

Venerdì 3 maggio 2024 ore 15:00 – 17:30

Il Seminario si terrà on-line su piattaforma Teams

LA GEOLOGIA NEL MONDO DEL LAVORO

A PIERLUIGI FRIELLO: UN GEOLOGO PROFESSIONISTA, UN AMICO

SEMINARI DI ORIENTAMENTO PER GLI STUDENTI ISCRITTI ALLA LAUREA TRIENNALE IN SCIENZE GEOLOGICHE

E ALLE LAUREE MAGISTRALI NEL SETTORE UTILI PER LA PREPARAZIONE AGLI ESAMI DI STATO

E PER L'AGGIORNAMENTO PROFESSIONALE CONTINUO DEI GEOLOGI PROFESSIONISTI

L'IDROGEOLOGIA TRA SCIENZA E PROFESSIONE

Lucia Mastrorillo

Geologa libera professionista

L'idrogeologia NON studia il dissesto idrogeologico

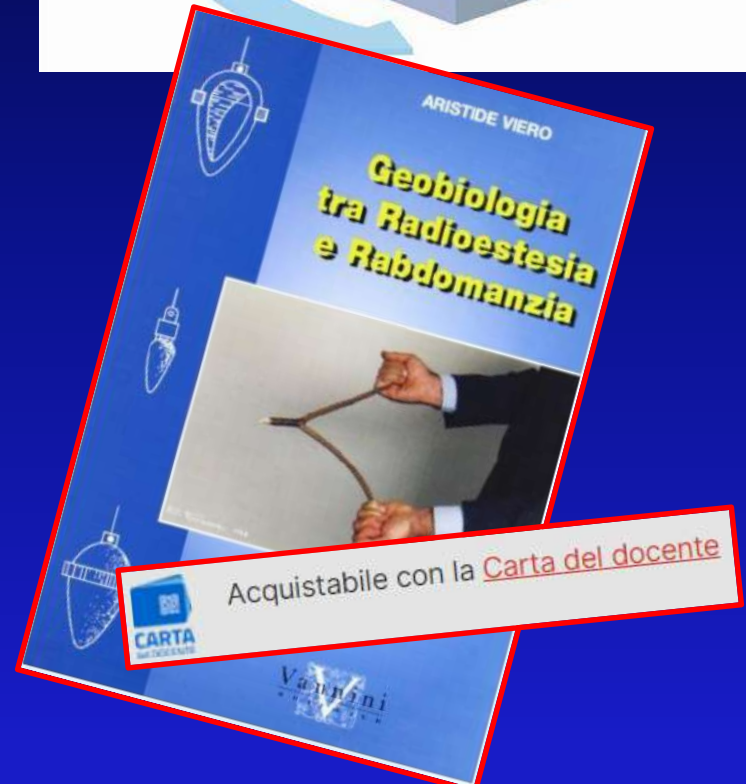
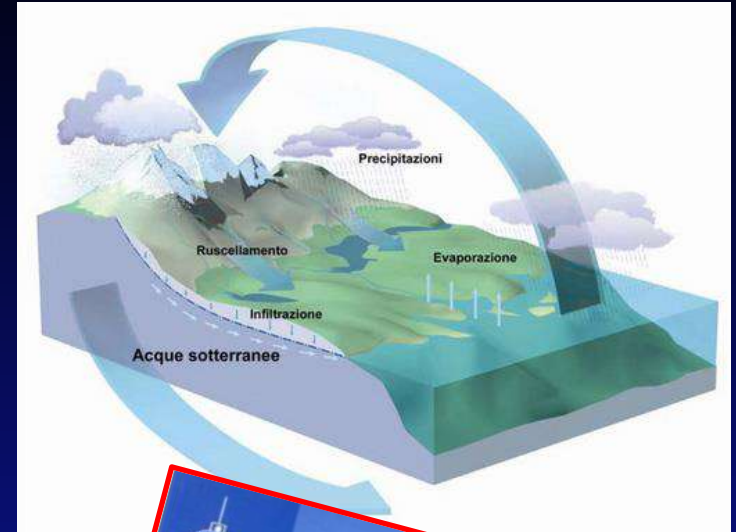
nonostante l'omonimia, idrogeologia ha obiettivi completamente differenti.



Il dissesto idrogeologico è l'insieme dei processi geomorfologici che producono la degradazione del suolo e di conseguenza l'instabilità o la distruzione delle costruzioni che sono localmente presenti; comprende tutti i processi naturali del modellamento della superficie terrestre fino ai processi più impattanti quali frane e alluvioni.

L'idrogeologia è la scienza che studia i processi fisici, chimici e idrodinamici (perché l'acqua sotterranea si muove...) che governano i rapporti acqua - roccia

La natura di tali rapporti, contestualizzata nell'assetto geologico-strutturale di un territorio, favorisce o ostacola la presenza in profondità di serbatoi idrici (acquiferi) che costituiscono la risorsa idrica sotterranea continuamente alimentata e rinnovata dal ciclo idrologico



RIFLESSIONE INIZIALE



Ma siamo così sicuri che
l'acqua sotterranea è
nascosta e invisibile ?

ACQUA SOTTERRANEA

componente nascosta (il più delle volte invisibile) dell'idrosfera di cui
riconosciamo l'importanza indiscussa come risorsa vitale e l'urgente
necessità di una sua tutela per il futuro del pianeta



Fiume Tevere dal Ponte della Scafa - Ostia
Luglio 2016



Portata = Ruscellamento + Flusso di base

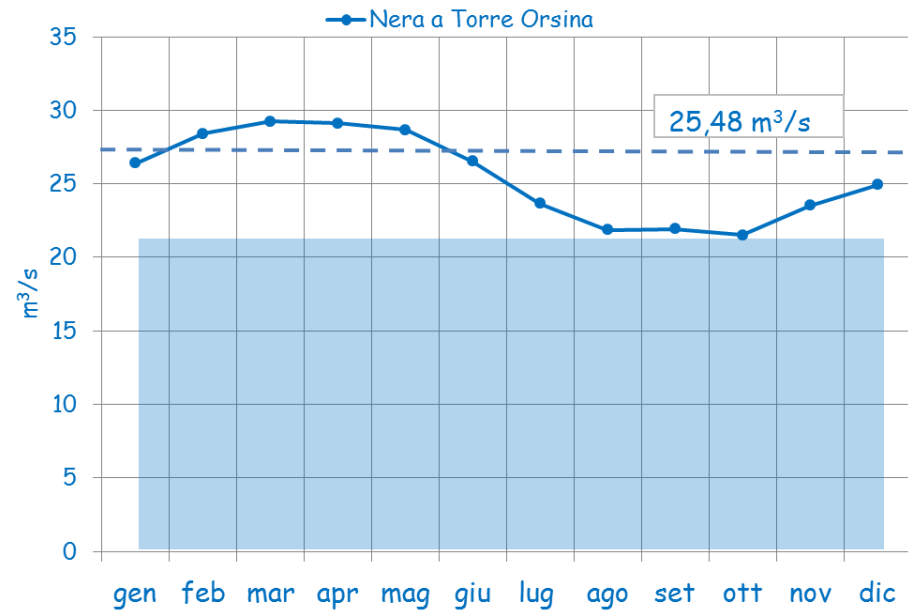
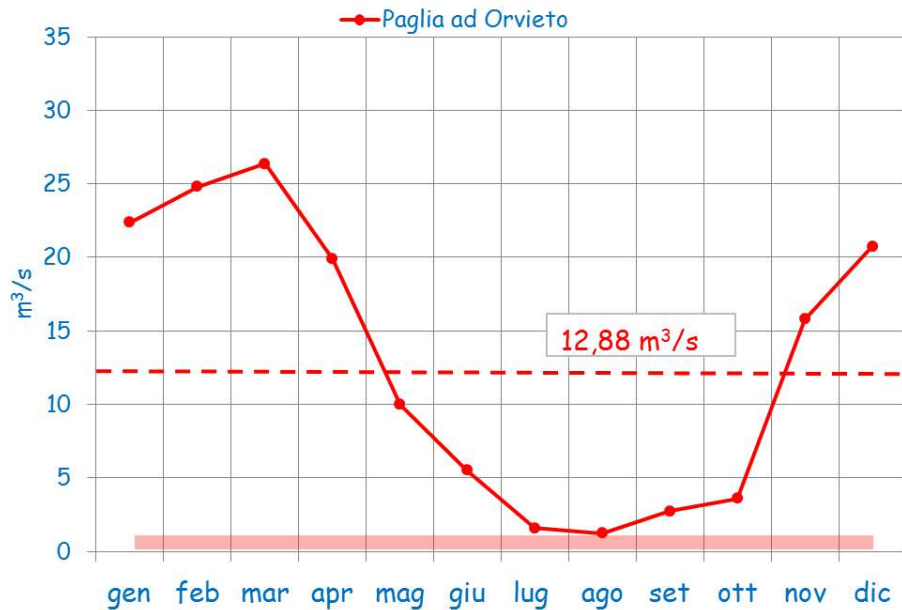
$$Q = R + F_b$$

Flusso di base: somma della portata di tutte le sorgenti presenti nel bacino idrografico

Bacino idrografico di 17.375 km²

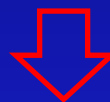
IDROGRAMMA

andamento nel tempo della portata misurata in una sezione del bacino idrografico

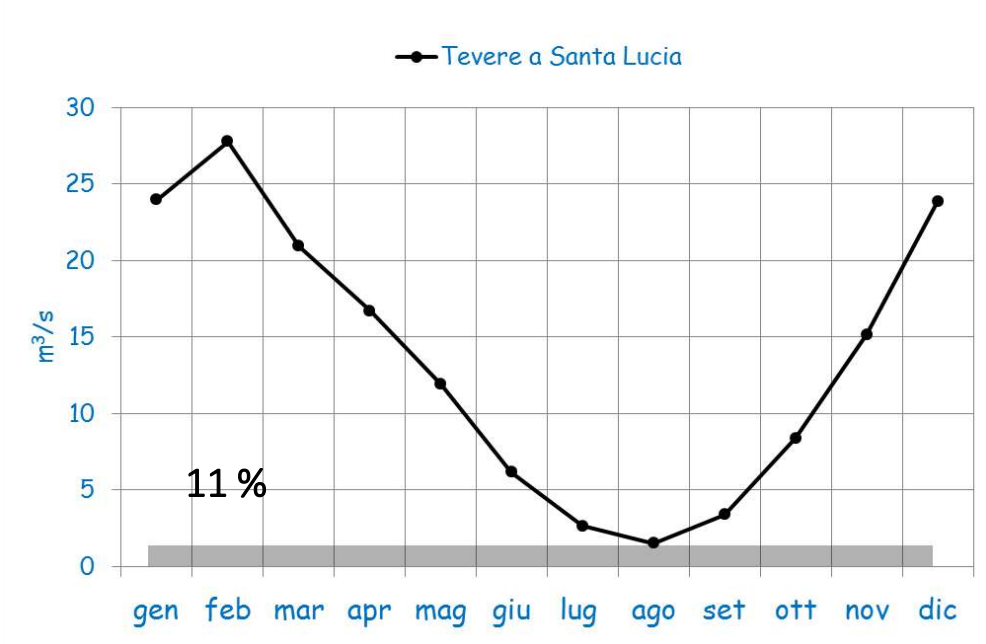


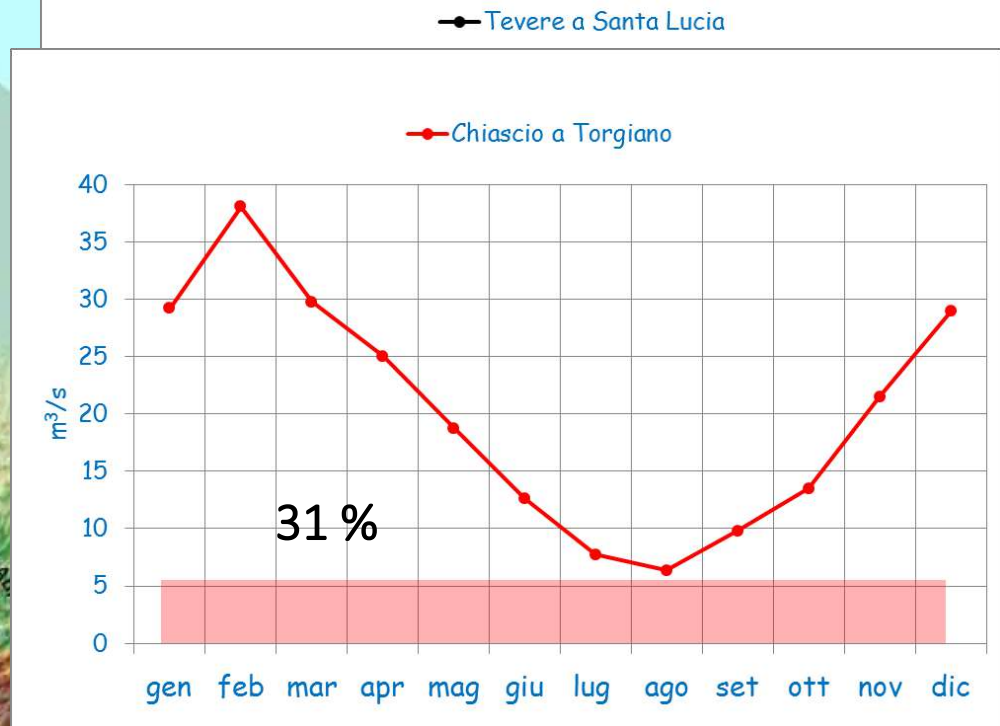
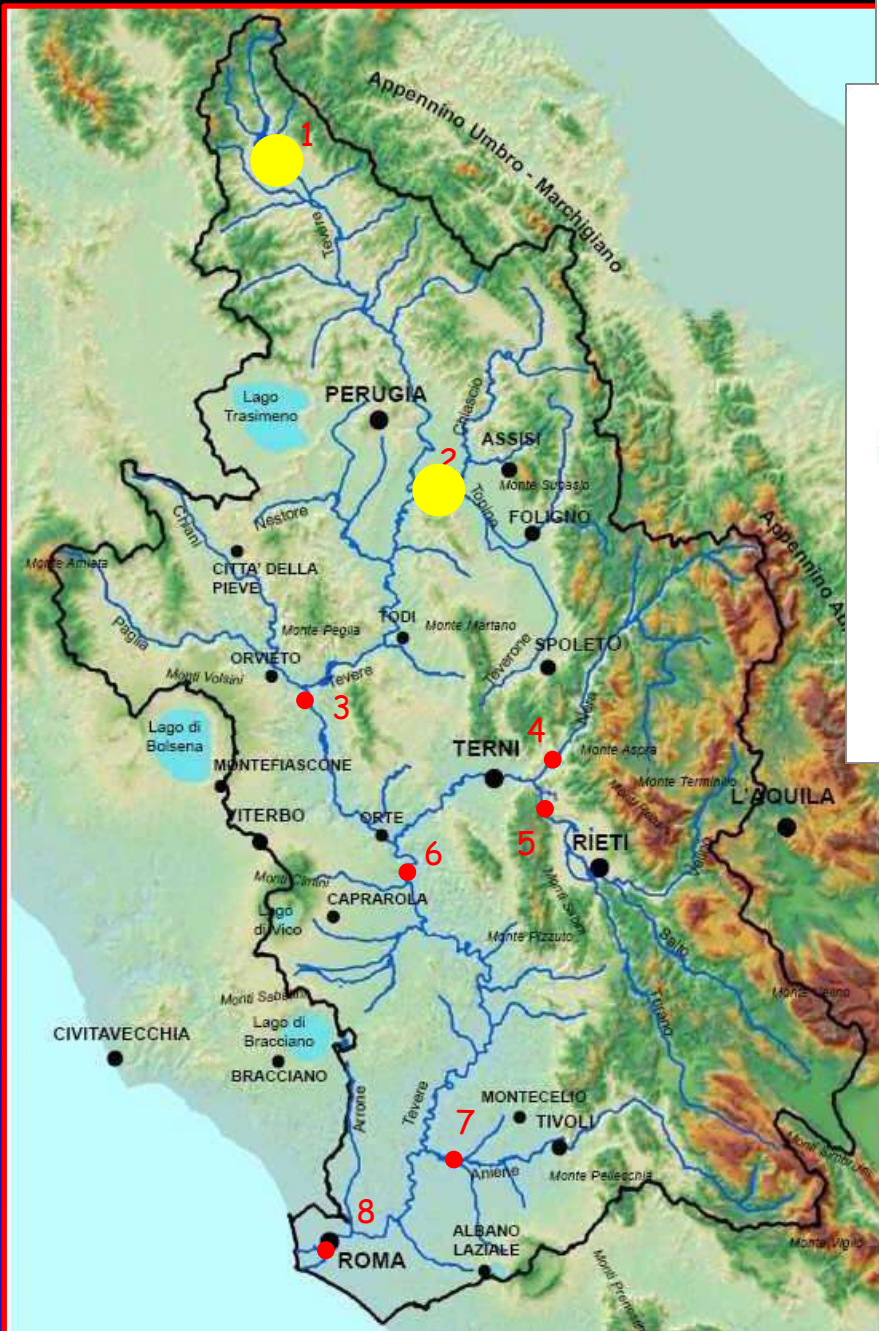
Flusso di base

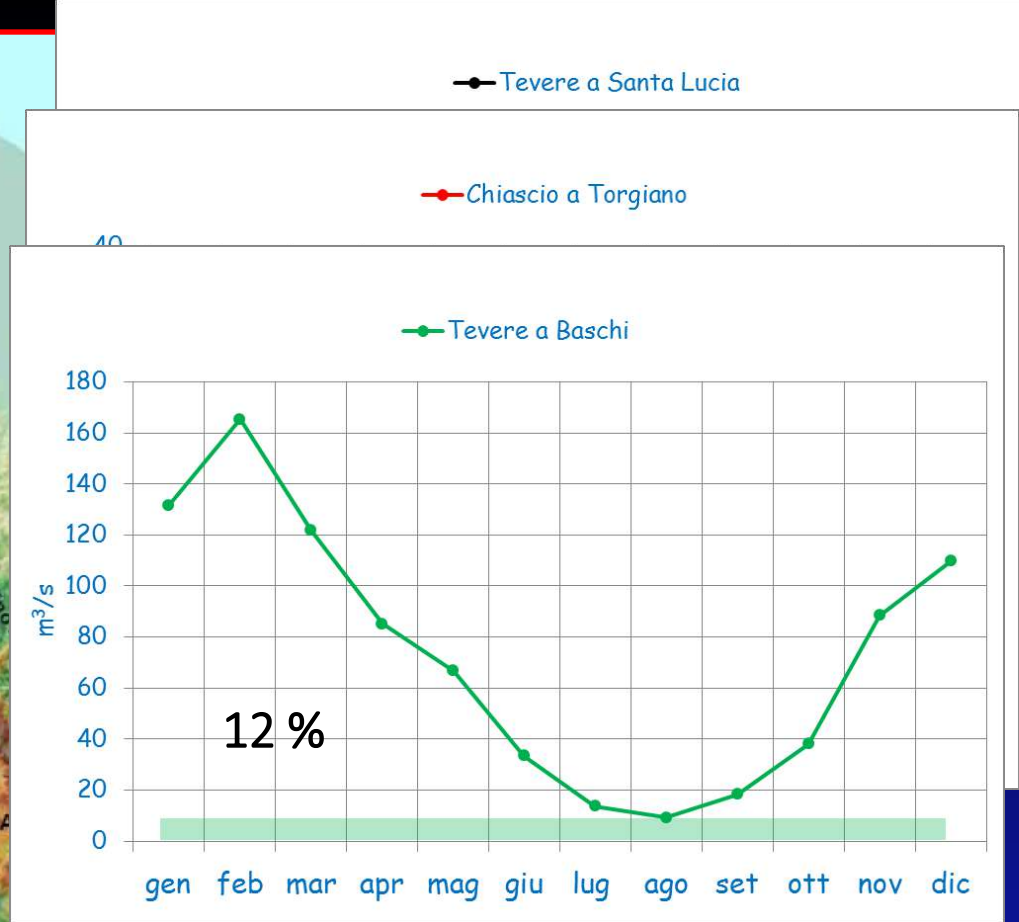
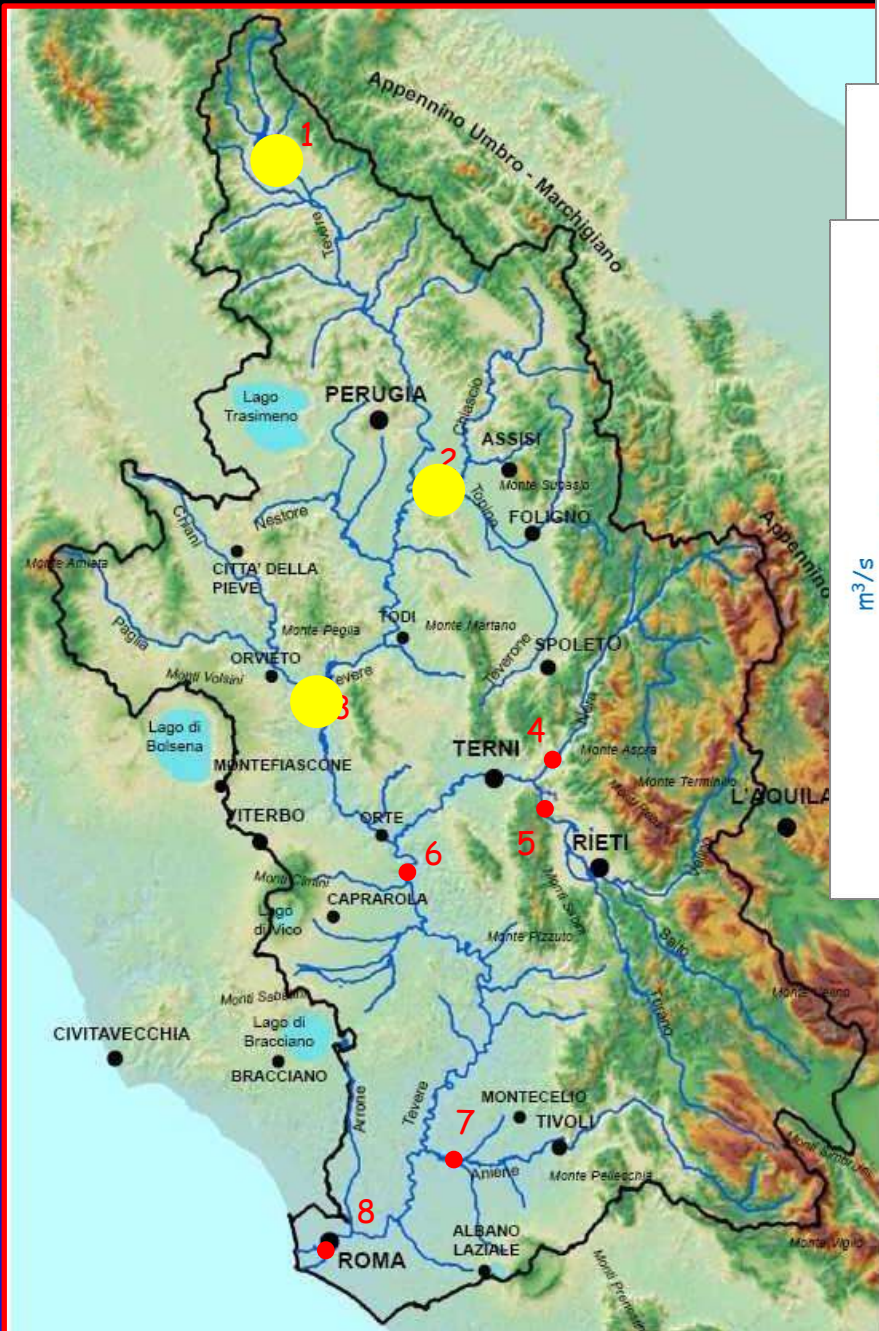
(somma della portata di tutte le sorgenti presenti nel bacino idrografico)



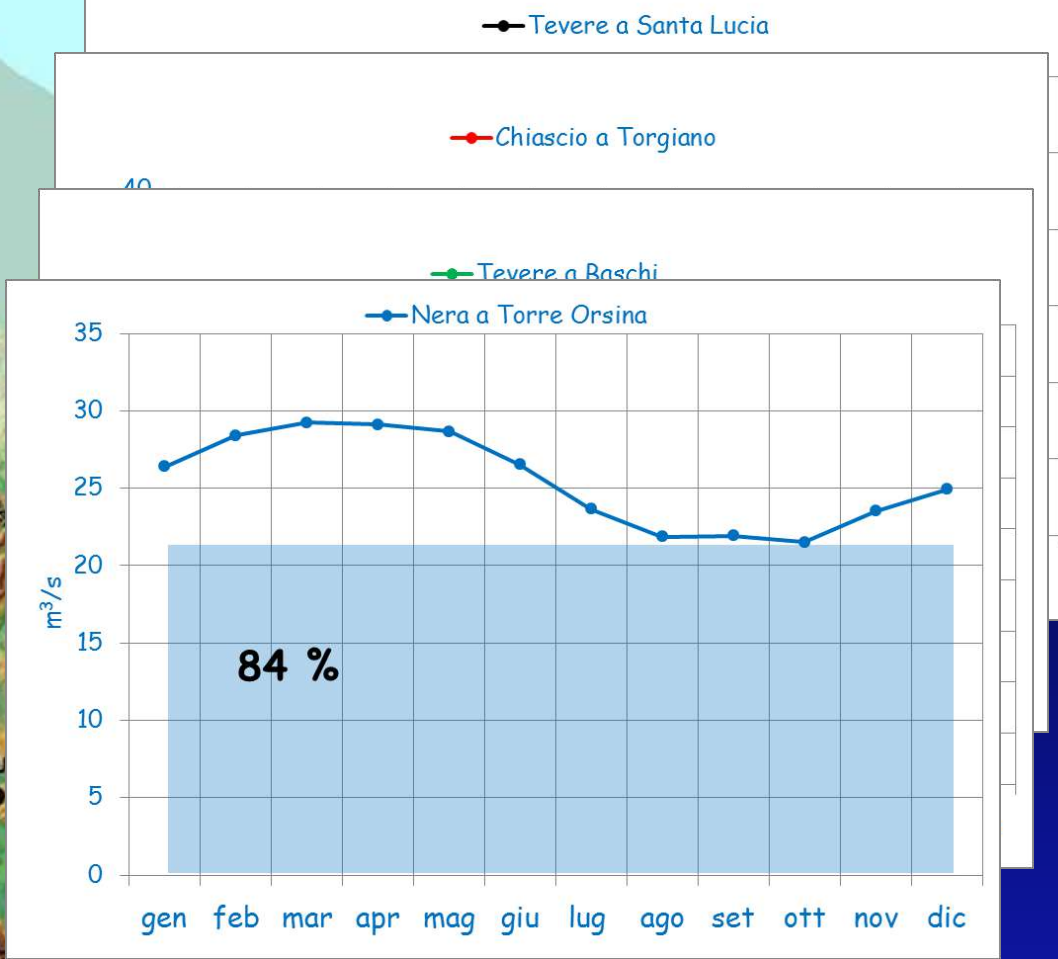
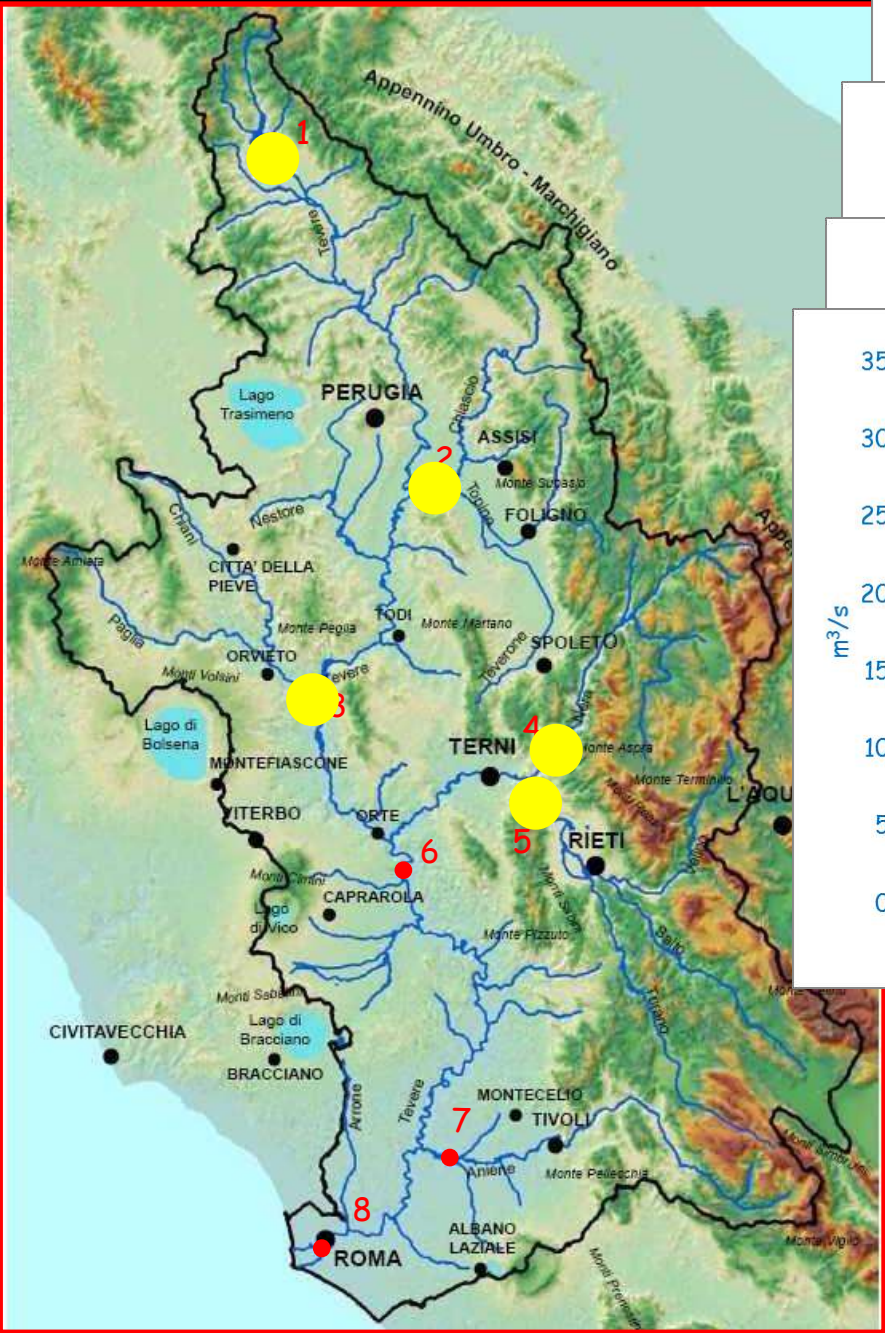
sostiene la portata nei mesi aridi

