

Suitability of using groundwater temperature and geology to predict arsenic contamination in drinking water – a case study in central Mexico

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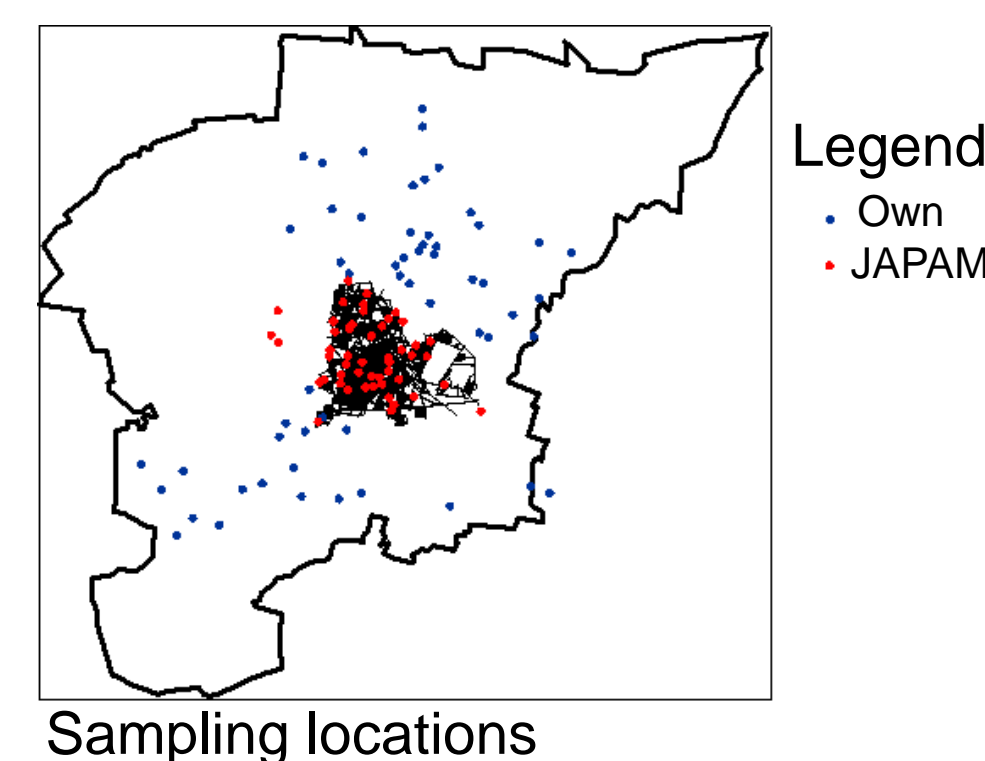


Introduction

- Arsenic in drinking water poses a wide risk to human health, and increases risk of cancer.
- In Irapuato, Mexico arsenic in drinking water is a concern and in some cases exceeds Mexican (0.025 mg/l) and WHO (0.010 mg/l) drinking water norms, but a cheap and simple method to identify risk areas is lacking.
- Locals know the temperature of their wells, which can possibly be an indicator for arsenic concentration.
- We studied whether local knowledge and available geology data can be used to identify areas at risk of arsenic contamination in Irapuato's drinking water.

