

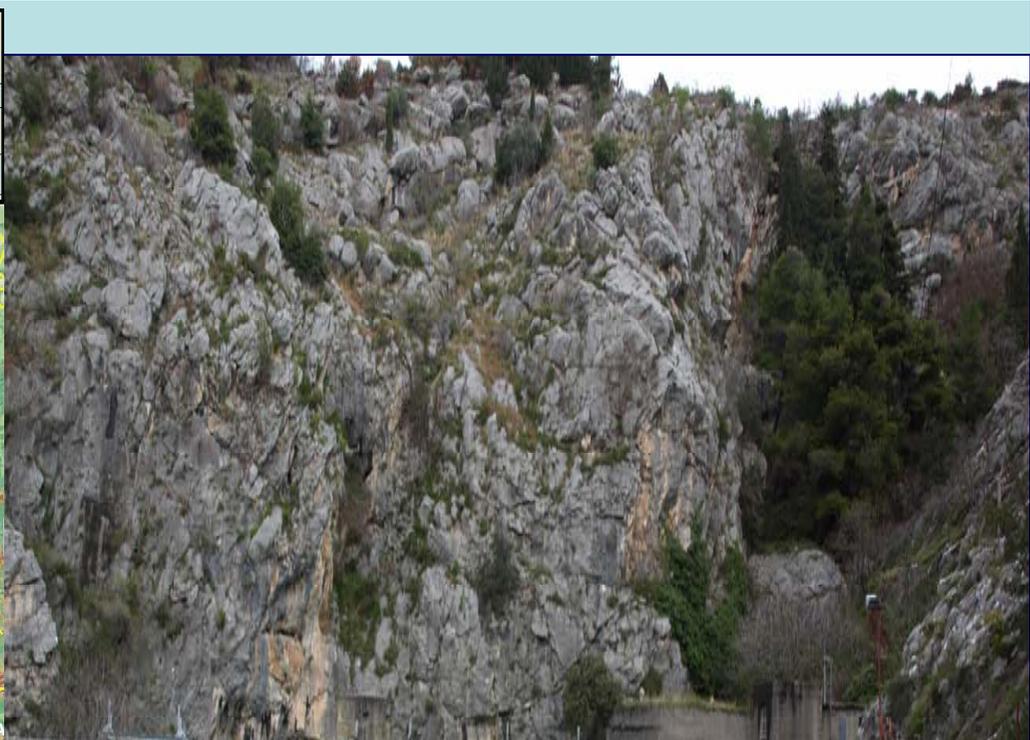
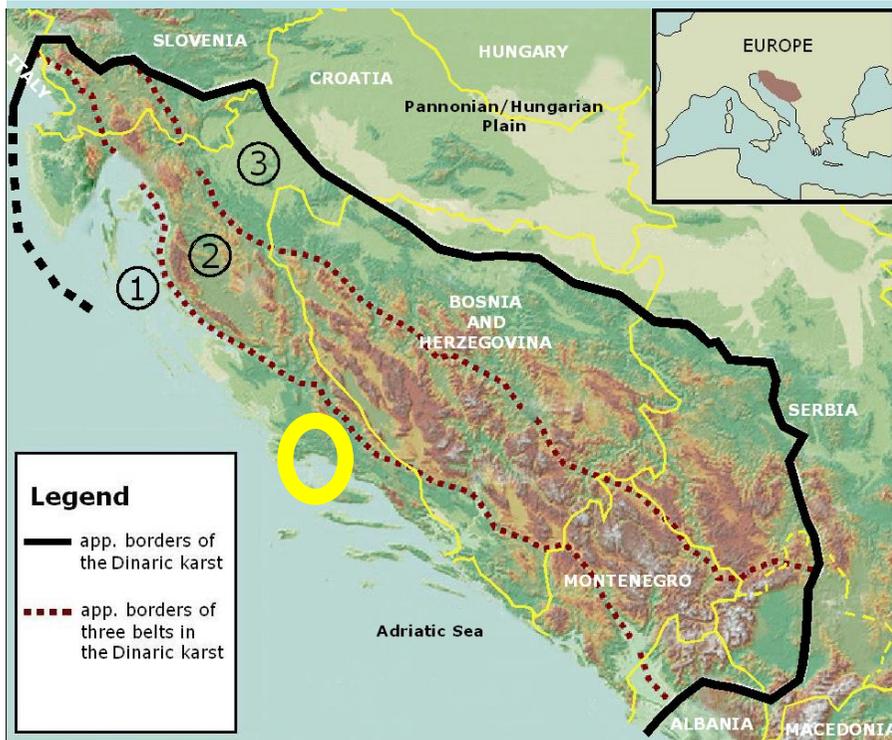
Hydrology of the karst spring Jadro (Croatia)

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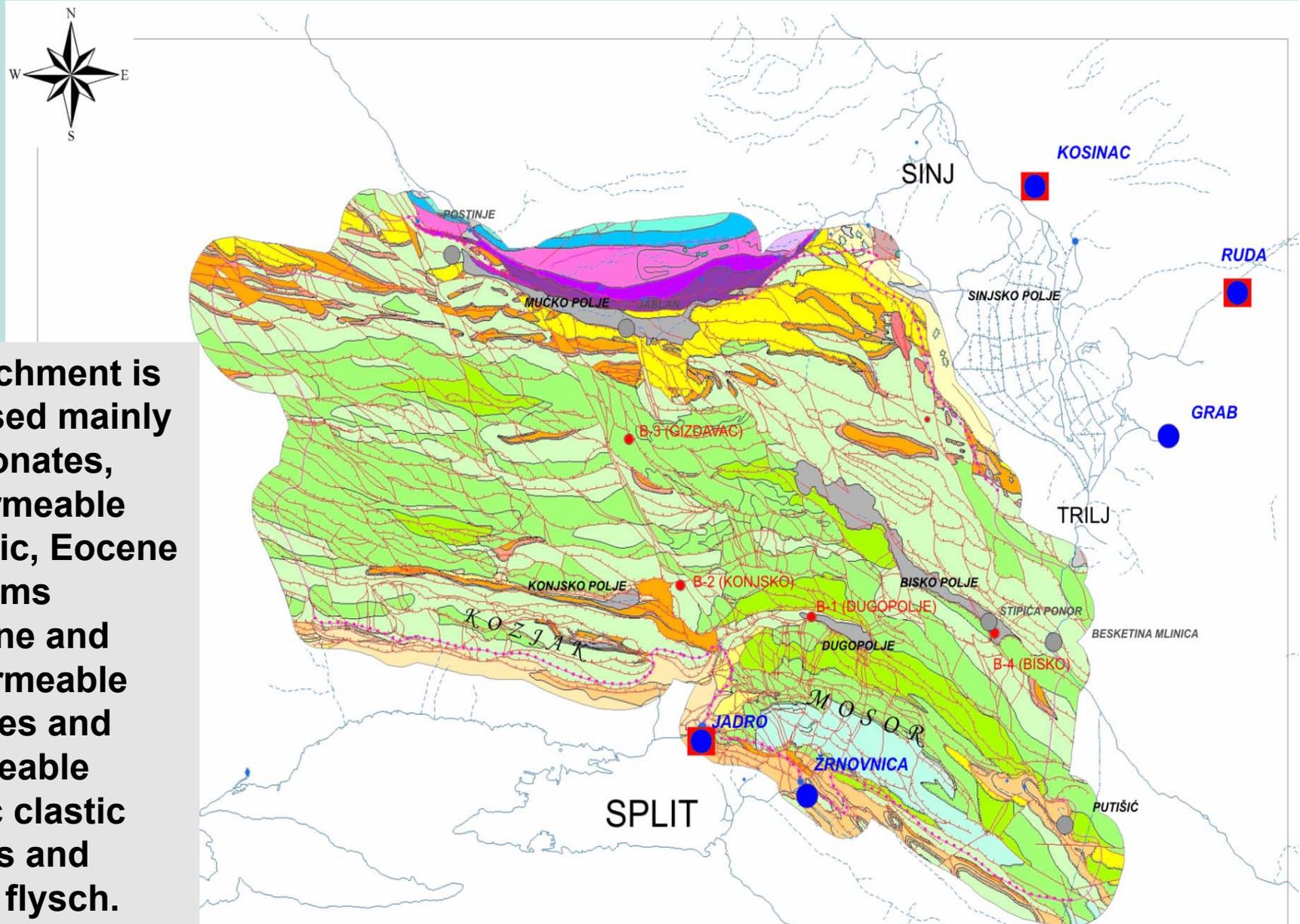
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Geological map of the Jadro and Žrnovnica catchment