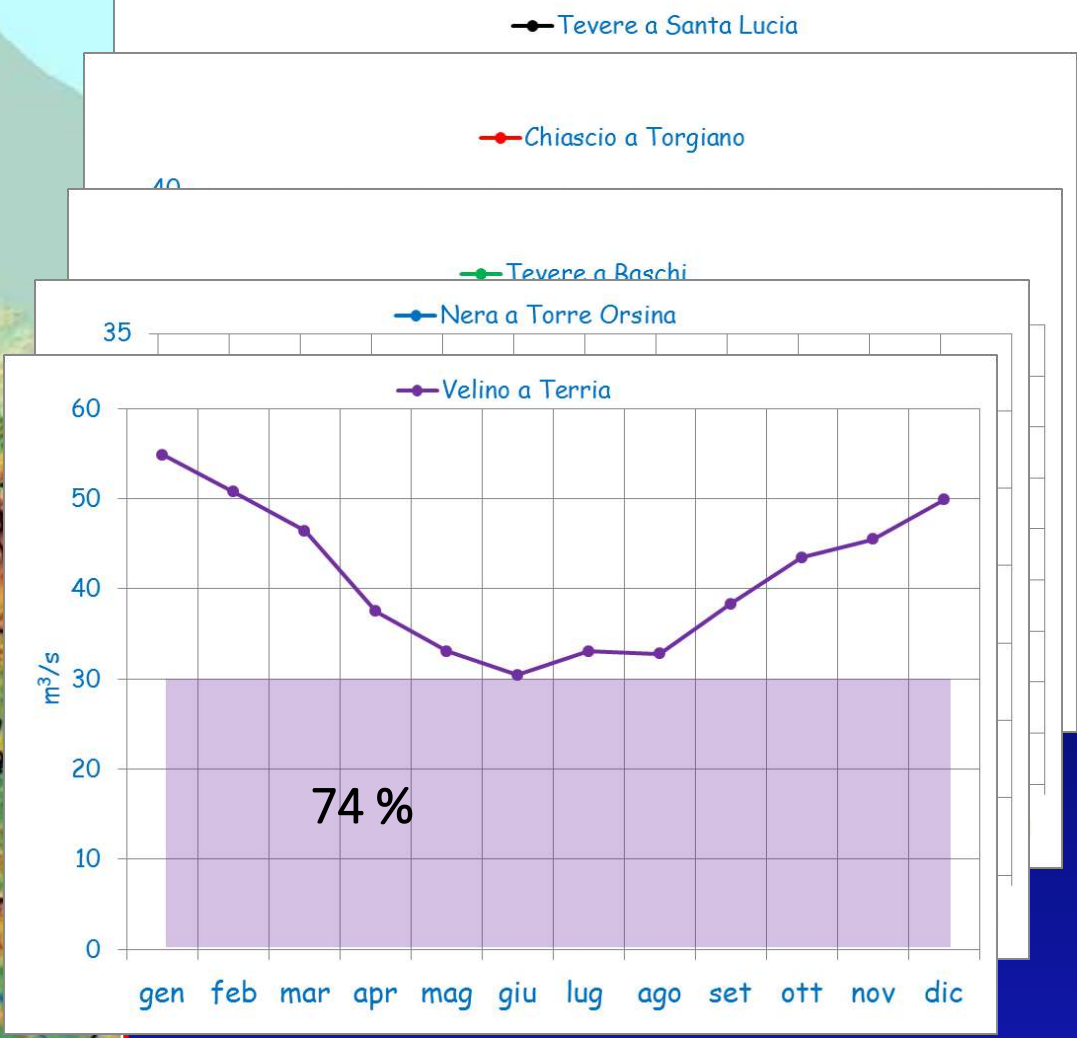
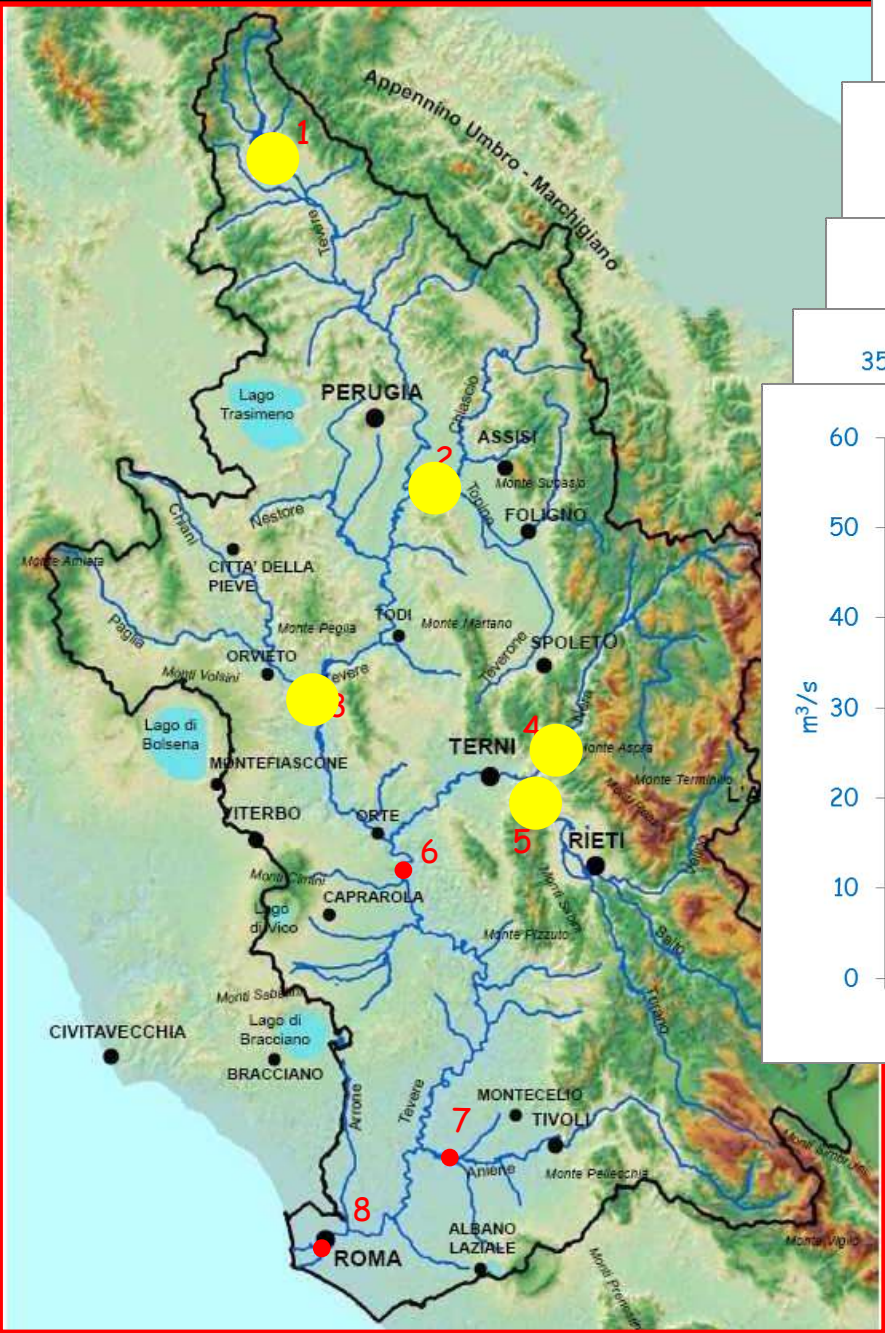


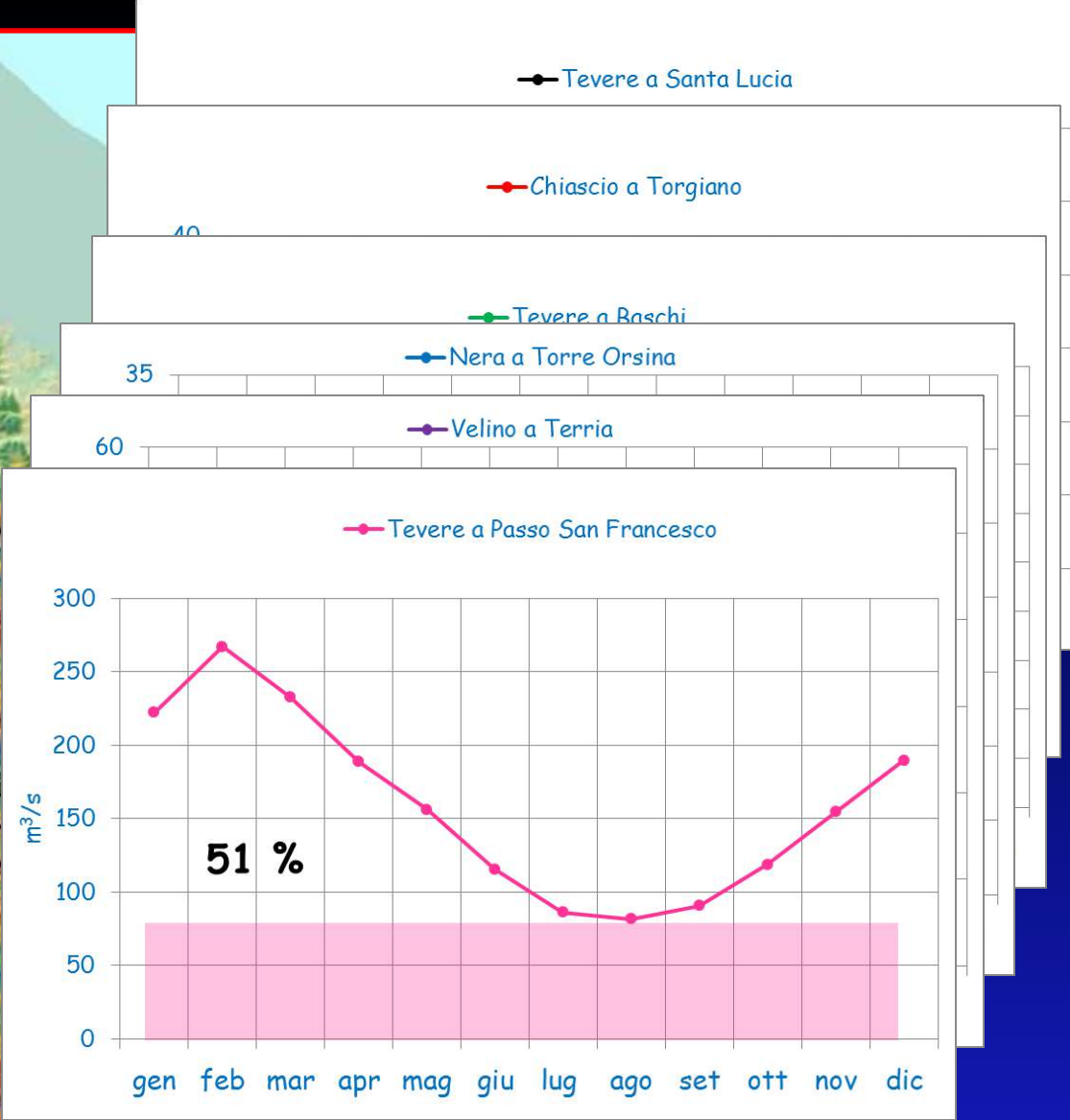
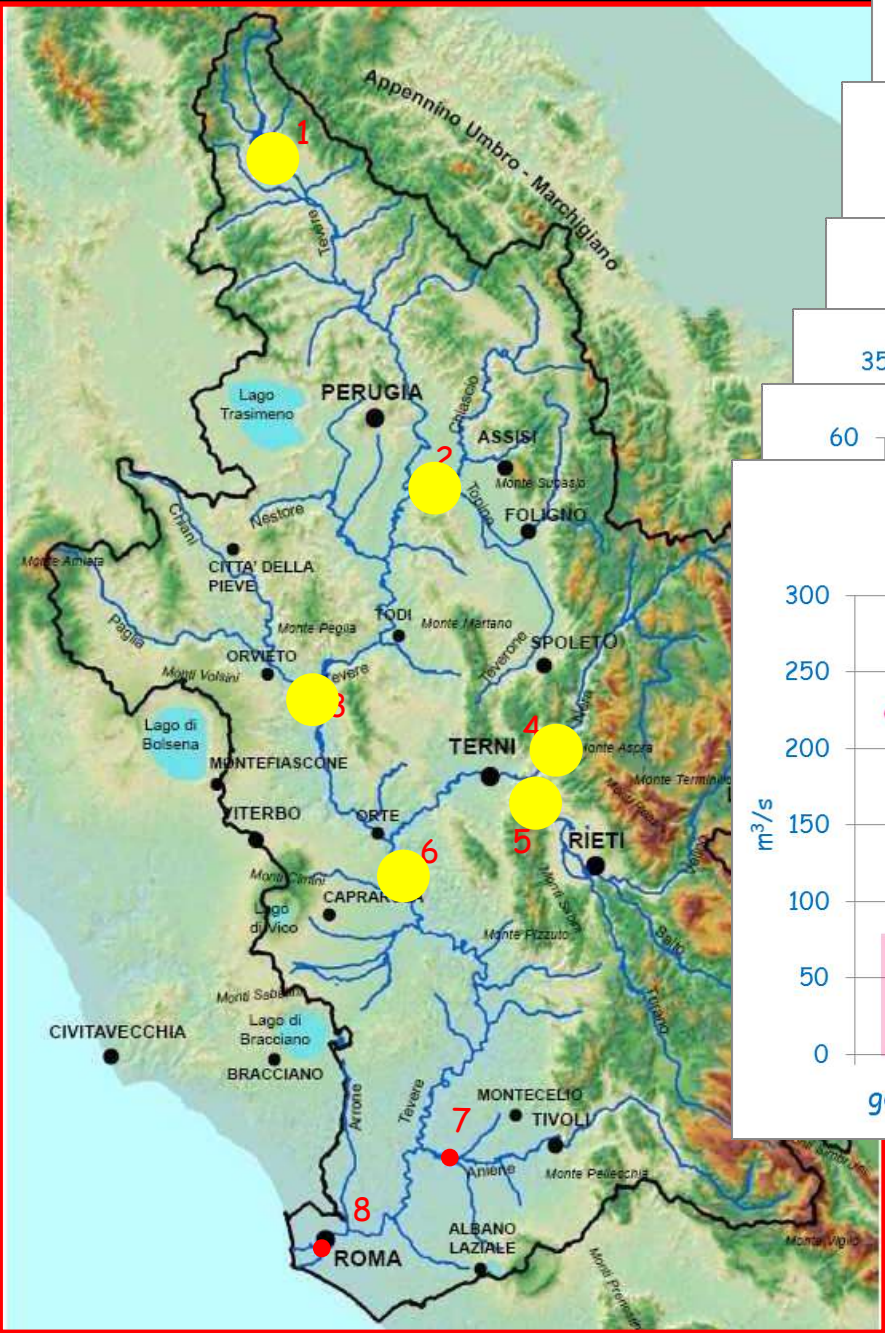


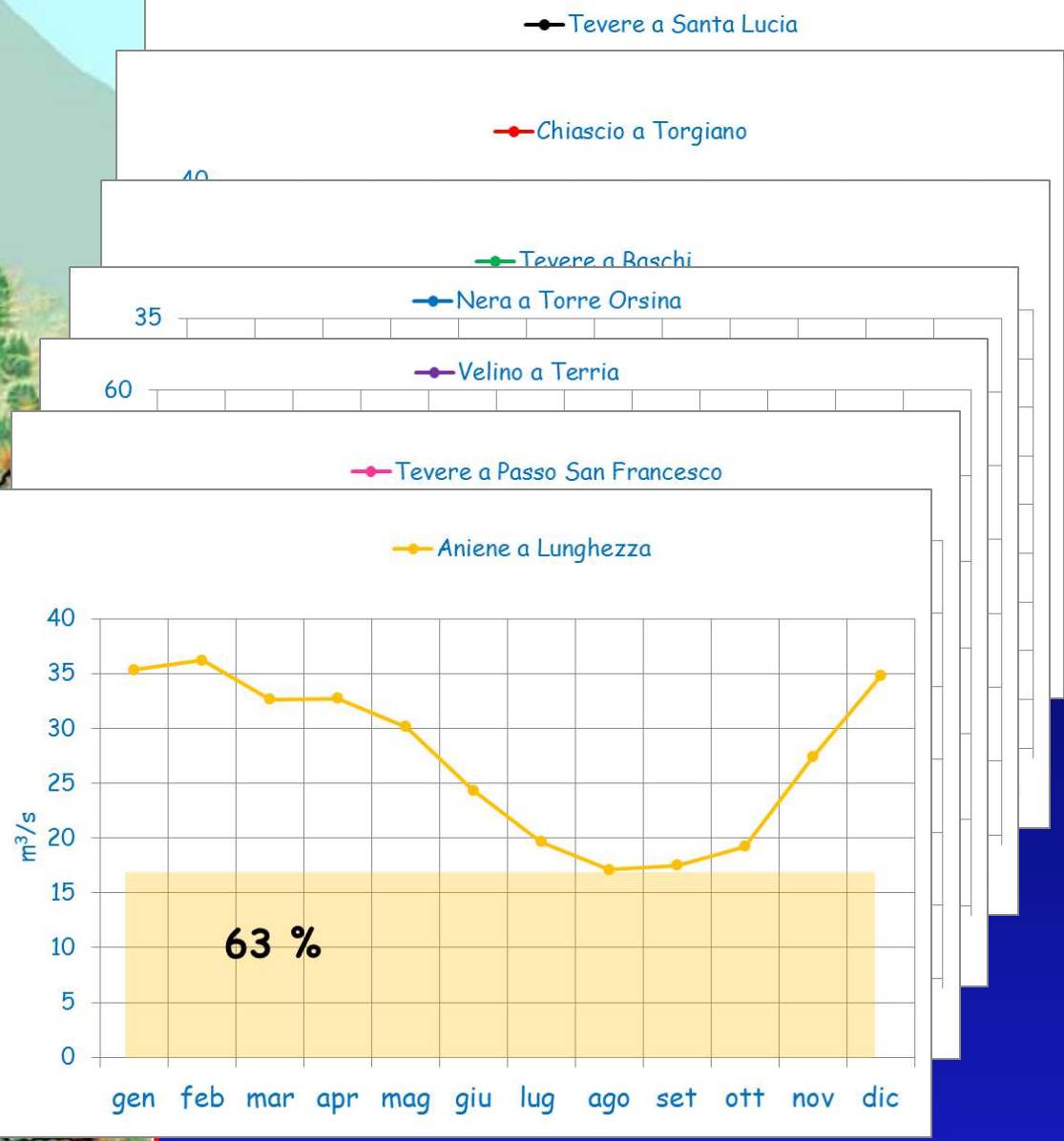
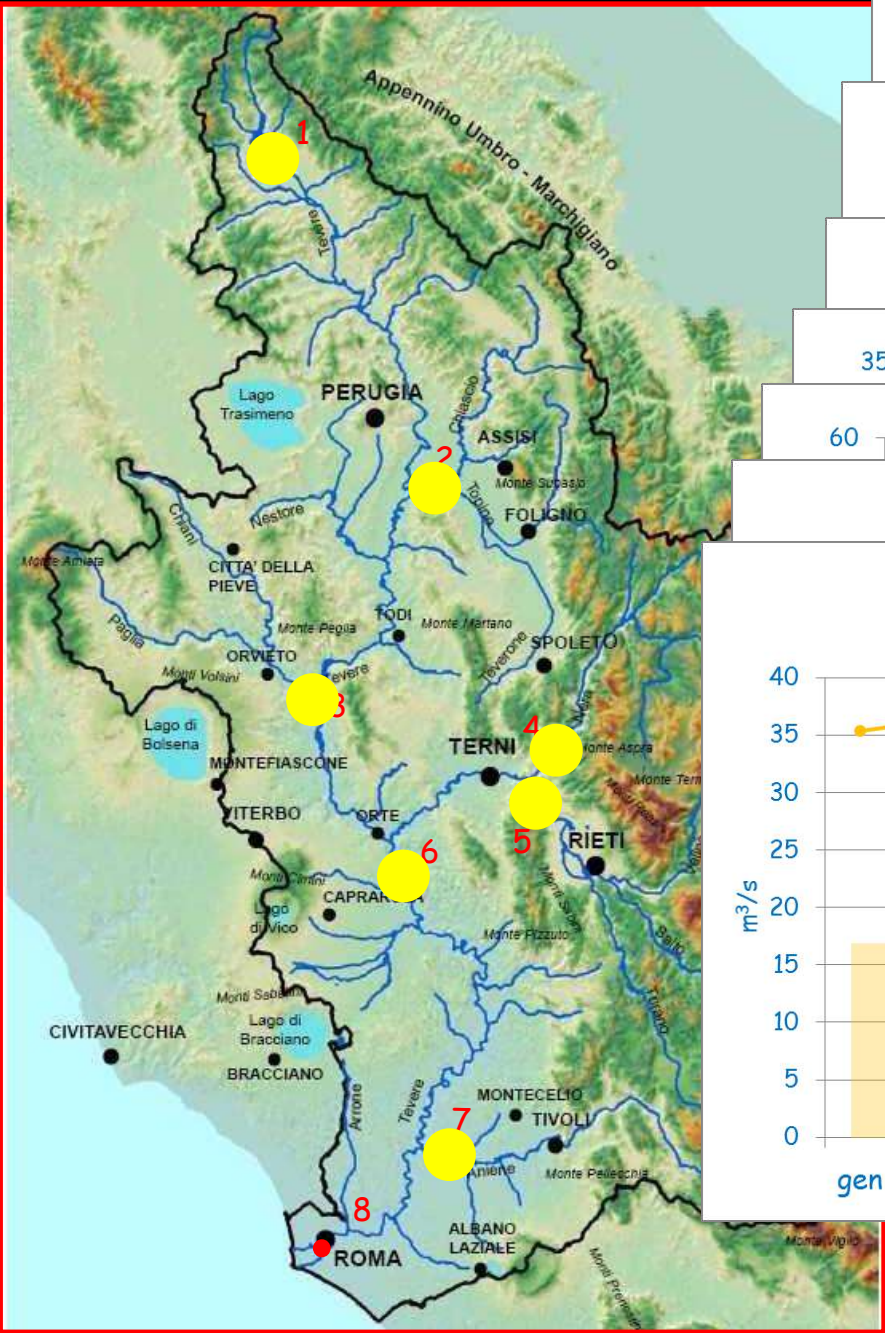


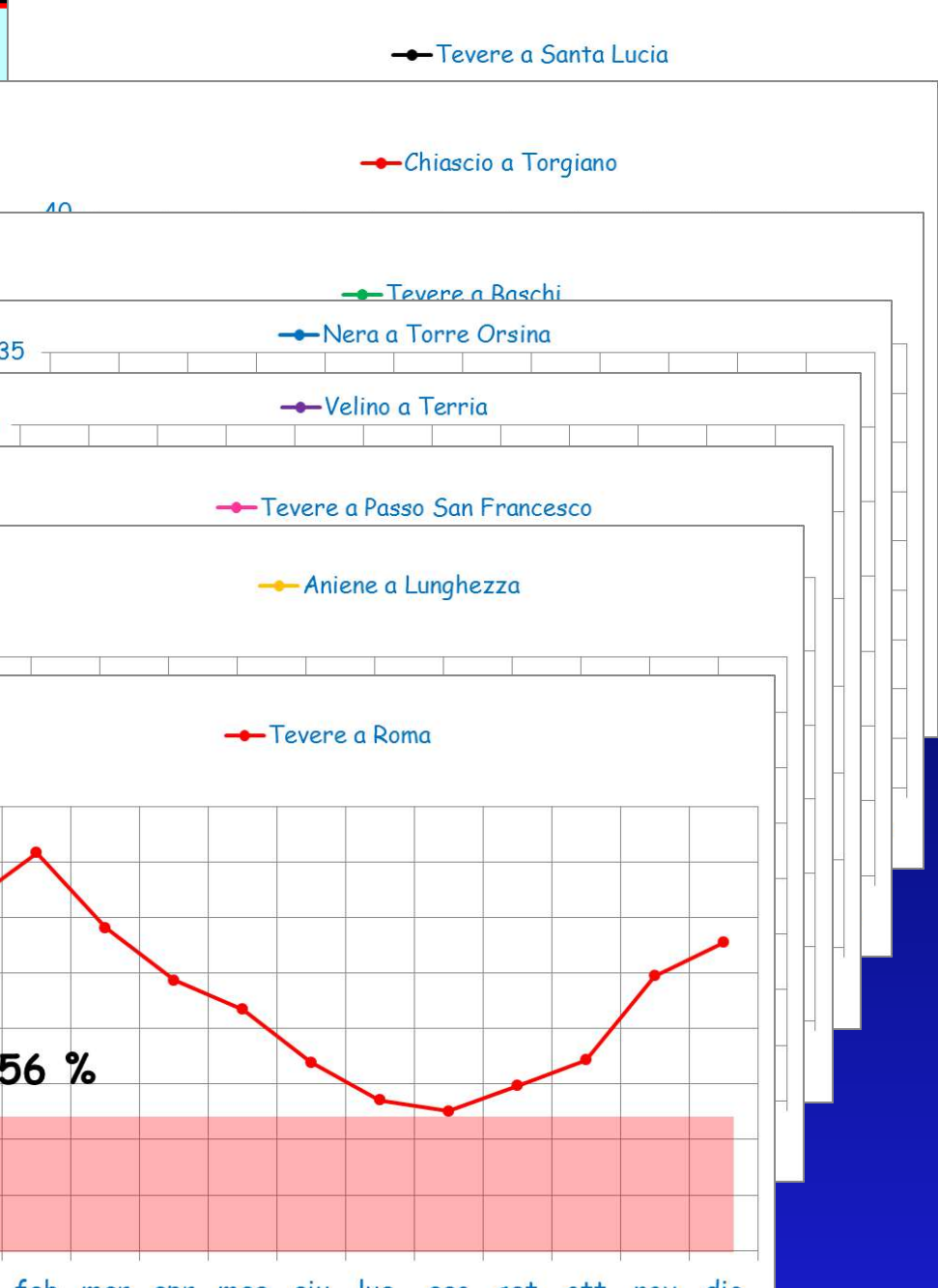
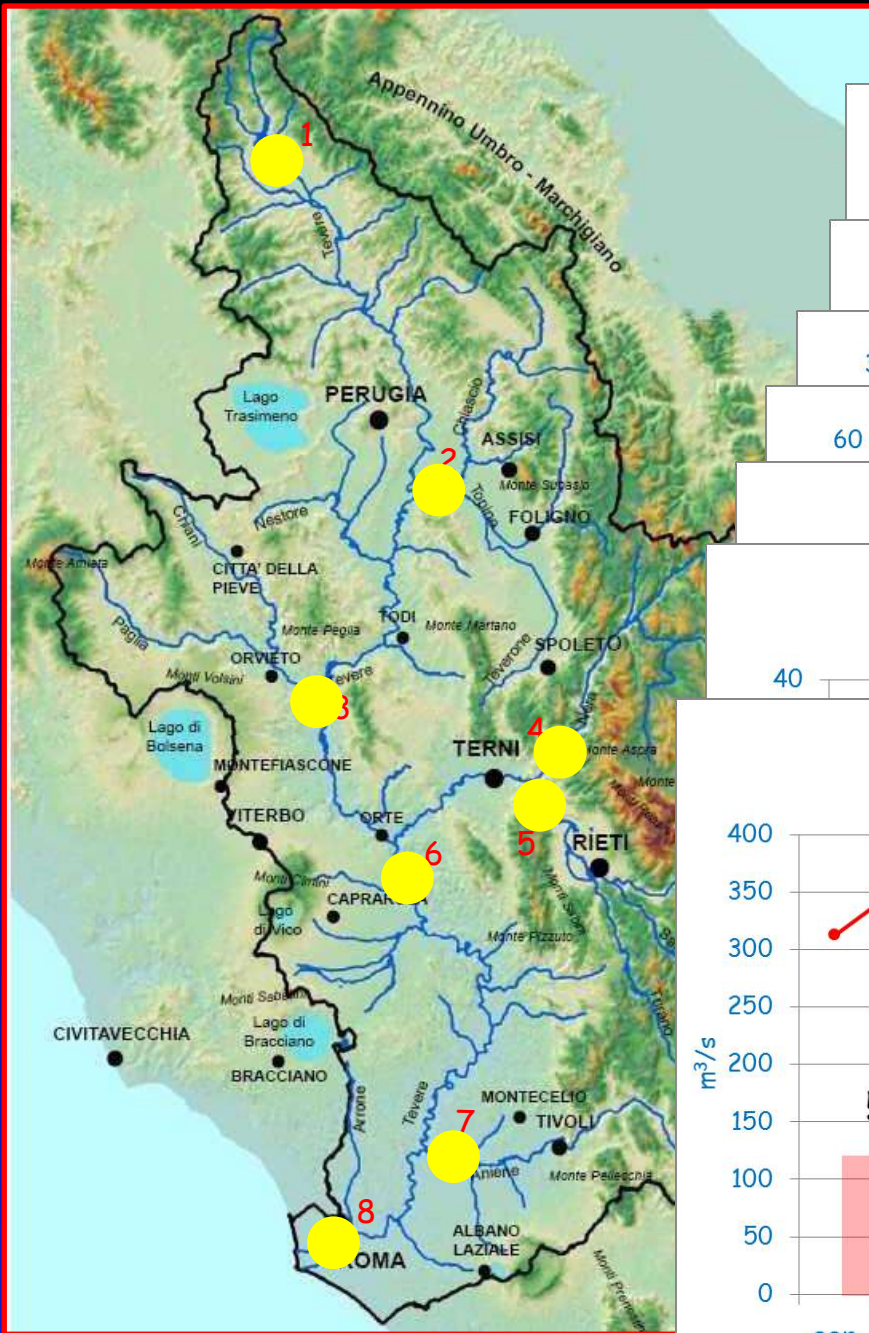
12%











Le acque sotterranee che emergono dalle sorgenti del bacino del Tevere garantiscono che in estate nel fiume ci sia una portata media annua di $125 \text{ m}^3/\text{s}$



Q media annua: $225 \text{ m}^3/\text{s}$

F_b medio annuo: $125 \text{ m}^3/\text{s}$



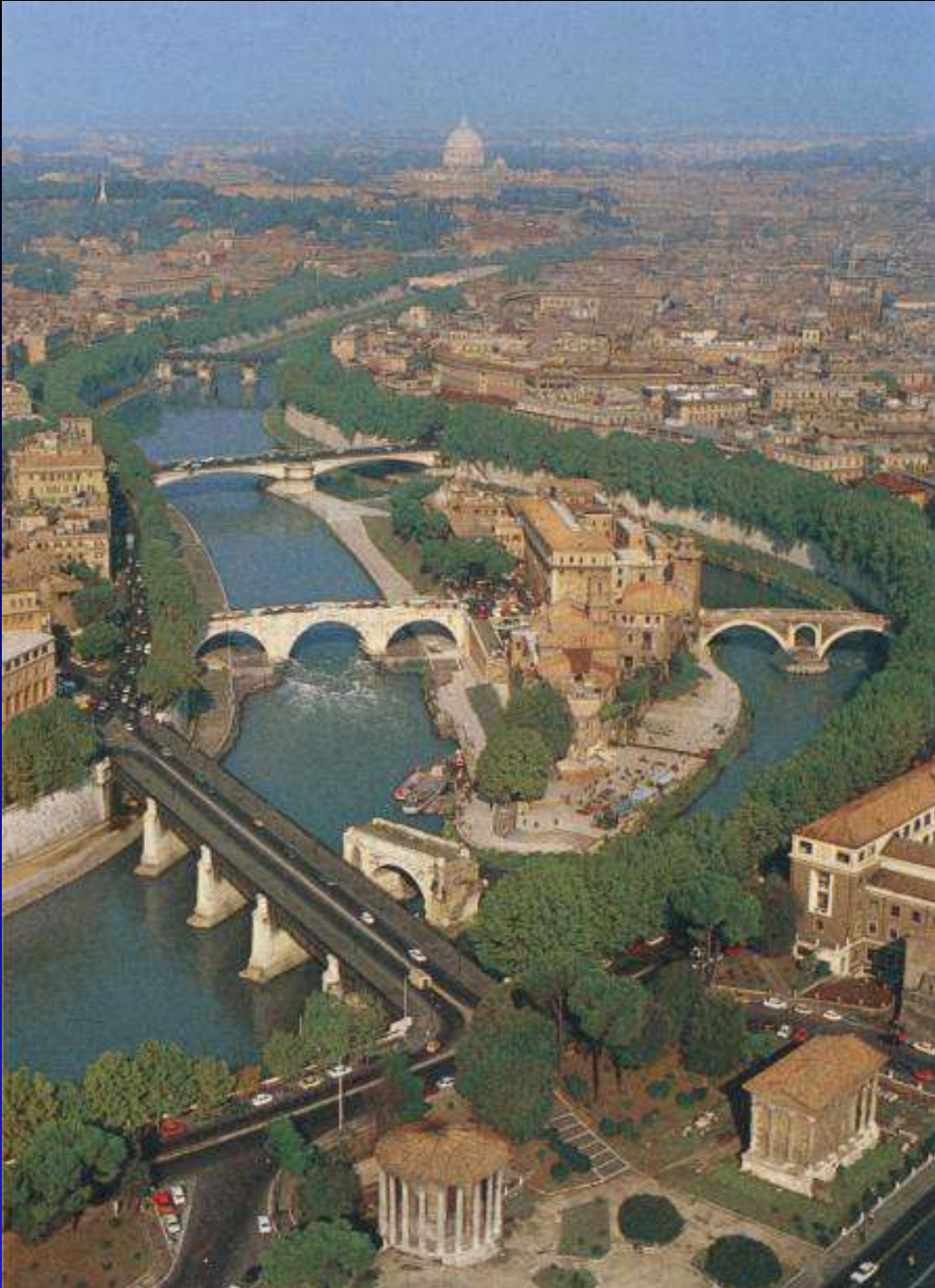
$125 \text{ m}^3/\text{s} = 125.000 \text{ L/s}$

