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# Water Chemistry and Carbon Flux in Storm Event in a Karst River


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# Outline

1. Introduction
2. Site description
3. Methods
4. Discussion
5. summary

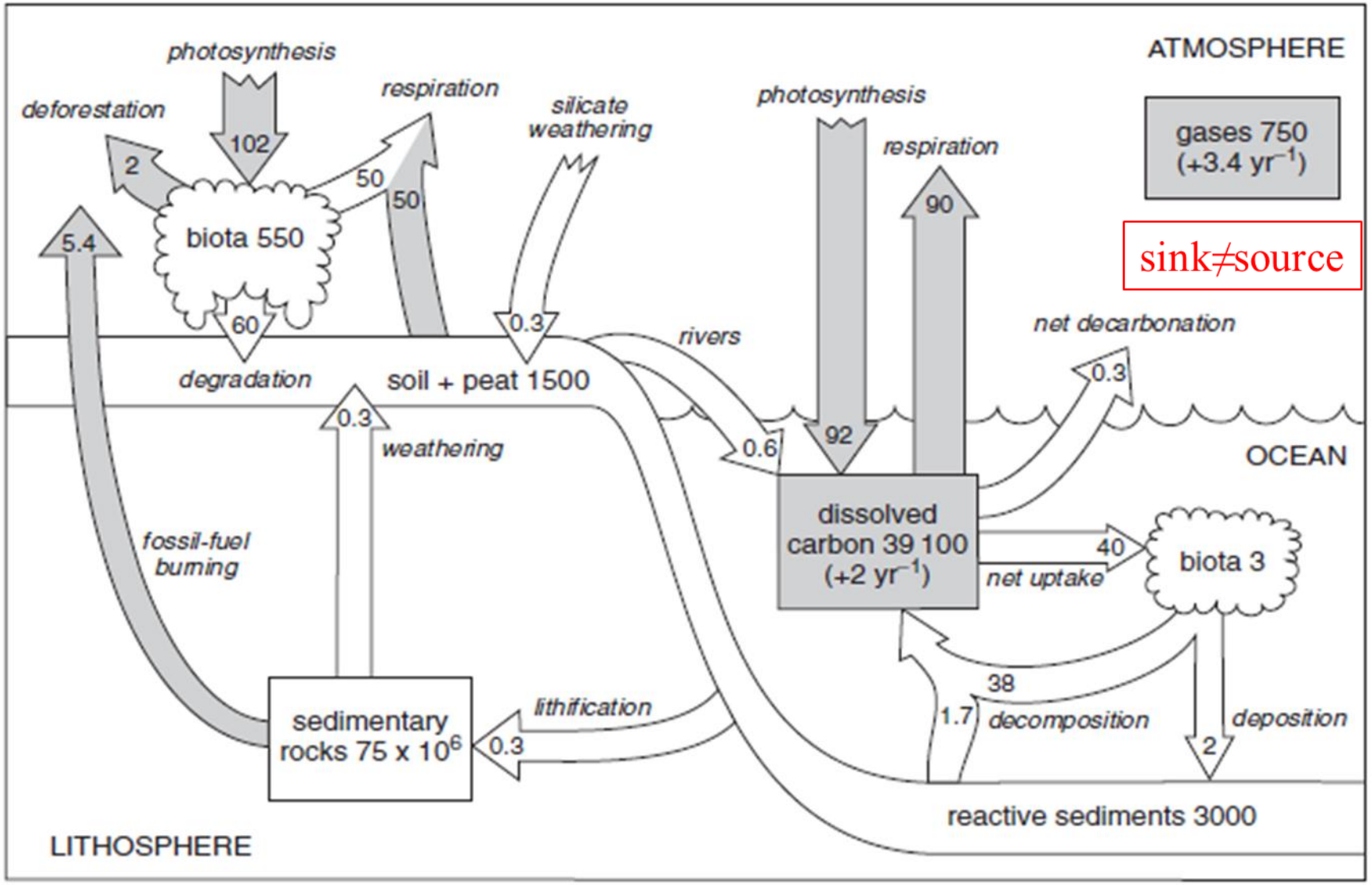



**Fig. 6.3** [illegible] attributed to fossil-fuel burning also contains a minor contribution from cement manufacturing (0.1 Gt yr$^{-1}$; after Siegenthaler & Sarmiento 1993). Major changes from the preindustrial cycle are indicated by half tones.

The economic and social development of China is experiencing a booming period, statistics shows that $CO_2$ emission will reach approximately 127 PgC (exceeding the estimation by 17 PgC), which is leading to a huge $CO_2$ reduction pressure

# 2. Site Description

- **Location**

Guilin city， SW China。

- **Catchment**

5585km$^2$

- **lithology**

Carbonate rocks 51.23%

- **Stratum**

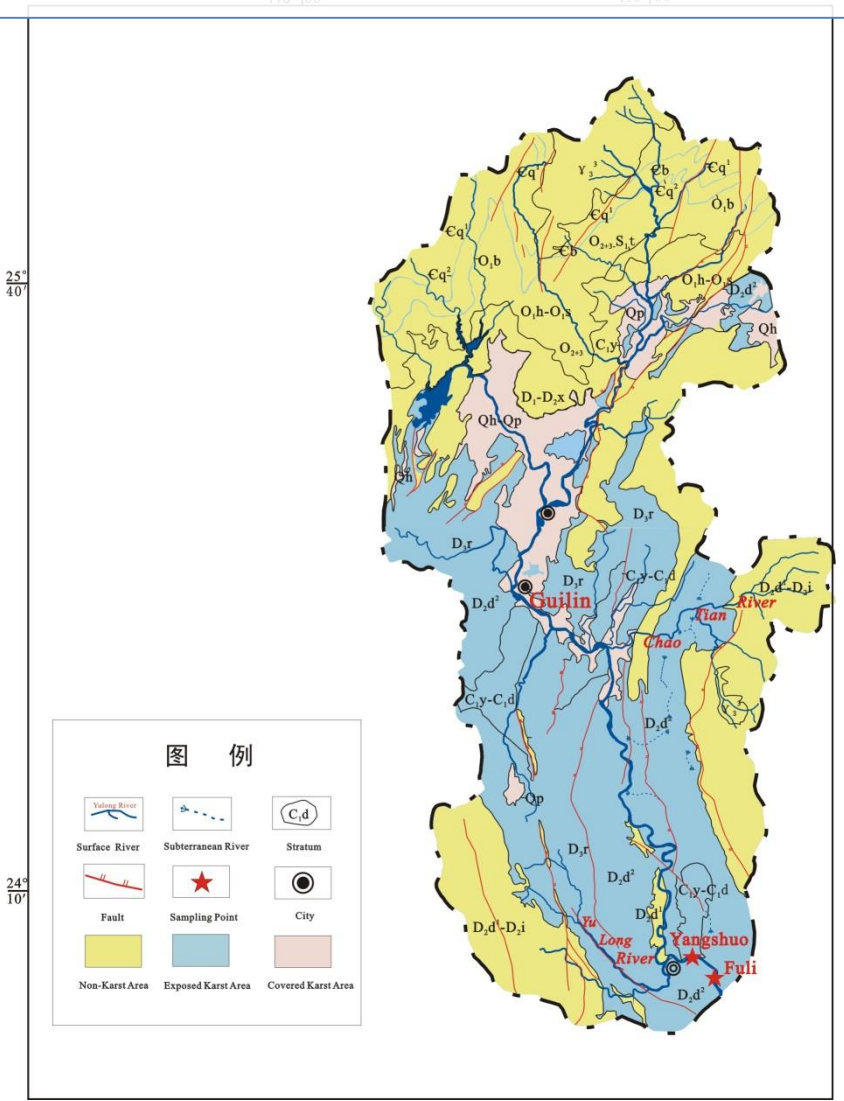
Middle Devonian ($D_2d$)