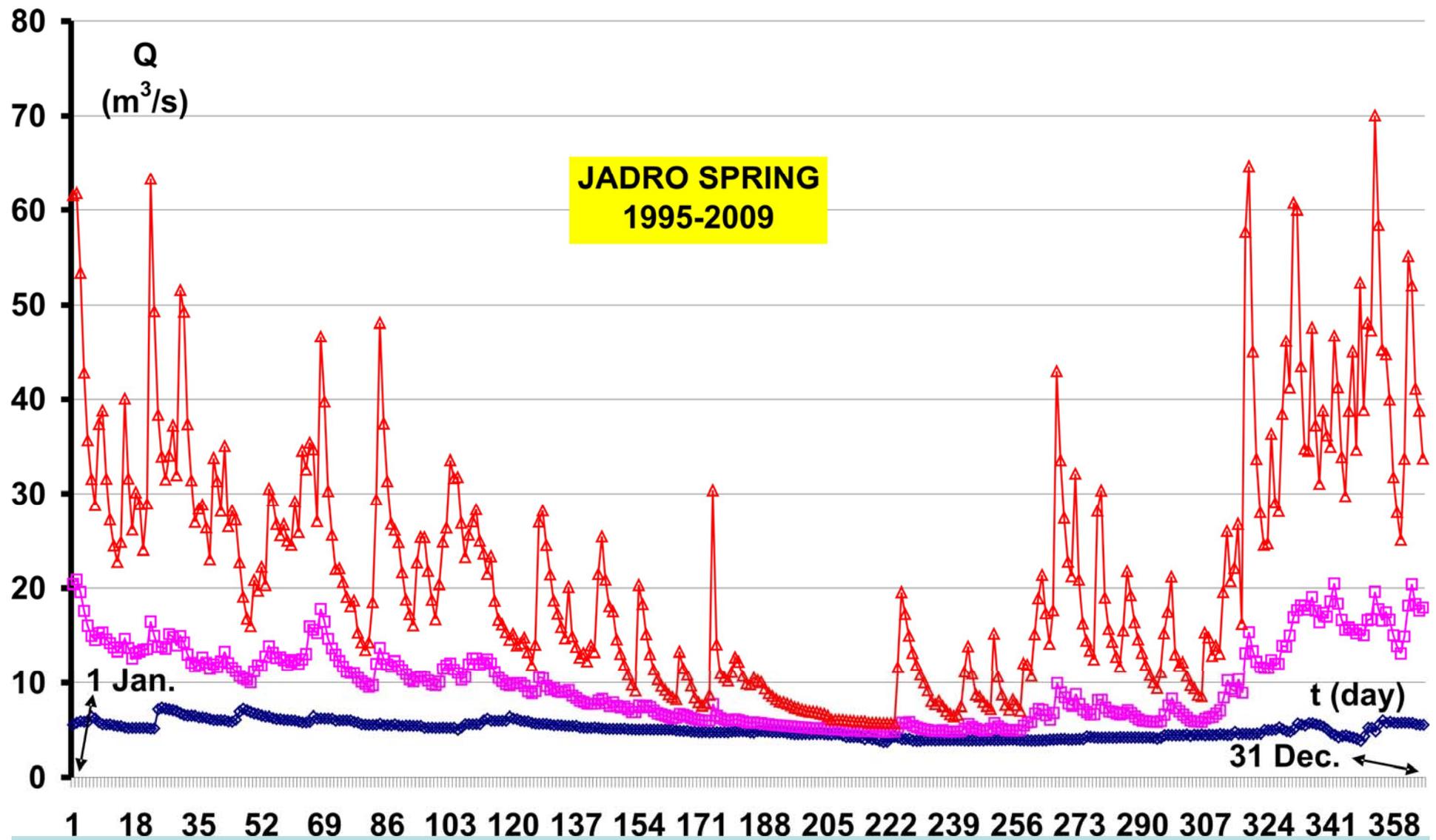
The catchment is composed mainly of carbonates, well permeable Mesozoic, Eocene and Permian limestone and less permeable dolomites and impermeable Triassic clastic deposits and Eocene flysch.





The Jadro Spring is principal water-supply source for the Split town and wider surrounding area (> 300,000 inhabitants). Forming the river Jadro which inflow after the 4.5 km into the Adriatic Sea.





$Q_{\text{mean}} = 9.85 \text{ m}^3/\text{s}$ (mean annual discharge)

$Q_{\text{max}} = 70.1 \text{ m}^3/\text{s}$ (18 Dec. 2004) (limited outflow capacity)

$Q_{\text{min}} = 3.72 \text{ m}^3/\text{s}$ (07 Aug. 1995)