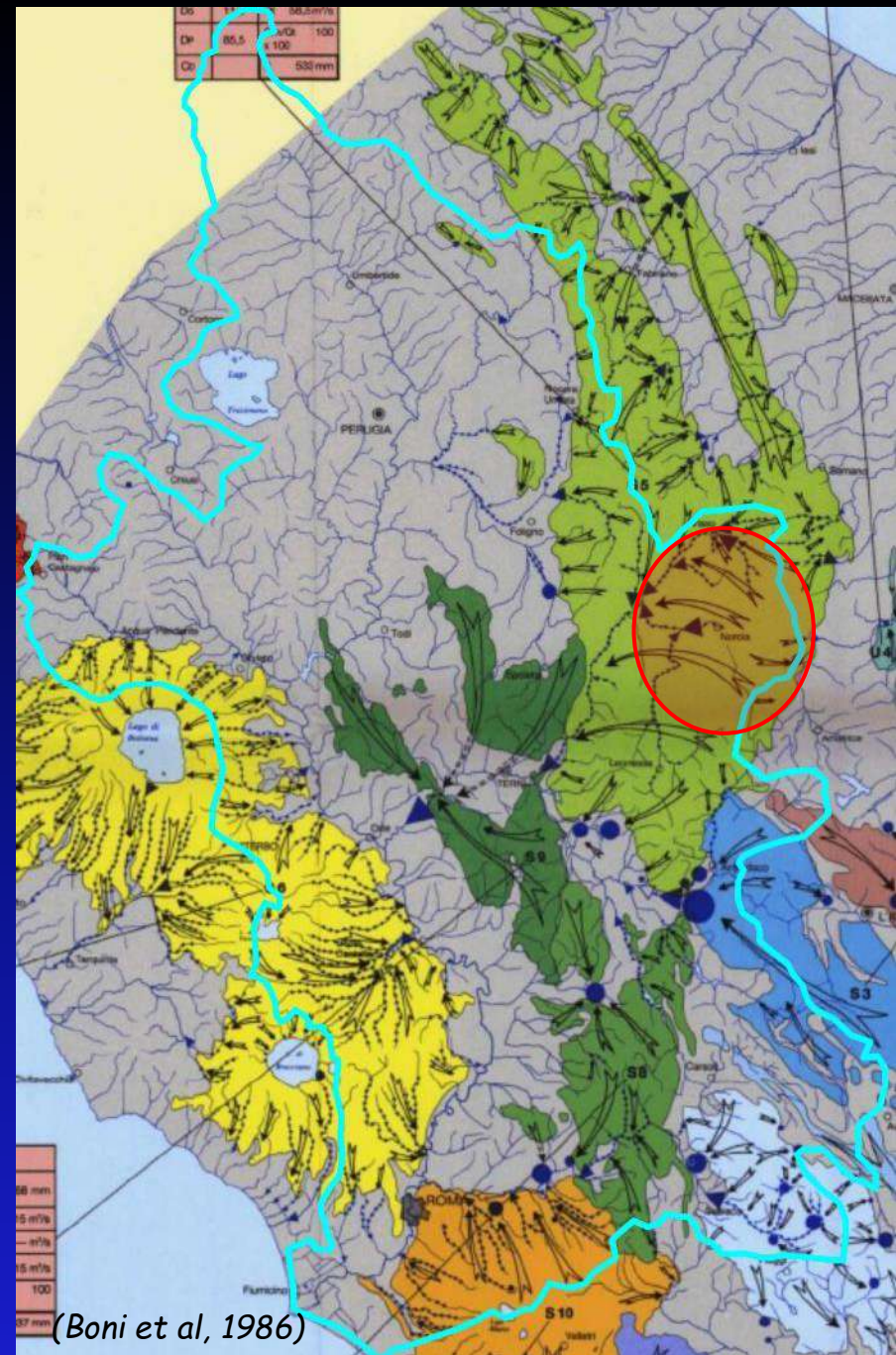
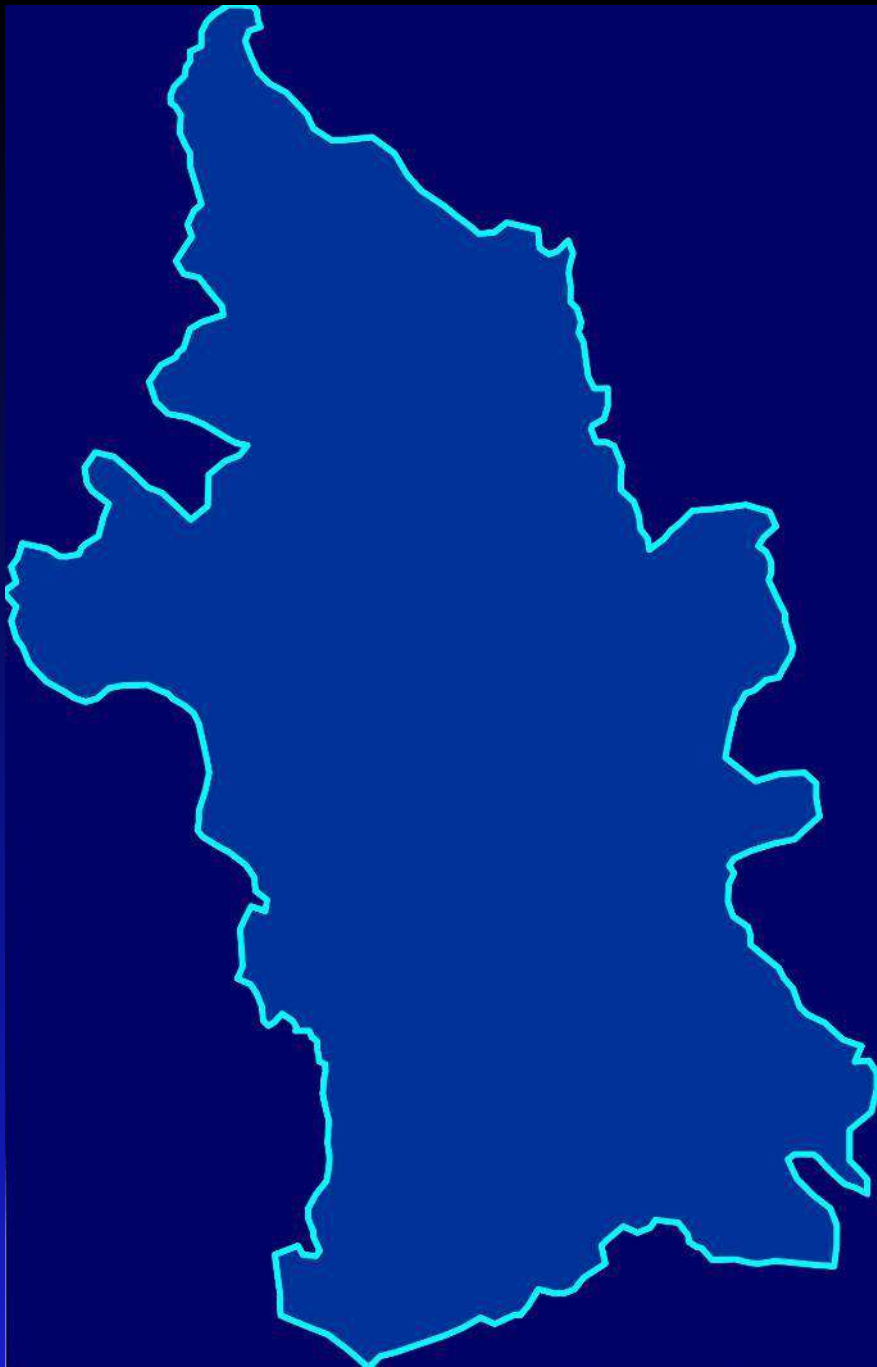
8 porti sul Tevere nella città di Roma

Ripa grande a Testaccio,
Ripetta,
Tiberino,
Fluviale (Emporium),
Leonino,
Arsenale Pontificio (Porta Portese),
Moderno dell'Arsenale,
Scalo De Pinedo

<https://libreriainternazionaleilmare.blogspot.com/2018/09/quanti-porti-ha-roma-sul-tevere.html>

75 m³/s provengono dalle sorgenti degli affluenti di sinistra alimentate dai grandi acquiferi carbonatici degli Appennini





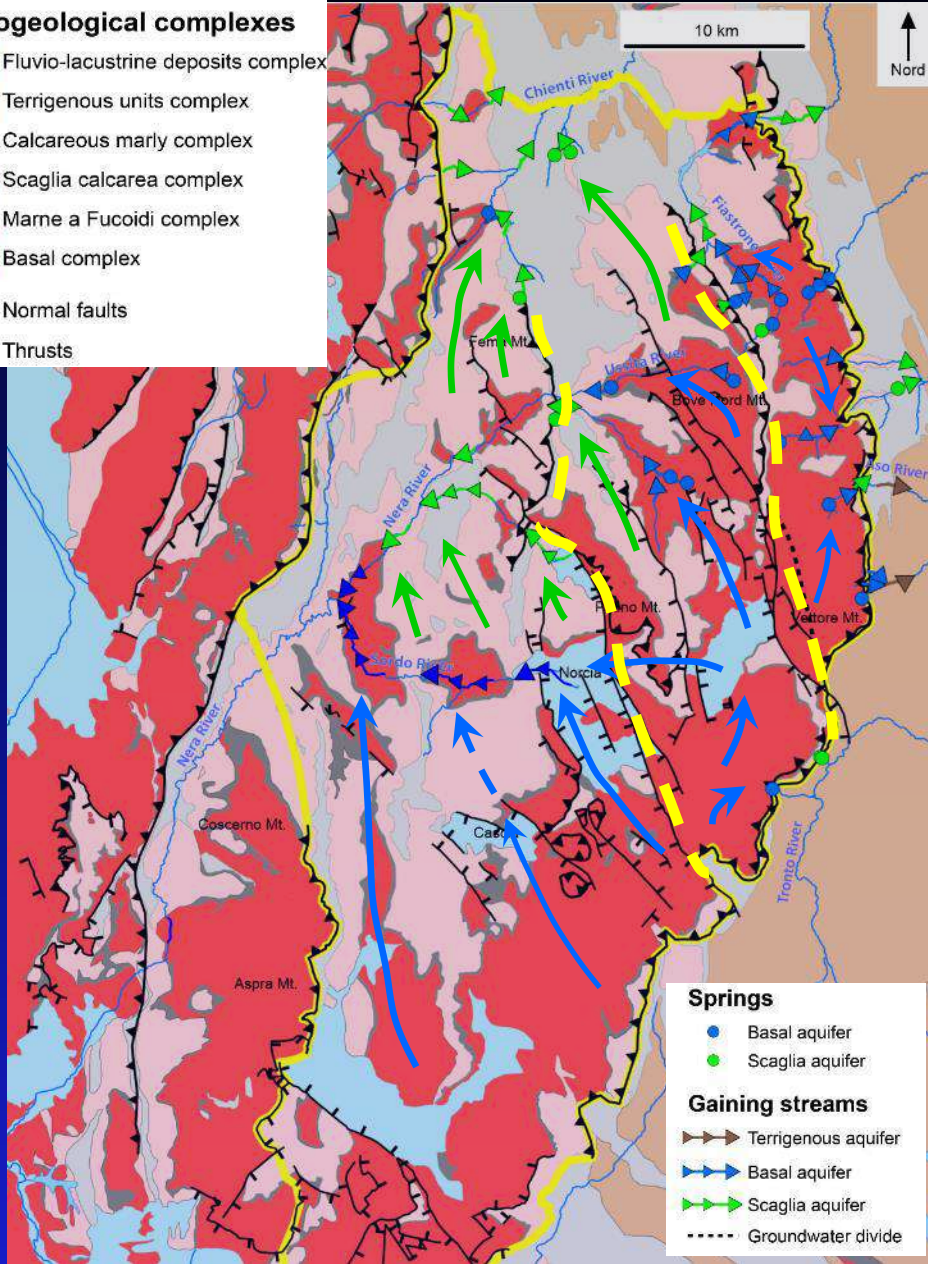
(Boni et al, 1986)

IDROSTRUTTURA DEI MONTI SIBILLINI (1500 km²)

Hydrogeological complexes

- Fluvio-lacustrine deposits complex
- Terrigenous units complex
- Calcareous marly complex
- Scaglia calcarea complex
- Marna a Fucoidi complex
- Basal complex

Normal faults
 Thrusts

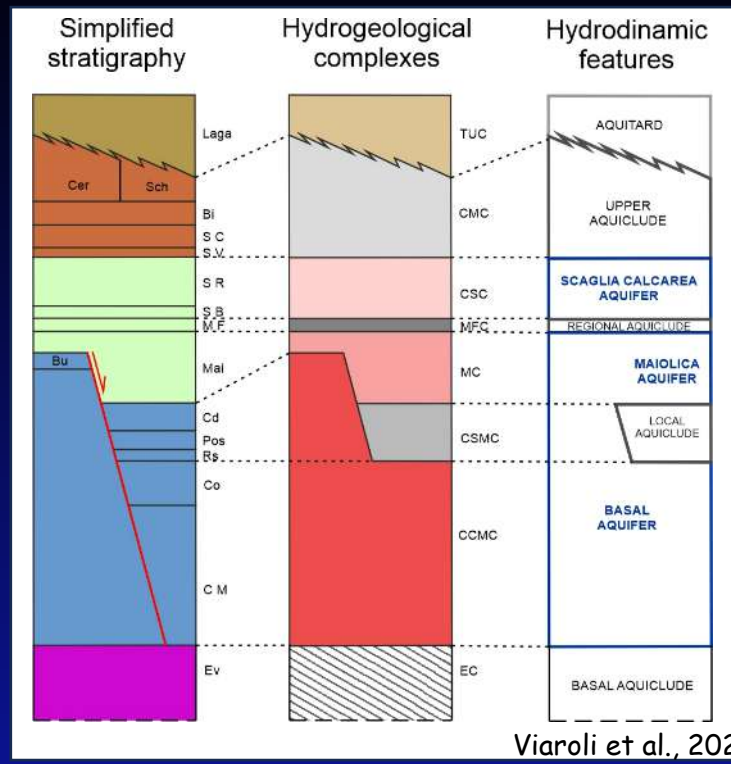


Springs

- Basal aquifer
- Scaglia aquifer

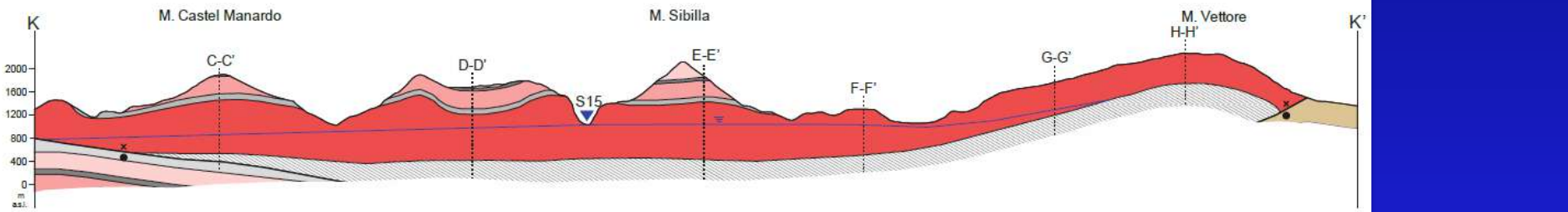
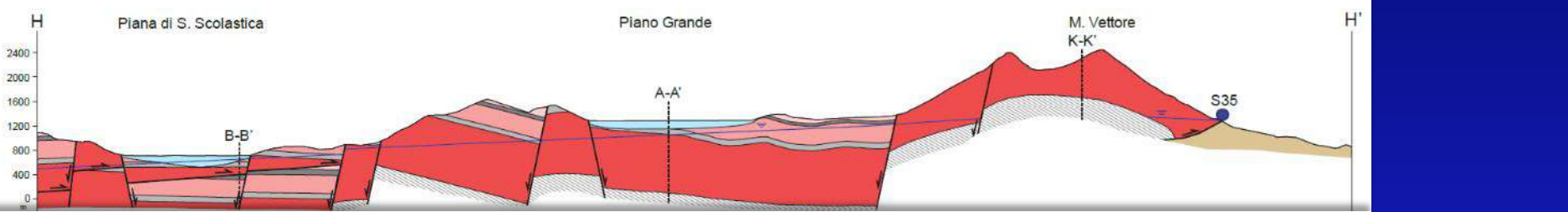
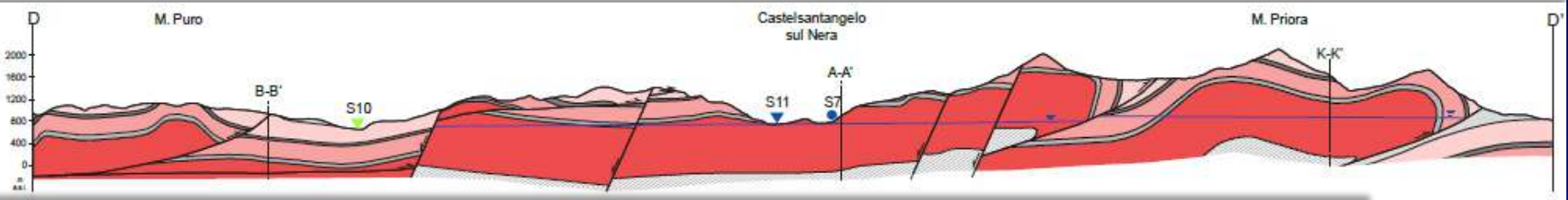
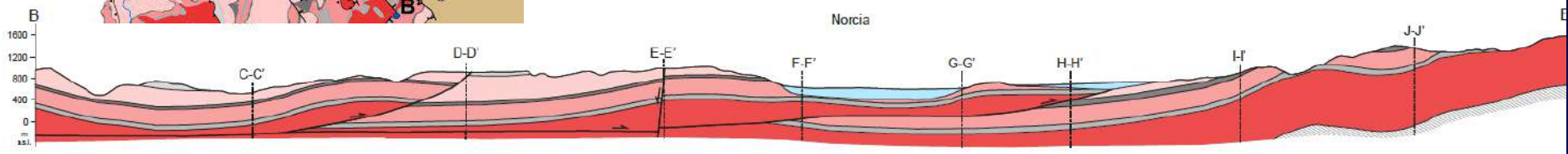
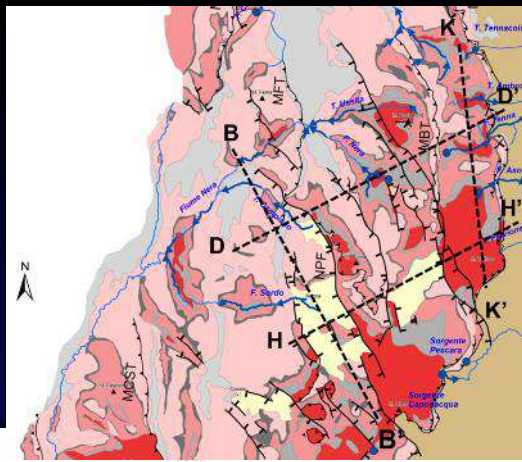
Gaining streams

- Terrigenous aquifer
- Basal aquifer
- Scaglia aquifer
- Groundwater divide



| AQUIFER | DISCHARGE (m ³ /s) | | |
|--------------|-------------------------------|-------------------|--------------------|
| | TOTAL | WEST SPRINGS | EAST SPRINGS |
| | | 1000-400 m a.s.l. | 1300 -800 m a.s.l. |
| BASAL | 13 | 10 | 3 |
| SCAGLIA | 5 | 3 | 2 |
| TOTAL | 18 | 13 | 5 |

THE UMBRIA-MARCHE HYDROGEOLOGICAL DOMAIN



IDROSTRUTTURA DEI MONTI SIBILLINI (18 m³/s)

Keywords:

acquifero basale

Sisma 2016

Siccità

Crisi idrica

13 m³/s FB

✓ Nera

5 m³/s FB

✓ Fiastrone

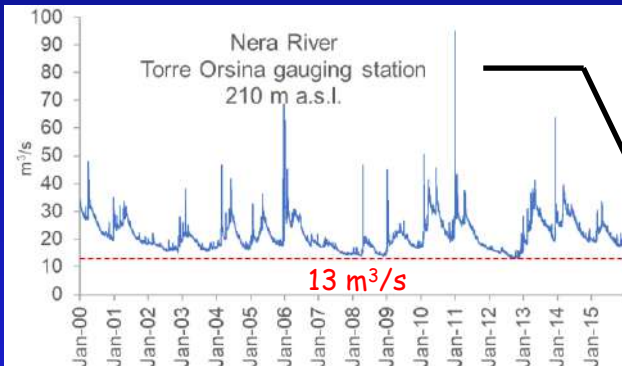
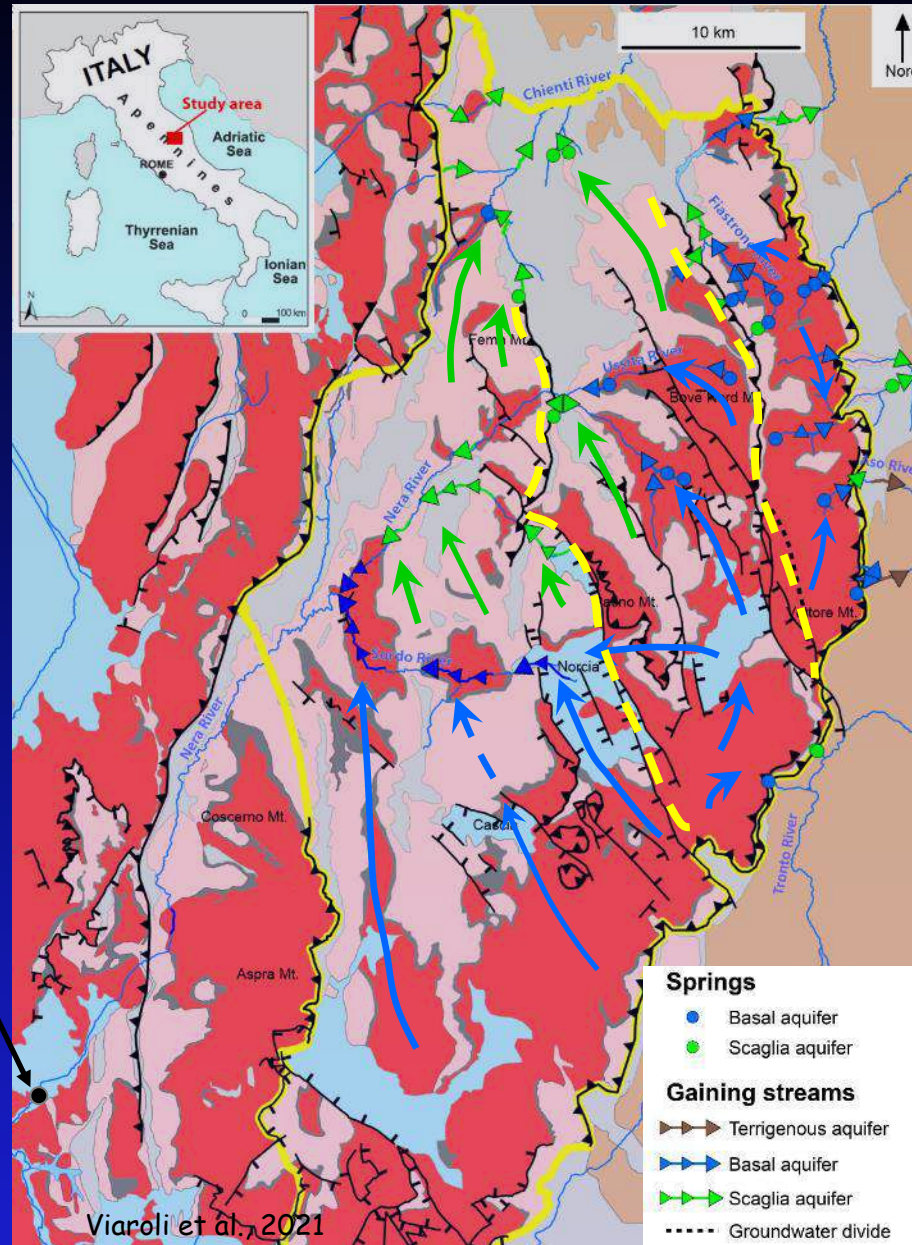
✓ Tennacola

✓ Tenna

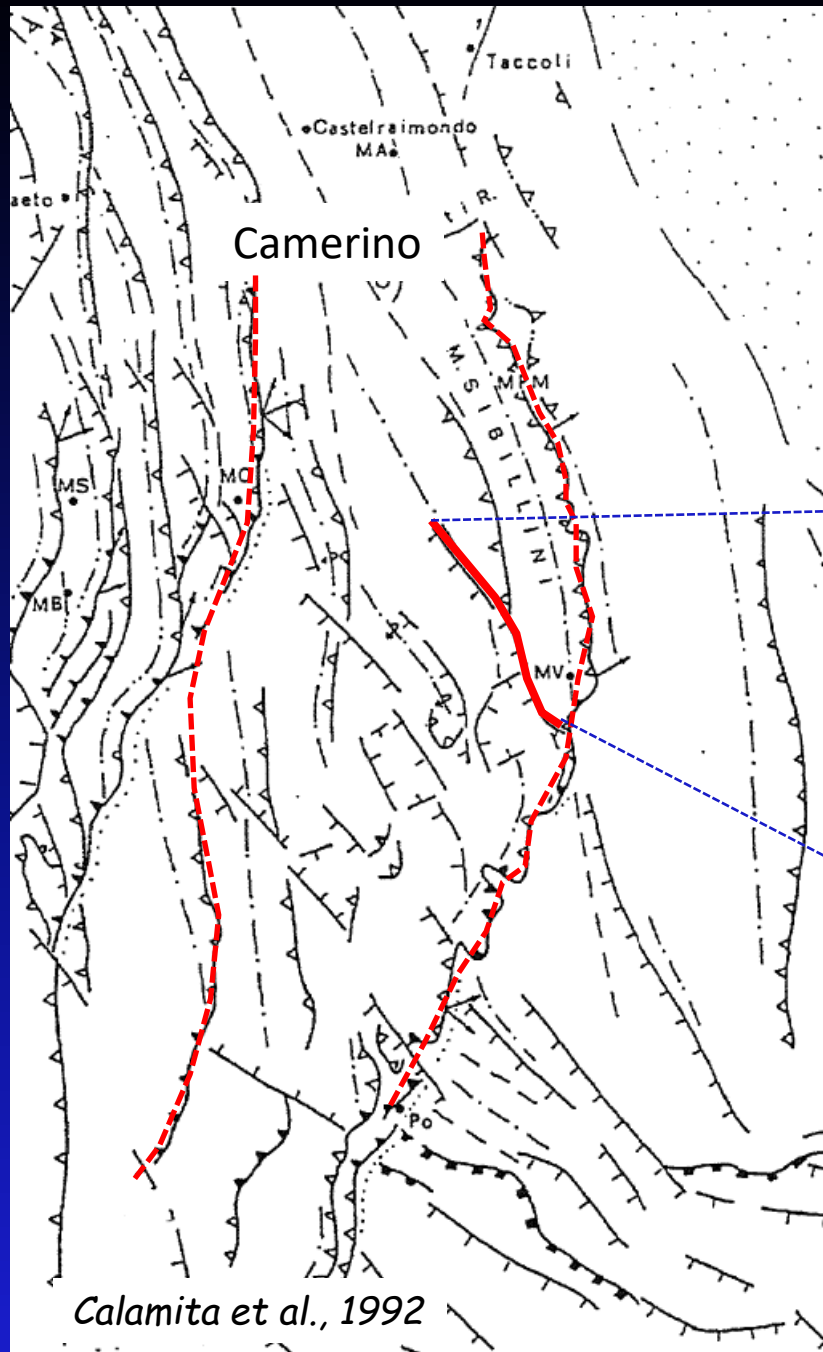
✓ Aso

✓ Fluvione

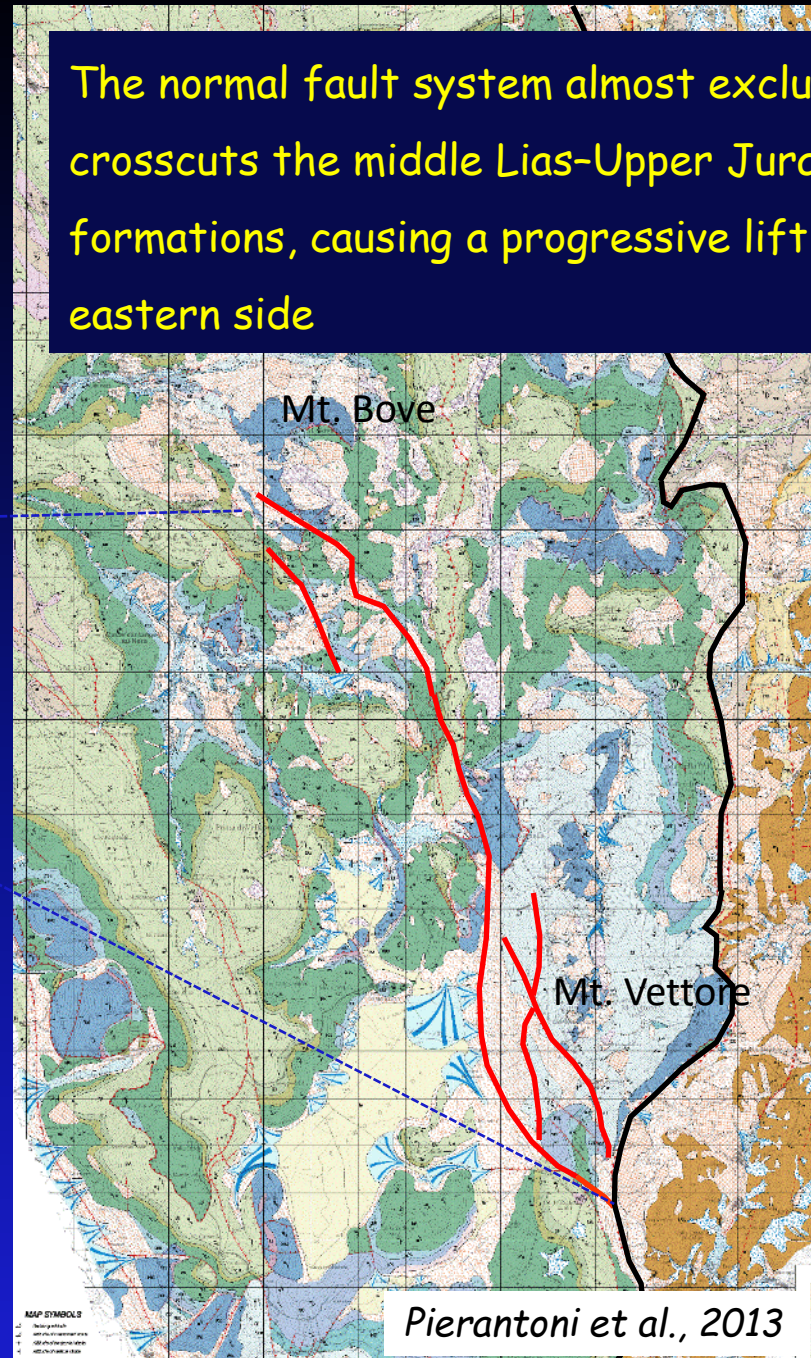
✓ Tronto



THE MT. BOVE - MT. VETTORE FAULT SYSTEM (BVF)



Calamita et al., 1992



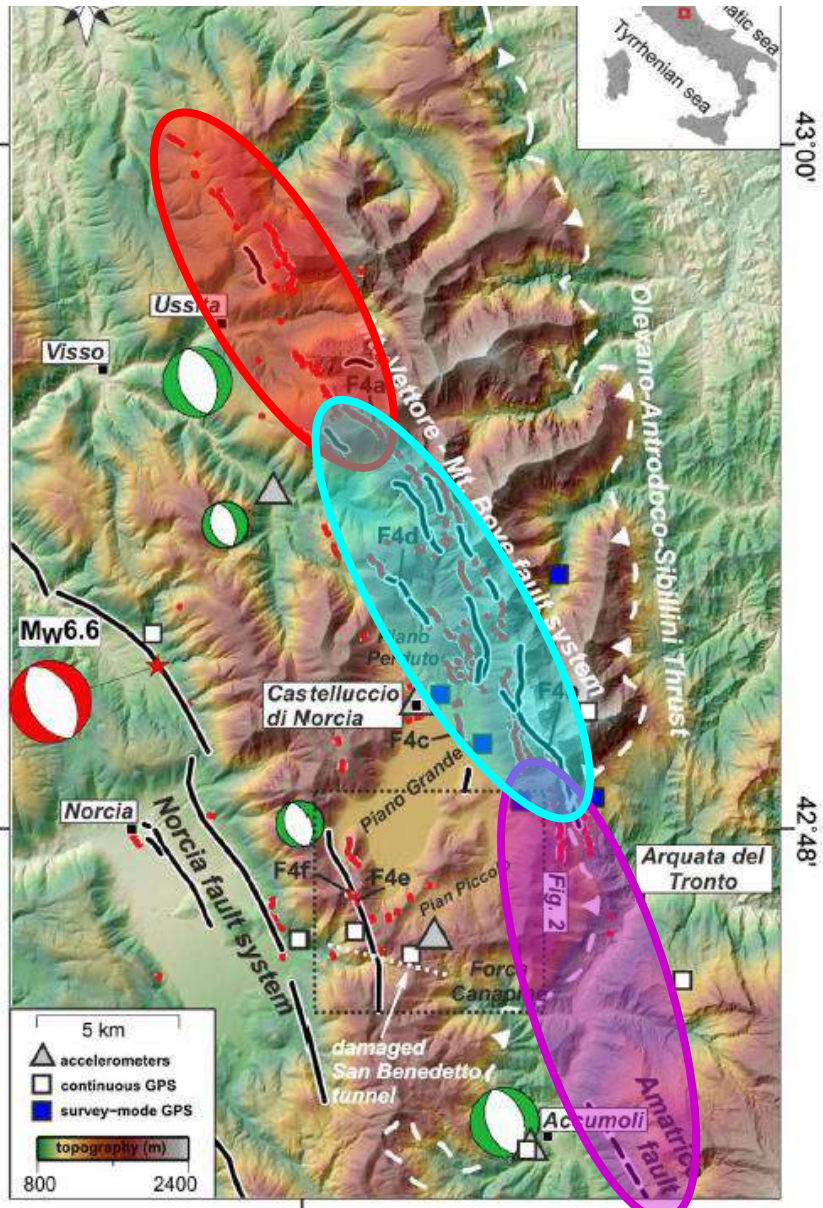
The normal fault system almost exclusively crosscuts the middle Lias-Upper Jurassic formations, causing a progressive lifting of the eastern side

Pierantoni et al., 2013

THE 2016 AMATRICE-NORCIA SEISMIC SEQUENCE

13°12'

Surface ruptures along the 28 km long VBF system (Red lines). Cheloni et al., 2019



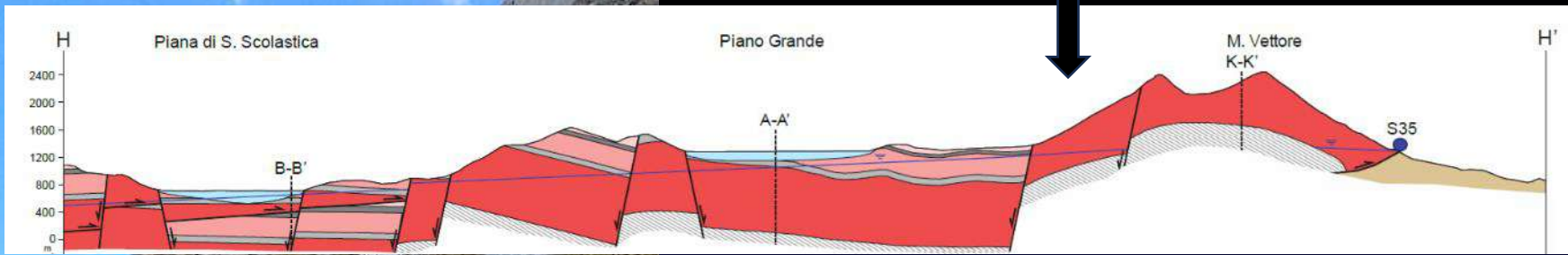
24 August 2016 earthquake (Mw 6.0): rupture of two distinct segments, one of which corresponds to the southern part of the VBF

26 October 2016 earthquake (Mw 5.9): activation of the northern ~15 km long segment of the VBF at a depth of ~ 4 km

30 October 2016 earthquake (Mw 6.5): rupture of the ~20 km long segment of the VBF that remained unbroken after the previous events







... but can an aquifer be faulted ?