Lower Carboniferous($C_1y$, $C_2d$)

- **monitoring site**

1 Yangshuo transection

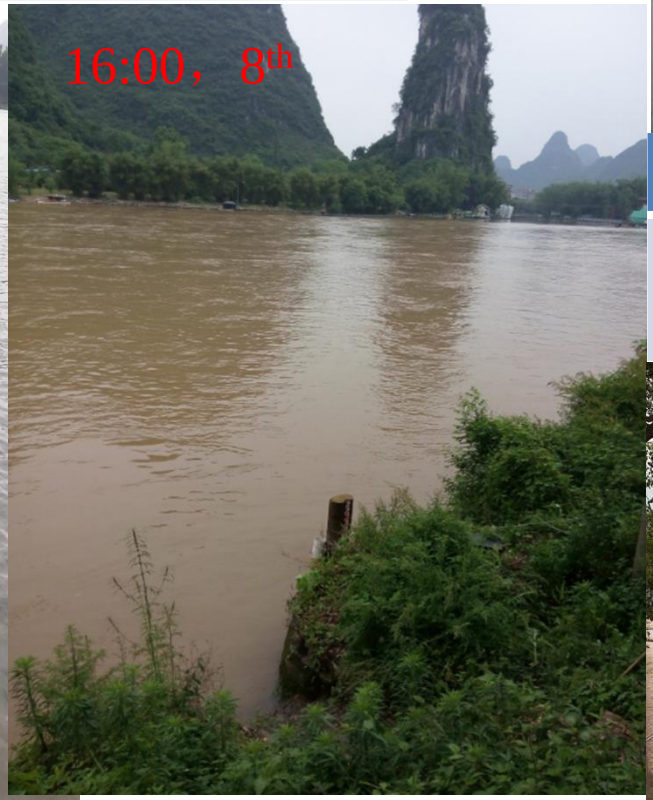
2 Fuli transection



# 01 - Yangshuo transection

| Measurements – surface layer |
| --- |
| Sampling(two hour/time) |
| Automatic monitoring (15min/time) |


| Period |
| --- |
| May 7th to 9th, 2015<br>50 hours in total |


# 02 - Fuli transection

| Measurements: surface layer and – 2m layer |
| --- |
| Sampling(two hour/time) |
| Automatic monitoring(15min/time) |

| Period |
| --- |
| May 5th to 7th, 2015<br>50 hours in total |

# 3. Methods

## Field water chemical parameters

| Field indexes | |
|---|---|
| pH | 15min/time |
| Do | 15min/time |
| Spc | 15min/time |
| T | 15min/time |
| $HCO_3^-$ | 2 hour/time |
| $Ca^{2+}$ | 2 hour/time |


# Field water chemical parameters


Total rainfall during monitoring priod : 42.5(mm)

Total flow during monitoring priod :9.42E+07 ($m^3/s$)

# Laboratory analysis

- **Main irons**

$K^+$、$Na^+$、$Ca^{2+}$、$Mg^{2+}$、$SiO_2$

$SO4^{2-}$、$NO_3^-$、$HCO_3^-$、$Cl^-$、$F^-$

# Calculation

$$C_{SF}=\sum_{t1}^{t2}\left(\left([HCO_3^-{}_{car}]+[HCO_3^-{}_{sil}]+[HCO_3^-{}_{acid}]\right)\times Q\right)$$

- $C_{SF}$ :the carbon flux during the monitering period($tCO_2$)
- $[HCO_3^-{}_{car}]$:the $HCO_3^-$ formed by carbonate ($tCO_2$)
- $[HCO_3^-{}_{sil}]$ :the $HCO_3^-$ formed by silicate weathering ($tCO_2$)
- $[HCO_3^-{}_{acid}]$ :the $HCO_3^-$ formed by carbonate weathering with the participation of allogenic acid ($tCO_2$)
- Q :the total flow during the monitering period.

