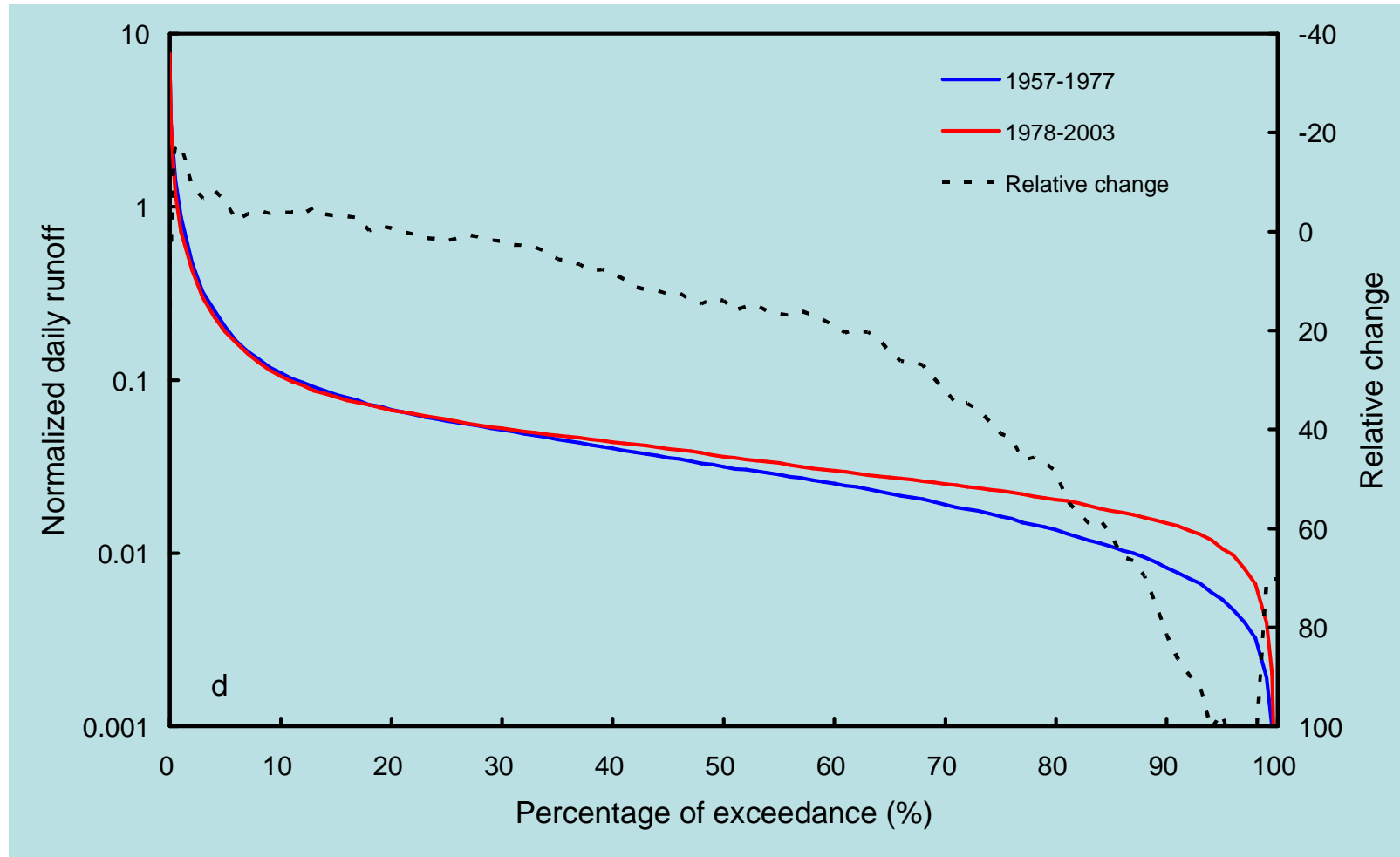


# Changes in flow duration curves (FDCs)



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## Yanhe River





# Changes in streamflow characteristics



Catchment	Index	1960s	1970s	1980s	1990s
	$Q_{50}$	0.11	0.11	0.08	0.05
<b>Jialu</b>	$Q_5/Q_{50}$	3.65	3.13	2.69	3.49
	$Q_{95}/Q_{50}$	0.40	0.32	0.31	0.12
	$Q_{50}$	0.04	0.03	0.02	0.02
<b>Qiushui</b>	$Q_5/Q_{50}$	8.71	7.65	7.05	7.41
	$Q_{95}/Q_{50}$	0.09	0.02	0.03	0.00
	$Q_{50}$	0.27	0.27	0.24	0.23
<b>Tuwei</b>	$Q_5/Q_{50}$	1.93	1.78	1.87	1.66
	$Q_{95}/Q_{50}$	0.60	0.57	0.53	0.47
	$Q_{50}$	0.03	0.03	0.04	0.03
<b>Yanhe</b>	$Q_5/Q_{50}$	6.14	5.66	5.08	5.44
	$Q_{95}/Q_{50}$	0.15	0.22	0.31	0.31



# Conclusions



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- The soil conservation measures in this region have modified the stream-flow characteristics in the last 50 years.

- Significant changes in annual stream-flow occurred in the year 1978 for the Jialu, Quishui, and Tuwei River catchments with strong decreasing trends during the period of 1979 to 2003.

- The exception to this is the Yanhe catchment, where a slight increase in annual stream-flow has been found.





# Conclusions



- The stream-flow regimes of the catchments have been significantly modified by the soil conservation measures, leading to reductions in stream-flow.
- The reduction in most flows for catchments in this region varies between 20 to 45%. However, the reduction in low flows tends to be more dramatic.





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Thank You