POST-SEISMIC EFFECTS ON FRACTURED CARBONATE AQUIFERS

- ✓ What happened to the aquifers?
- ✓ How do fractured carbonate aquifers react in sudden fault rupture situations?

The effects on the aquifers can be only recognised with
PREEXISTING MONITORING HYDROGEOLOGICAL NETWORKS

What needs to be monitored ?

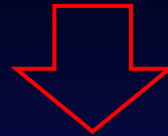
lots of things... but at the least:

- spring discharges
- river hydrometric levels or discharges
- piezometric heads in wells and piezometers
- groundwater physical and chemical parameters

It's best that the monitoring is **continuous** or, at the least, **periodic**

August 2016 - January 2017

a seismic sequence affected the Umbria-Marche hydrogeological domain



- ✓ an informal call for all available hydrogeological data from June 1st 2016 to February 28th 2017 was opened
- ✓ data from regional hydrographic services, water supply companies and the research teams monitoring the earthquake zones were collected
- ✓ 2018: the 2016-2017 regional framework of the earthquake's effects was published


Hydrogeology Journal (2018) 26:1009–1026
<https://doi.org/10.1007/s10040-017-1717-7>

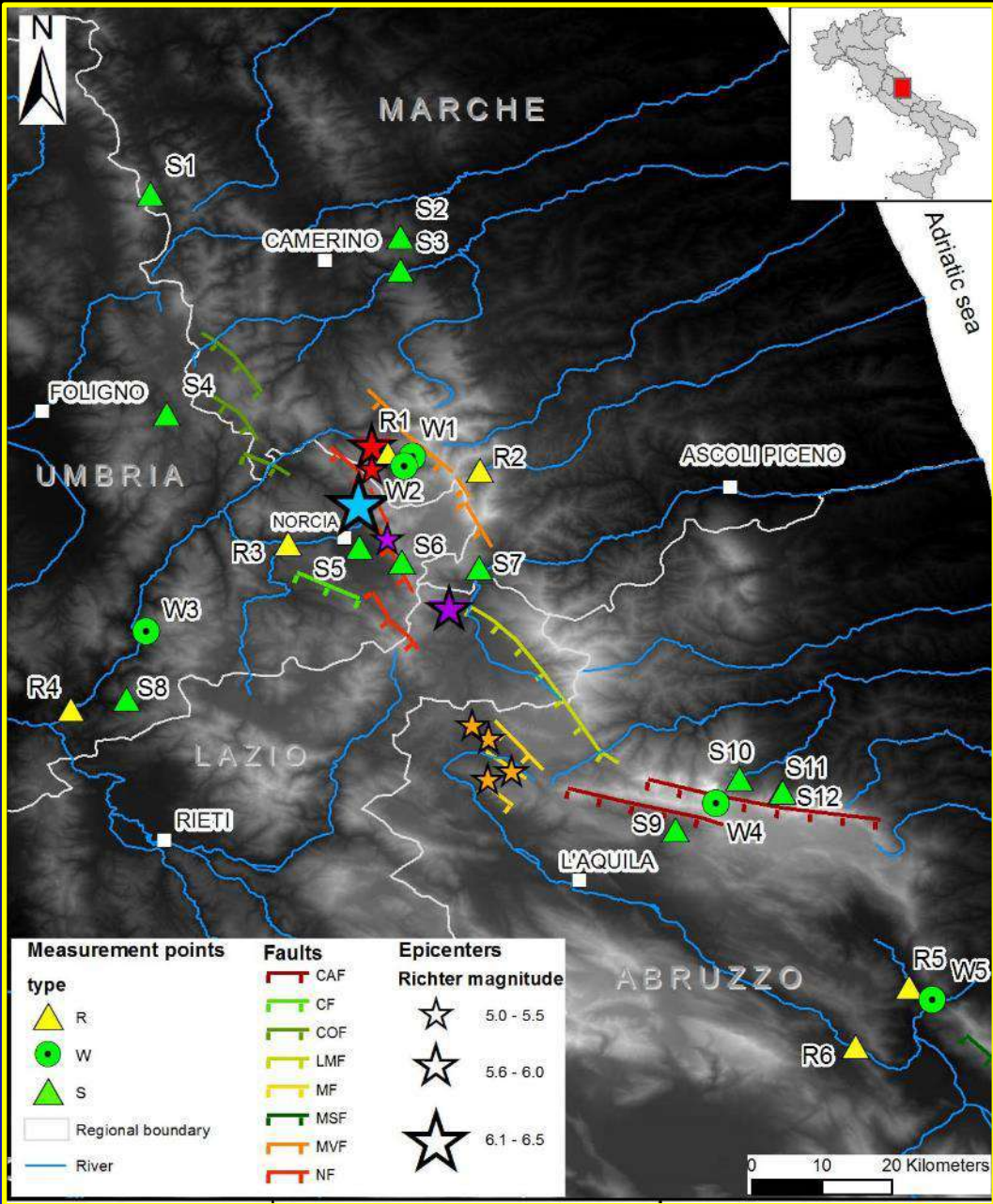


PAPER



Water-table and discharge changes associated with the 2016–2017 seismic sequence in central Italy: hydrogeological data and a conceptual model for fractured carbonate aquifers

Marco Petitta^{1,2} · Lucia Mastrorillo³ · Elisabetta Preziosi²  · Francesca Banzato¹ · Marino Domenico Barberio¹ · Andrea Billi⁴ · Costanza Cambi⁵ · Gaetano De Luca⁶ · Giuseppe Di Carlo⁷ · Diego Di Curzio⁸ · Cristina Di Salvo⁹ · Torquato Nanni¹⁰ · Stefano Palpacelli¹⁰ · Sergio Rusi⁸ · Michele Saroli¹¹ · Marco Tallini¹² · Alberto Tazioli¹⁰ · Daniela Valigi⁵ · Paola Vivalda¹⁰ · Carlo Doglioni¹



23 monitoring sites

(Epicentral distance of up to 100 km)

- 5: piezometric heads in wells (W)
- 12: spring discharges (S)
- 6: river discharges (R)

Data aggregated at daily scale

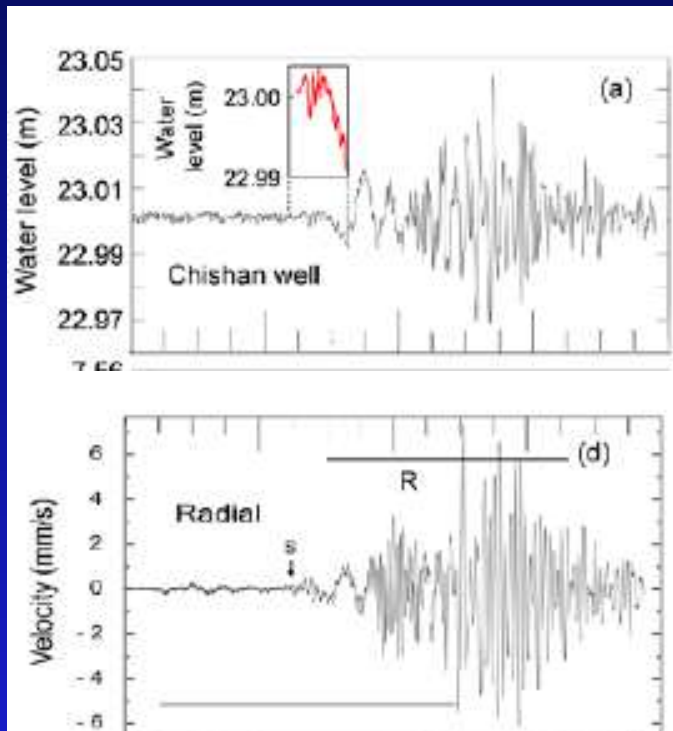
- ★ August 24th 2016 Mw 6.0
- ★ October 26th 2016 Mw 5.9
- ★ October 30th 2016 Mw 6.5
- ★ January 18th 2017 Mw 5.5

The goal was to know the earthquake induced "groundwater changes"

WHAT DOES "GROUNDWATER CHANGES" MEAN ?

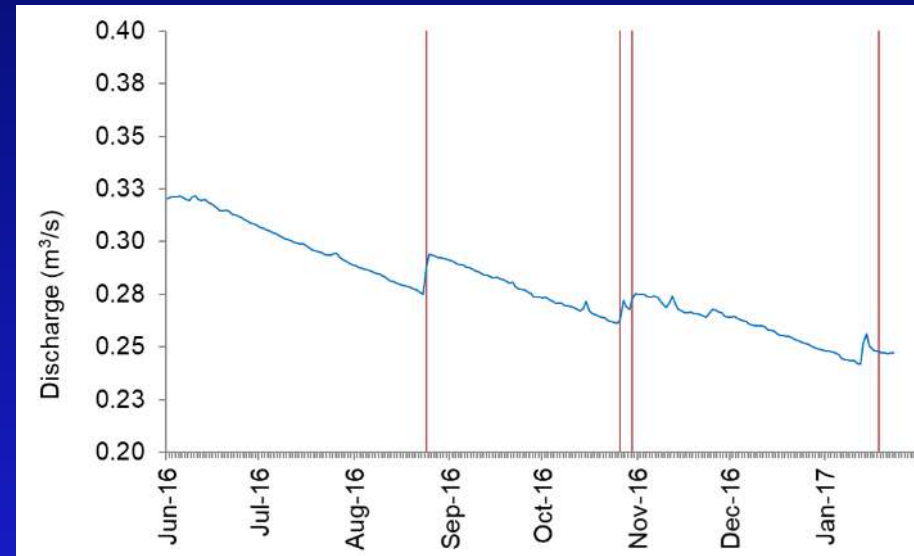
TRANSIENT MODIFICATION

a quick oscillation, observed in sites equipped with high-frequency recordings



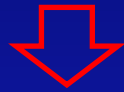
SUSTAINED OFFSET

- ✓ abrupt rises or falls
- ✓ sustained gradual rise lasting for several days after the shock



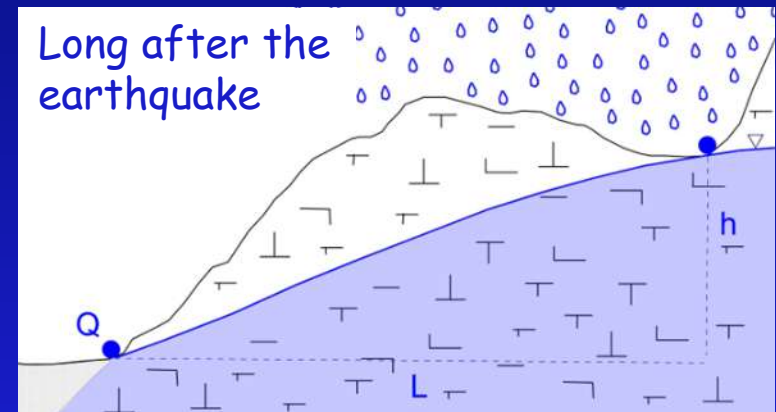
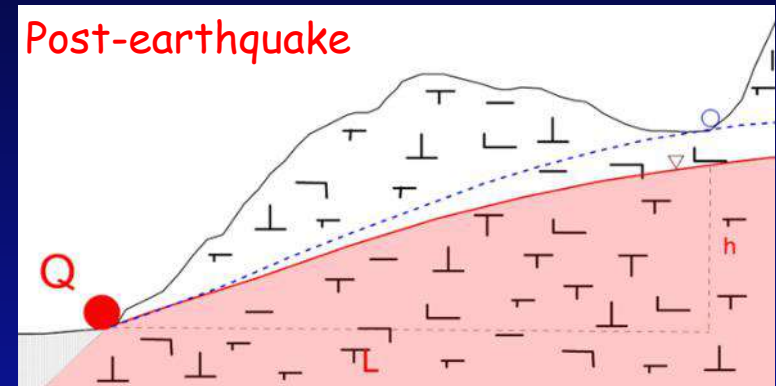
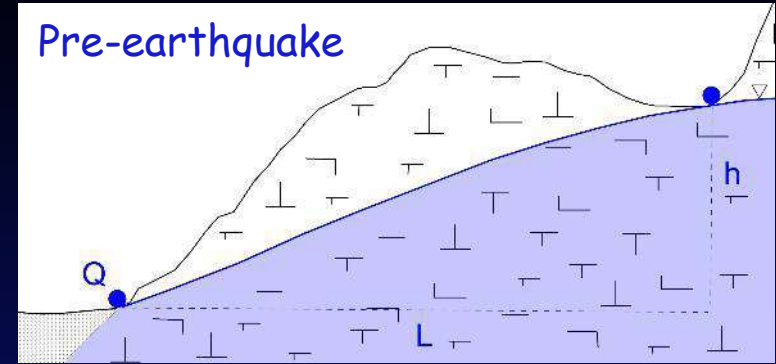
Main mechanisms proposed to explain these responses

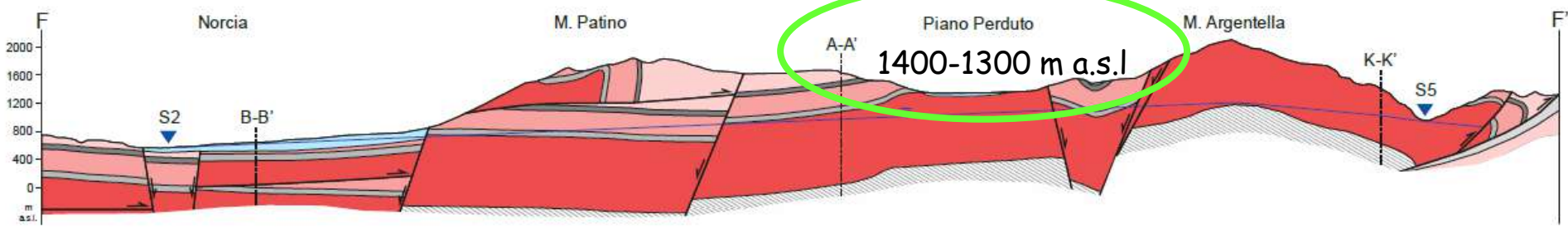
- ✓ co-seismic static strain increases pore pressure that may contribute to change permeability (Transient modifications);
- ✓ earthquake-related dynamic strains may increase permeability, permitting a more rapid flow, which in fractured aquifers can be enhanced by fracture cleaning, eventually increasing discharge;



increase in hydraulic conductivity and changes to the hydraulic head at the aquifer scale

$$\text{Darcy's Law: } Q = KAi \quad (i = h/L)$$

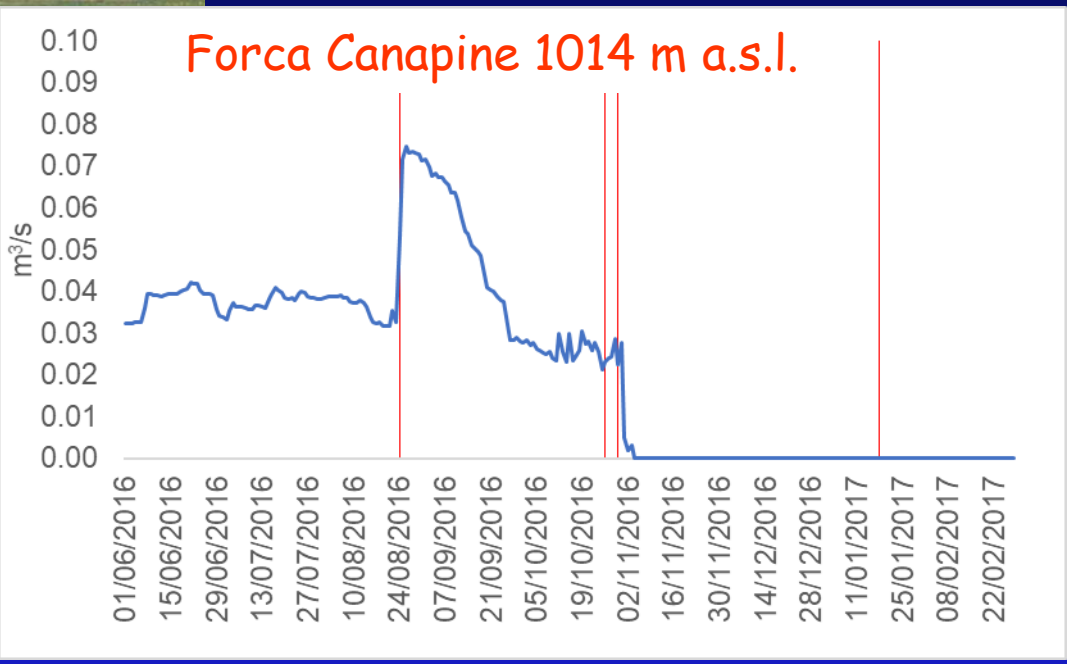


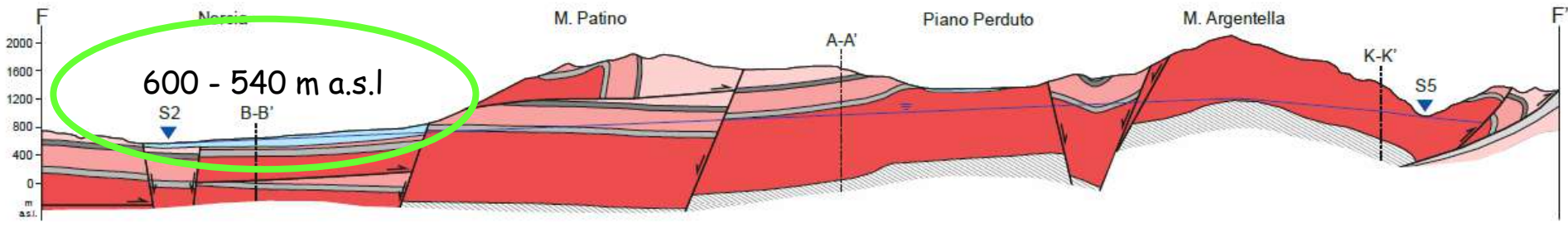


Fonte delle Monache 1323 m a.s.l.

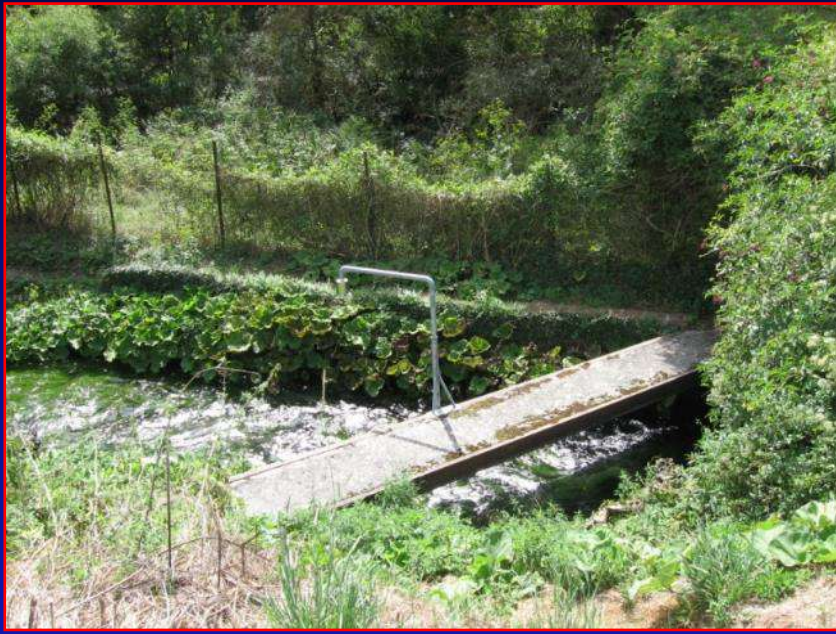


May 2017





Sordo River 540 m a.s.l.
Ponte Mollo discharge gauging station

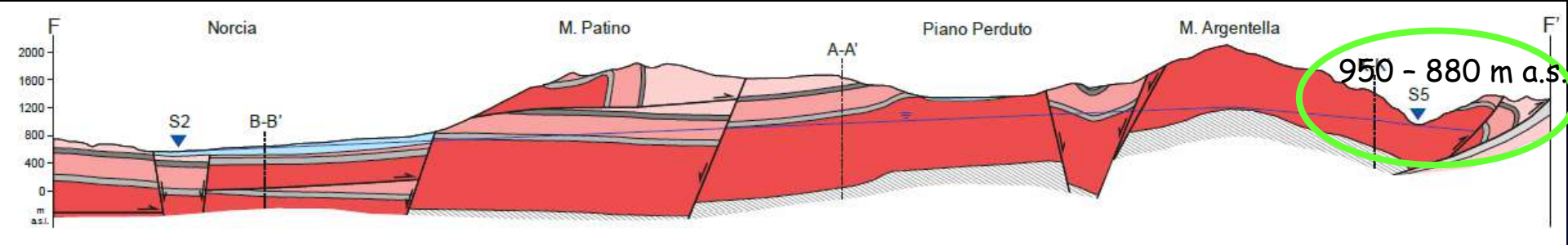


September 2010
1.80 m³/s



Dicember 2016
4.00 m³/s





June 2011

October 2020



Foce spring
(910 m a.s.l.)



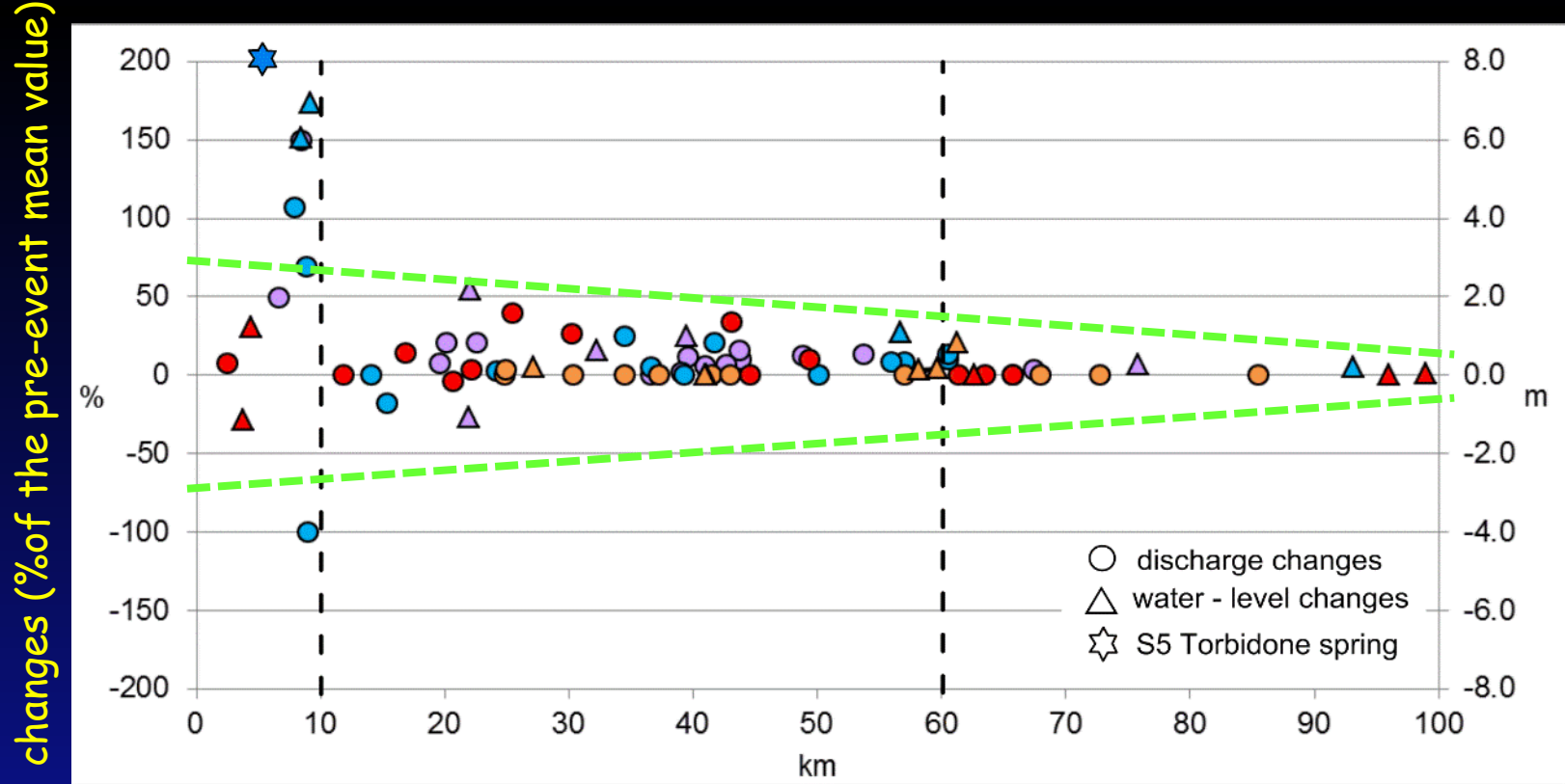
Foce spring
(910 m a.s.l.)



Aso River
(885 m a.s.l.)



Aso River
(885 m a.s.l.)