# 4. Discussion

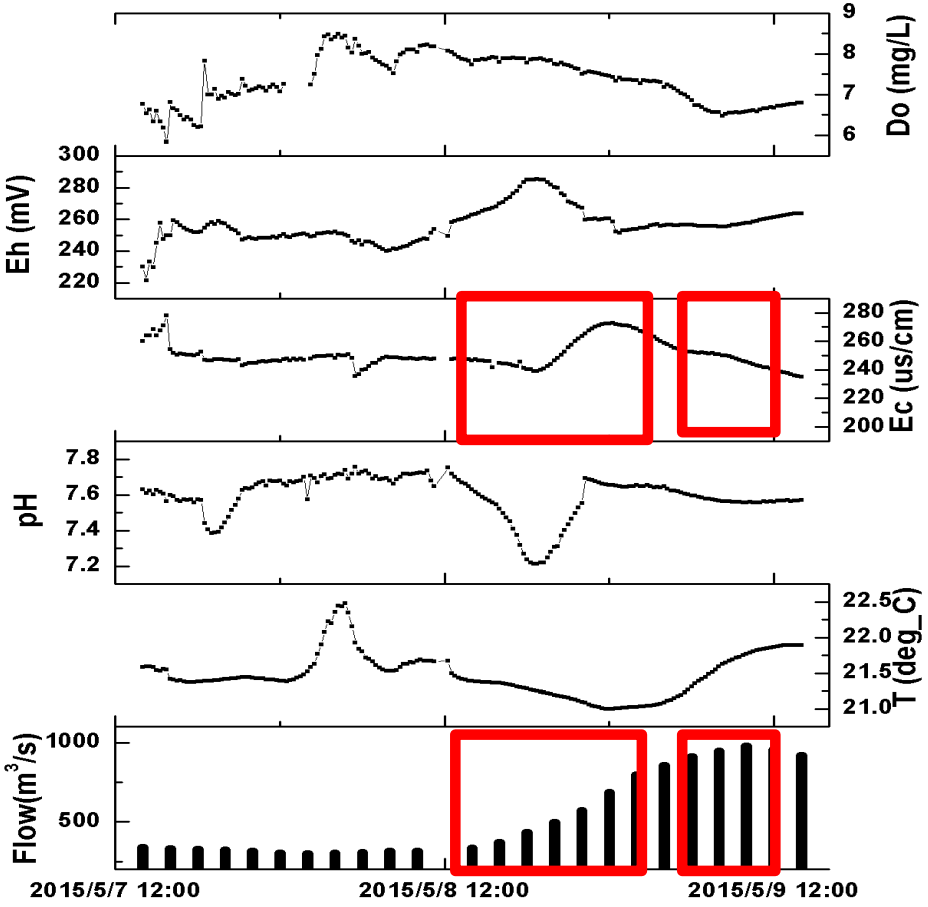
4.1 Water chemical variation

4.2 Major ions variation and

4.3 Inorganic carbon flux

4.4 Inorganic carbon sources

# 4.1 Water chemical variation



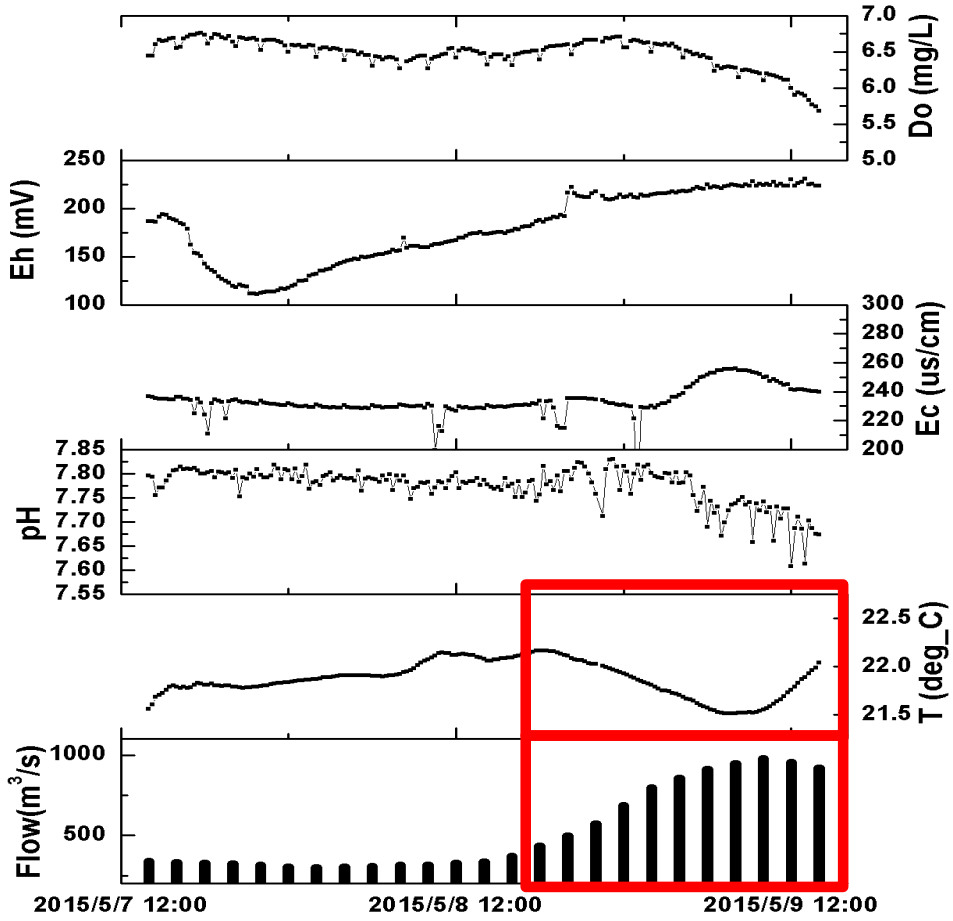

01-Yangshuo transection

(surface layer)

Ec and pH increased as water flow increased,indicating a fast water-rock interaction during the storm event, Ec increased and pH decreased indicating dilution effect was stronger than The piston effect.

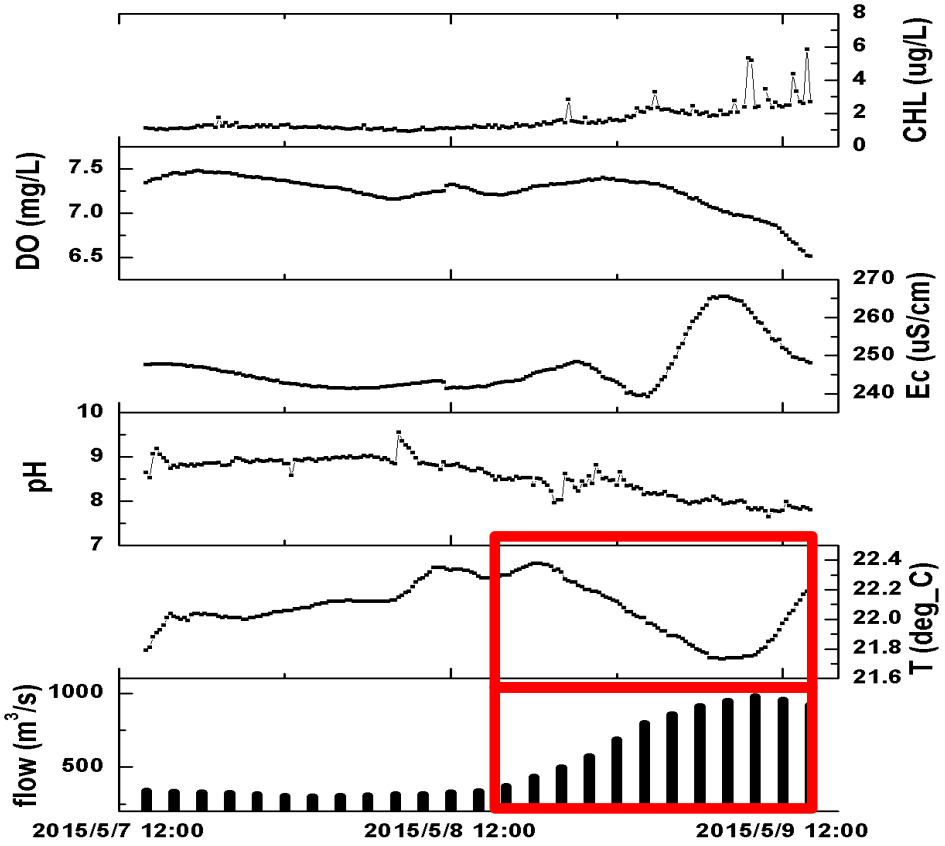
Rock weathering was enhanced before the peak and diluted during the peak.

# 4.1 Water chemical variation




02 - Fuli transection (surface layer)

