INVESTIGATING THE INFLUENCE OF AIR POLLUTION EMISSION SOURCES ON PRECIPITATION CHEMISTRY IN KEY SAMPLING SITES IN THE PHILIPPINES

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INTRODUCTION

WET DEPOSITION

- scavenging of gaseous and aerosol particles by hydrometeors from the atmosphere and is consequently brought to Earth's surface

ACID RAIN

- produced when rainwater reacts with excessive amounts of acid precursor compounds (e.g., SO_2 and NO_X)
- Rainwater pH threshold: 5.6

SCIENCE QUESTIONS

- What are the chemical characteristics and acidity of rainwater in these key sampling sites in the Philippines?
- What are the pollution sources that contribute to the chemical composition found in the rainwater samples?

SAMPLING SITES

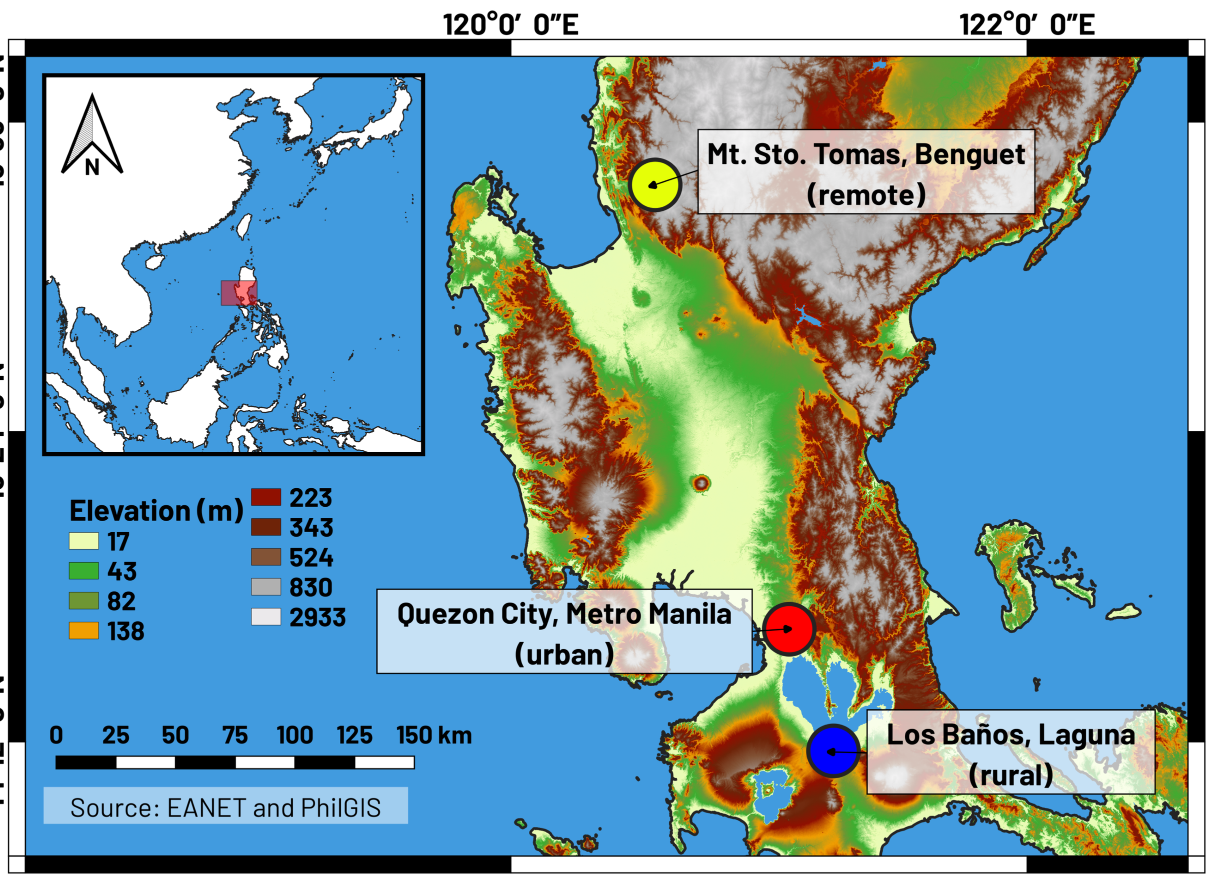

Figure 1. The key sampling sites are located in Northern Philippines. Available data for the site is shown in this figure: Quezon City, Metro Manila (urban, 55 m agl, 2000-2016, & 2019); Los Baños, Laguna (rural, 25 m agl, 2000-2016); and Mt. Santo Tomas, Benguet (remote, 1500 m agl, 2006-2016)

HIGHLIGHTS:

1. The seasonal behavior of pH and EC is likely due to the observed corresponding seasonality in the ionic species concentrations in rainwater.
2. PMF analyses suggest that there are four-factor solutions for the three sampling sites.
3. PSCF analyses suggest that the observed ionic species concentrations in rainwater are associated with the seasonal prevailing winds (e.g. Northeast monsoon and Southwest monsoon.