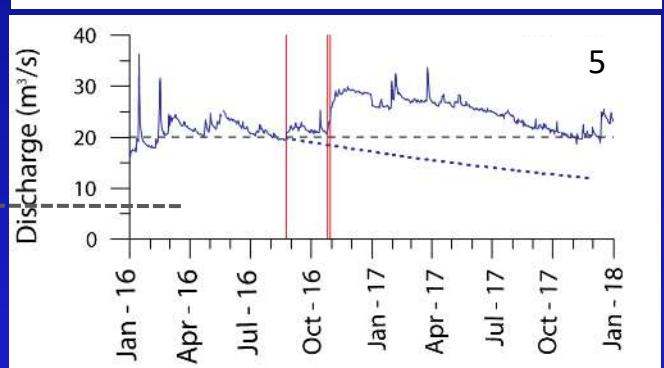
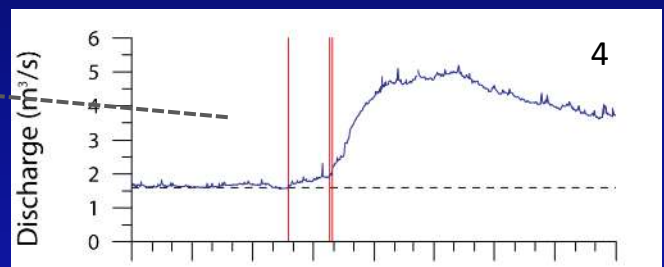
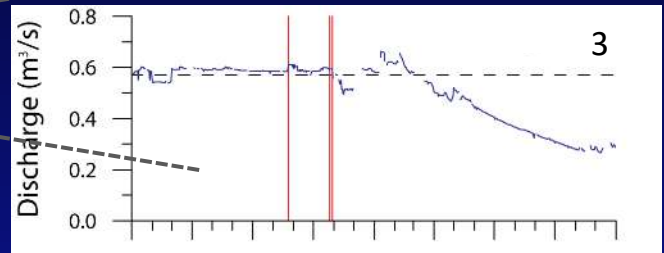
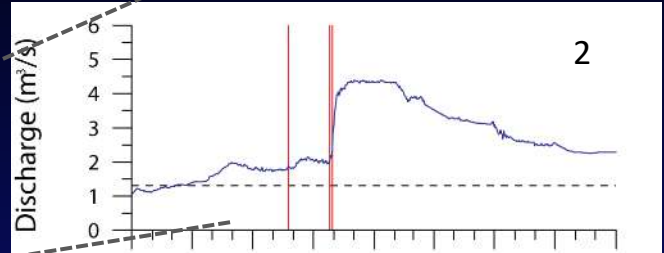
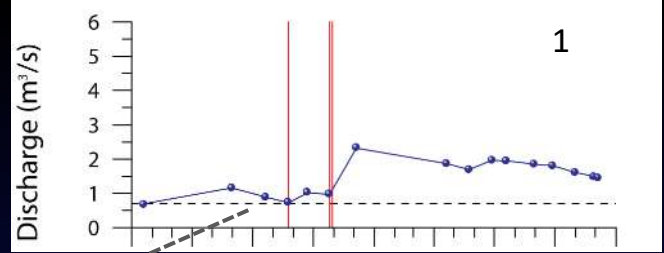
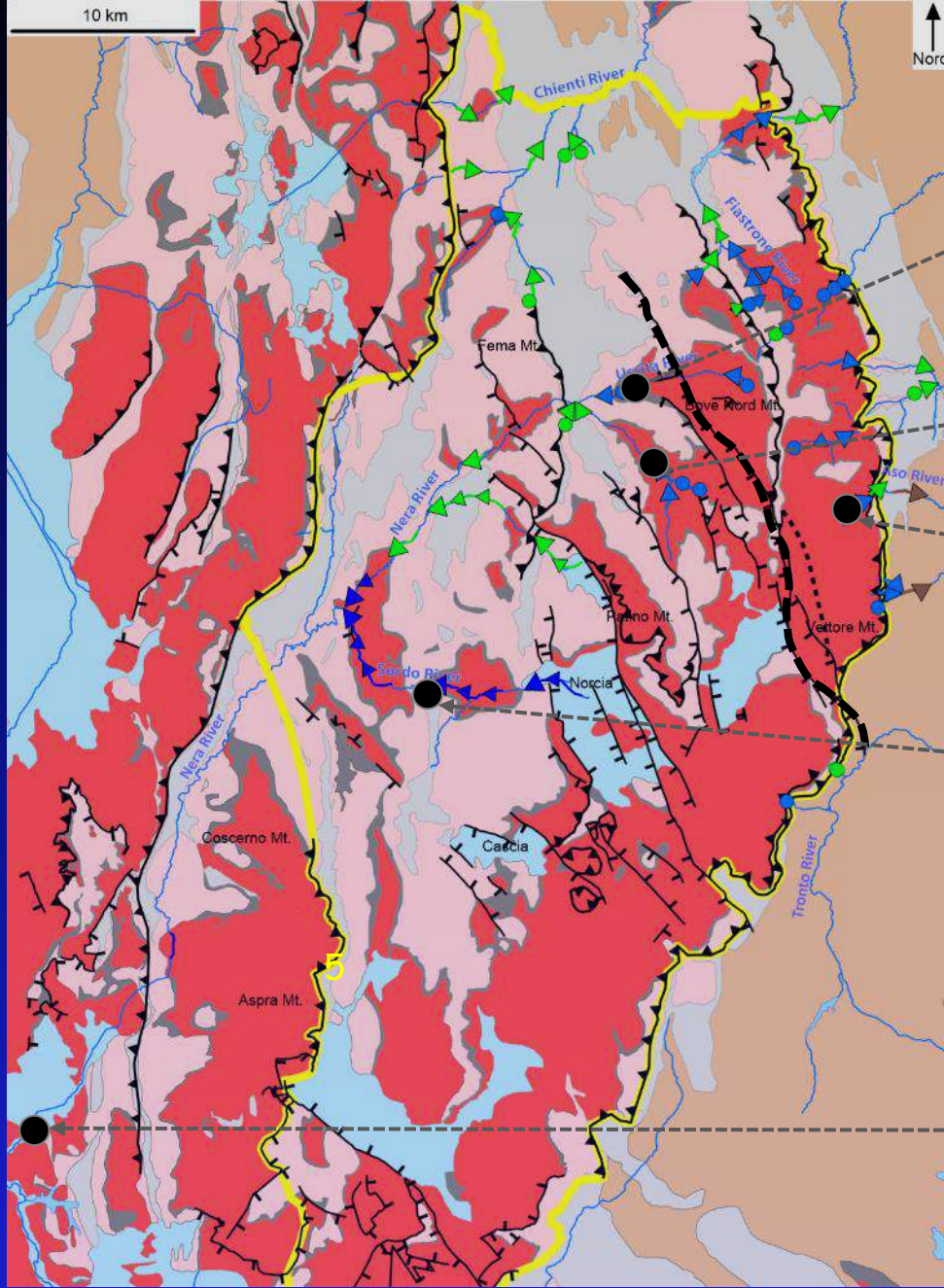


epicentral distance

- August 24th 2016 Mw 6.0
- October 26th 2016 Mw 5.9
- October 30th 2016 Mw 6.5
- January 18th 2017 Mw 5.5

- Sibillini area
- Basal aquifer

FOCUS ON THE SIBILLINI BASAL AQUIFERS

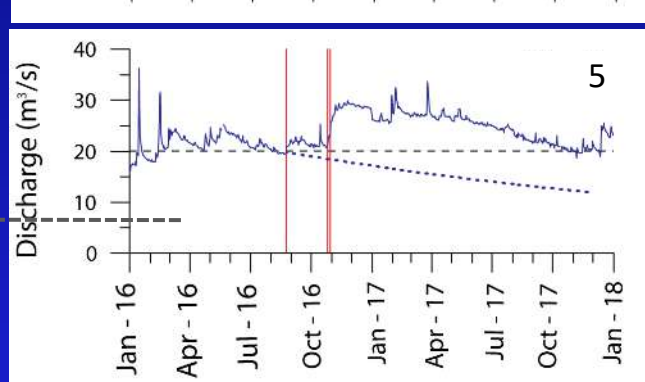
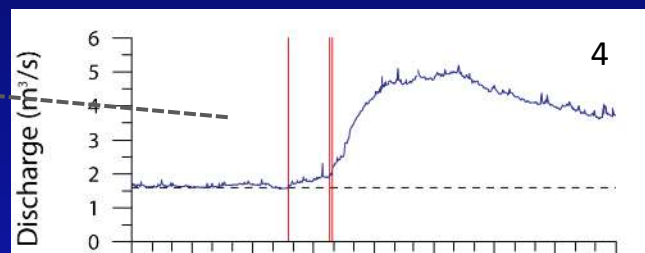
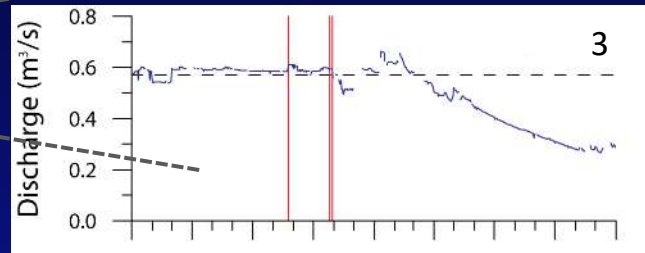
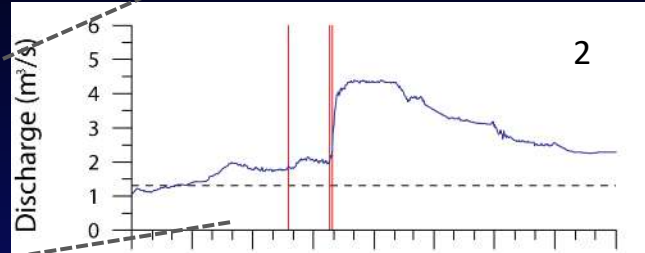
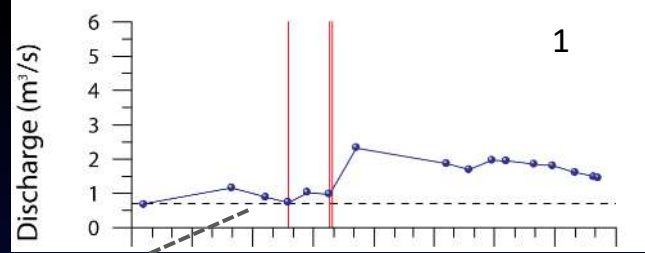
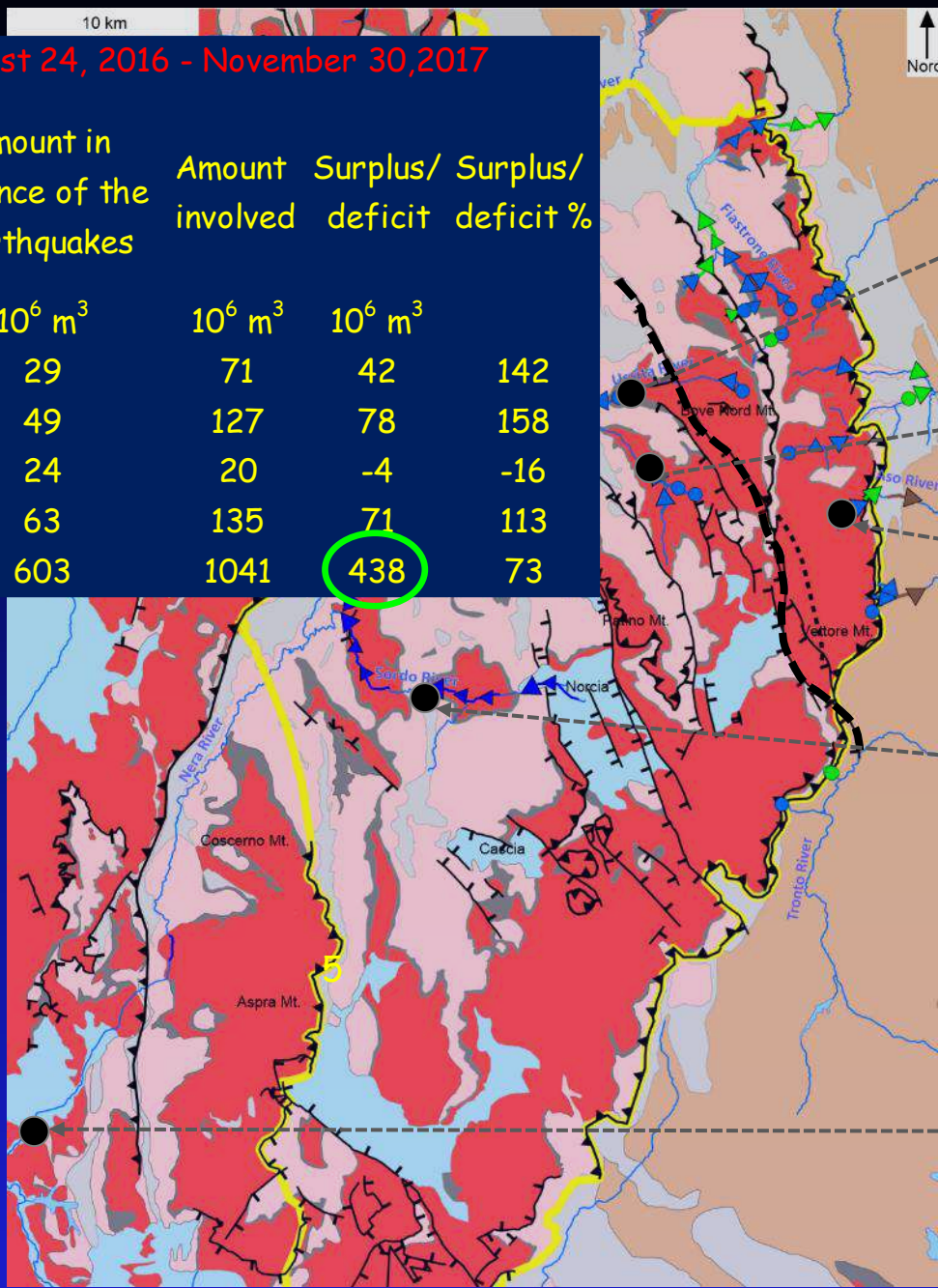


FOCUS ON THE SIBILLINI BASAL AQUIFERS

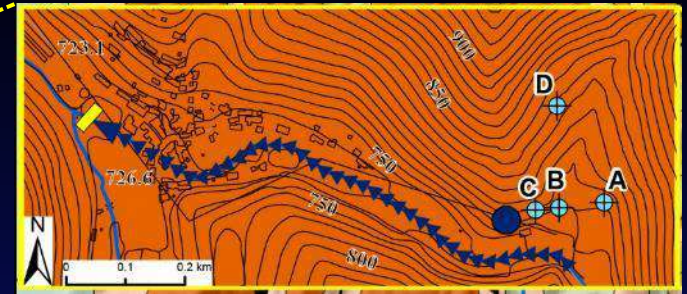
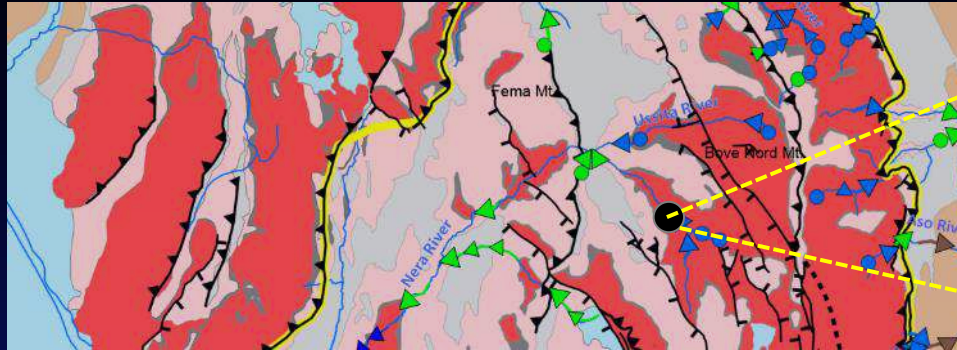
August 24, 2016 - November 30, 2017

Amount in absence of the earthquakes Amount involved Surplus/ deficit Surplus/ deficit %

| | 10^6 m^3 | 10^6 m^3 | 10^6 m^3 | |
|---|--------------------|--------------------|--------------------|-----|
| 1 | 29 | 71 | 42 | 142 |
| 2 | 49 | 127 | 78 | 158 |
| 3 | 24 | 20 | -4 | -16 |
| 4 | 63 | 135 | 71 | 113 |
| 5 | 603 | 1041 | 438 | 73 |



HOW MUCH HAS THE HYDRAULIC CONDUCTIVITY INCREASED?



Darcy's Law: $Q = KAi$

Q = spring discharge

A = cross-sectional area to flow

i = hydraulic gradient between the D piezometer and the spring

PERMEABILITY INCREASE

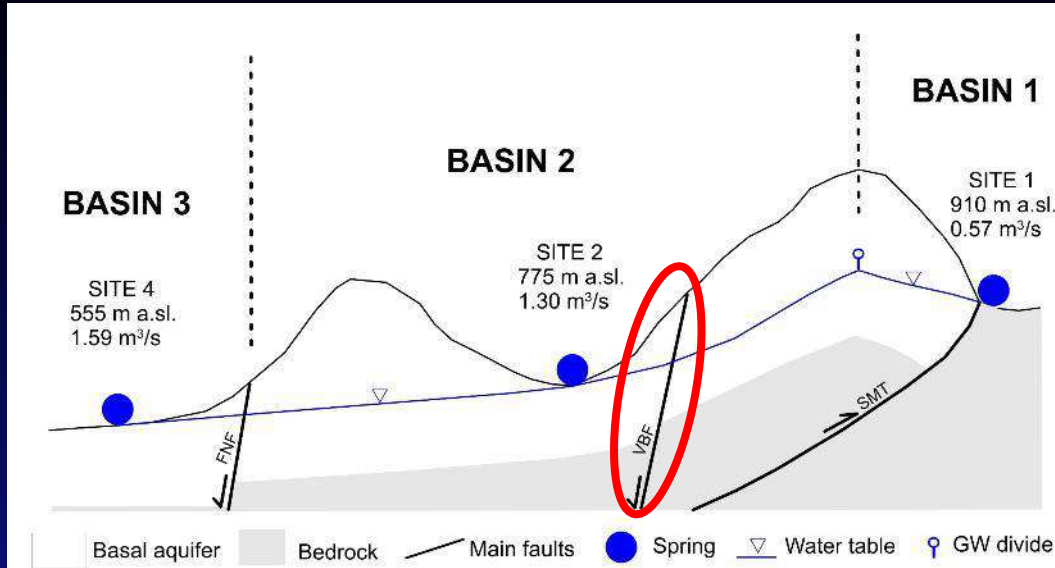
13% (August) of the pre-event values

19% (October)

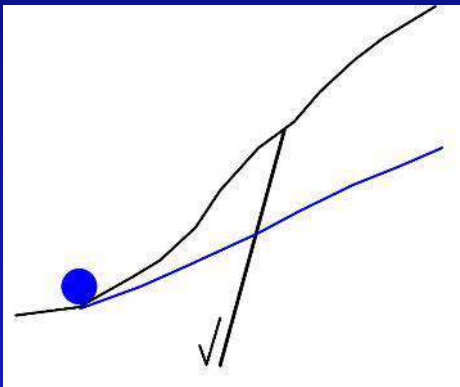
| Event | Pre-seismic i | Post-seismic i | Pre-seismic Q (m ³ /s) | Post-seismic Q (m ³ /s) | Pre-seismic KA (m ³ /s) | Post-seismic KA (m ³ /s) | ΔKA (m ³ /s) |
|---------|-----------------|------------------|-------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|---------------------------------|
| August | 0.0932 | 0.0895 | 1.88 | 2.05 | 20.17 | 22.91 | 2.73 |
| October | 0.0950 | 0.0895 | 2.16 | 2.40 | 22.74 | 26.82 | 4.08 |

THE LARGE AMOUNT OF ADDITIONAL DISCHARGE, CANNOT BE
ATTRIBUTED ONLY TO THE PERMEABILITY INCREASE

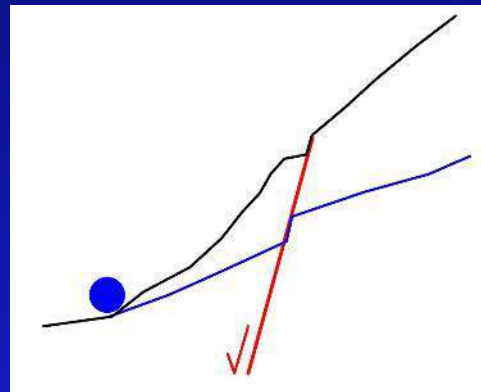
WHAT IF THE BASAL AQUIFER IS FAULTED?



AQUIFER FAULT RUPTURE



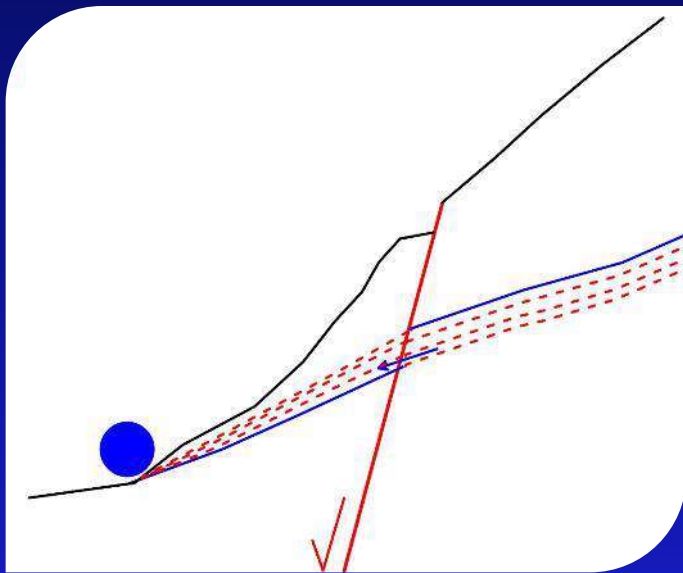
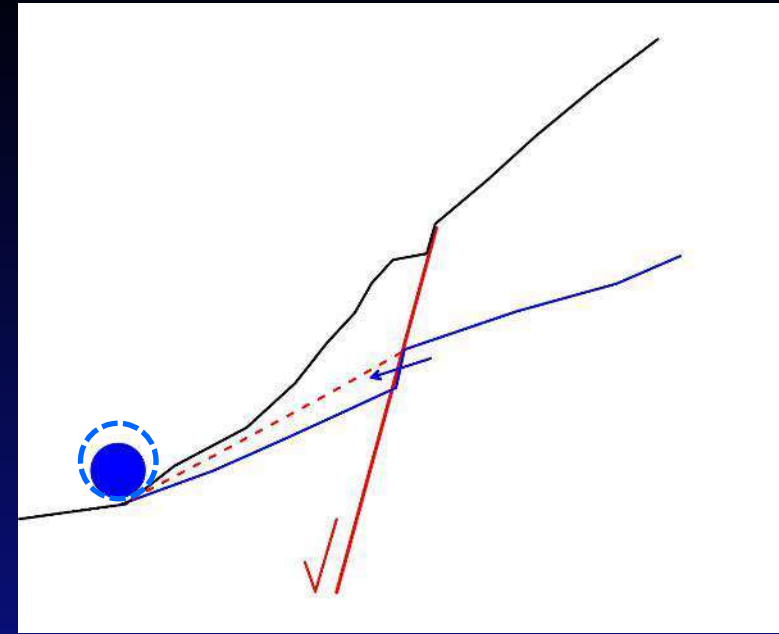
Pre-earthquake



Post-earthquake

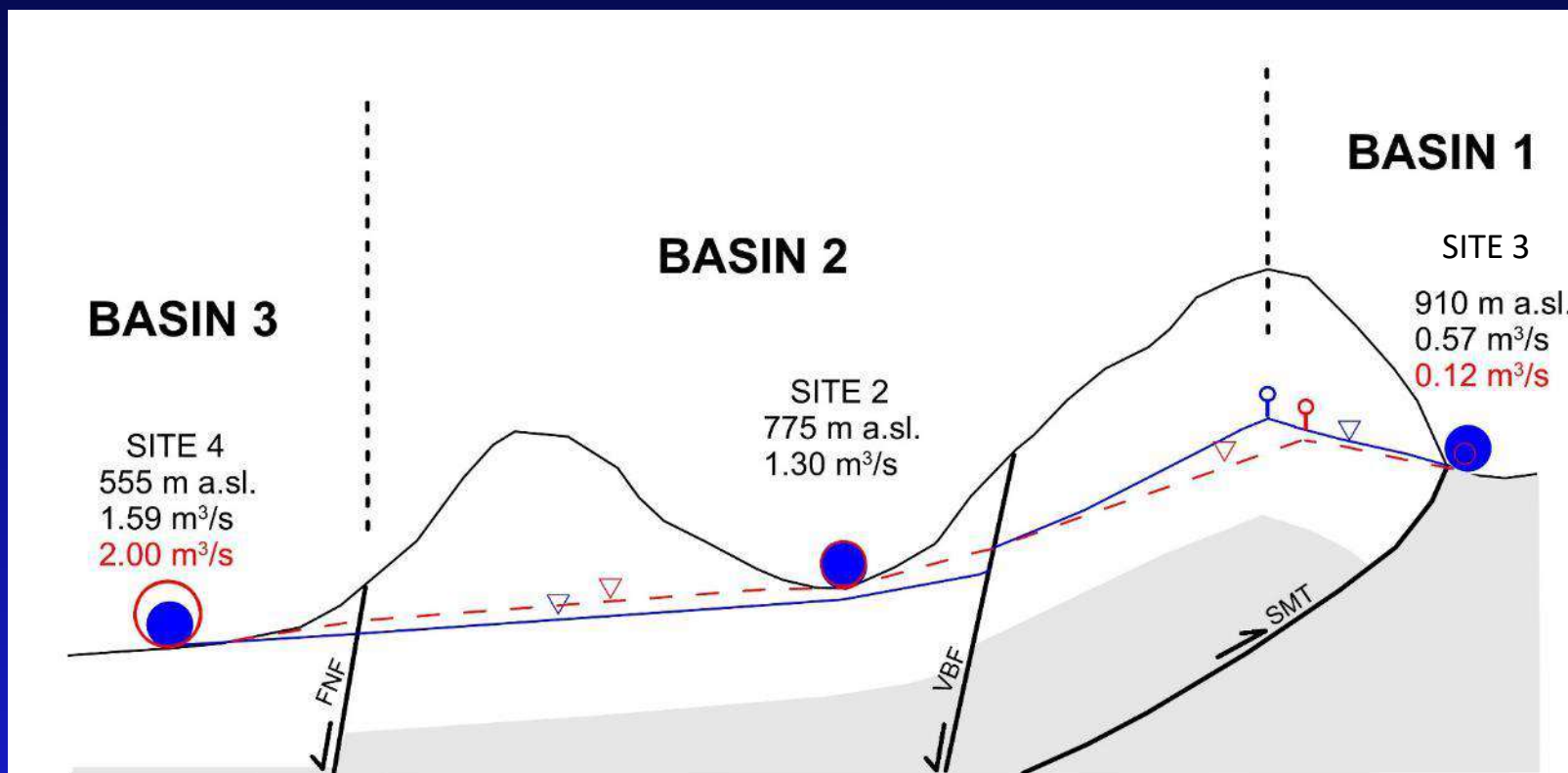
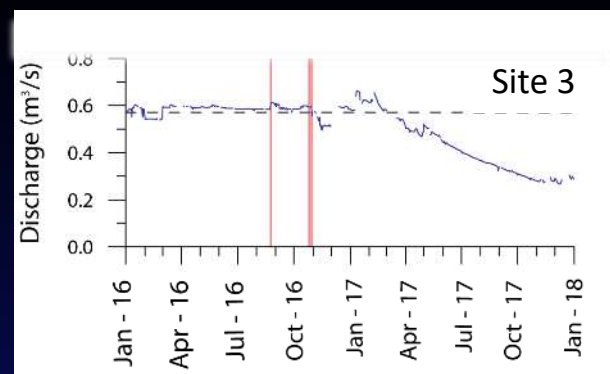
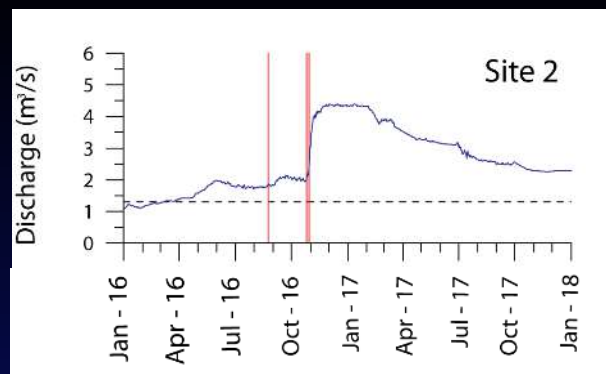
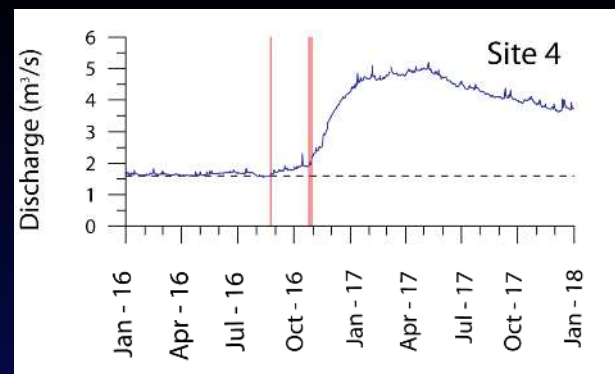
HOW DOES "AQUIFER FAULT RUPTURE" WORK ?

i) The sudden formation of a displaced section area on a fault plane inside the saturated zone of the aquifer, induces an abrupt hydraulic imbalance, favouring a groundwater transfer surplus through the newly displaced section



ii) The system gradually tends to a new hydraulic equilibrium. The rate of the transient surplus discharge starts to decrease according to the hydraulic gradient drop. At the same time, the height of the wetted section decreases, contributing to the consequential reduction of the surplus discharge

iii) When the hydraulic gradient stabilizes, a new steady-state condition is reached



IS IT POSSIBLE TO EVALUATE HOW MUCH GROUNDWATER SURPLUS HAS FLOWN THROUGH THE DISPLACED SECTION?

$$\text{Darcy's Law: } Q = KAi$$

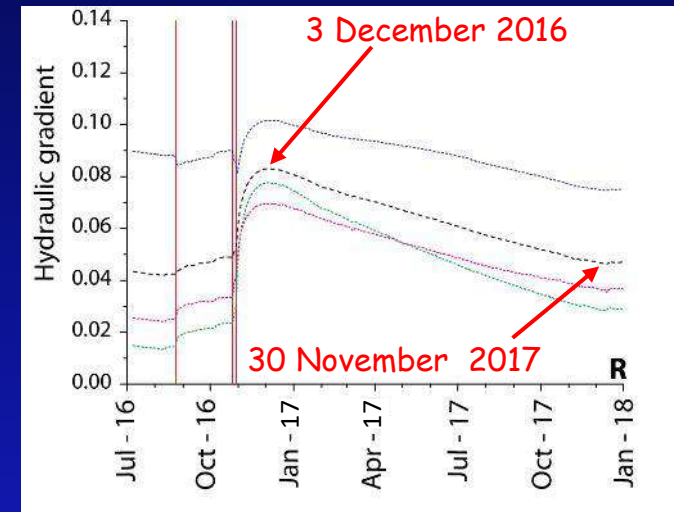
From literature:

- vertical offsets : 0.775 m
 - length of the fault segment : 20 km
 - hydraulic gradient (i): 0.03 - 0.04
 - hydraulic conductivity (k) : 2×10^{-2} - 4×10^{-2} m/s
- $A: 15.5 \times 10^3 \text{ m}^2.$

Surplus (Q): $19 \text{ m}^3/\text{s}.$

The surplus discharge

- ✓ constant until the hydraulic gradient starts to decrease (December 3, 2016)
- ✓ progressively decreased following the hydraulic gradient trend reduction until November 30, 2017

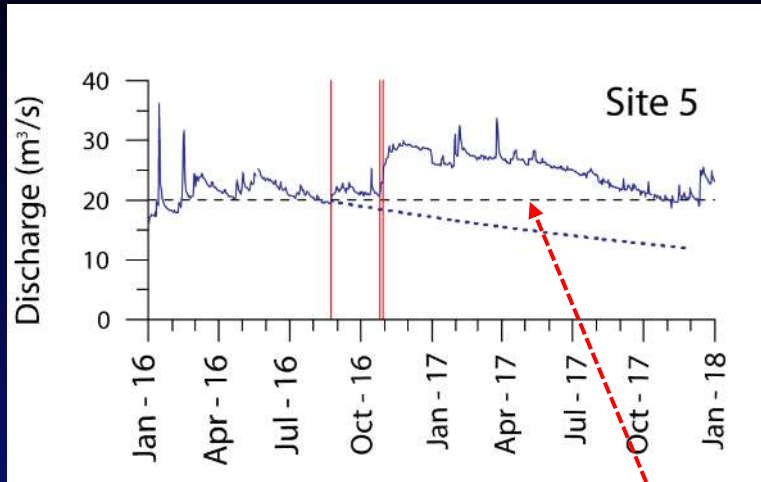


31 October - 3 December 2016: $53 \times 10^6 \text{ m}^3$

3 December 2016 - 30 November 2017: $421 \times 10^6 \text{ m}^3$

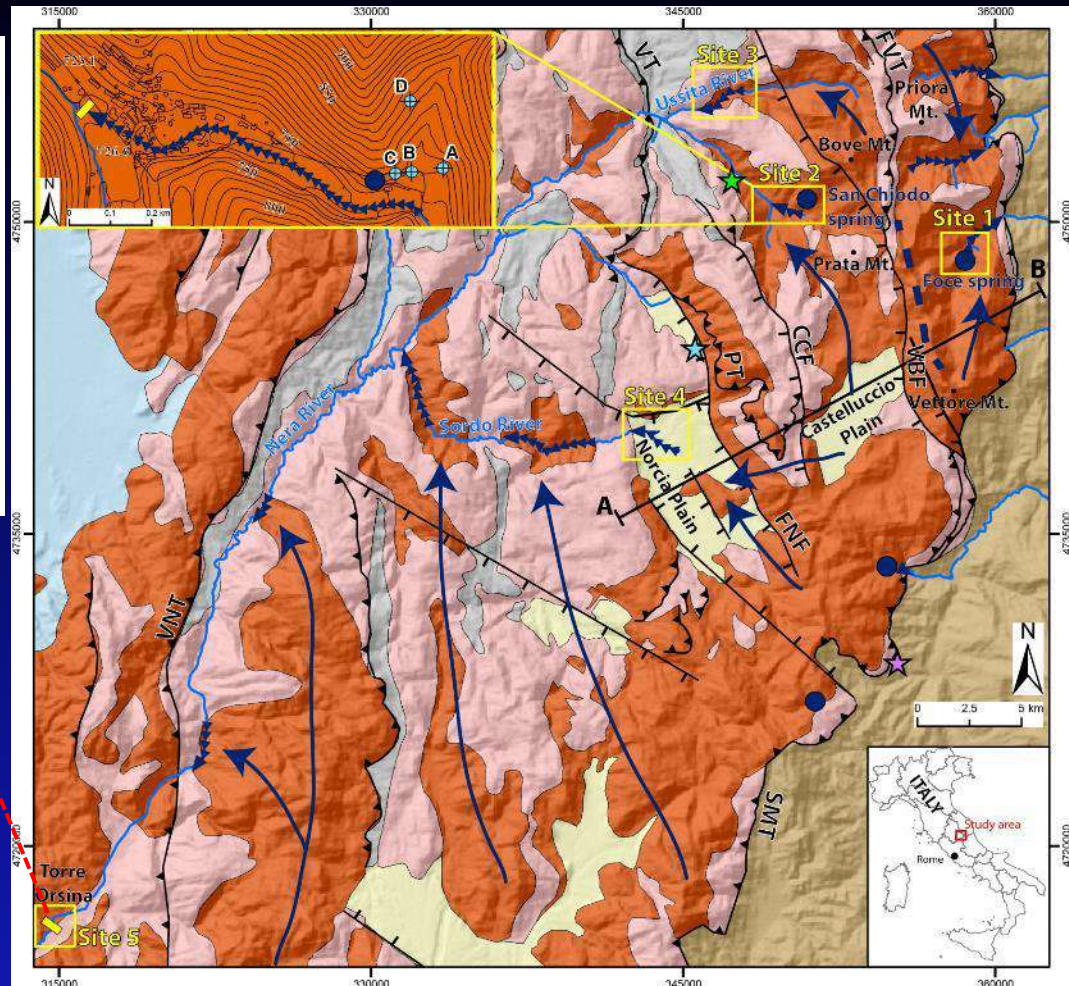
Total surplus mobilized by the AFR mechanism: $474 \times 10^6 \text{ m}^3$