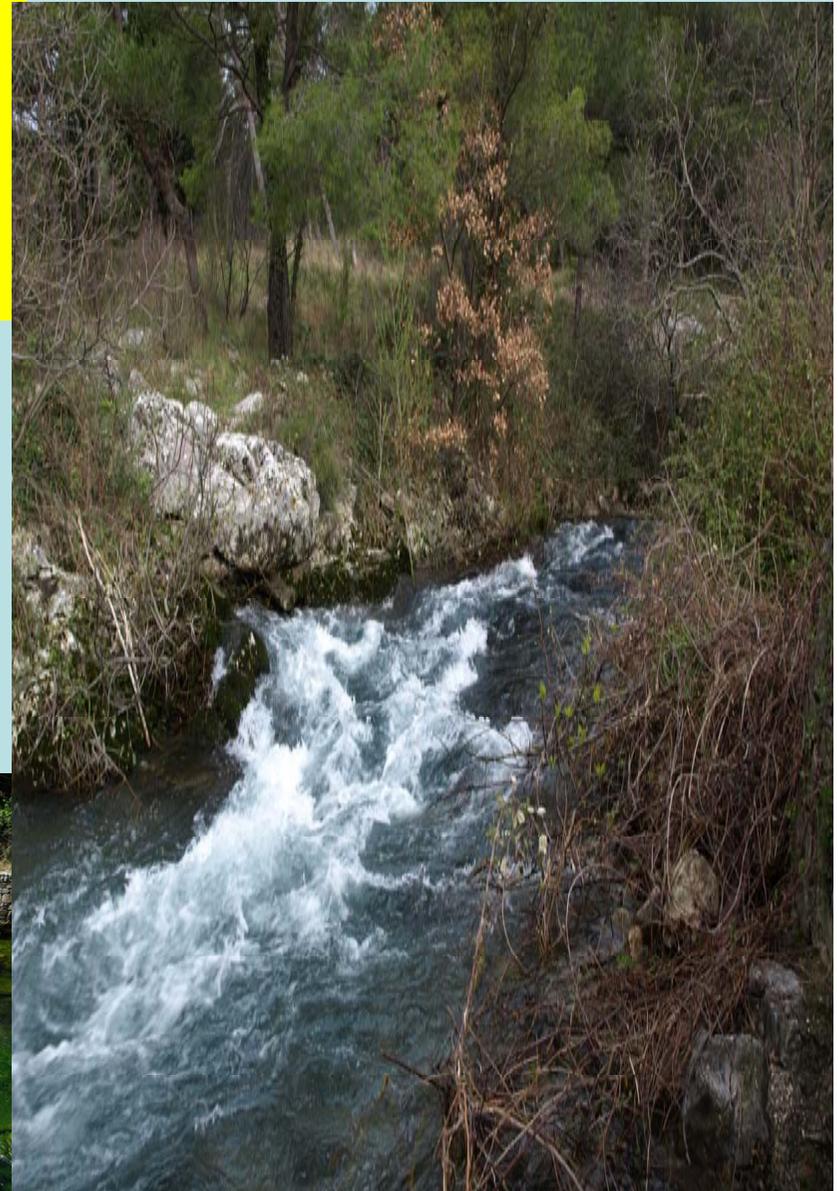
ŽRNOVNICA SPRING

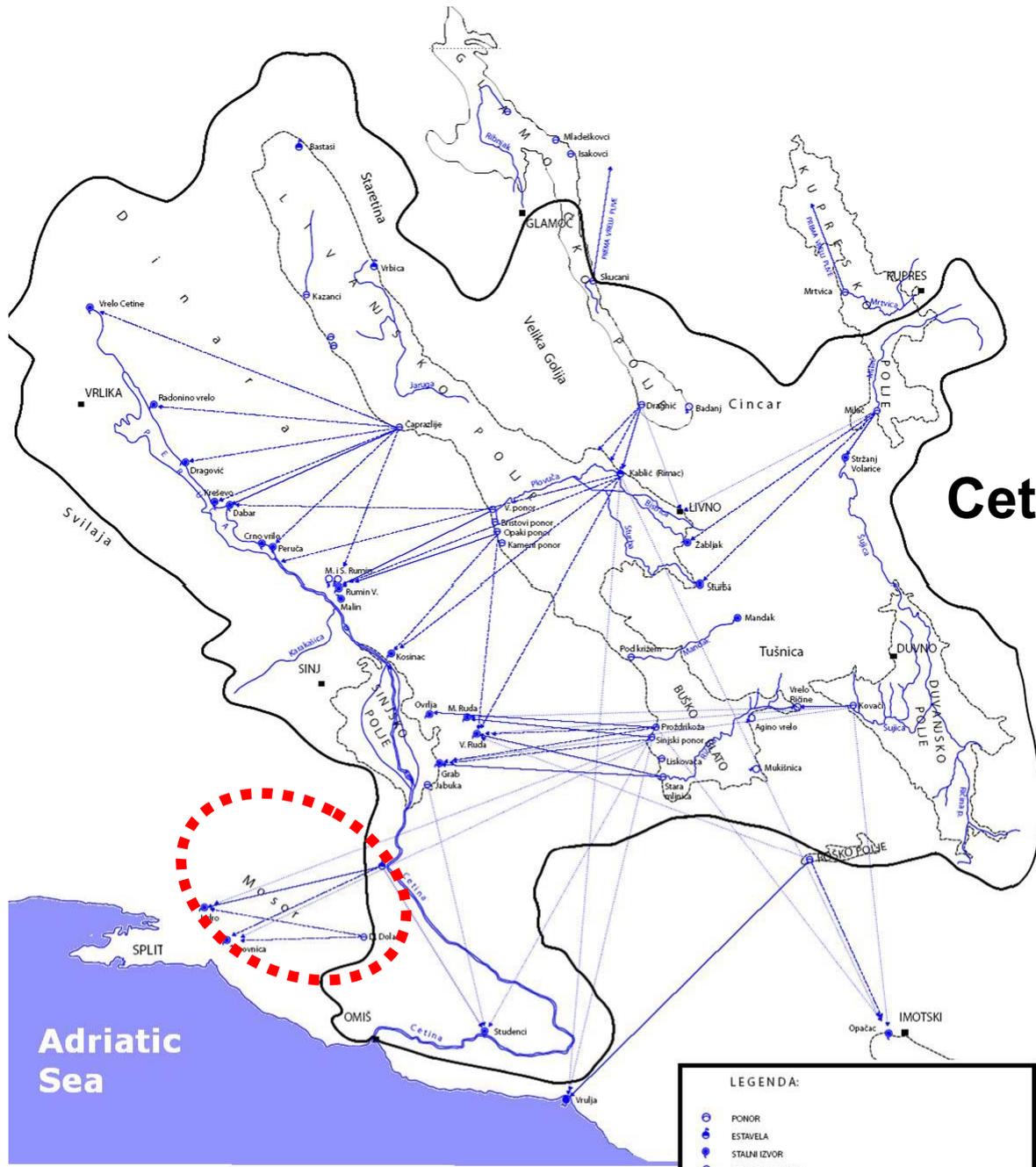
1990-2009

$Q_{\text{mean}} = 1.83 \text{ m}^3/\text{s}$

$Q_{\text{max}} = 16.7 \text{ m}^3/\text{s}$ (18 Dec. 2004)

$Q_{\text{min}} = 0.215 \text{ m}^3/\text{s}$ (9, 10, 11, 14 Sep. 1993)





Cetina River catchment

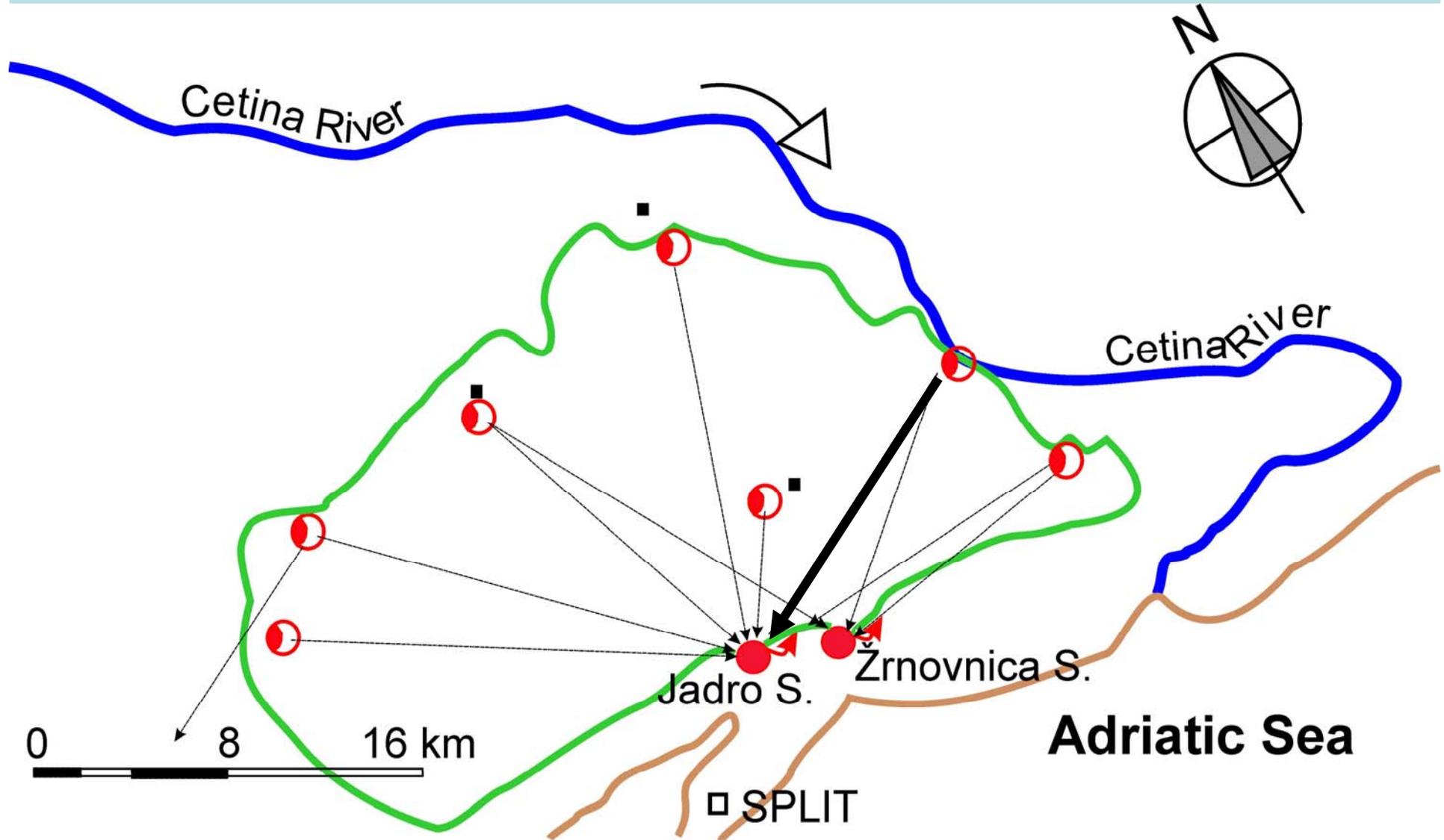
LEGENDA:

- ⊖ PUNOR
- ⊕ ESTAVELA
- ⊙ STALNI IZVOR
- ⊙ POVREMENI IZVOR
- UTVRBENA JAKA PODZEMNA VEZA
- - - UTVRBENA PODZEMNA VEZA
- ⋯ PROBLEMATIČNA PODZEMNA VEZA
- ⋯ GRANICA SLIVA CETINE

IZVOR PODATAKA:
 ANTUN MAGDALENIĆ
 "HIDROGEOLOGIJA SLIVA
 CETINE" - disertacija
 Zagreb, 1970. god.



Tracing experiments





Dugopolje



Konjsko

Catchment area and boundaries !!???