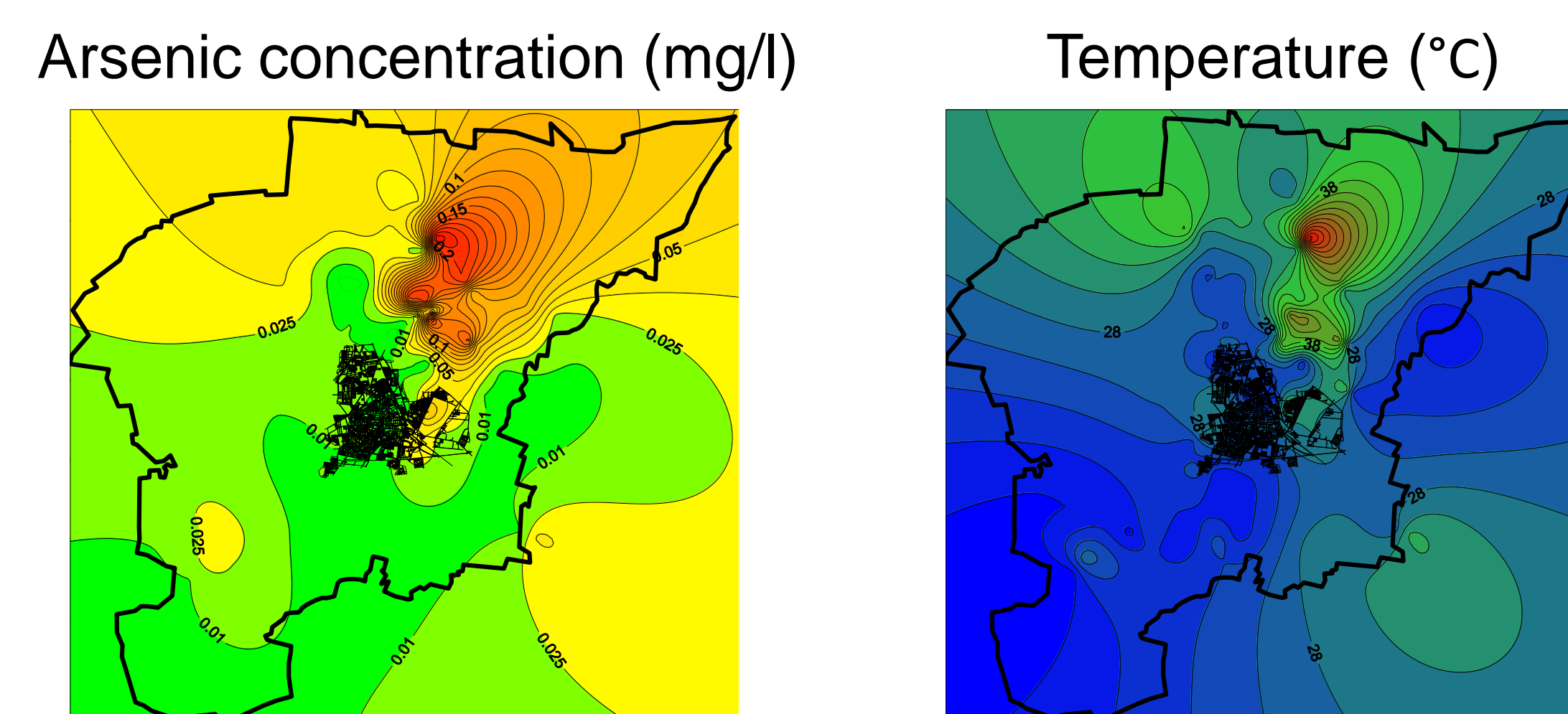