Total surplus mobilized by the AFR mechanism: $474 \times 10^6 \text{ m}^3$



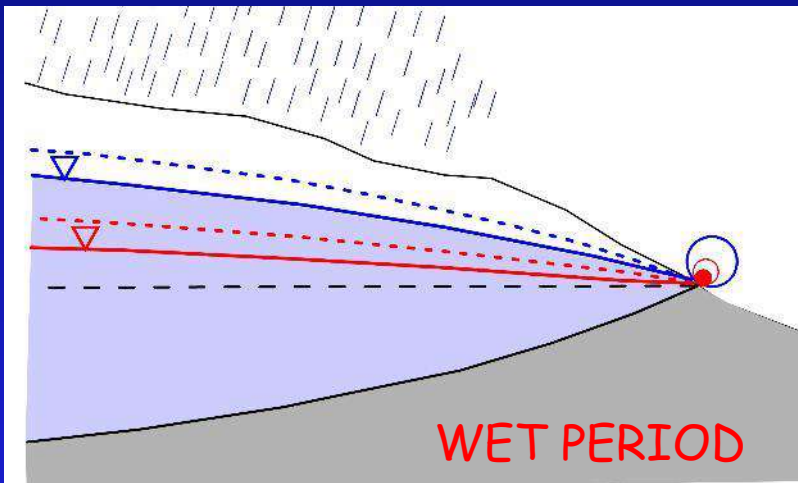
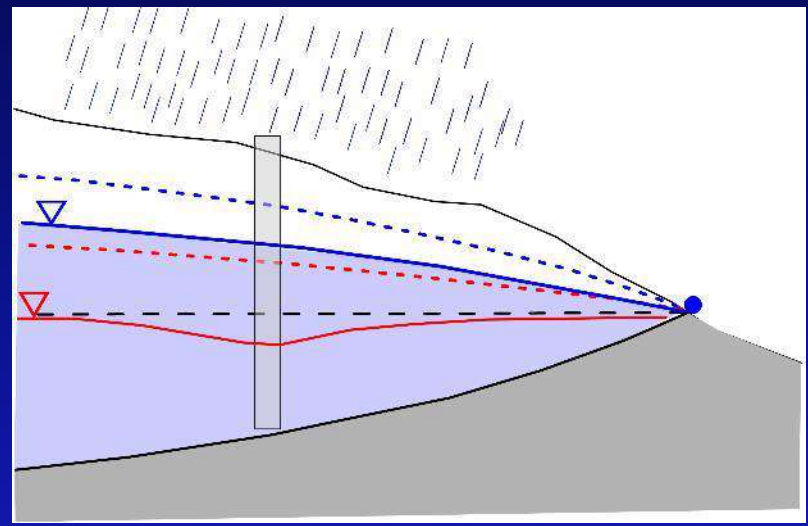
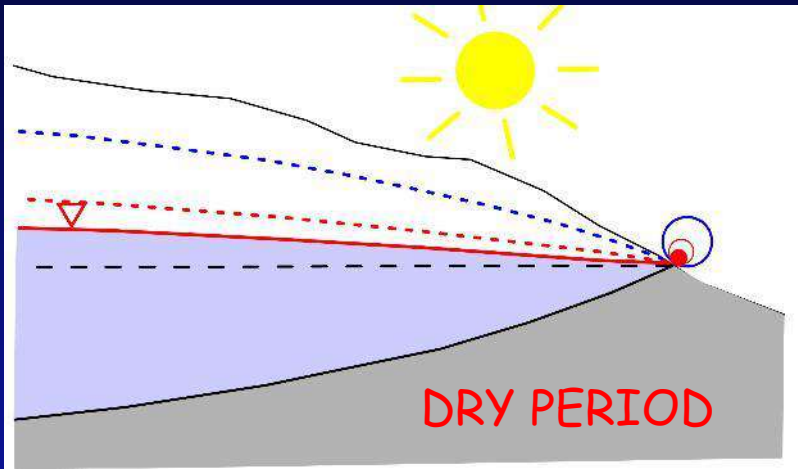
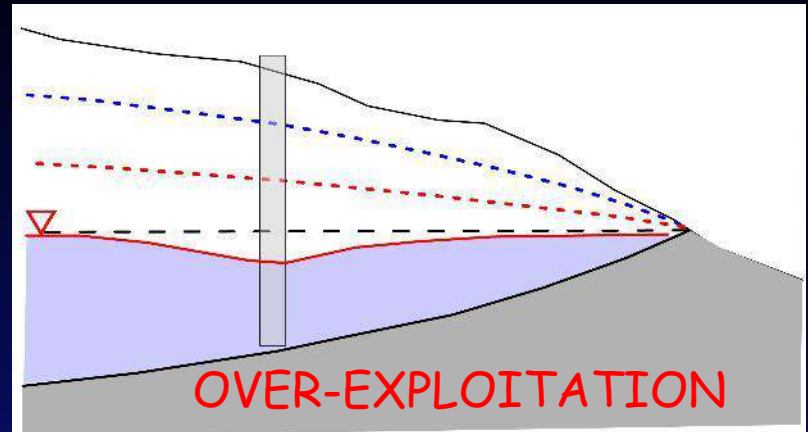
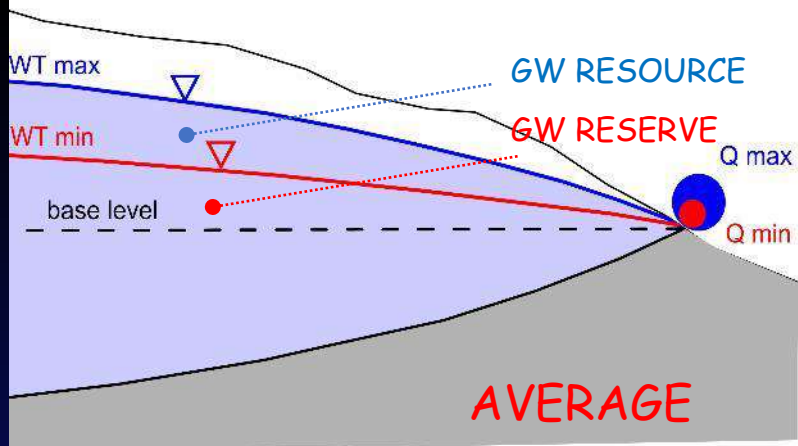
Total discharge increase
in Torre Orsina station:

$438 \times 10^6 \text{ m}^3$



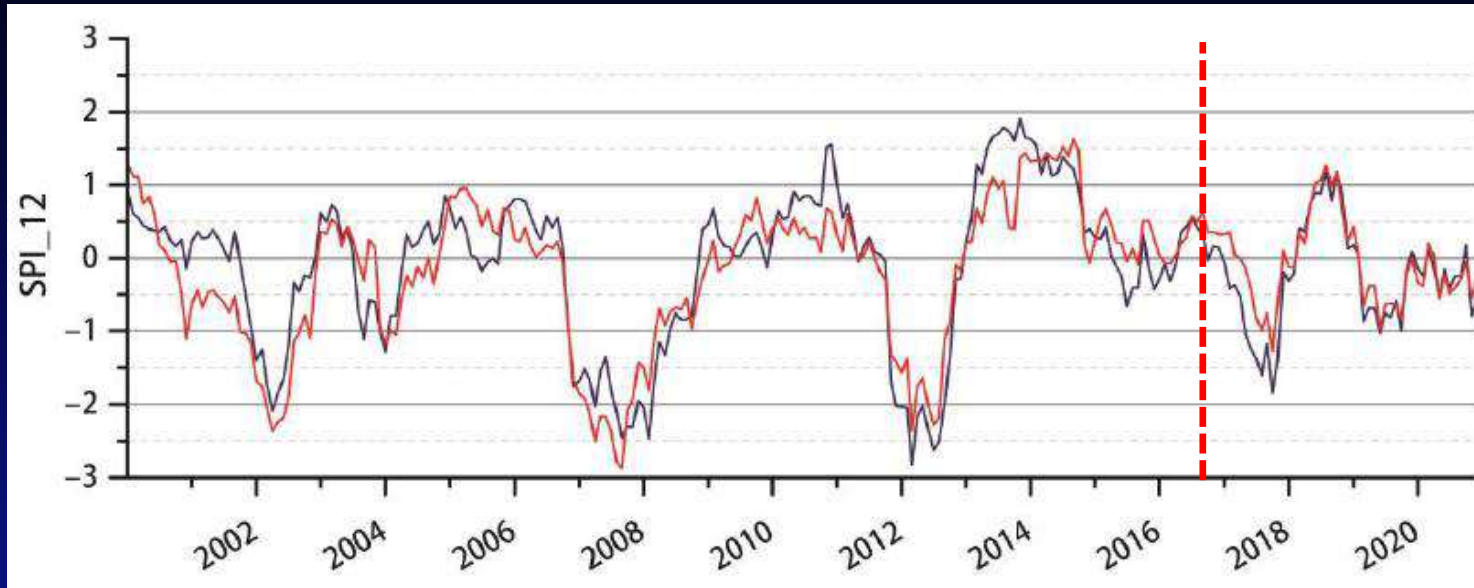
!! The surplus outflow induced by the earthquake has exhausted the groundwater resources and partially depleted the groundwater reserves

TO SEMPLIFY.....



..and what if the recharge is not enough ?

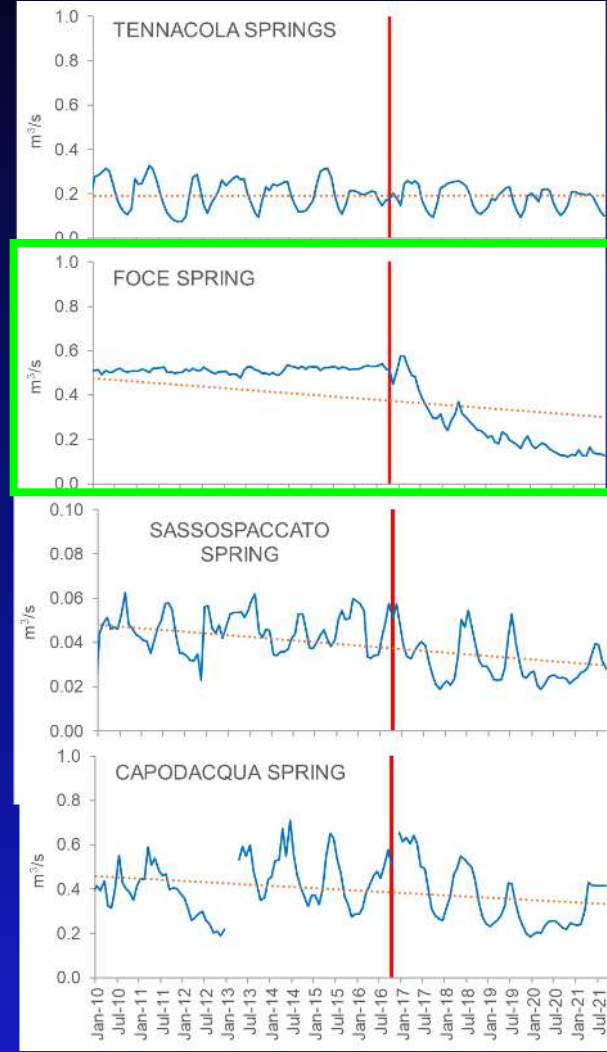
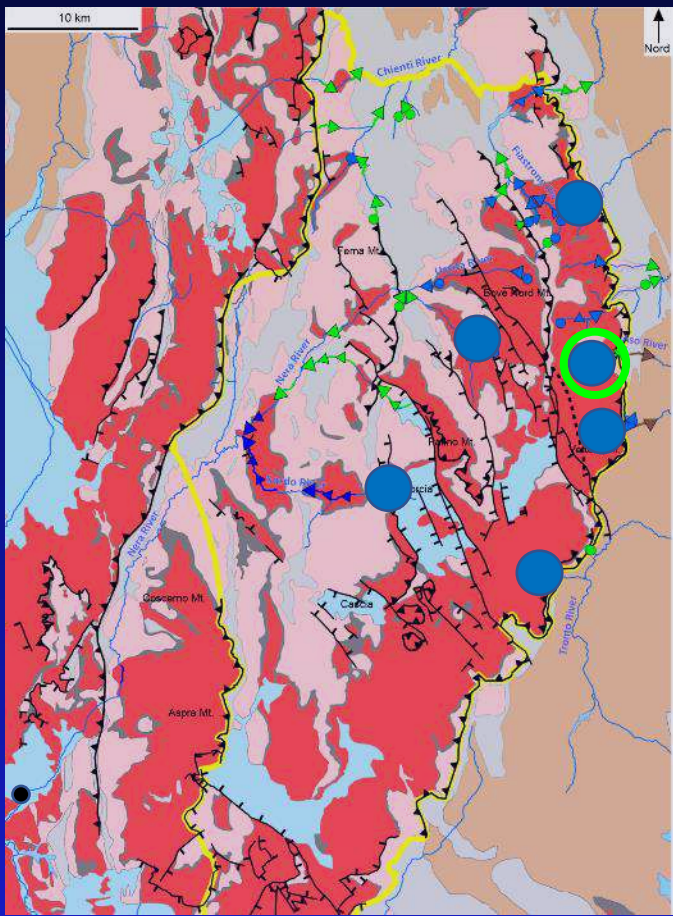
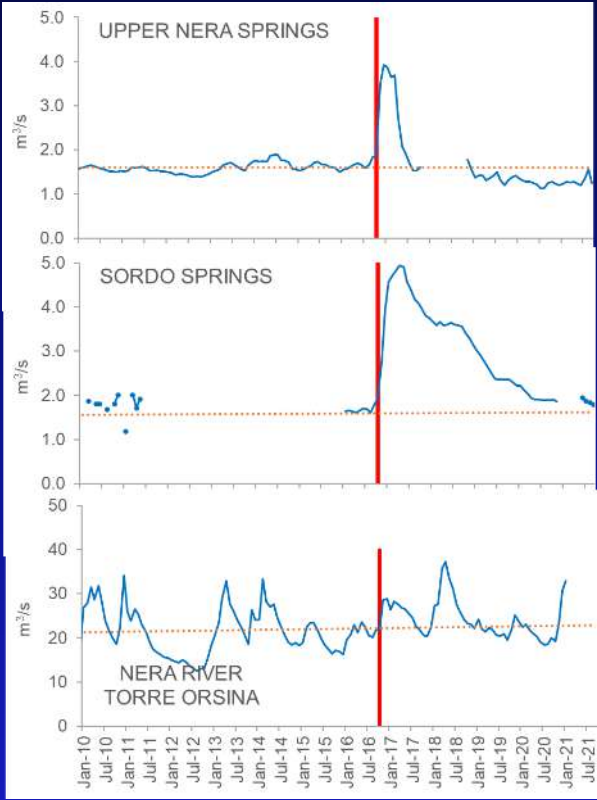
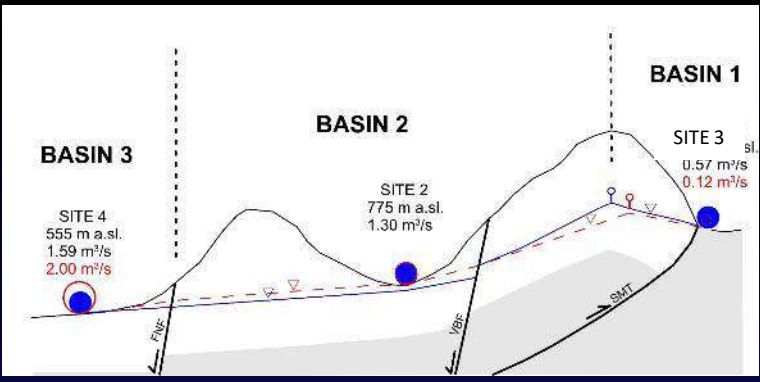
The post-seismic moderately dry period was not sufficient to fully recharge the drained aquifers



The SPI indicators shows the anomalies (deviation from the mean) of the observed total precipitation for an accumulation period of interest (e.g. 3, 12, 48 months) SPI values are in units of standard deviation from long-term mean

| ANOMALY | RANGE OF SPI VALUES | PRECIPITATION REGIME |
|----------|--|----------------------|
| Positive | $2.0 < \text{SPI} \leq \text{MAX}$ | Extremely wet |
| | $1.5 < \text{SPI} \leq 2.0$ | Very wet |
| | $1.0 < \text{SPI} \leq 1.5$ | Moderately wet |
| None | $-1.0 < \text{SPI} \leq 1.0$ | Normal precipitation |
| Negative | $-1.5 < \text{SPI} \leq -1.0$ | Moderately dry |
| | $-2.0 < \text{SPI} \leq -1.5$ | Very dry |
| | $\text{MIN} \leq \text{SPI} \leq -2.0$ | Extremely dry |

eight years after the earthquake, the hydrodynamic modification of the basal aquifer has not been recovered



Since 2016 water supply crisis on the Eastern side

.... E QUI FINISCE LA SCIENZA E INIZIANO I PROBLEMI...

Captazione
idropotabile di Foce
Galleria drenante con
imbocca a 910 m s.l.m

PRE -SISMA

Q m captata : 600 -
500 L/s

Q m esubero: 100 L/s

POST - SISMA

Q m captata: 150 L/s

Q m esubero: 0 L/s

Rete di adduzione CIIP spa

Acquedotto Pescara d'Arquata

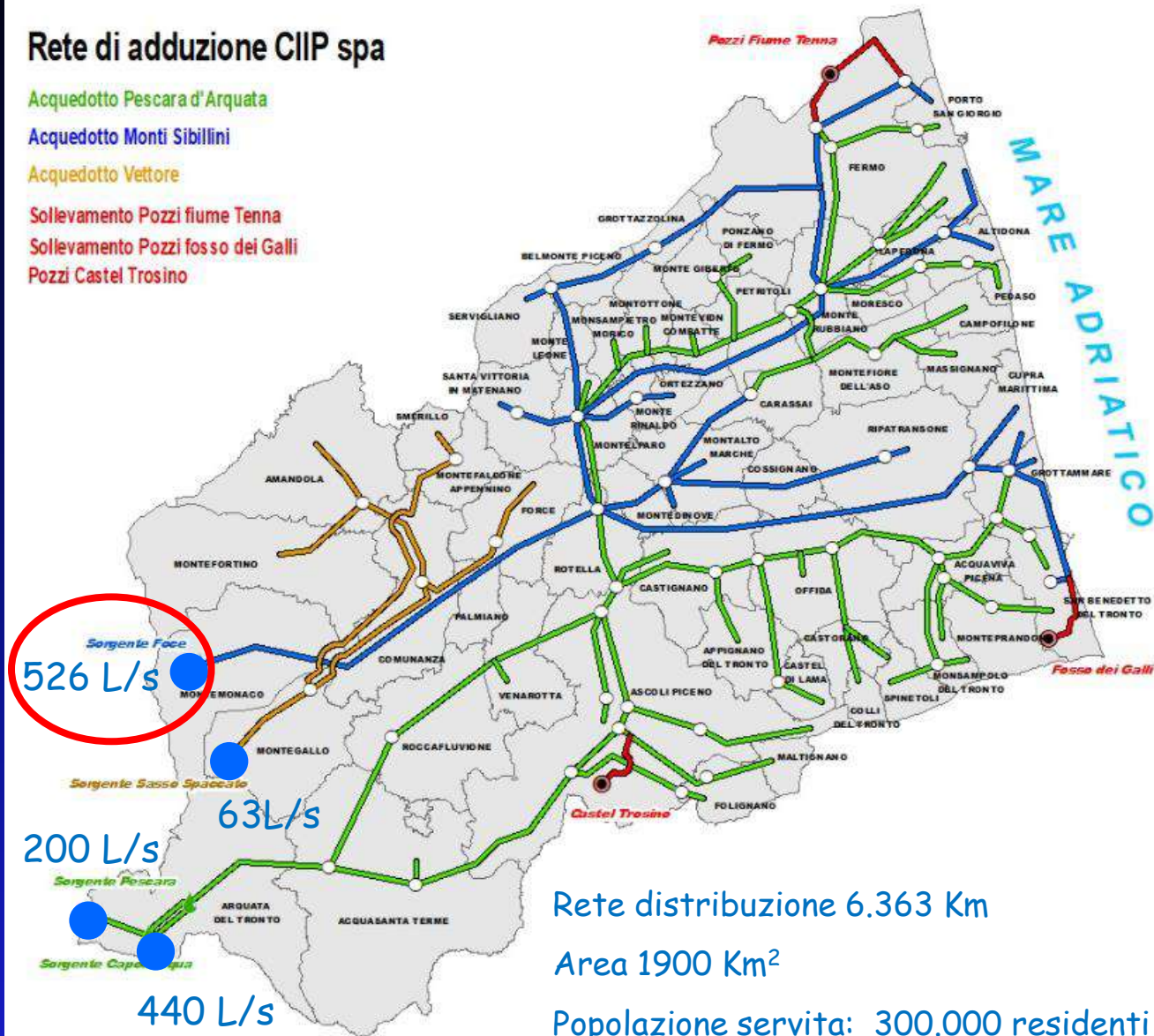
Acquedotto Monti Sibillini

Acquedotto Vettore

Sollevamento Pozzi fiume Tenna

Sollevamento Pozzi fosso dei Galli

Pozzi Castel Trosino



526 L/s

63 L/s

200 L/s

440 L/s

Rete distribuzione 6.363 Km

Area 1900 Km²

Popolazione servita: 300.000 residenti +
160.000 fluttuanti

200.000 - 250.000 utenti senz'acqua

CHE PROSPETTIVE PER LA CAPTAZIONE DI FOCE ?

quadro idrogeologico locale (pre sisma)

Sorgenti lineari Scaglia

Quota: 830 - 737 m

Q media 140L/s

Sorgenti lineari Maiolica

Quota: 860 - 840 m

Q media: 231 L/s

Gruppo sorgivo basale

Q media: 1295 L/s

Area di ricarica: 50 km²

Galleria drenante a 910 m

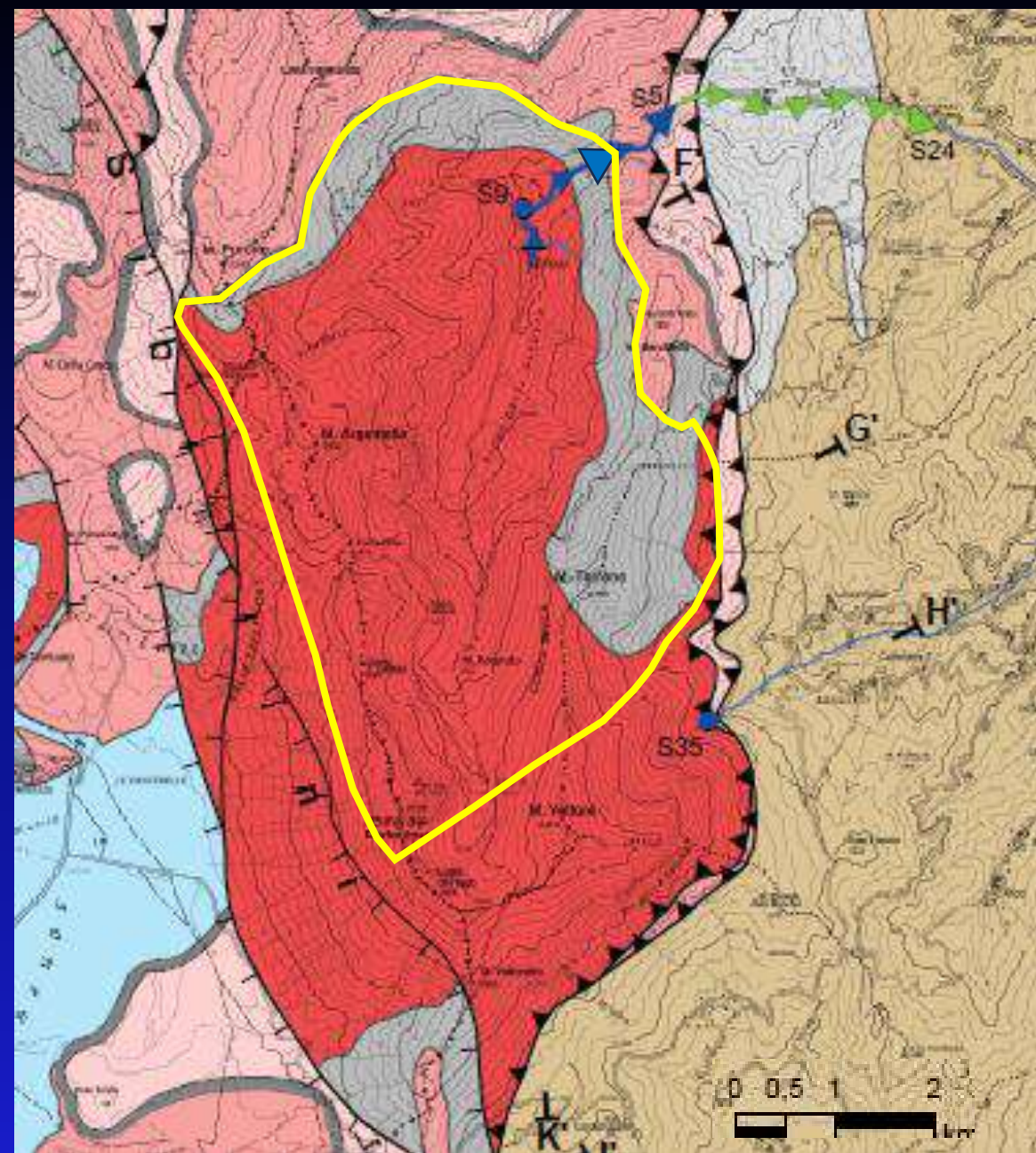
Q prelevata: 526 L/s

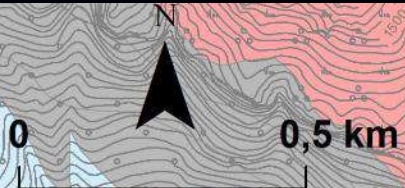
Q esubero: 100 L/s

Sorgenti lineari Aso

Quota 950 - 885 m

Q media: 769 L/s





DATI DISPONIBILI

| SEZIONI | 2010-2016 | 2017-2023 |
|------------|------------|------------|
| AS40 | 16 | 50 |
| AS45 | 16 | 50 |
| AS50 | 16 | 50 |
| AS60 | 16 | 50 |
| AS80 | 16 | 50 |
| AS90 | 16 | 50 |
| AS135 | 16 | 50 |
| TOT | 112 | 350 |

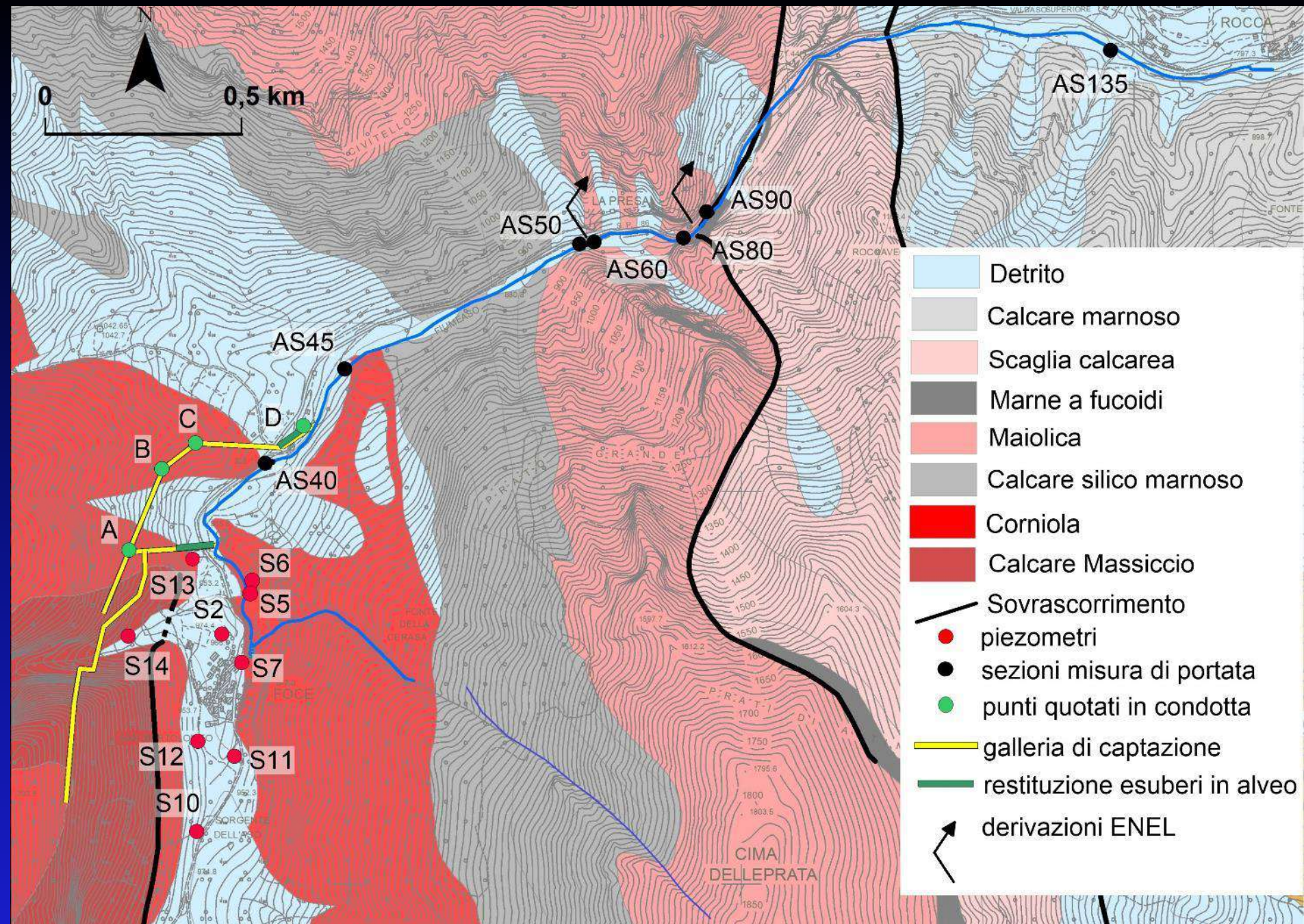
| PIEZOMETRI | 2010-2016 | 2017-2023 |
|------------|------------|------------|
| S2 | 82 | 51 |
| S5 | 80 | 53 |
| S6 | 81 | 60 |
| S7* | 84 | 40 |
| S10* | 75 | 59 |
| S11 | 75 | 64 |
| S12* | 74 | 65 |
| S13* | 75 | 62 |
| S14* | 73 | 63 |
| A* | 80 | 59 |
| TOT | 779 | 576 |

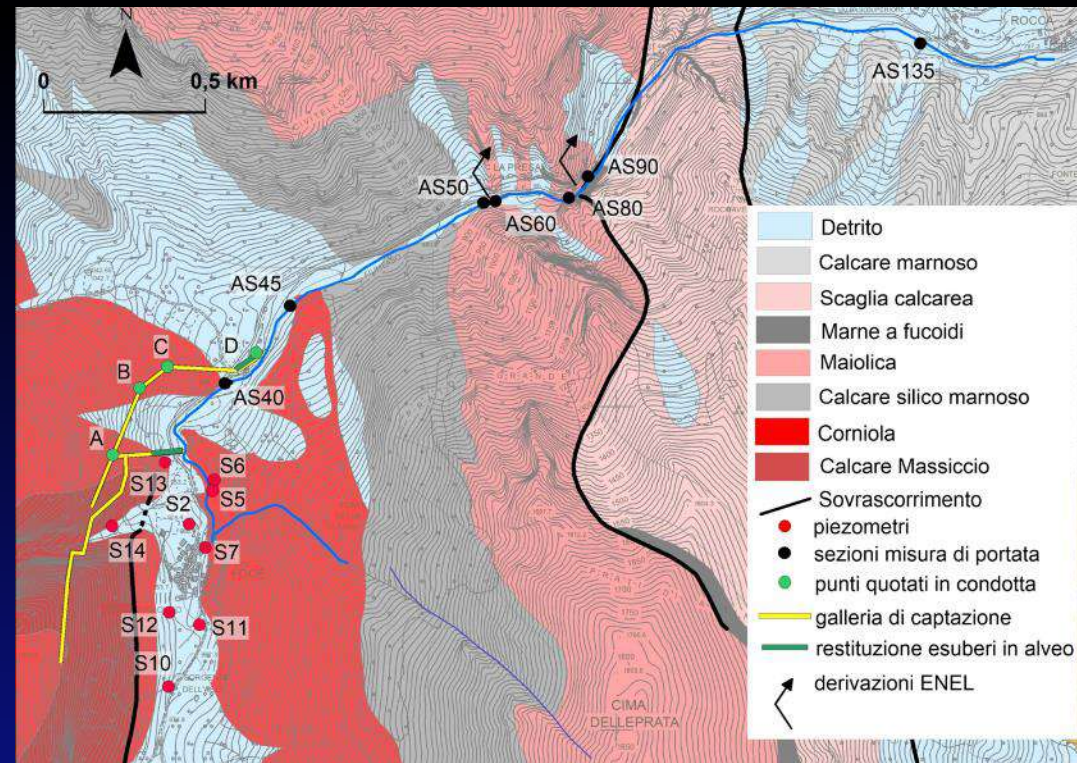
noso
area
oidi
o marnoso
ssiccio
mento
ra di portata