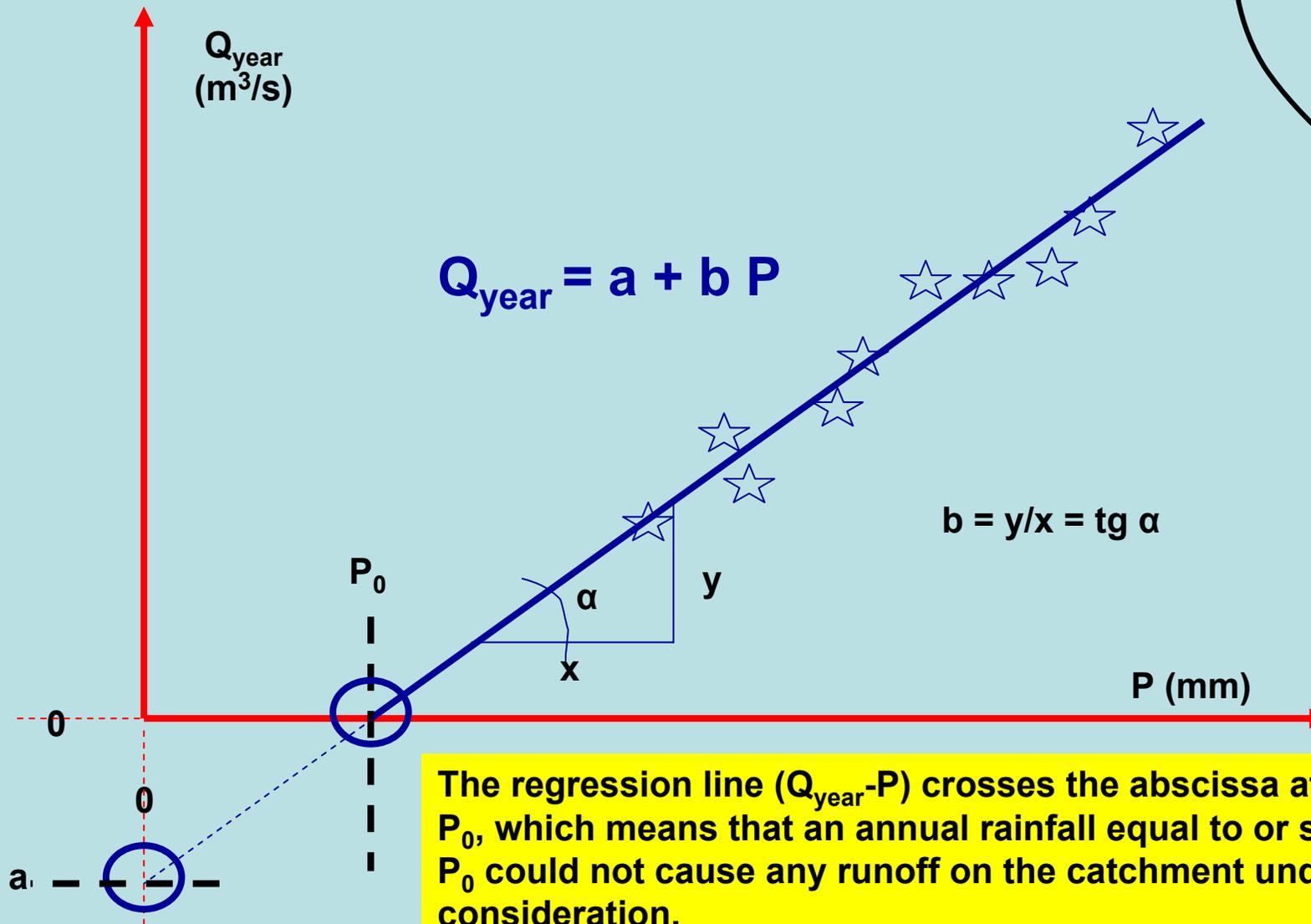


Gizdovac

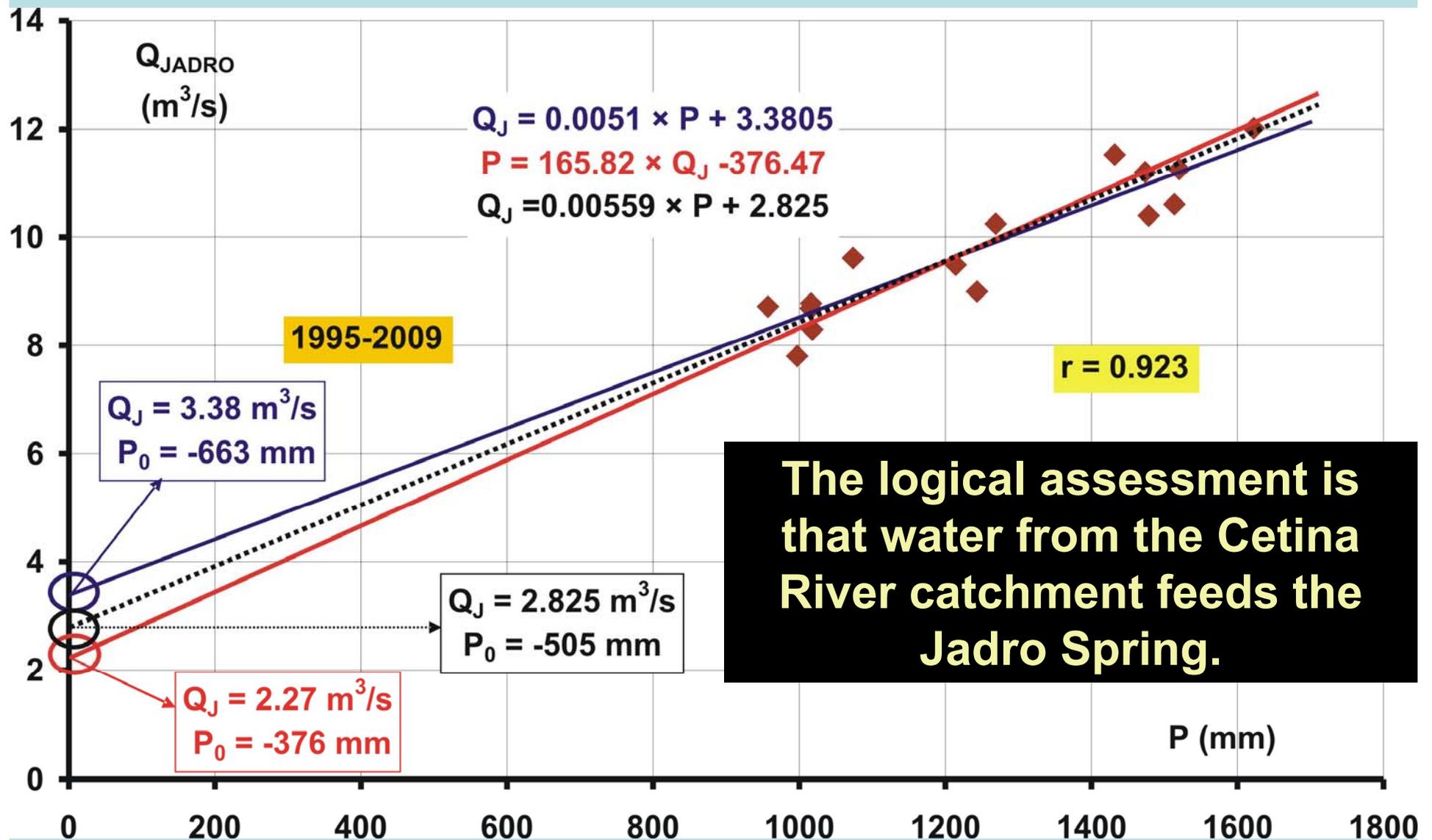


Bisko Polje

Relationship between annual runoff (Q_{year}) and annual rainfall (P) on the catchment A



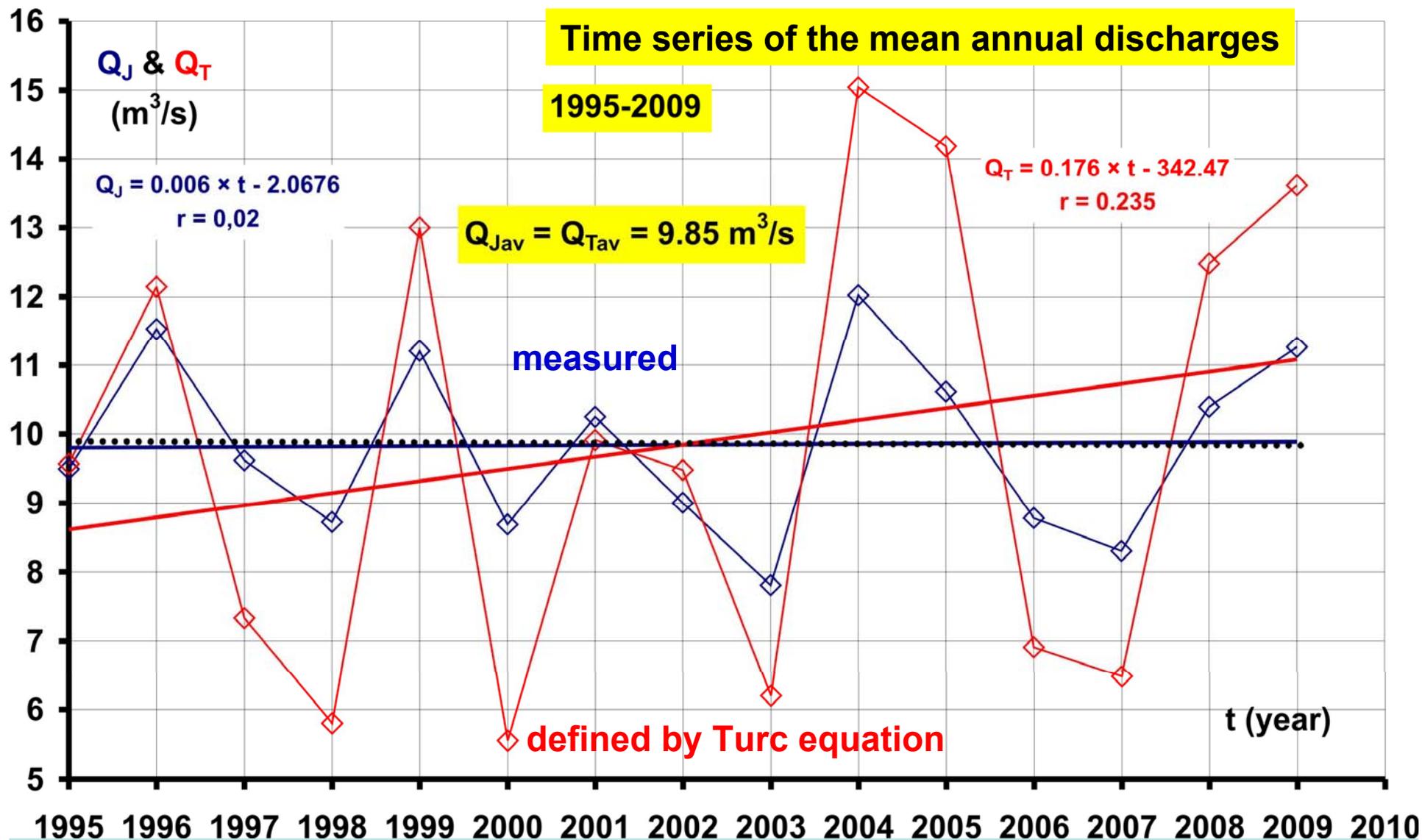
The regression line ($Q_{\text{year}}-P$) crosses the abscissa at the point P_0 , which means that an annual rainfall equal to or smaller than P_0 could not cause any runoff on the catchment under consideration.