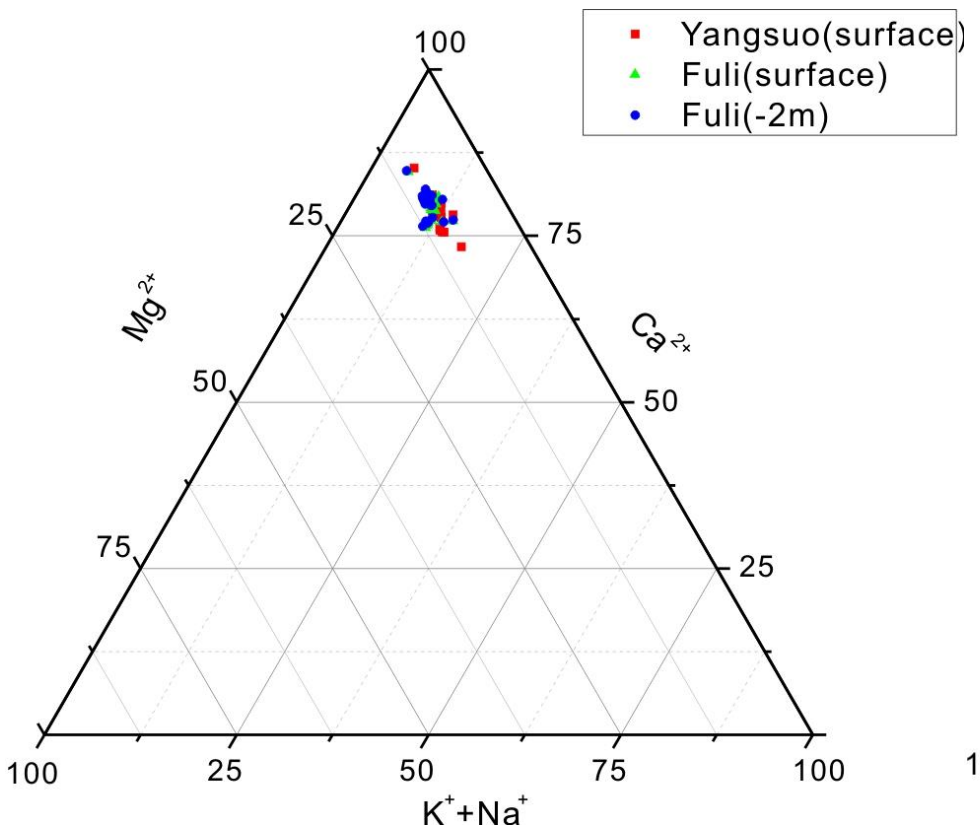
# 4.1 Water chemical variation

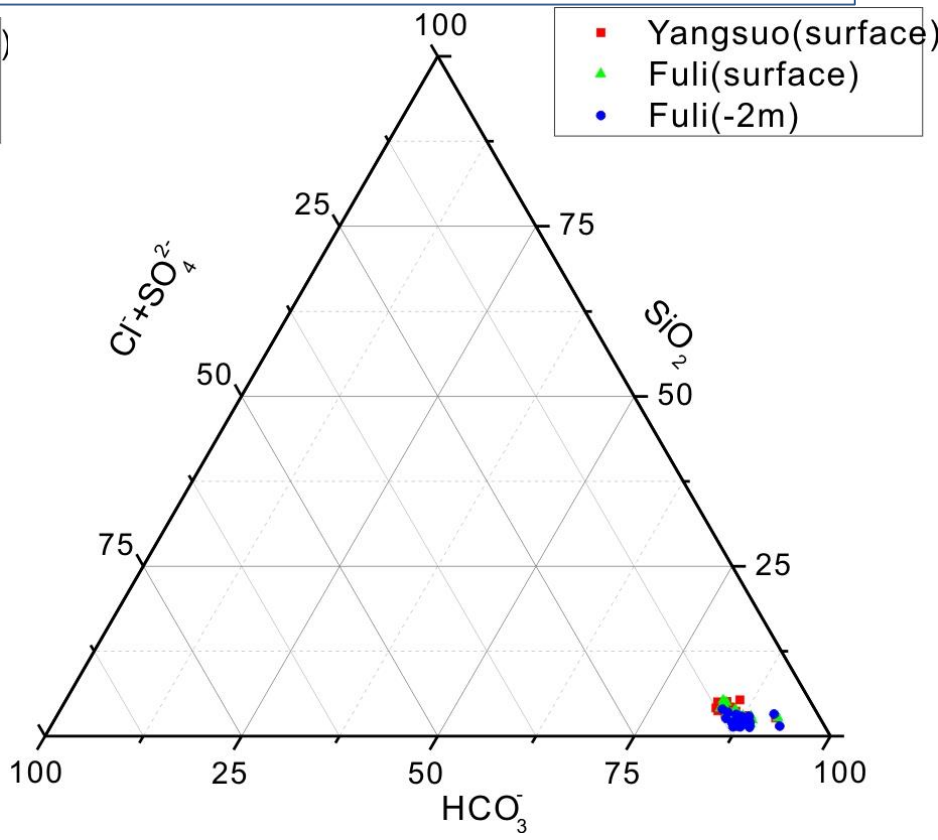



02 - Fuli transection (-2m layer)

Ec increased, pH decreased, indicating that the water-rock interaction reached its maximum rate under the continuous precipitation, or the rainwater flowed into the river as surface flow

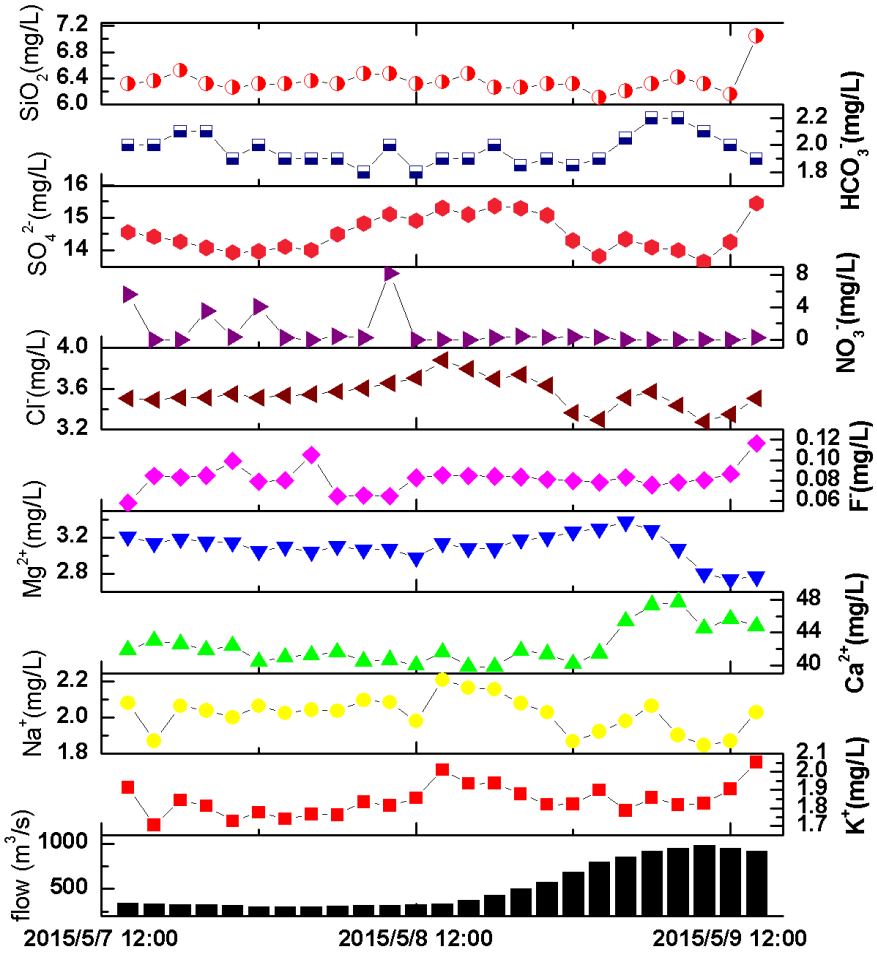
# 4.2 Major ions variation




Piper diagram of water samples from three transections during monitoring

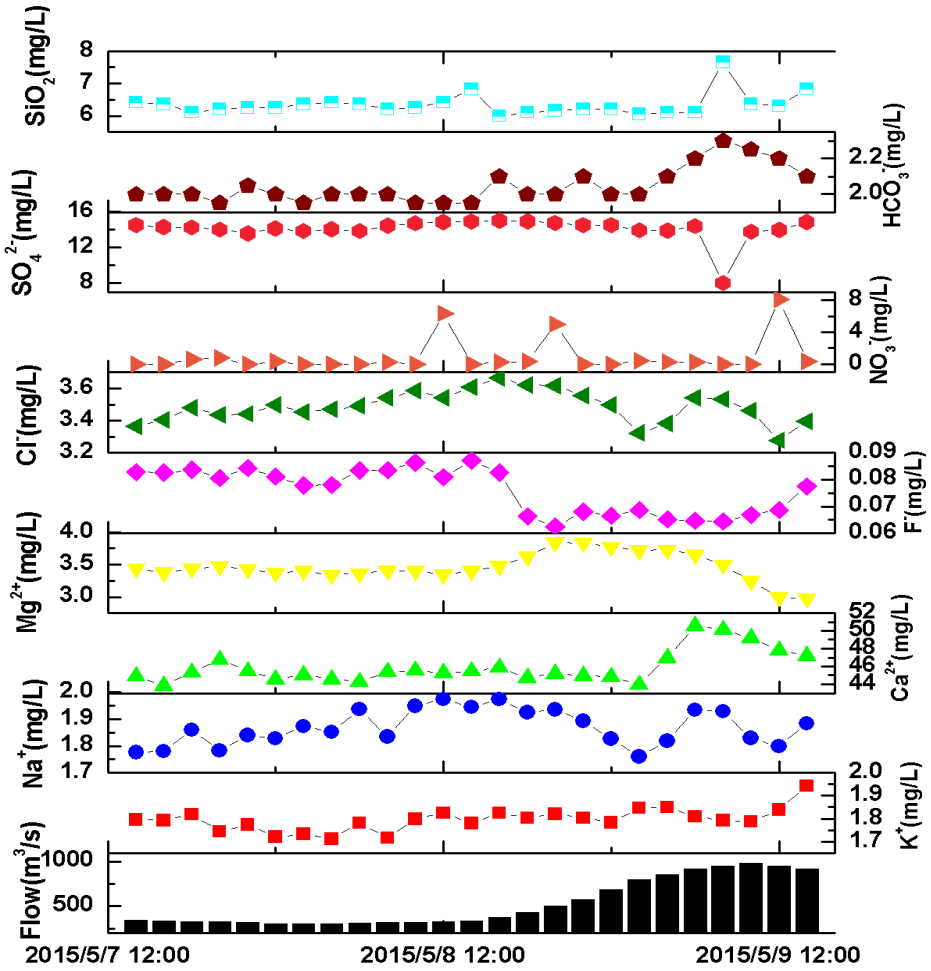
# 4.2 Major ions variation




01-Yangshuo transection

(surface layer)