Monitoraggi a partire dal 2007

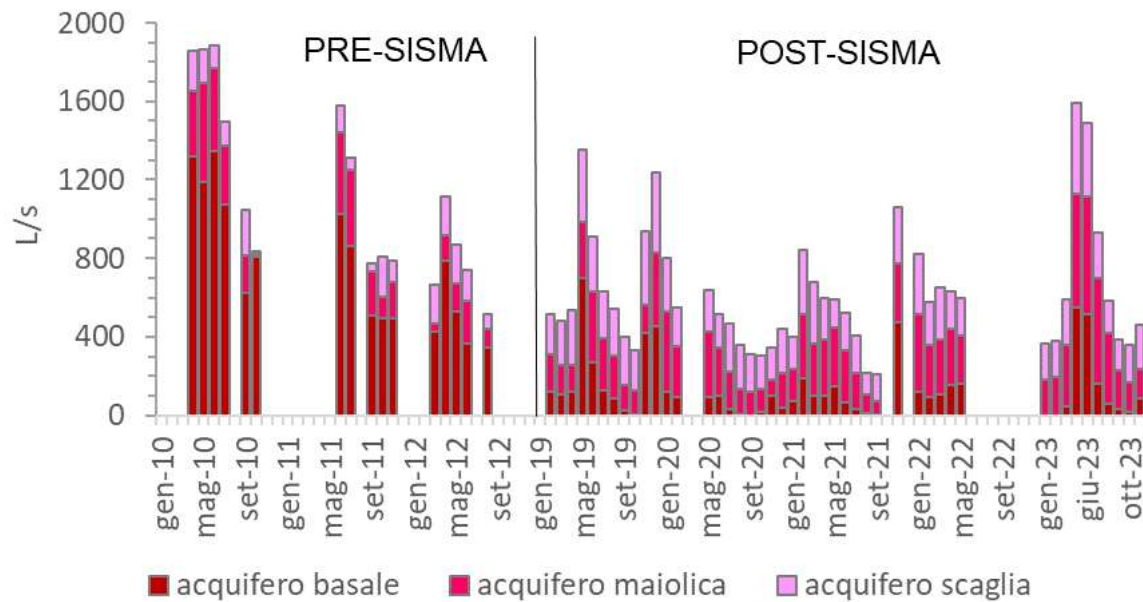


- punti quotati in condotta
- galleria di captazione
- restituzione esuberanti in alveo
- ↙ derivazioni ENEL



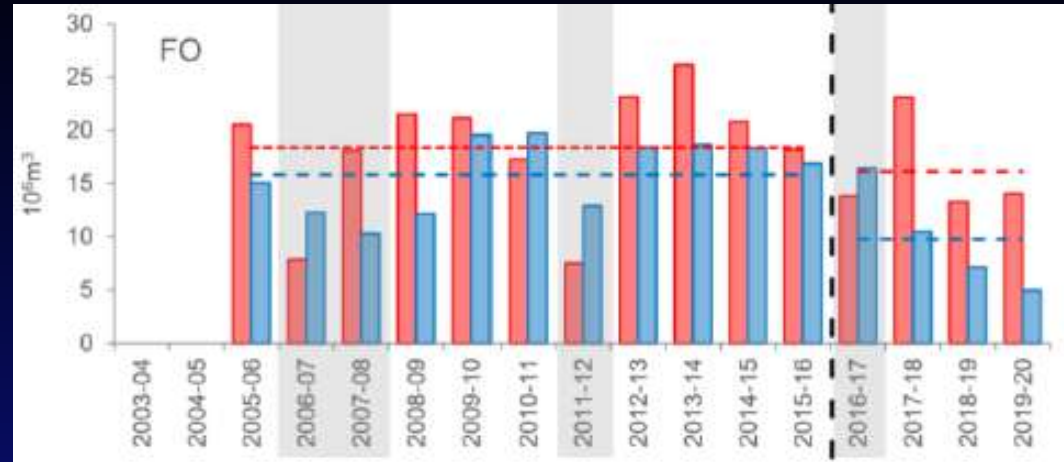
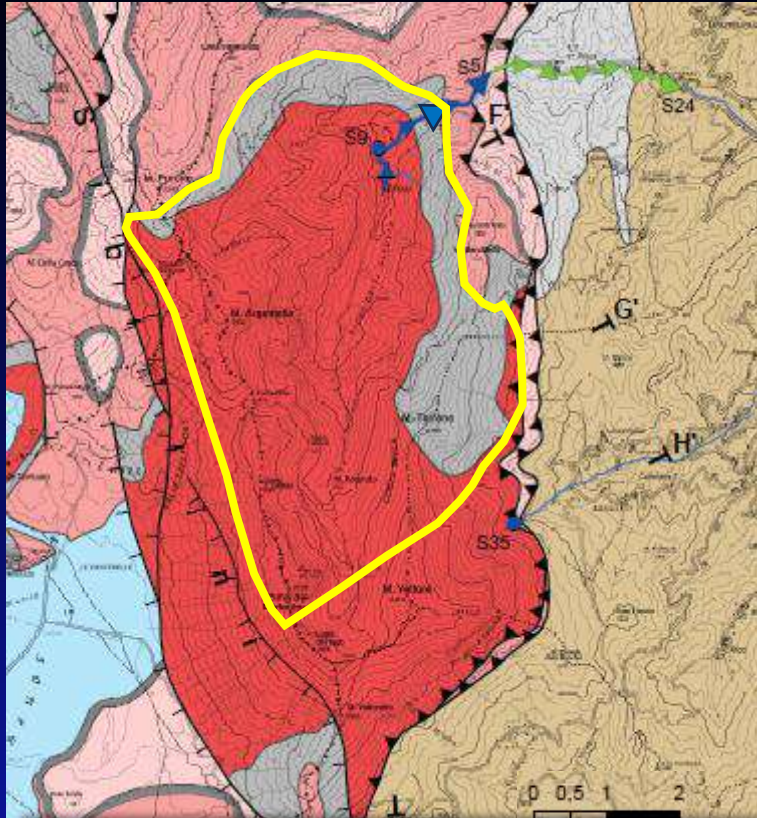


- ✓ Riduzione di circa il 50% della portata totale del fiume
- ✓ Riduzione dell' 80% del contributo di acque sotterranee dell'acquifero basale

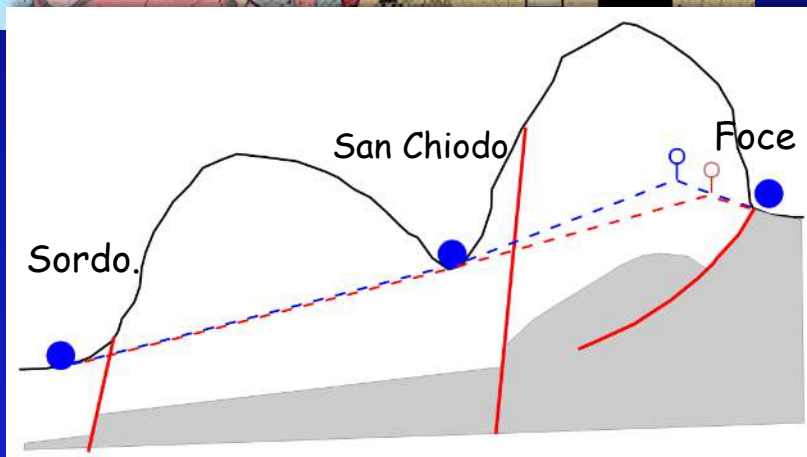


| ACQUIFERO | PORTATA MEDIA (L/s) | |
|-----------|---------------------|------------|
| | PRE - SISMA | POST-SISMA |
| BASALE | 769 | 137 |
| MAIOLICA | 231 | 249 |
| SCAGLIA | 140 | 234 |
| TOT | 1134 | 620 |

Verifica dell'area di ricarica sull'area di alimentazione



| | PRE - SISMA | POST- SISMA |
|-----|--------------------------------------|----------------|
| | 10 ⁶ m ³ /anno | |
| IN | 18 | 16 |
| OUT | 16 | 10 |



**RIDUZIONE
DELL'AREA DI RICARICA**
coerente col modello
interpretativo a scala regionale

Esiste la possibilità di un ripristino delle condizioni pre sisma?

Quali previsioni future per la captazione di Foce ?

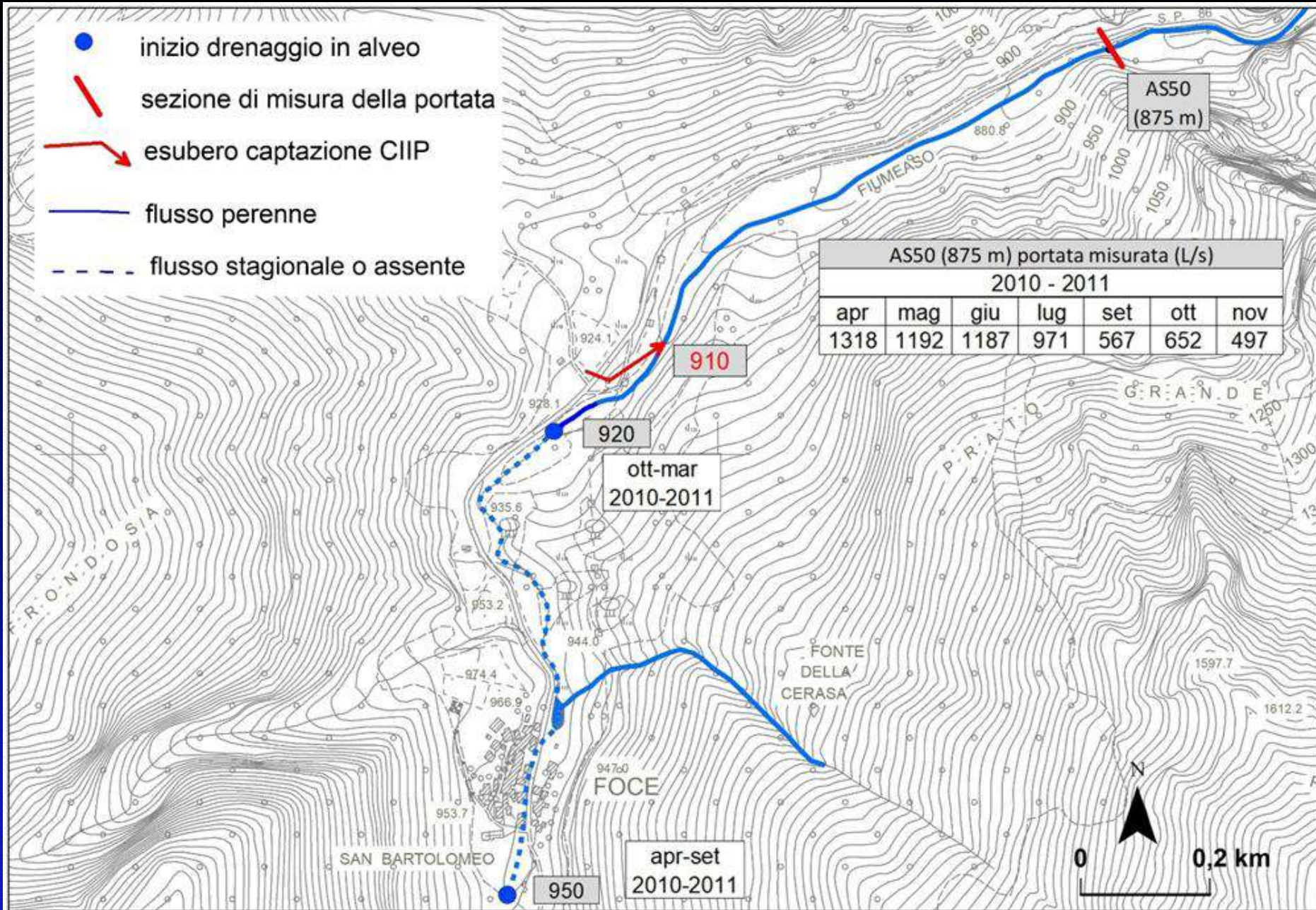


(CIIP)

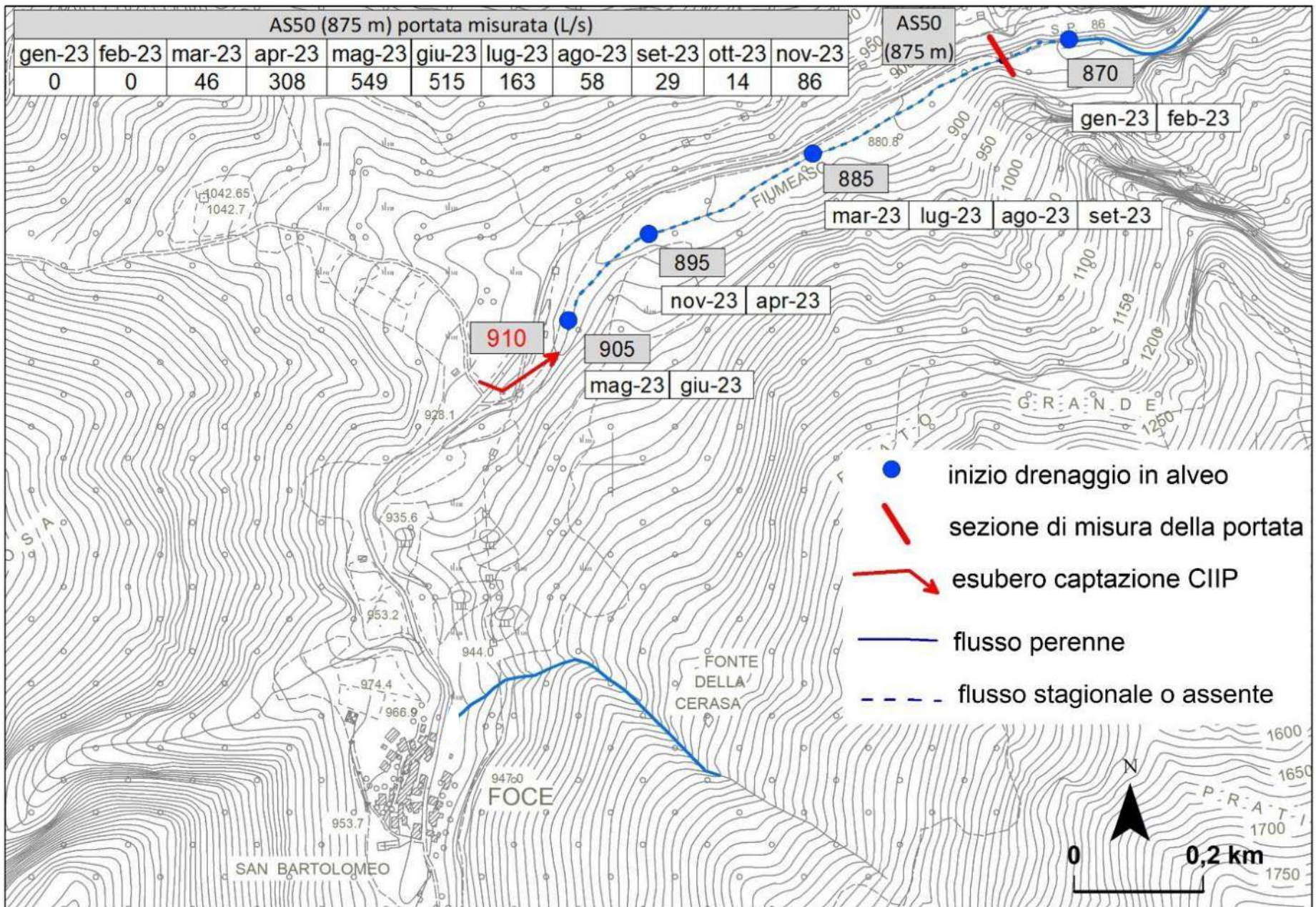
Esiste la possibilità di un ripristino delle condizioni pre sisma?

L'attuale stato del corso d'acqua è l'effetto del sisma o anche della captazione?

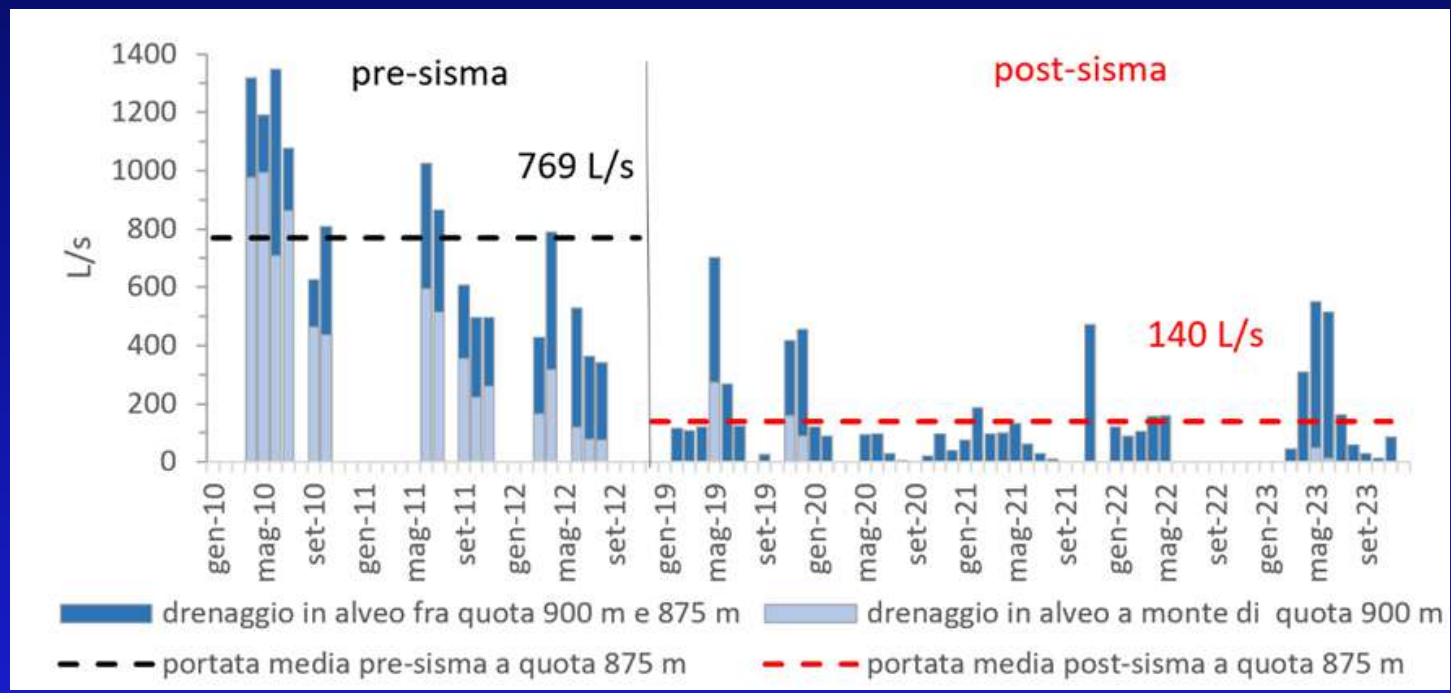
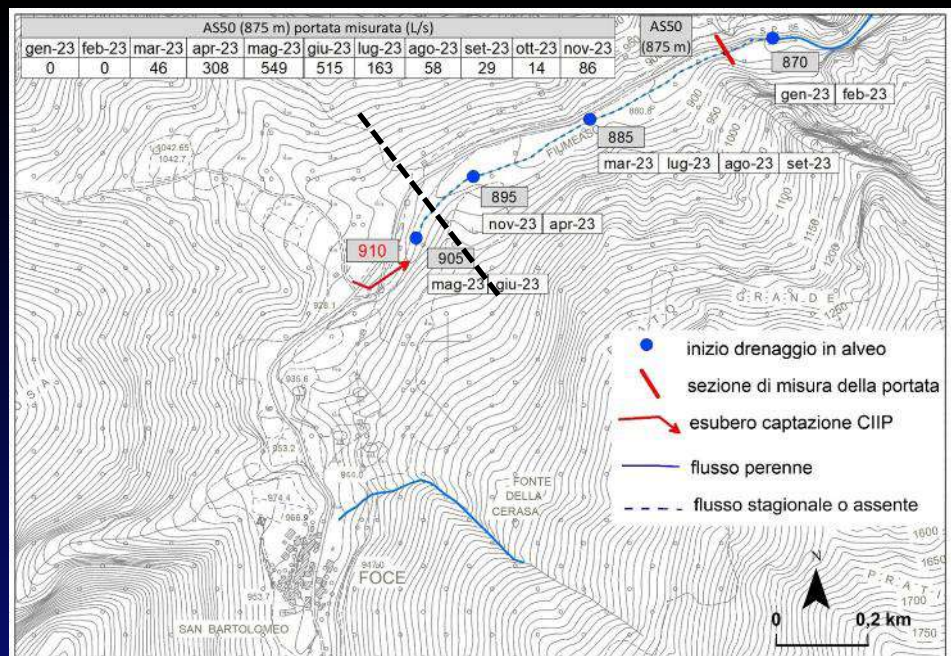
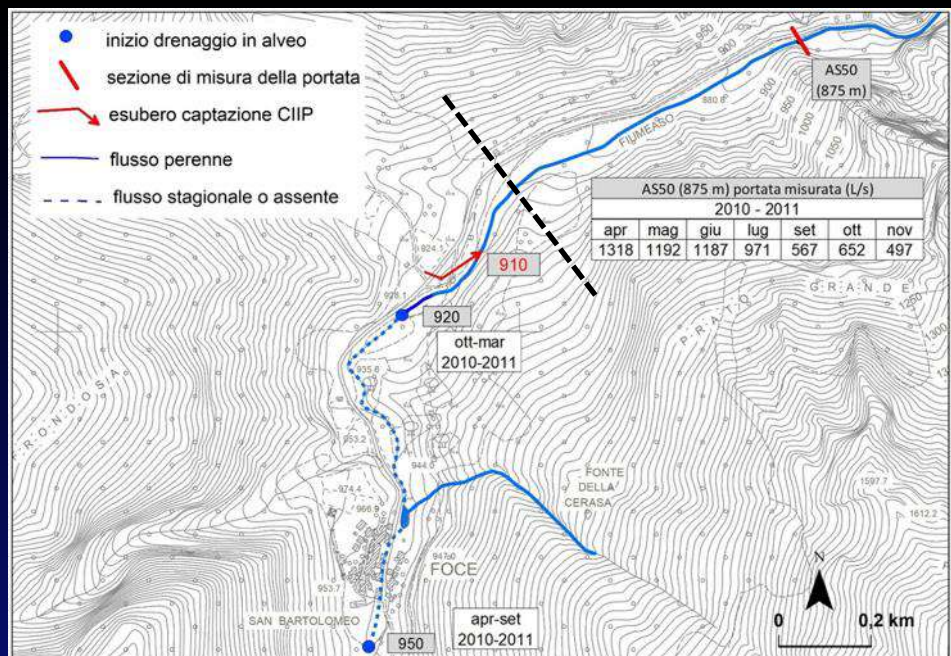


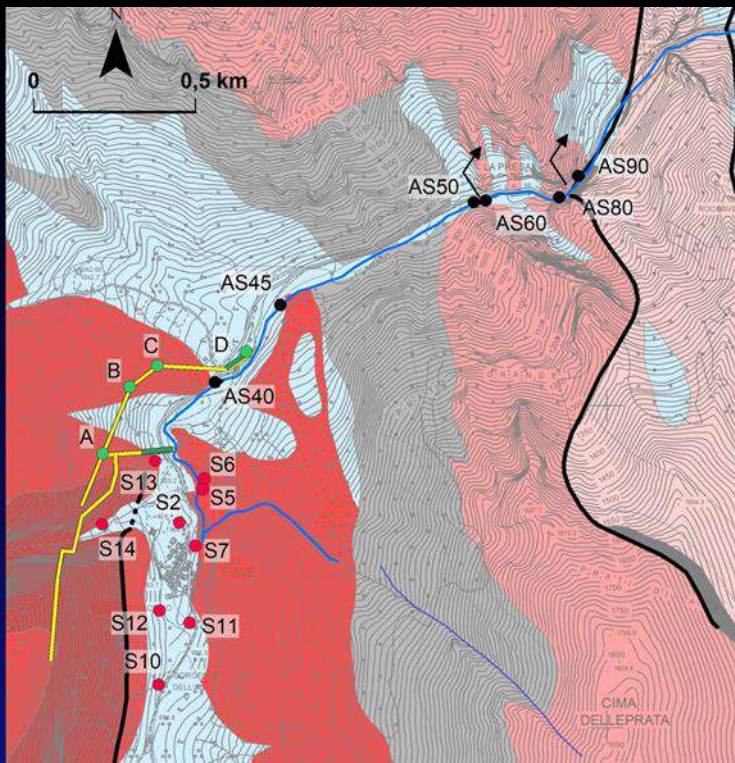


Drenaggio in alveo dell'acquifero basale nella condizione pre-sisma (rilevamento 2010-2011)

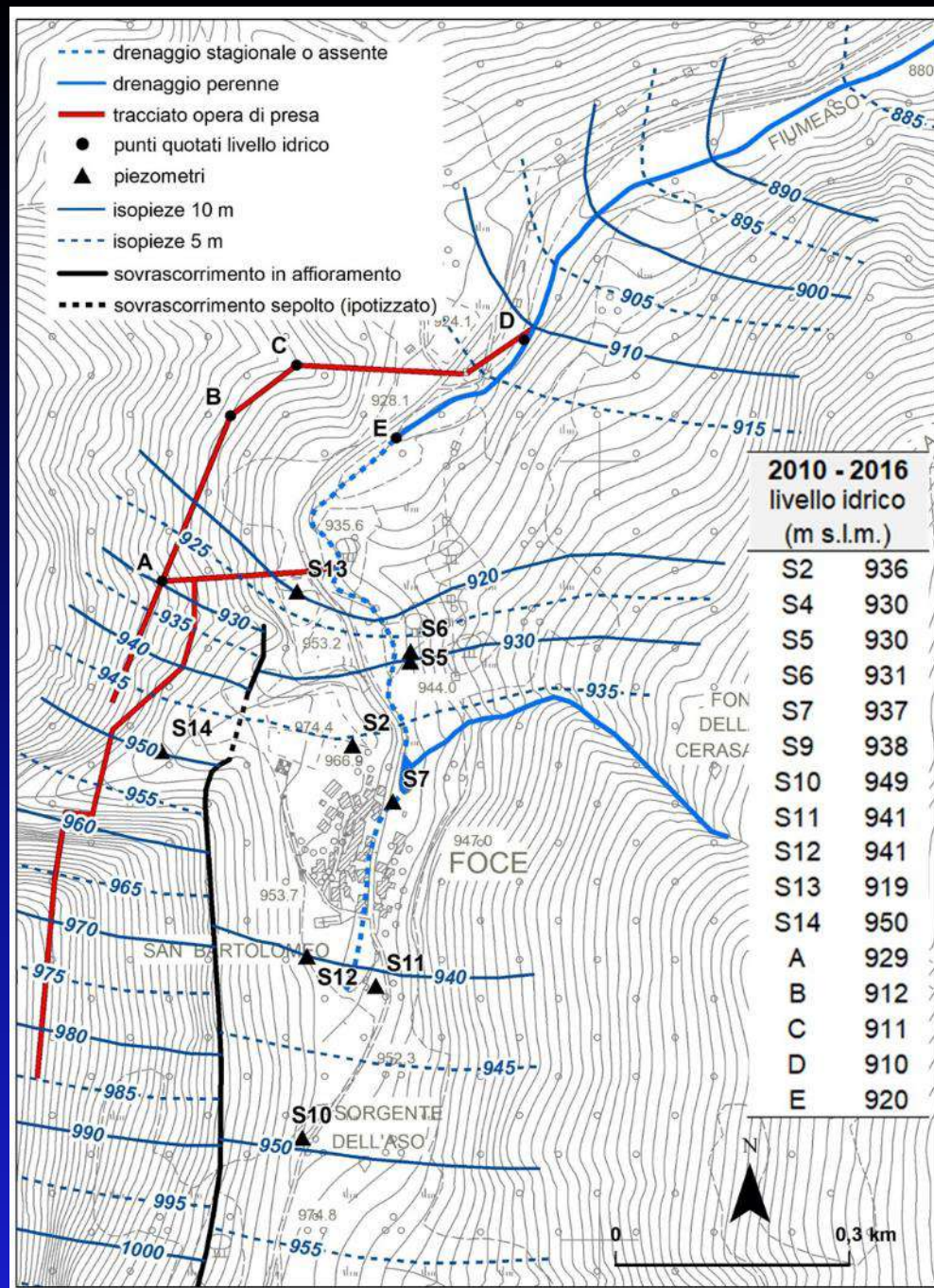


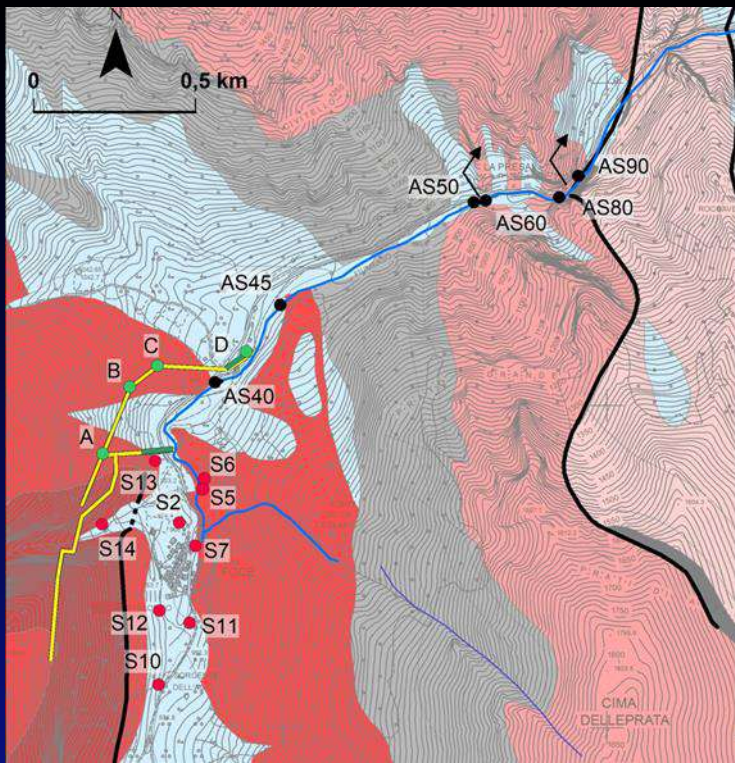
Drenaggio in alveo dell'acquifero basale nella condizione attuale (rilevamento 2023)