The logical assessment is that water from the Cetina River catchment feeds the Jadro Spring.

P_0 is between -376 and -663 mm ???

From the hydrological point of view this is unacceptable and can be explained by fact that the Jadro Spring is feed with water from another source.

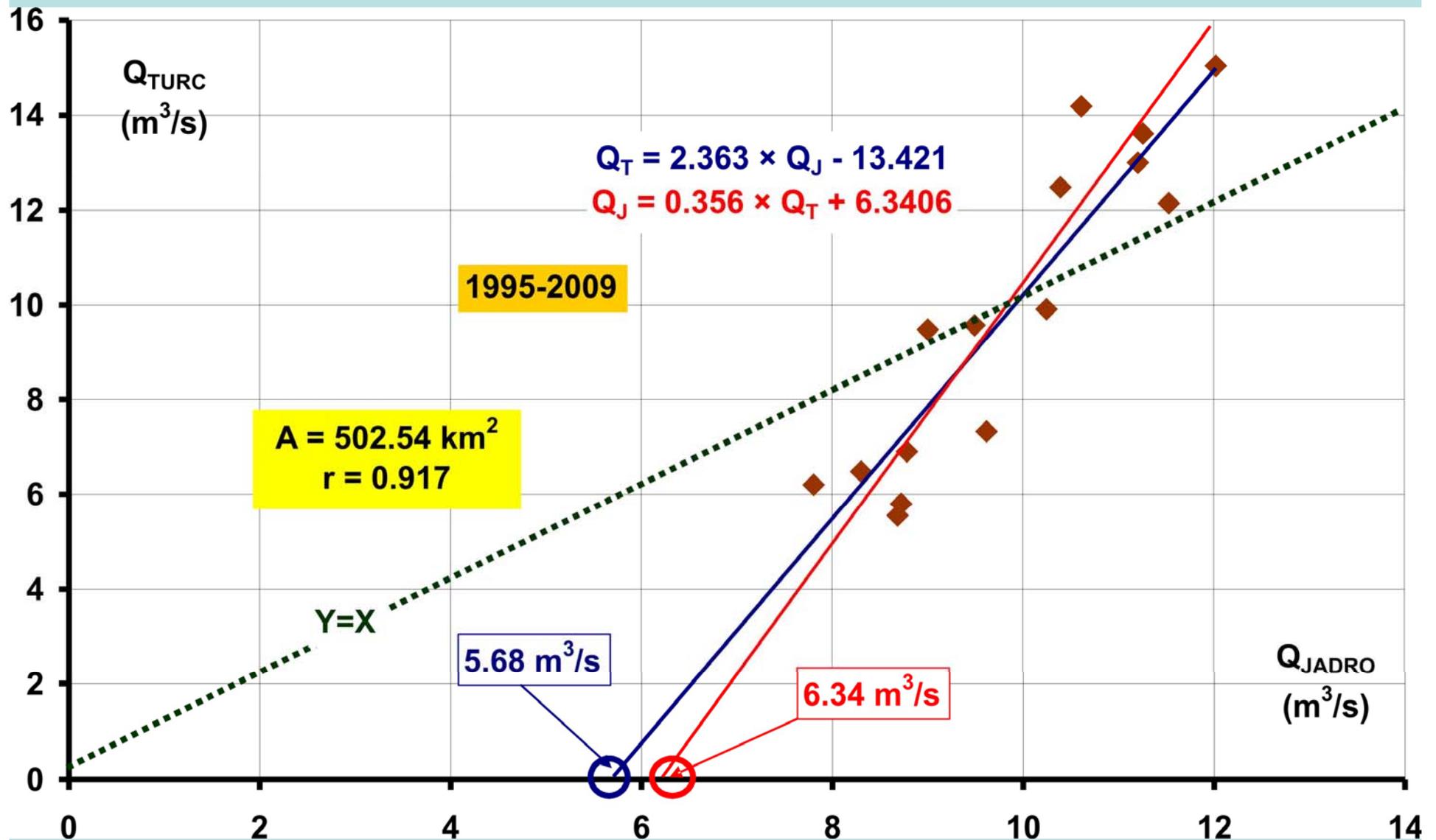


$$D = P / \sqrt{0.9 + (P^2 / L^2)}$$

$$L = 300 + 25 \times T + 0.05 \times T^3$$

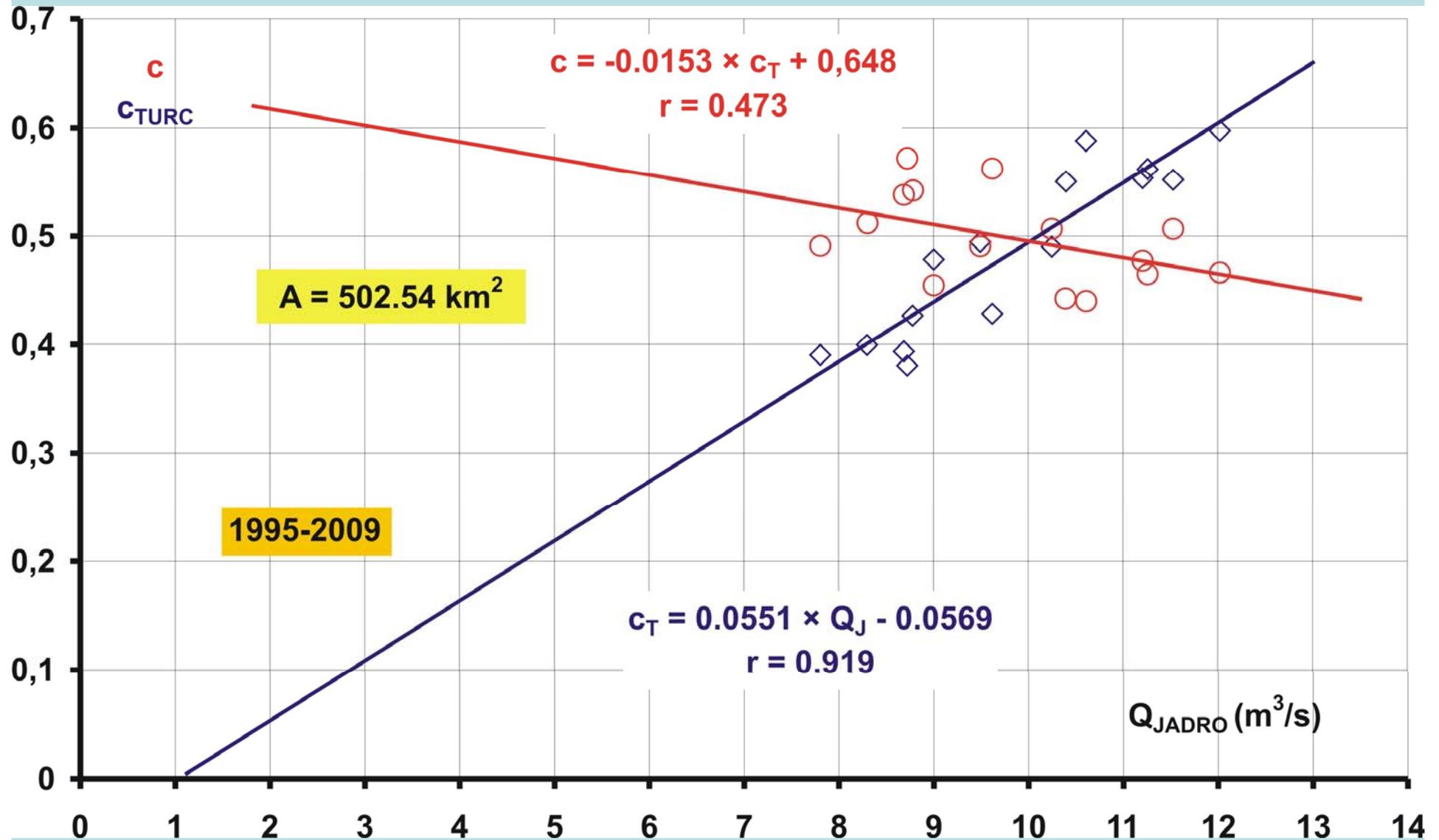
$A_{\text{JADRO-TURC}} = 502.5 \text{ km}^2$
 $A_{\text{ŽRNOVNICA-TURC}} = 80.1 \text{ km}^2$