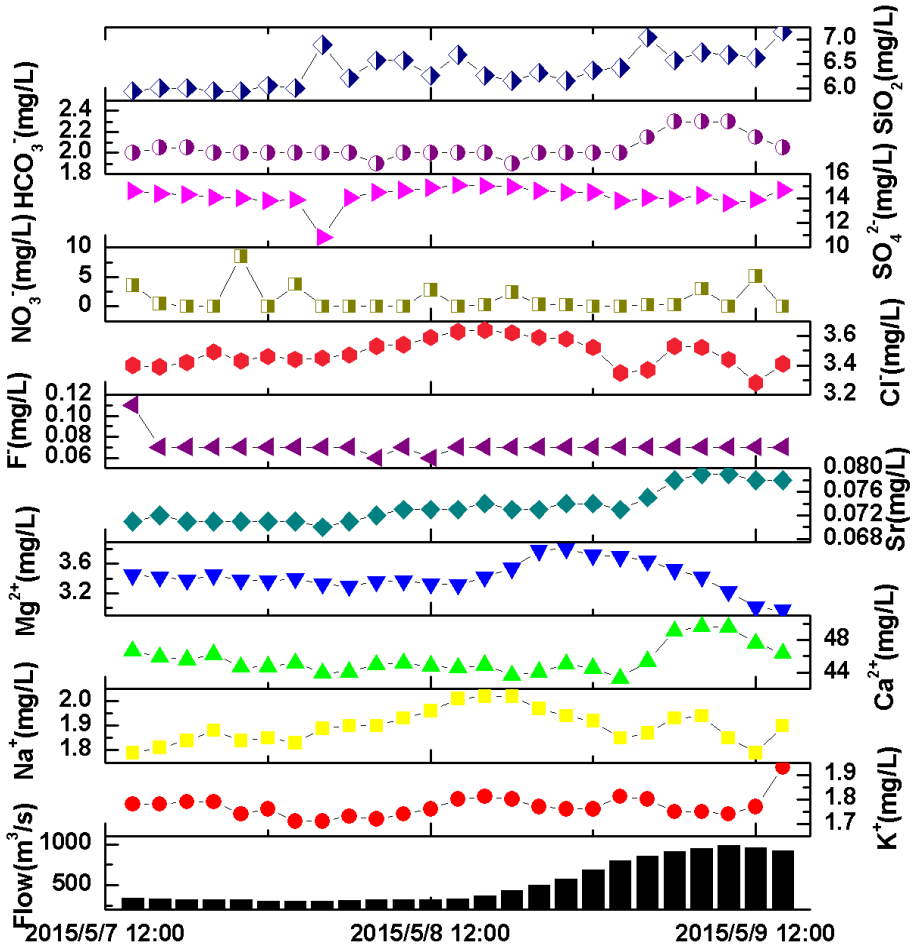
# 4.2 Major ions variation




02 - Fuli transection

(surface layer)

# 4.2 Major ions variation




02 - Fuli transection
(-2m layer)

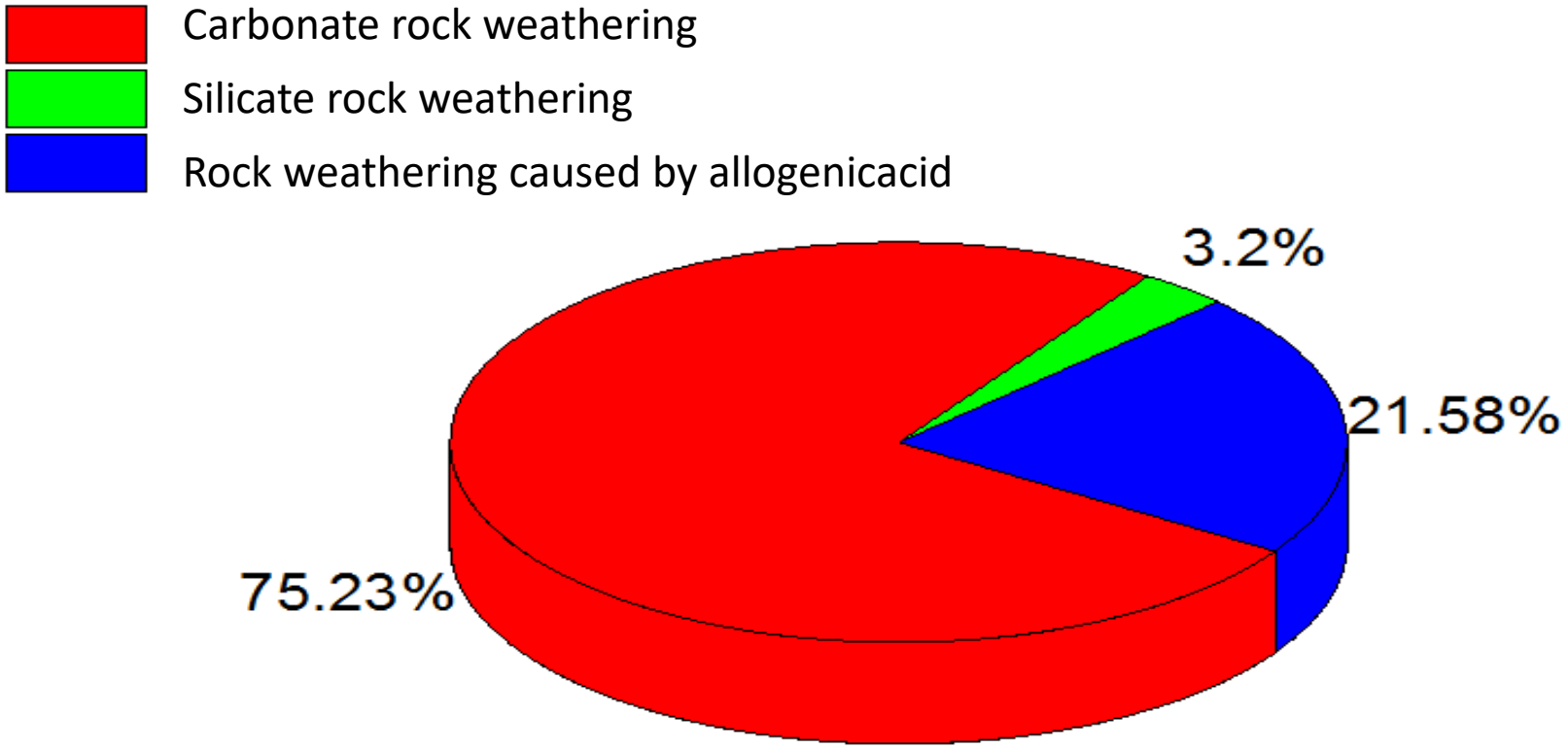
# 4.3 Inorganic carbon flux

- The tatal carbon flux increased from upstream (01-Yangshuo) to downstream (02-Fuli)
- Lithology
- Soil

| Transection | Carbon flux ($tCO_2$) |
|---|---|
| 01-Yangshuo Surface layer | 4122.29 |
| 02-Fuli Surface layer | 4322.14 |
| 02-Fuli -2m layer | 4324.91 |