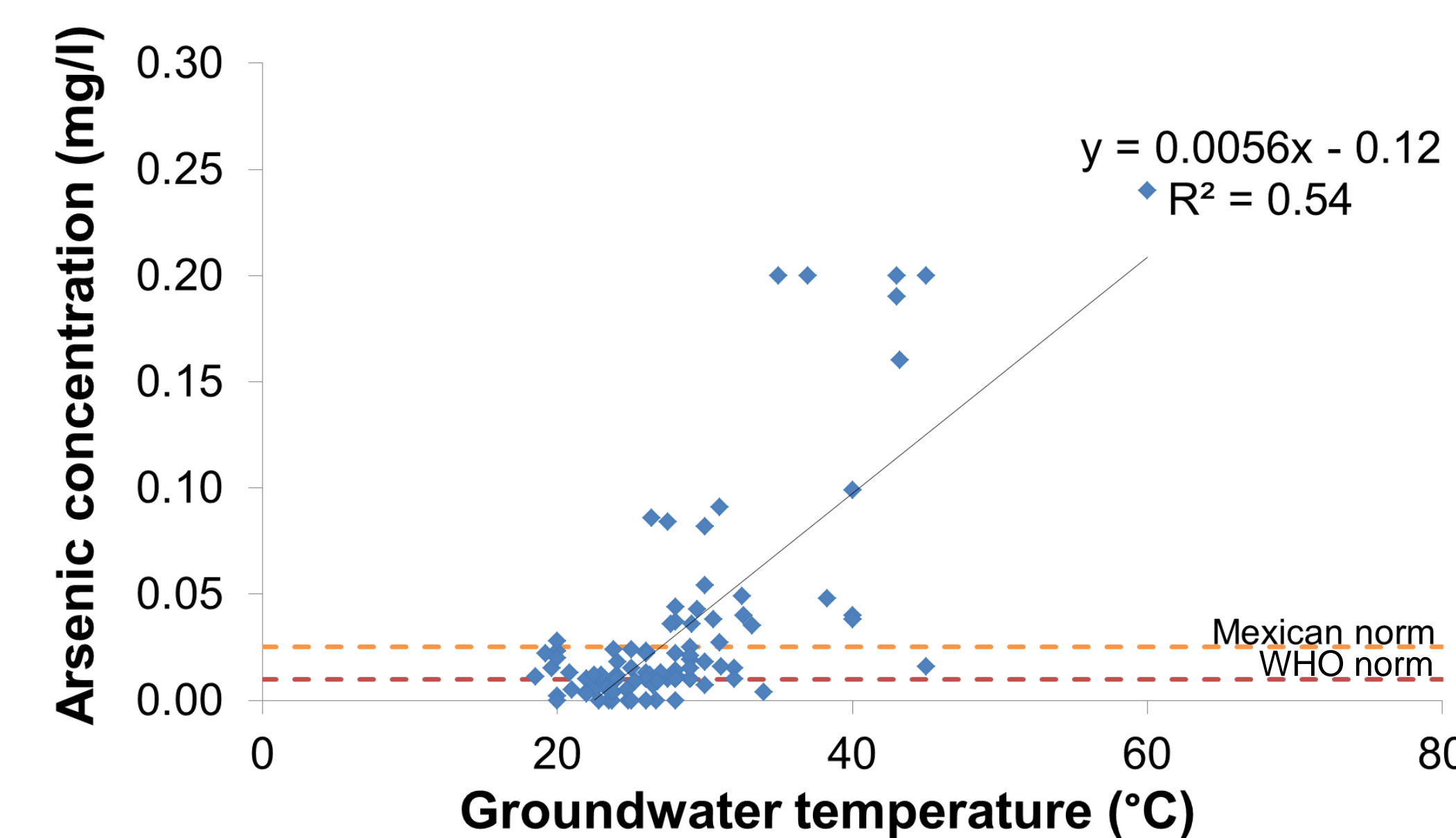
Methodology