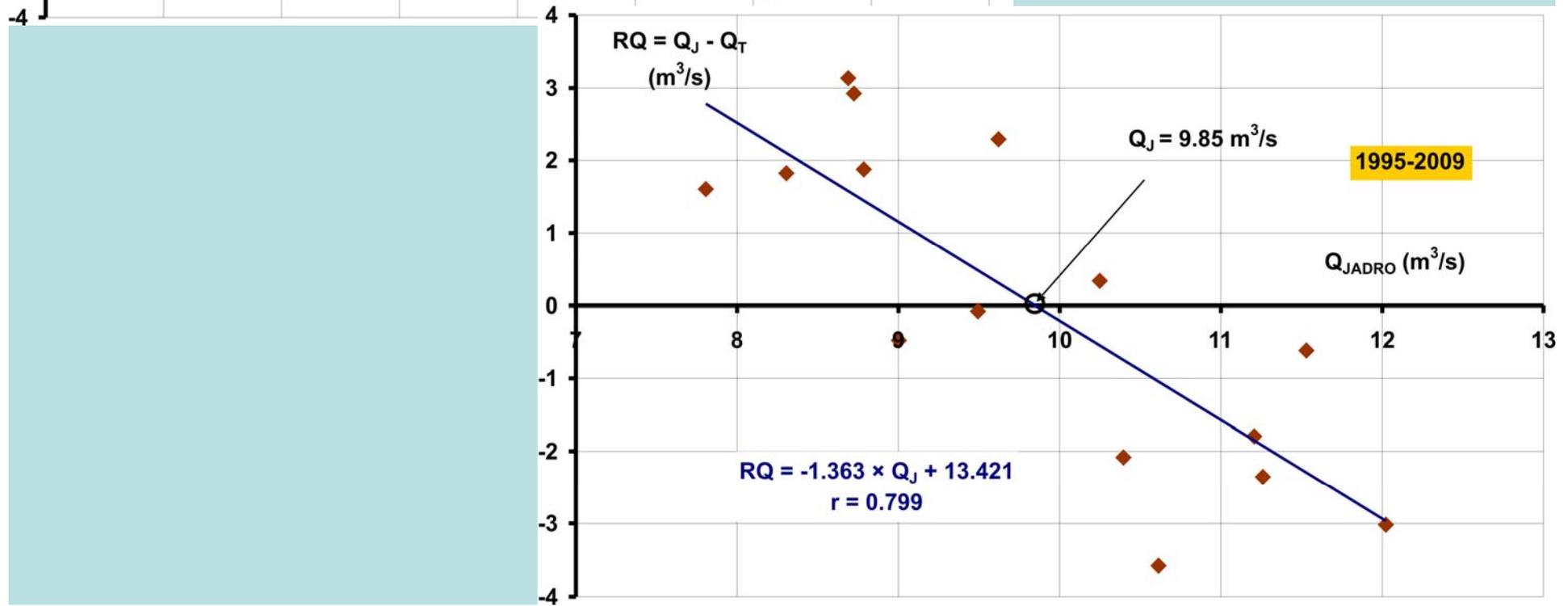
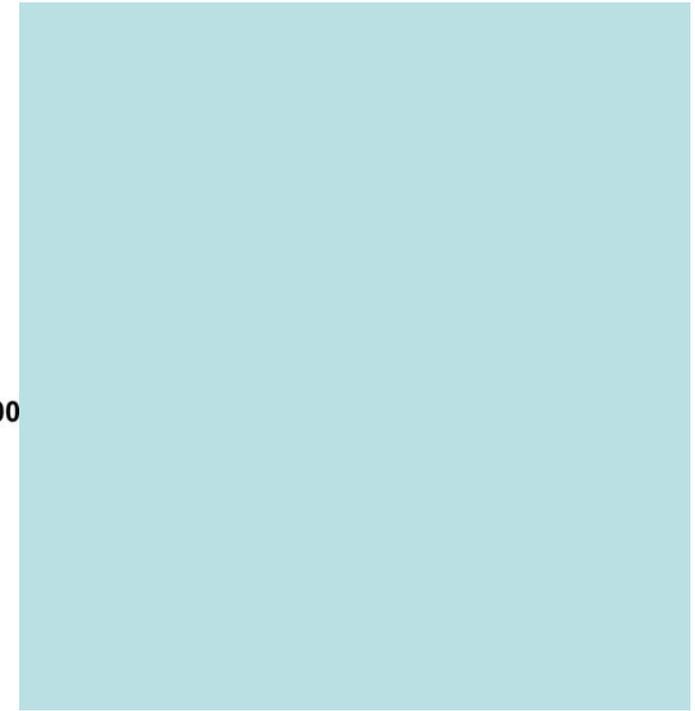
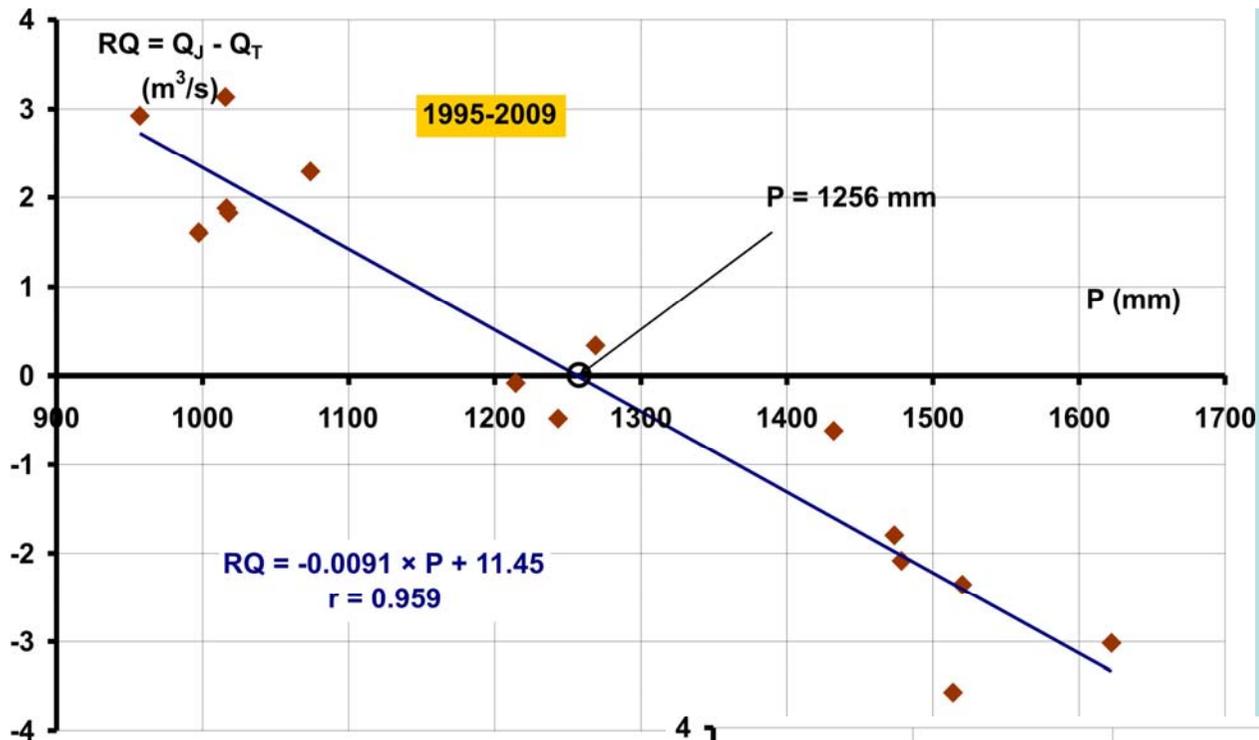
Relationship between the Jadro Spring mean annual discharges defined by Turc equation (Q_{TURC}) and measured data (Q_{JADRO})