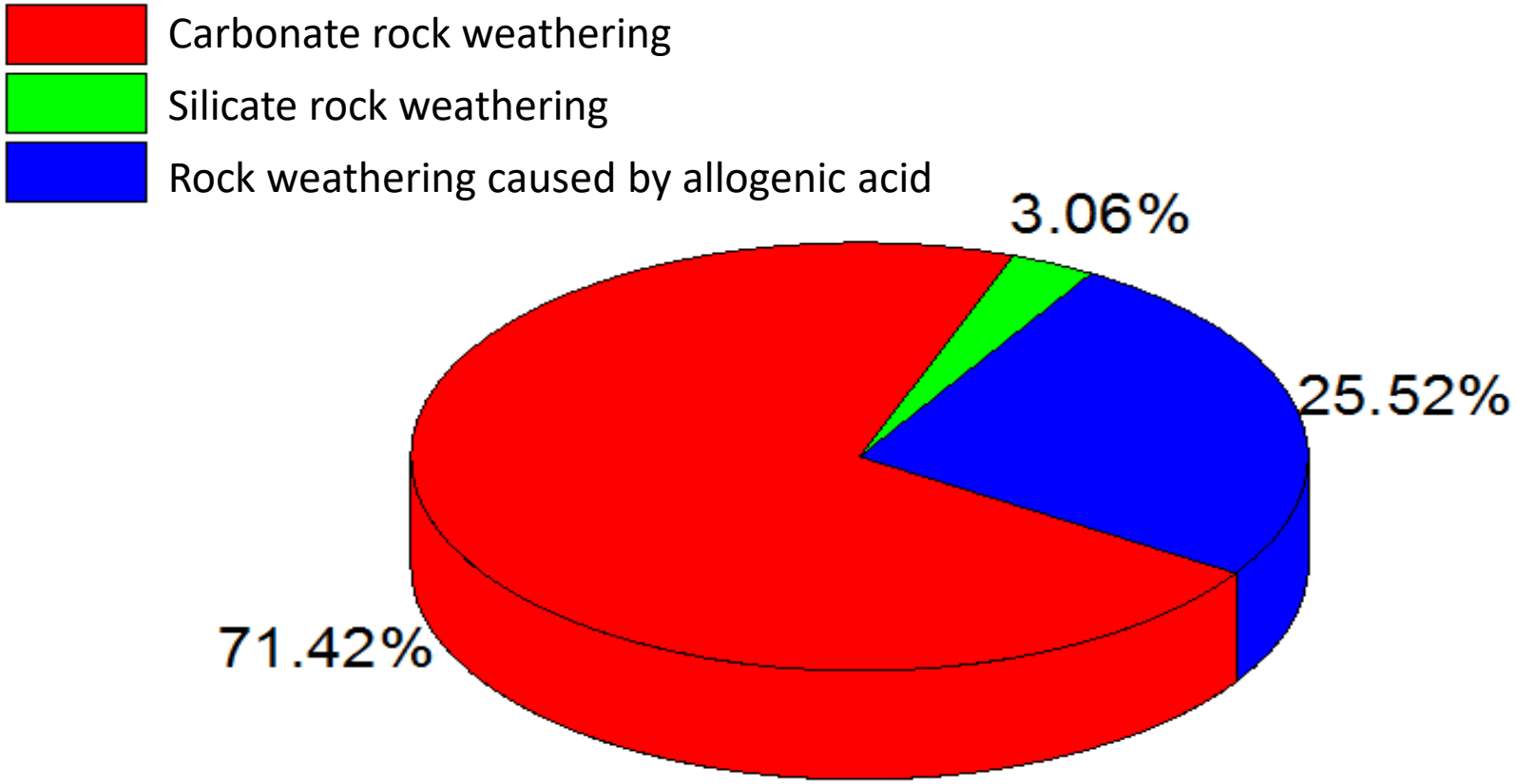
# 4.4 Inorganic carbon sources

## 01-Yanshuo transection (Surface layer)



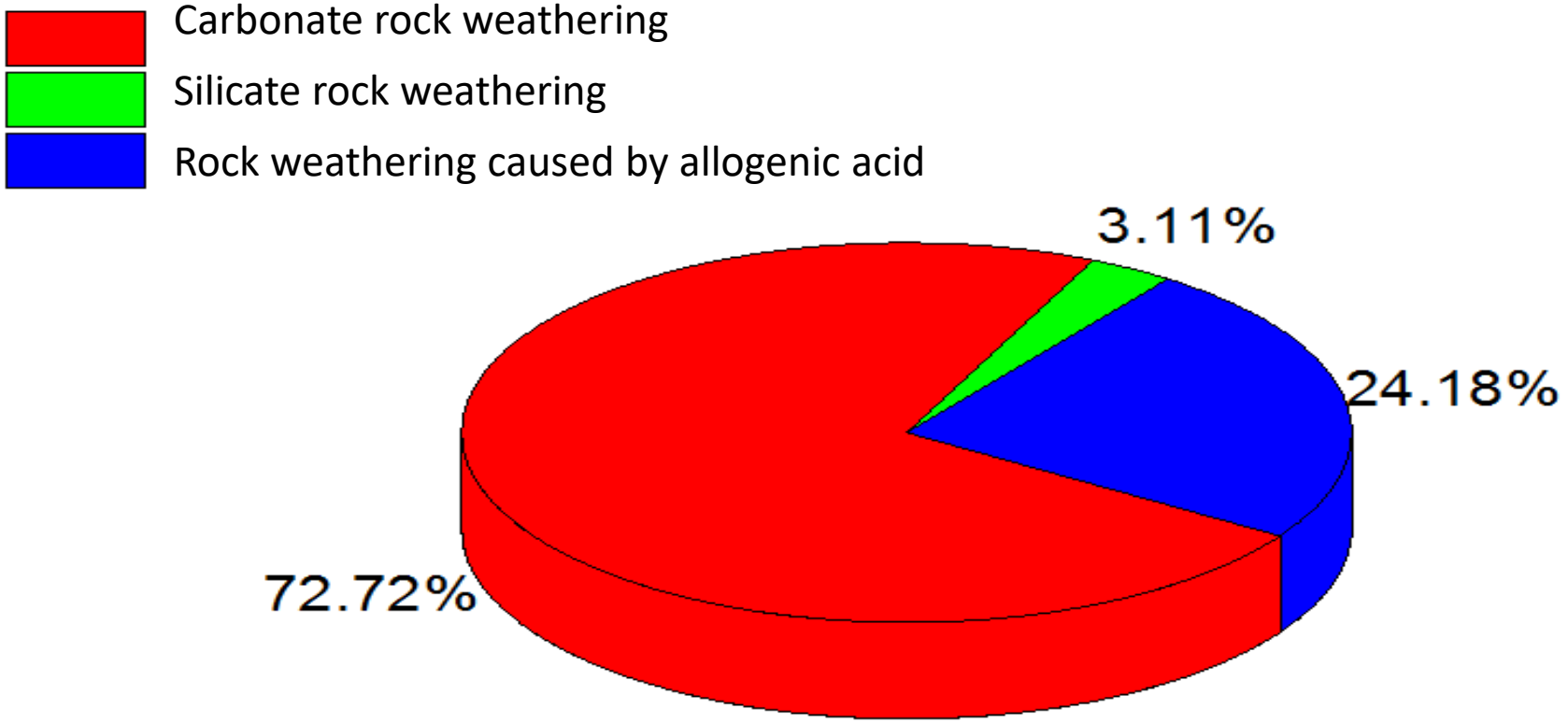
# 4.4 Inorganic carbon sources

## 02-Fuli transection (Surface layer)



# 4.4 Inorganic carbon sources

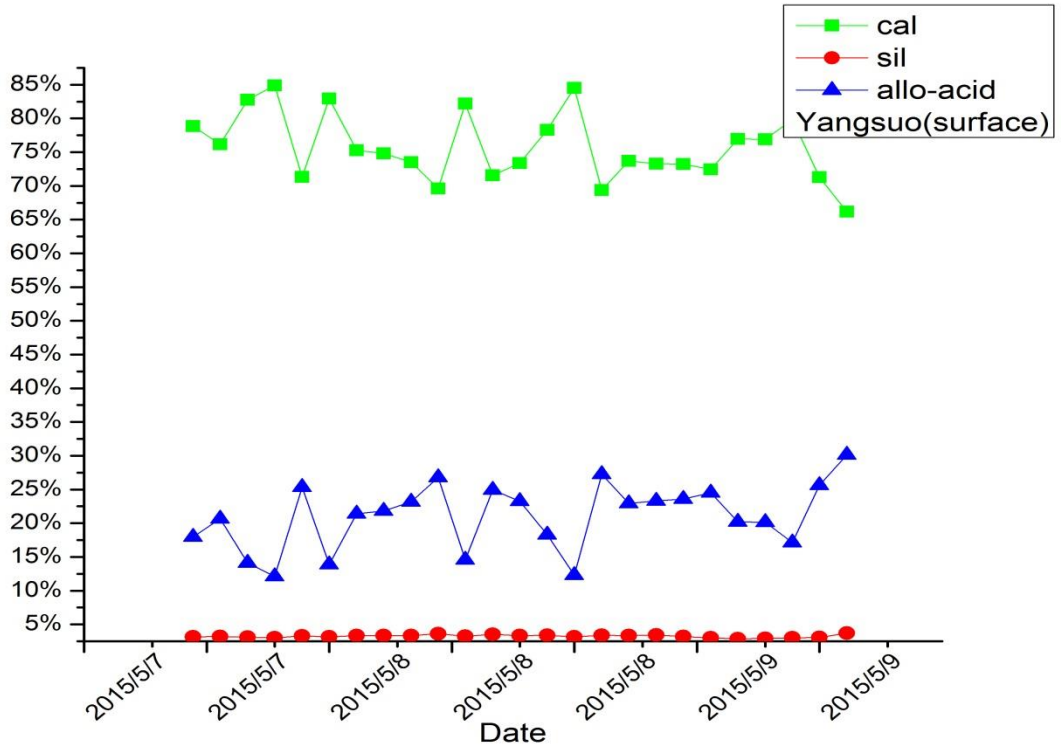