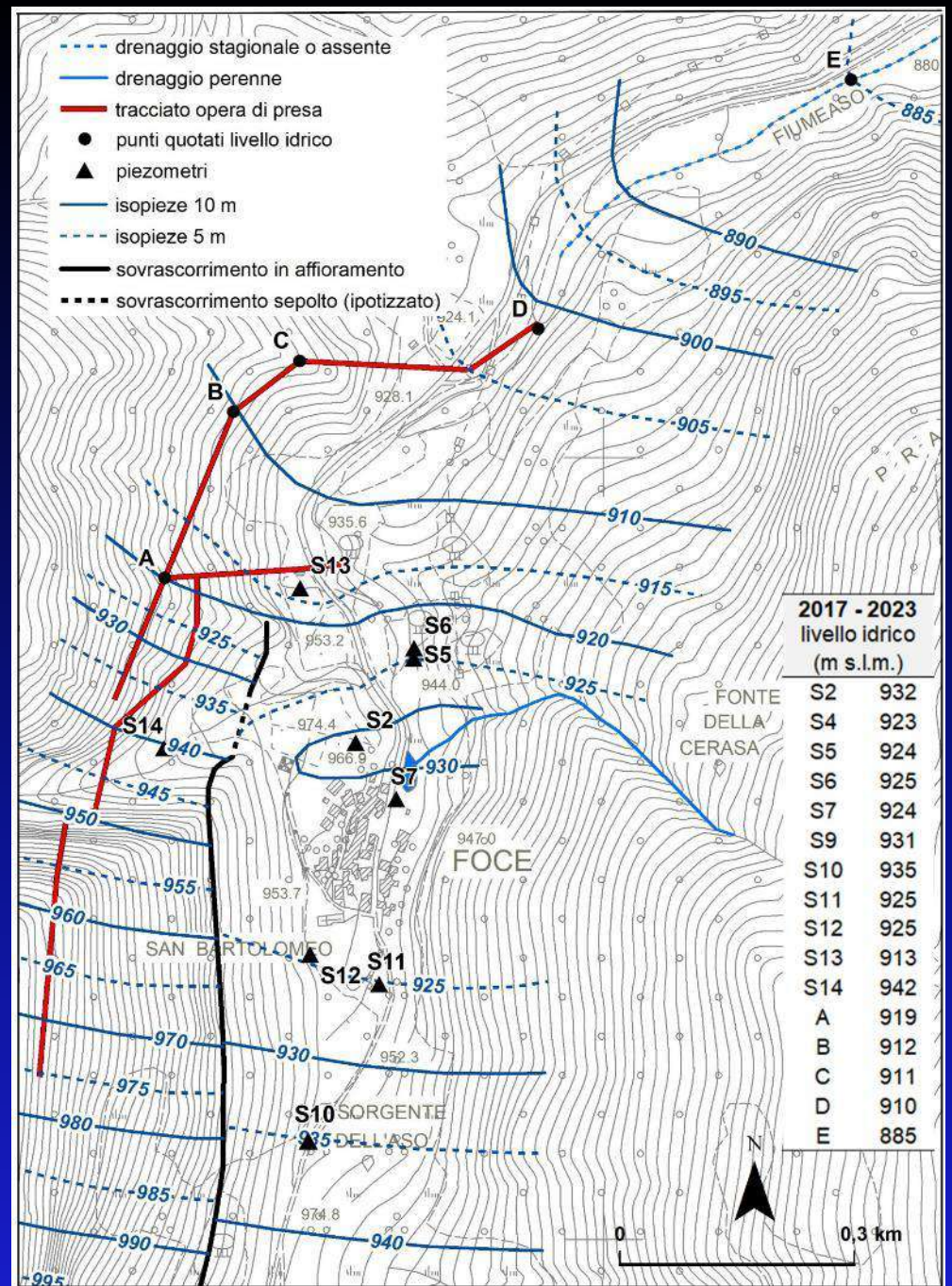


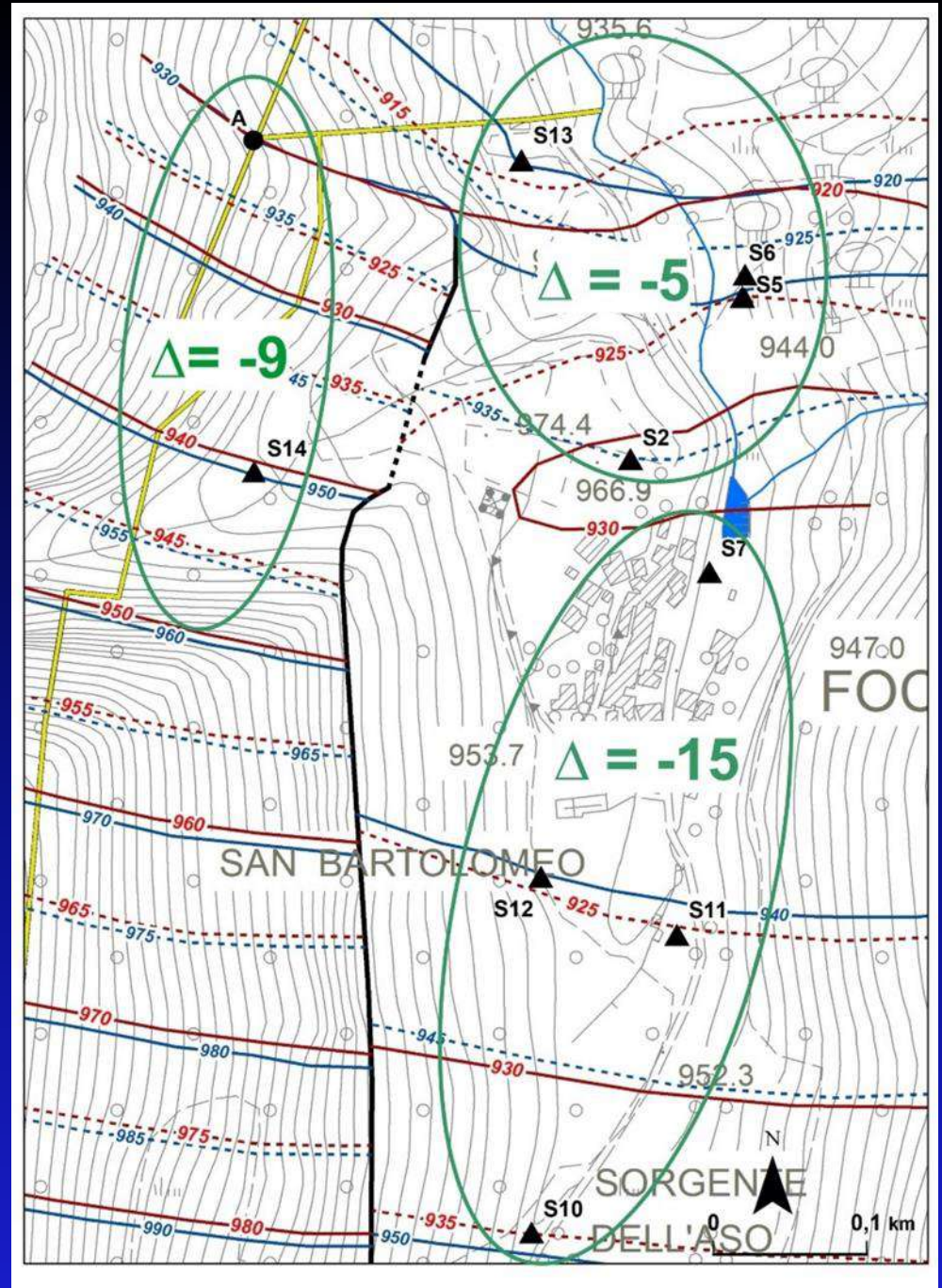
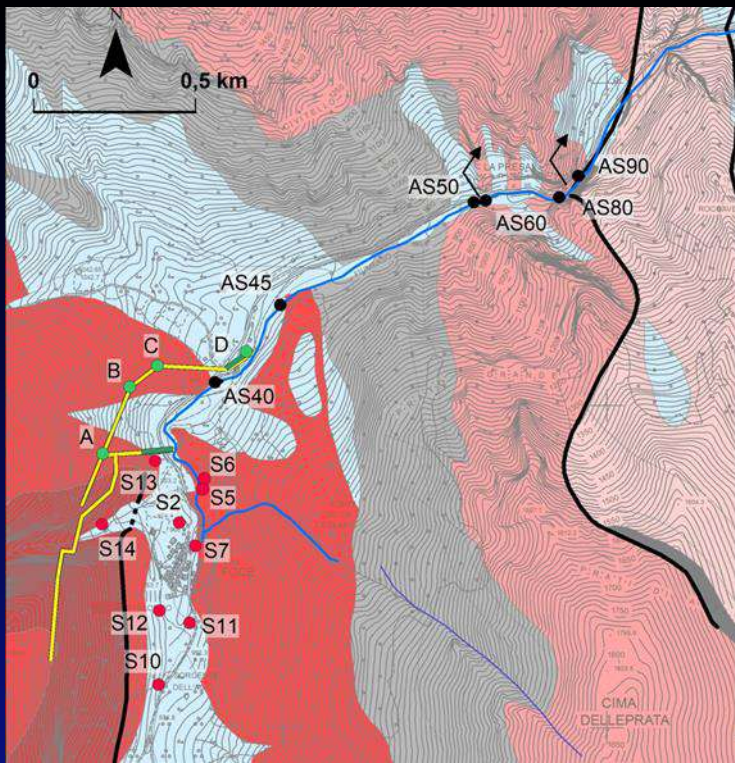
Situazione media pre sisma



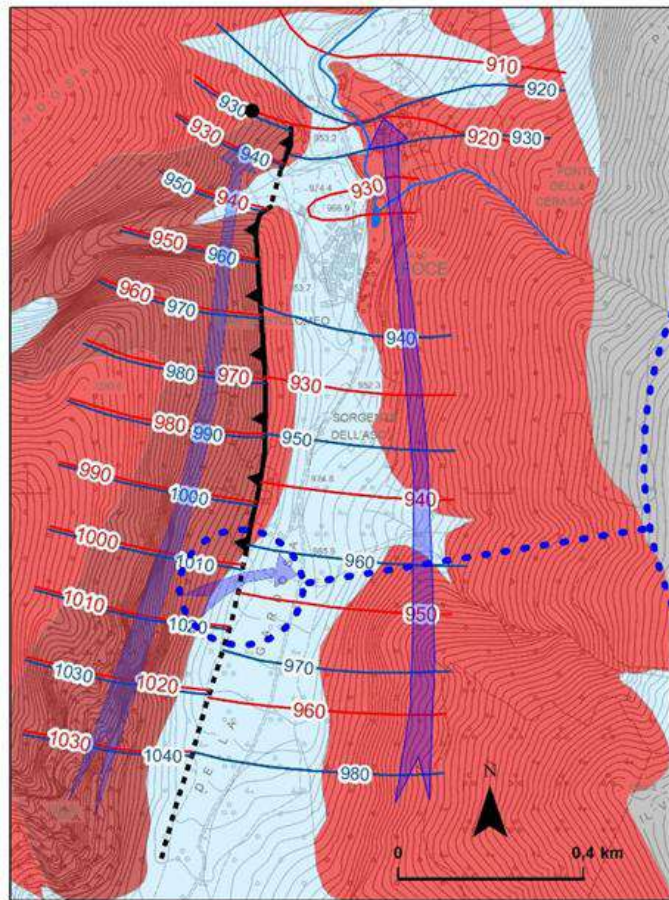


Situazione media attuale

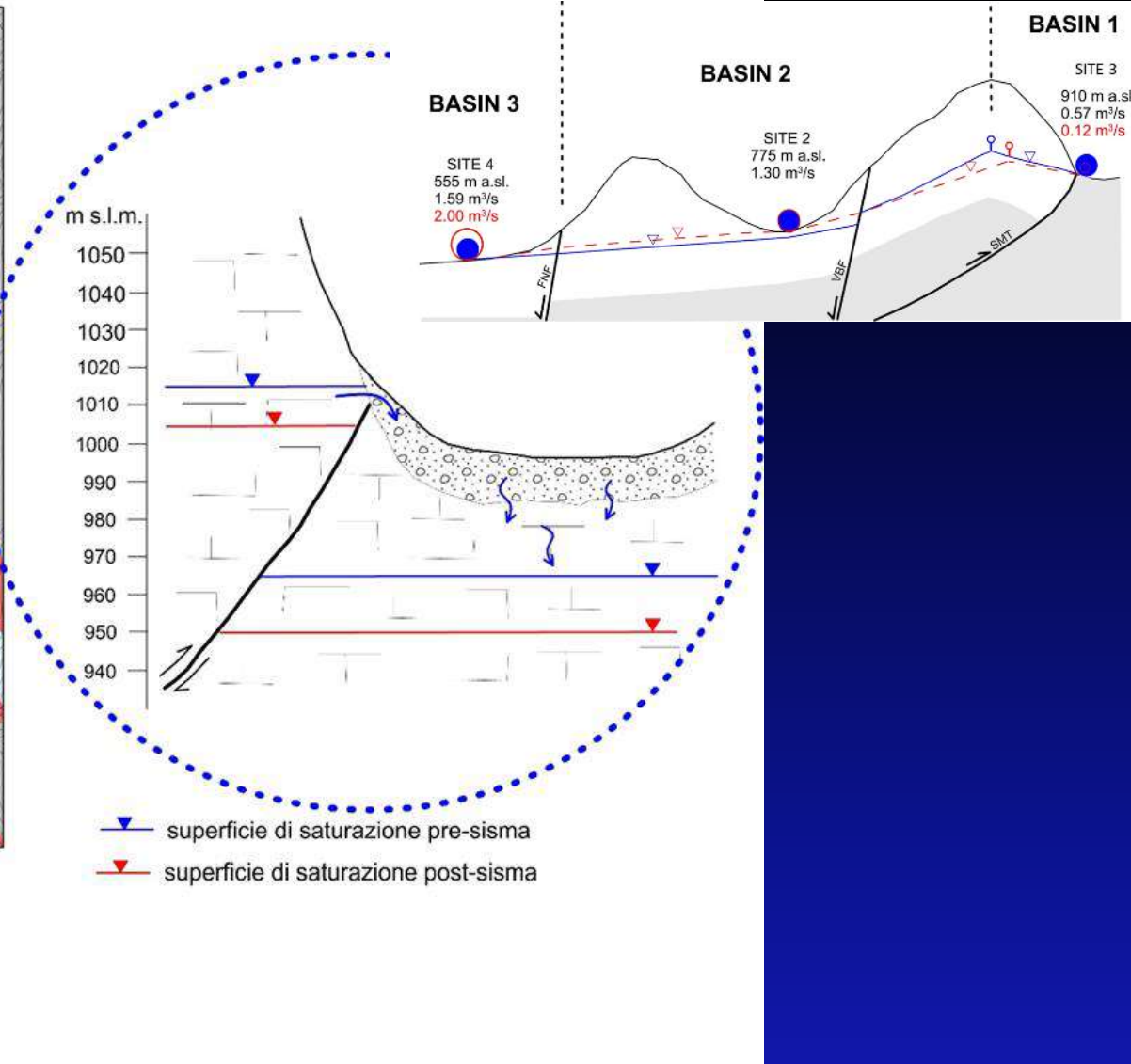




Confronto Δ piezometrici



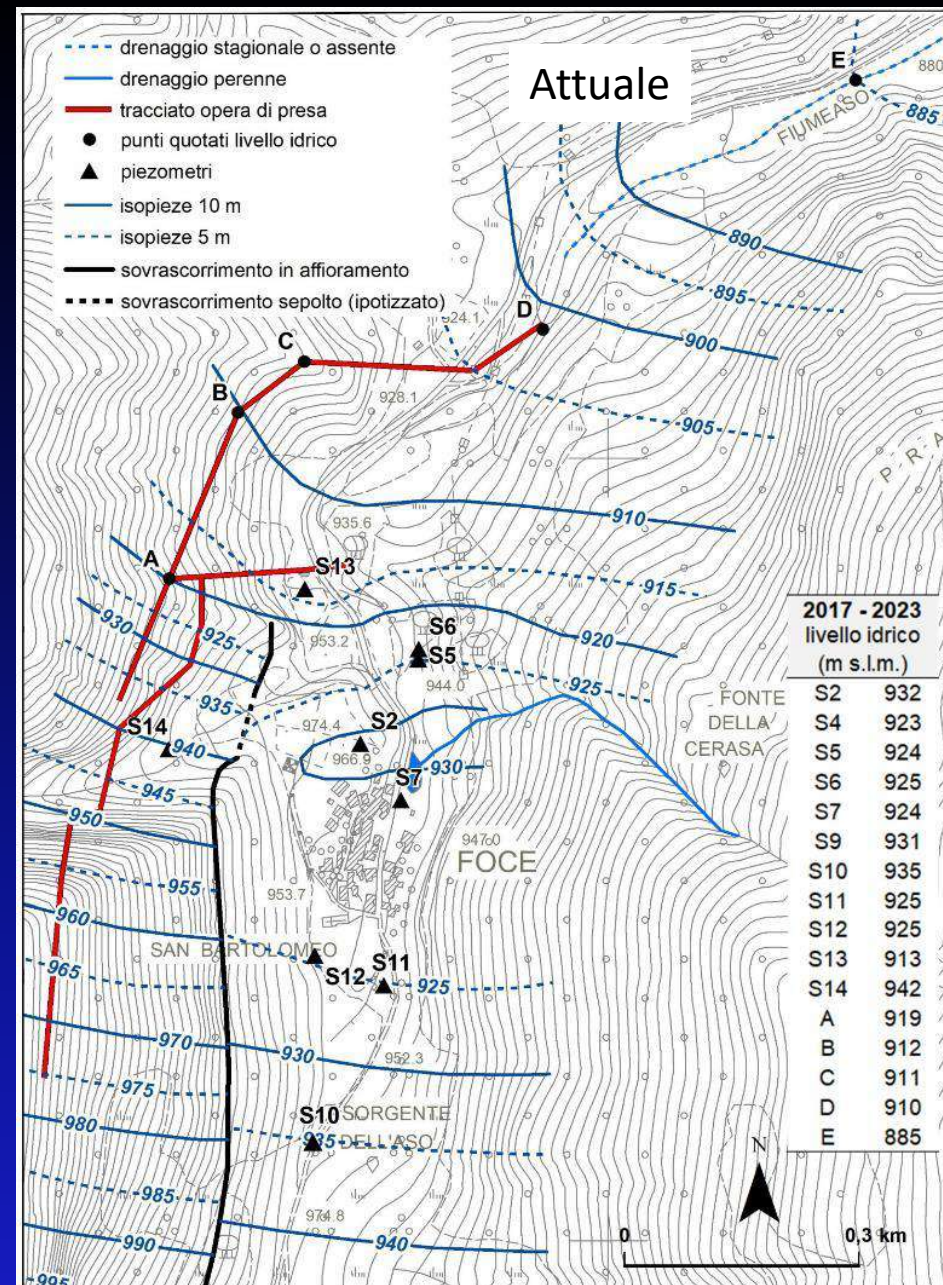
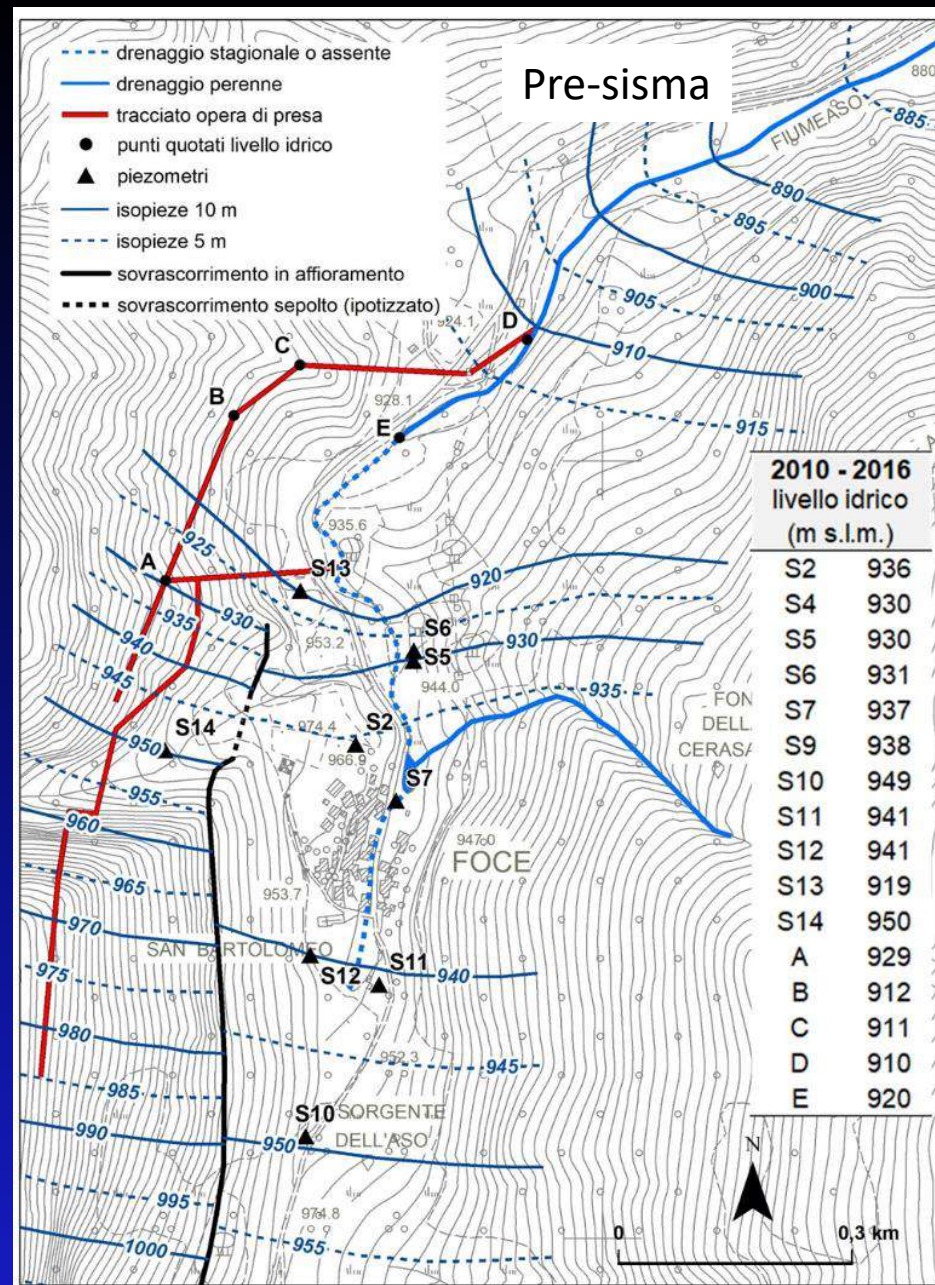
- Depositi di copertura
- Complesso calcareo-silico-marnoso
- Corniola
- Calcare Massiccio
- sovrascorrimento in affioramento
- sovrascorrimento sepolto (ipotizzato)
- isopieze pre-sisma
- isopieze post-sisma
- linee di flusso
- imbocco galleria drenante



Esiste la possibilità di un ripristino delle condizioni pre sisma?

Quali previsioni future per la captazione di Foce?

L'attuale stato del corso d'acqua è l'effetto del sisma o anche della captazione?



Effetto del sisma: riduzione (annullamento) degli effetti della captazione sulla portata del fiume

MINISTERO DEI LAVORI PUBBLICI

PROVVEDITORATO ALLE OO. PP. PER LE MARCHE

ANCONA

N. 105461

CONSORZIO IDRICO INTERCOMUNALE DEL PICENO

ASCOLI PICENO

ACQUEDOTTO DEI MONTI SIBILLINI

1° LOTTO

(LAVORI DI RICERCA DELLA SORGENTE DELL'ASO)

PROGETTO ESECUTIVO

AII. 1

RELAZIONE

Roma, 10 luglio 1969

STUDIO D'INGEGNERIA
CARLO LOTTI & C.
ROMA

geologo Prof. **Manfredo Manfredini** che ha espresso le risultanze del proprio studio nella relazione unita al progetto.

Come risulta da tale relazione, la situazione geologica della zona della sorgente, abbastanza lineare, consente di ubicare con precisione la serie geologica che il fiume Aso attraversa dai terreni più antichi ai più moderni percorrendo la valle dopo Foce e di conseguenza di localizzare le zone "acquifere" e quelle "asciutte".

Poiché la zona "acquifera" è quella del Lias a monte di Foce in sinistra del fiume Aso, la galleria di ricerca è stata fissata a quota sufficientemente bassa per drenare tutte le acque sorgentizie. Di conseguenza anche la ubicazione planimetrica dell'imbocco della galleria è risultato stabilito.

Tale galleria dovrebbe raccogliere tutte le acque della sorgente e prosciugare l'alveo sino praticamente alle ulteriori scaturigini sorgentizie del "calcere maiolica" e quindi sino a valle praticamente della presa ENEL.

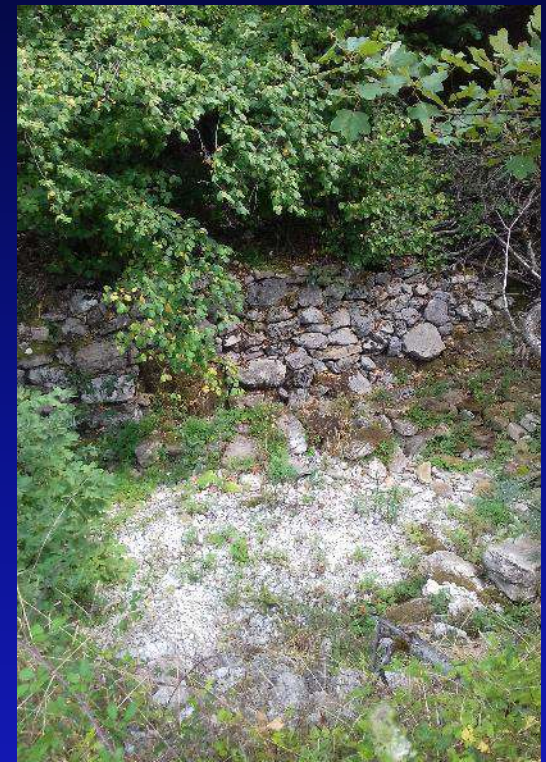
Peraltro tale previsione geologica contrasta con un superficiale esame delle cose in quanto la portata del fiume Aso cresce con una certa continuità da Foce sino alla presa ENEL come pure cresce la temperatura dell'acqua dell'alveo e delle scaturigini visibili.

L'aumento della portata può essere dovuto alla circolazione idrica sotterranea che per la diminuzione della importanza del materasso alluvionale

SITUAZIONE ATTUALE

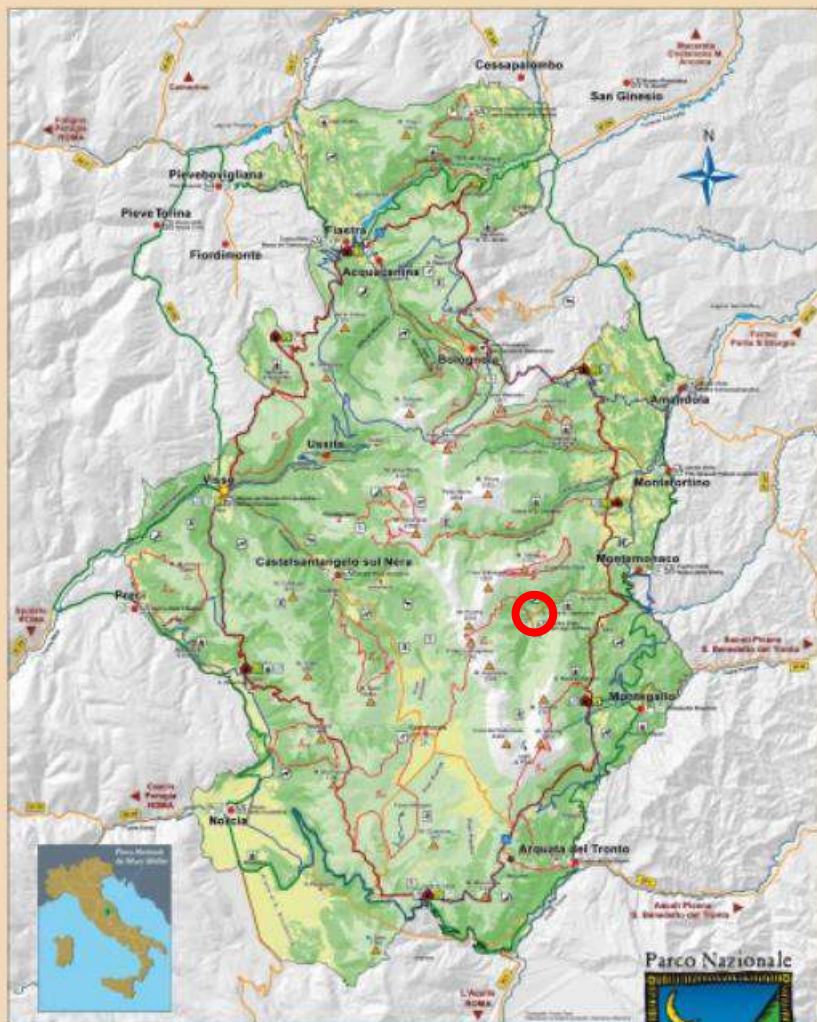
«Richiesta di variante di concessione per la captazione idropotabile da sorgente per 200 l/s presso l'opera esistente a Foce di Montemonaco»

Originaria concessione autorizzata prevedeva un prelievo di 526 l/s subordinato al mantenimento di un DMV da 296,96 l/s a 197,97 l/s sul Fiume Aso presso la sezione a 900 m s.l.m.



SITUAZIONE ATTUALE

PARCO NAZIONALE DEI MONTI SIBILLINI



Legenda

- Confini Anelli dei Sibillini
- Confini Anelli Provinciali
- Confini Anelli del Parco (corrispondono ai confini del Parco)
- Strada
- Stazione Carabinieri
- Stazione Polizia Provinciale
- Stazione Polizia Municipale
- Stazione Polizia Provinciale
- Stazione Polizia Provinciale
- Stazione Polizia Provinciale
- Stazione Polizia Provinciale

- Punti Tappe Scavalco Anelli dei Sibillini
- Punti Tappe Scavalco Anelli dei Sibillini
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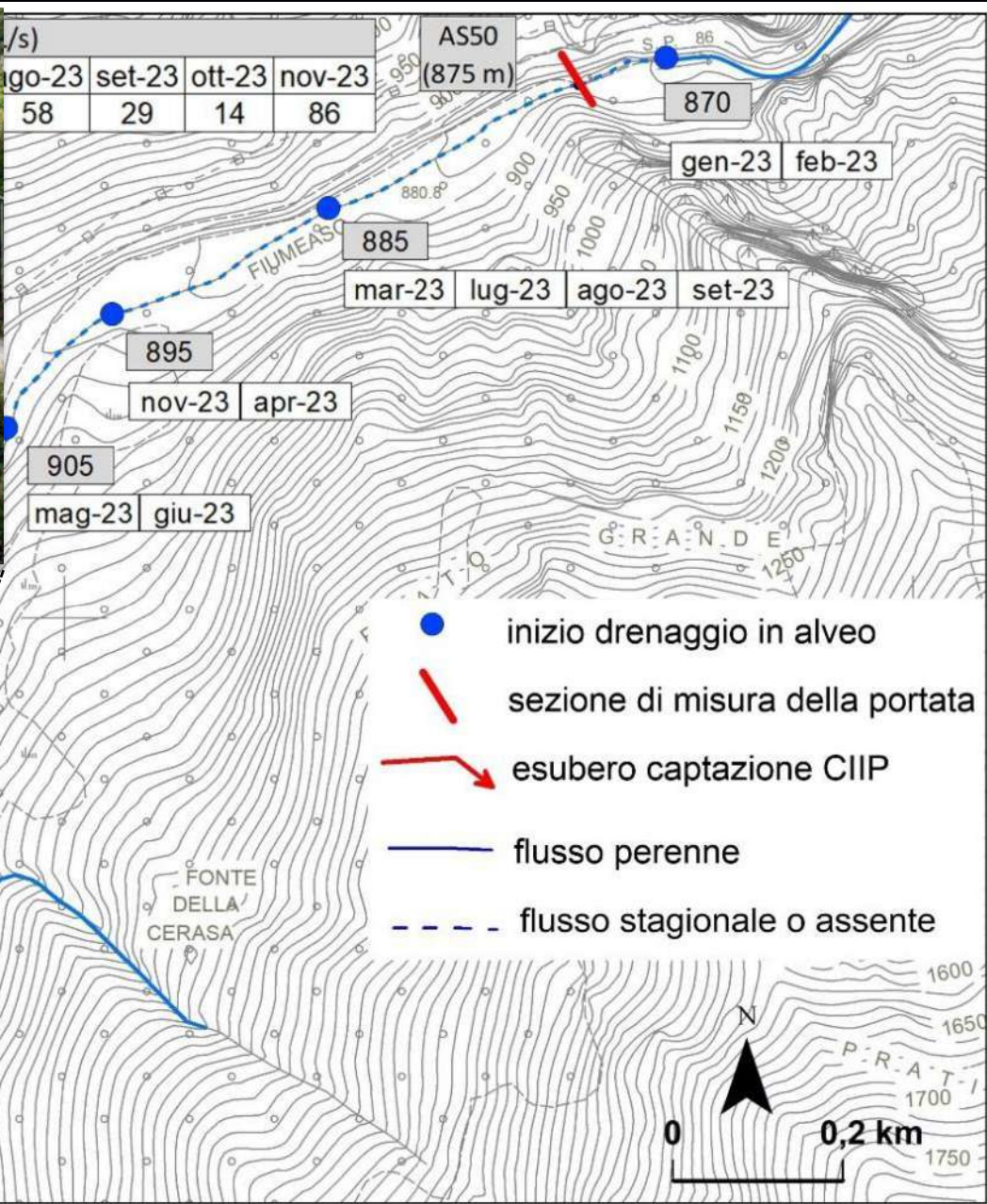
- Stazione Carabinieri
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l'opera di captazione è situata all'interno del Parco Nazionale dei Monti Sibillini istituito nel 1993

- nella zona 1 "in cui è prevalente l'interesse di conservazione ambientale" di cui al D.M. del 03/02/1990;
- in zona B del Piano per il Parco (approvato con D.C.D. n. 59 del 18.11.2002 ed adottato con DGR Marche n.898 del 31.07.2006 e DGR Umbria n. 1384 del 02.08.2006), di "riserva generale orientata, dove si favorisce il potenziamento delle funzionalità ecosistemiche e la conservazione delle risorse paesistico-culturali presenti anche attraverso la riduzione dei fattori di disturbo e C, "di protezione, interessate dalle attività agro-silvo-pastorali.
- All'interno della rete Ecologica Europea "Natura 2000" e, in particolare, della ZPS IT5330029 *Dalla Gola del Fiastrone al Monte Vettore* e delle ZSC IT5340013 *Monte Porche - Palazzo Borghese - Monte Argentella* e IT5340014 *Monte Vettore e Valle del lago di Pilato.*





Drenaggio in alveo dell'acquifero basale nella condizione attuale (rilevamento 2023)