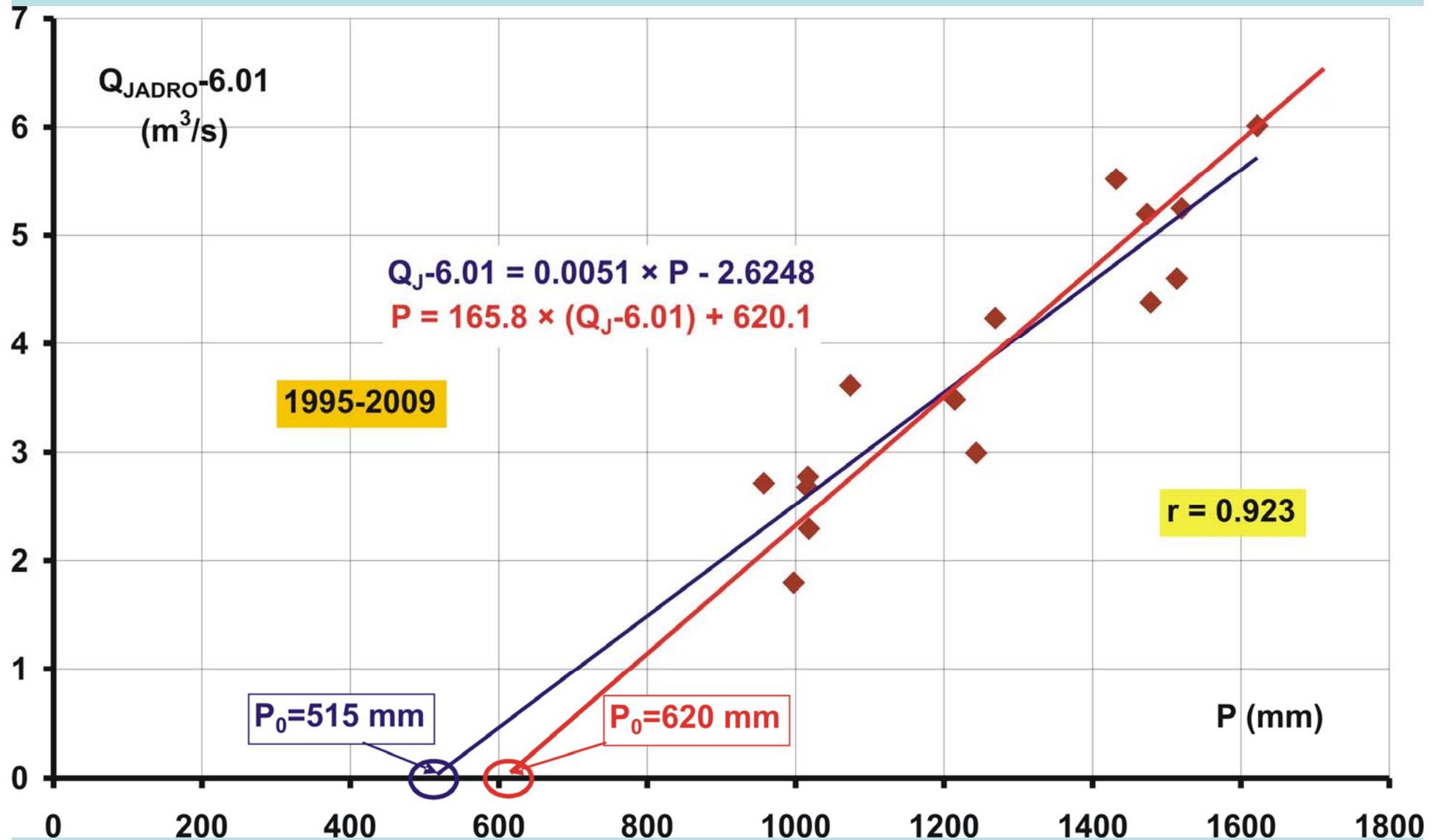
c – annual runoff coefficient

c - measured; c_T - Turc

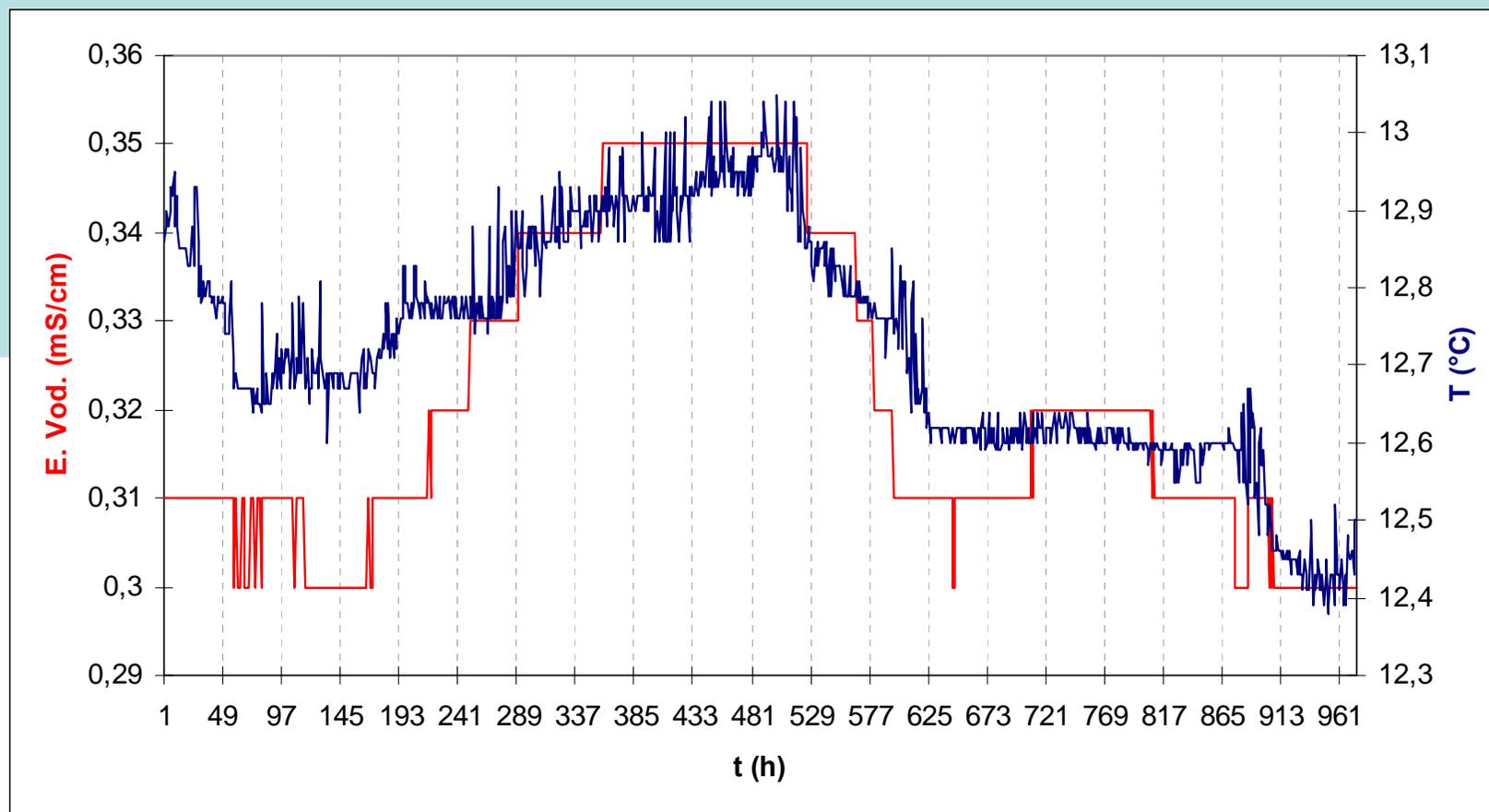




Subtraction of 6.01 m³/s from the measured Jadro Spring mean annual discharges



P_0 is between 515 and 620 mm



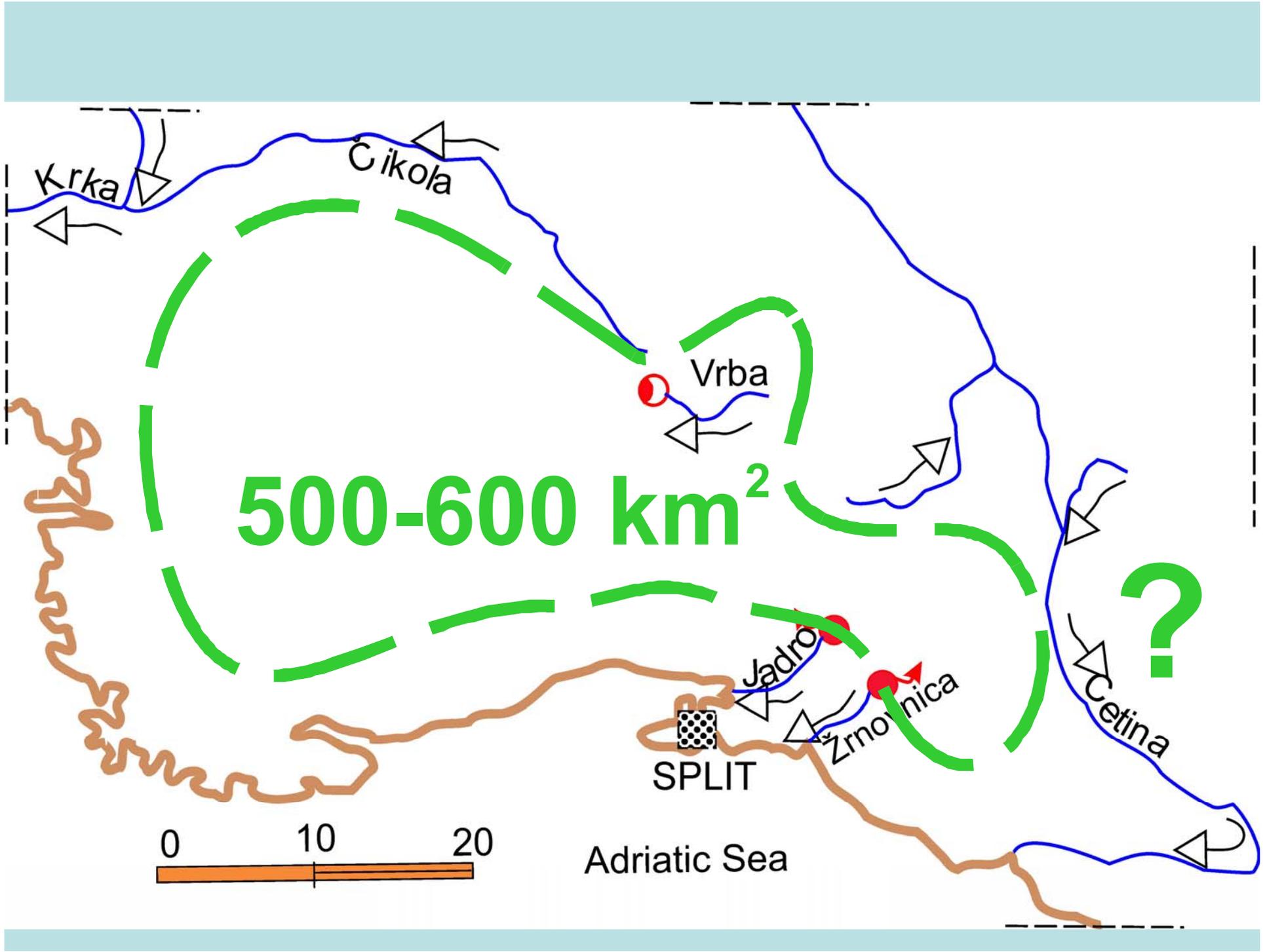
$\Delta t = 1h$

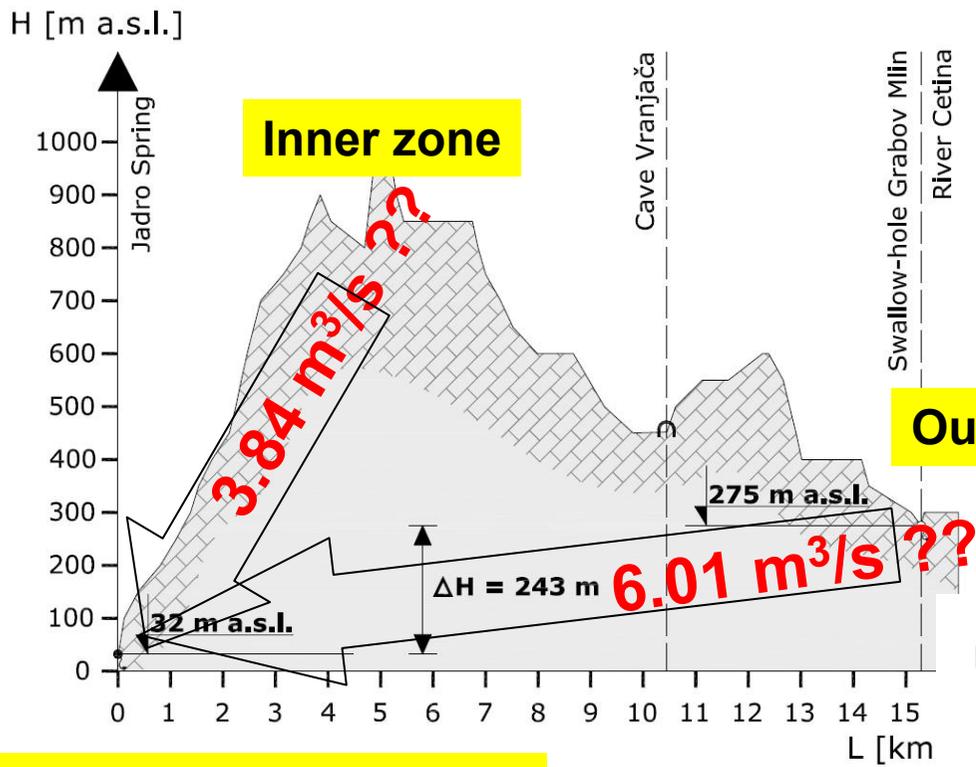
28 Sep. – 8 Nov. 2010 (in progress...)