## 02-Fuli transection (-2m layer)



# 4.4 Inorganic carbon sources

## 01-Yanshuo transection (Surface layer)

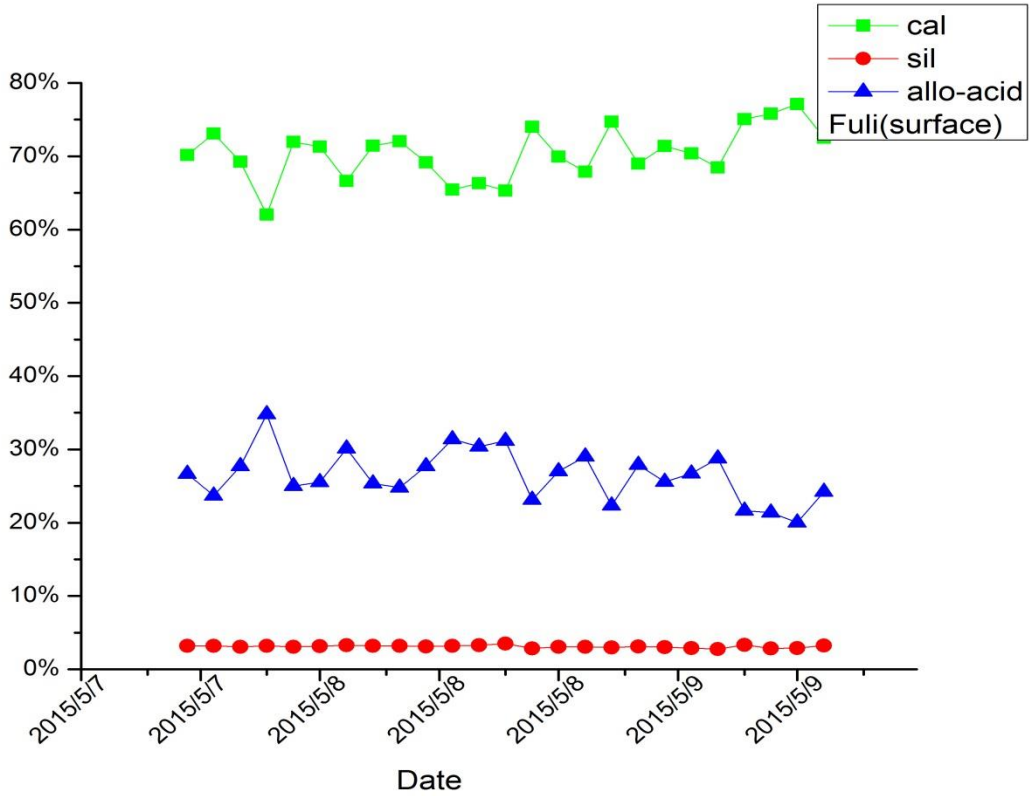
Variations of carbon source contributions against time



# 4.4 Inorganic carbon sources

## 02-Fuli transection (Surface layer)

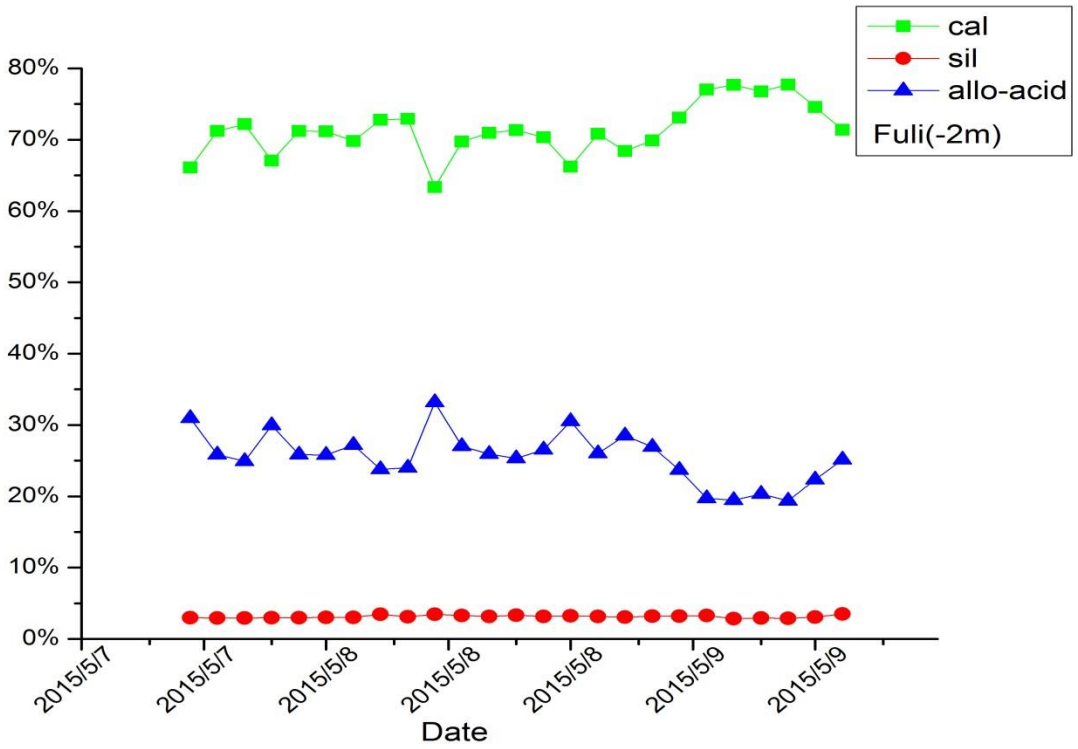
Variations of carbon source contributions against time