- Groundwater temperature and arsenic concentration data were collected for 111 wells.
- Data consists of field measurements as well as government data collected by the JAPAMI.



Arsenic and temperature

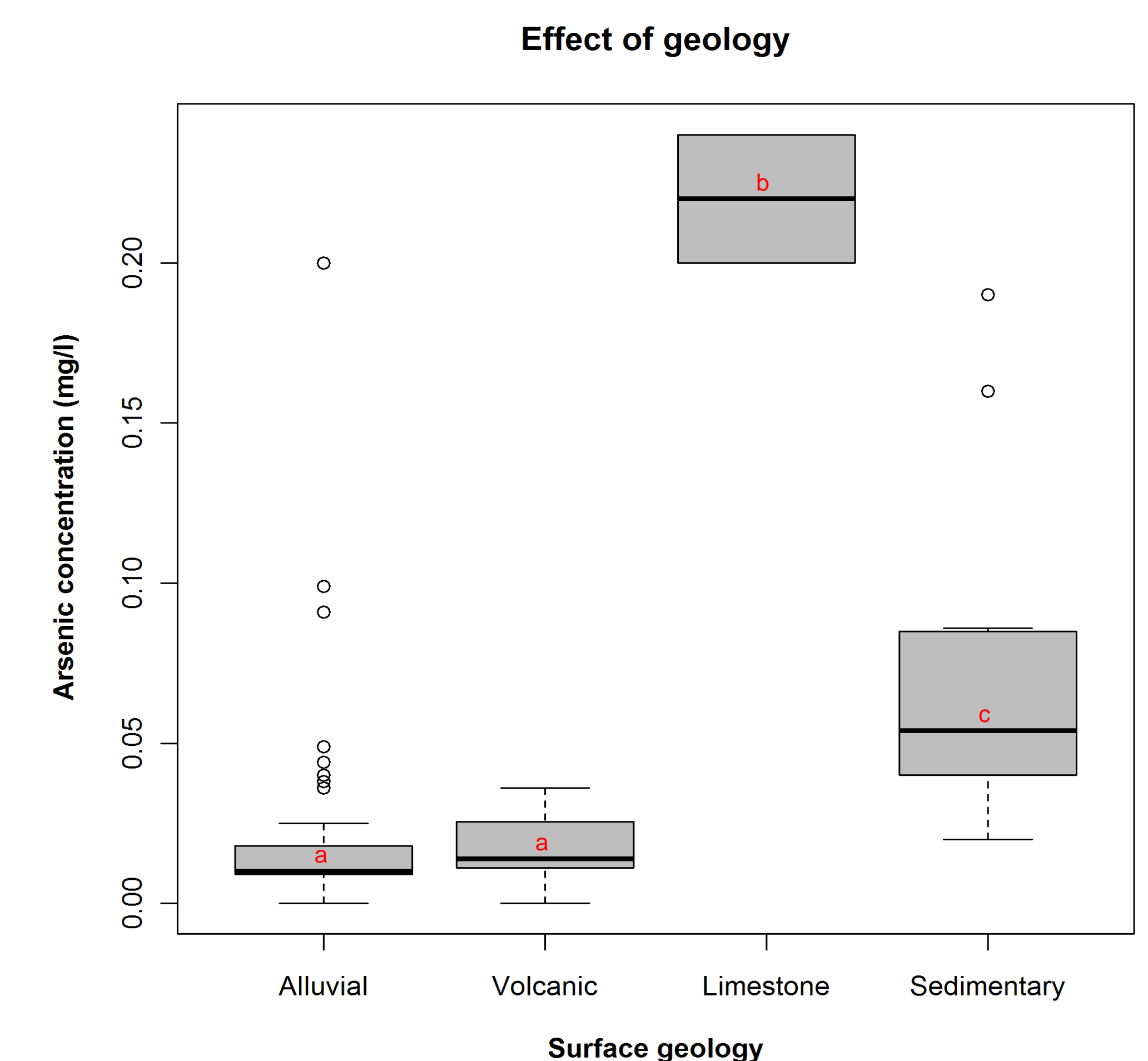
- 24% (27 out of 111) of the wells exceeded the Mexican norm and 51% (57 out of 111) exceeded the WHO norm.
- There was a fairly good ($R^2=0.54$) correlation between groundwater temperature and arsenic concentration.



- In general, groundwater $>27.4^{\circ}\text{C}$ exceeded Mexican arsenic norms in drinking water and $>25.9^{\circ}\text{C}$ WHO norms.
- The percentage of wells exceeding Mexican and WHO drinking water norms that are not detected when using this temperature cut-off (the false negative rates) are 7 and 20%, respectively.

Arsenic and surface geology

- The surface geology of the municipality comprised of alluvial sediments, volcanic rock, limestone and other sedimentary rocks (sandstone, conglomerate).
- The area was dominated by alluvial soil, with only 2% of measurements in limestone and 9% in other sedimentary rock types.



- Surface geology had significant effects on arsenic concentration, with limestone and other consolidated sedimentary areas having significantly higher arsenic levels in groundwater than areas with alluvial sediments and volcanic rocks.



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Conclusion In Irapuato, groundwater temperature can be used to evaluate which areas are likely to exceed arsenic drinking water norms, though additional factors could lower the false negative rate. Wells in limestone, and to a lesser degree sandstone and conglomerate, were particularly vulnerable for arsenic contamination. Water managers can use this to target high-risk areas and for the development of water management and treatment plans.