$T_{\min} = 12.38 \text{ }^{\circ}\text{C} - T_{\max} = 13.05 \text{ }^{\circ}\text{C}$

(1979-1985) $T_{\min} = 10.77 \text{ }^{\circ}\text{C} - T_{\max} = 15.02 \text{ }^{\circ}\text{C}$

$E.C._{\min} = 0.30 \text{ mS/cm} - E.C._{\max} = 0.35 \text{ mS/cm}$





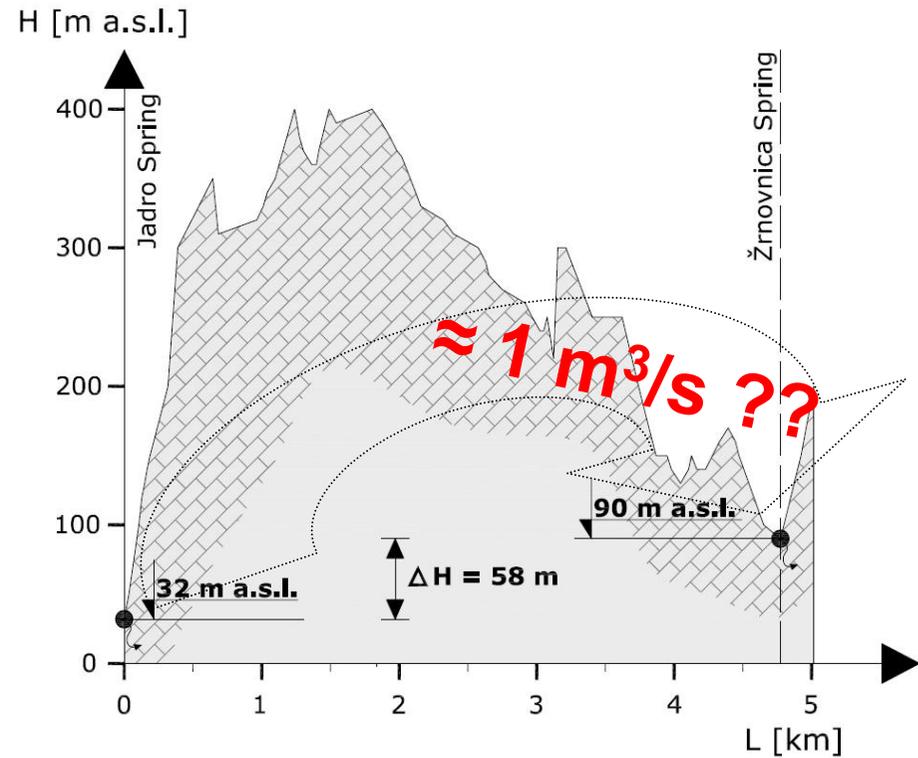
CONCLUSION ?

Outer zone

JADRO S. - ŽRNOVNICA S.

CETINA R. - JADRO S.

Analysis is in progress!





**Thank you for your
kind attention!**