# 4.4 Inorganic carbon sources

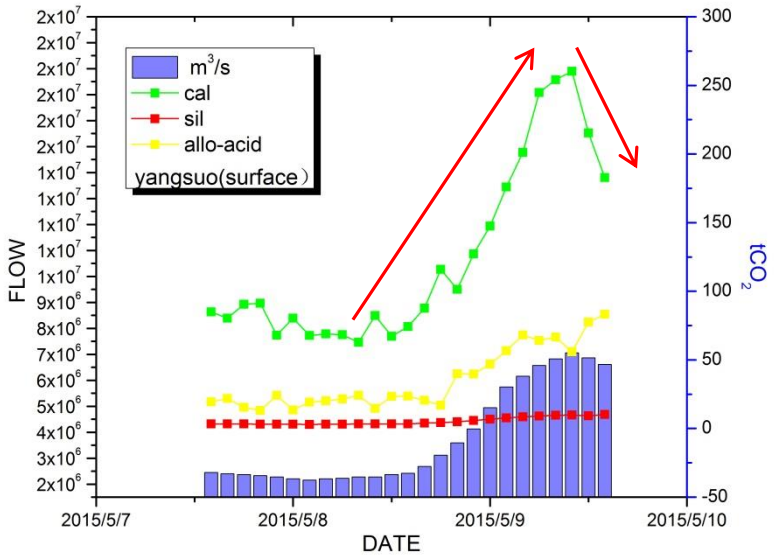
## 02-Fuli transection (-2m)

Variations of carbon source contributions against time

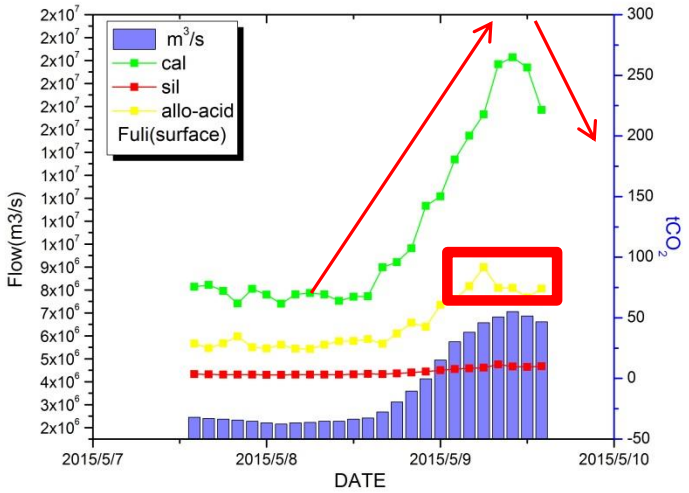


# 4.4 Inorganic carbon sources

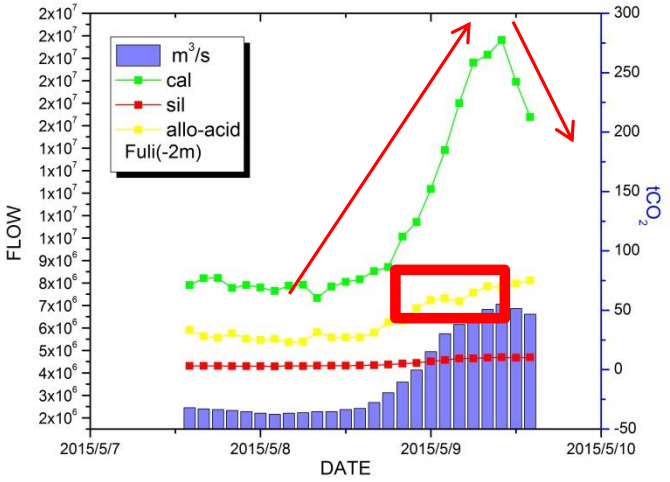
01-Yanshuo transection (Surface layer)




02-Fuli transection (Surface layer)




02-Fuli transection (-2mlayer)



# 5. Summary

## Water chemical

- Hydrochemical facies of the three transections were $HCO_3^-$-Ca, reflectiing lithological control on the Hydrochemical facies

- The variation of $Cl^-$、$F^-$、$Na^+$、$K^+$ would come from varied sources

# 5. Summary

## Rock weathering

- Rock weathering was enhanced before the peak and diluted during the peak.

- Under the continuously precipitation, the maximum capacity of water-rock interaction was reached, or the rain flowed into river as surface flow.

# 5. Summary

**Carbon flux**

- The *CSF*s of Yangshuo, Fuli and Fuli (-2m) transections were 4122.29 $tCO_2$ , 4322.14 $tCO_2$, and 4324.91 $tCO_2$
- The percentages of carbonate weathering accounted for 75.23%, 71.42% and 72.72%
- The percentages of silicate weathering were 3.2%, 3.06% and 3.11%
- The proportion of weathering caused by allogenic acid were 21.58%, 25.52% and 24.18%, which caused the distinct carbon loss

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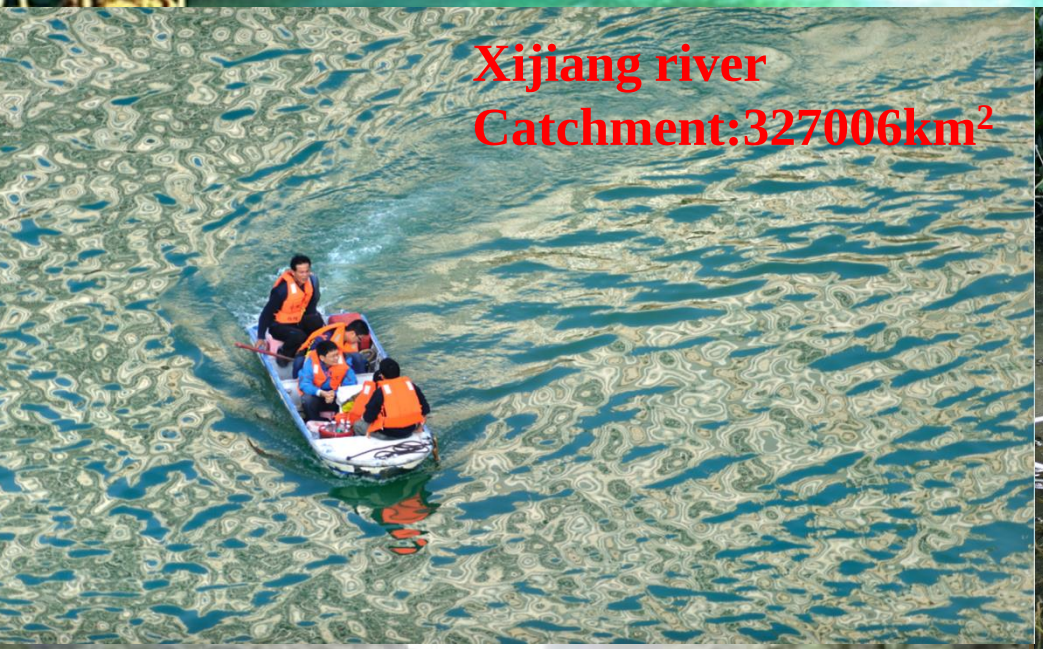

Xijiang river
Catchment:327006km$^2$

Banzhai stream (groundwater-fed)
Catchment: 30km$^2$

Yaji karst experimental site
Catchment:2km$^2$

Thanks!