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RESULTS

VOLUME WEIGHTED MEAN ION CONCENTRATIONS, PRECIPITATION, pH, & ELECTRICAL CONDUCTIVITY

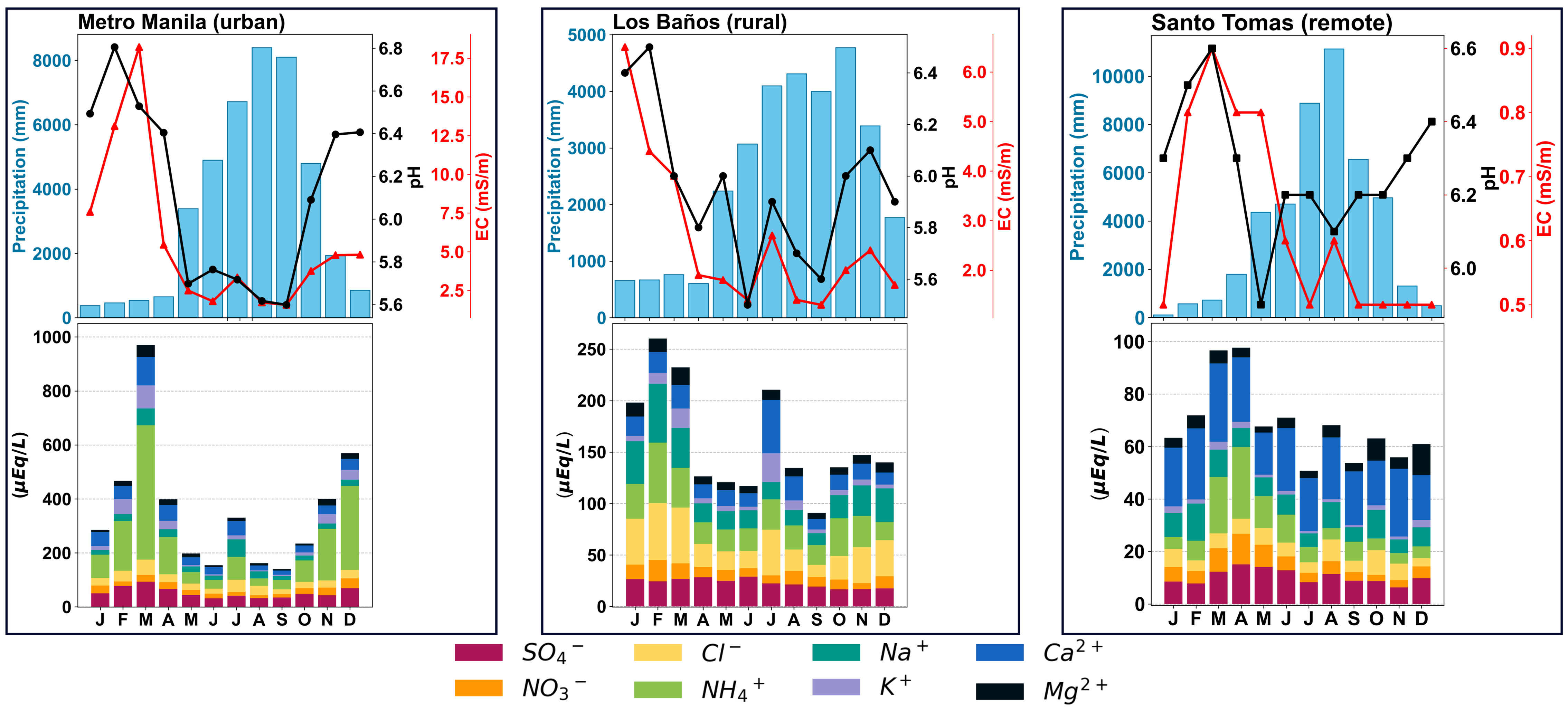

Figure 2. Volume weighted mean ion concentrations, precipitation, pH, & electrical conductivity (EC) at three sampling sites. The monthly mean precipitation shows an inverse relationship with pH and EC with distinct characteristics during the monsoon seasons, i.e., high pH and EC values during the dry season (November-May) and low values in the wet season (June-October).

- Brownian diffusion of aerosol particles and gases is very efficient for larger particle sizes due to its inertia during the dry season.
- The slightly acidic nature of the cloud droplets will increase the rainwater acidity in the wet season.

POSITIVE MATRIX FACTORIZATION (PMF)

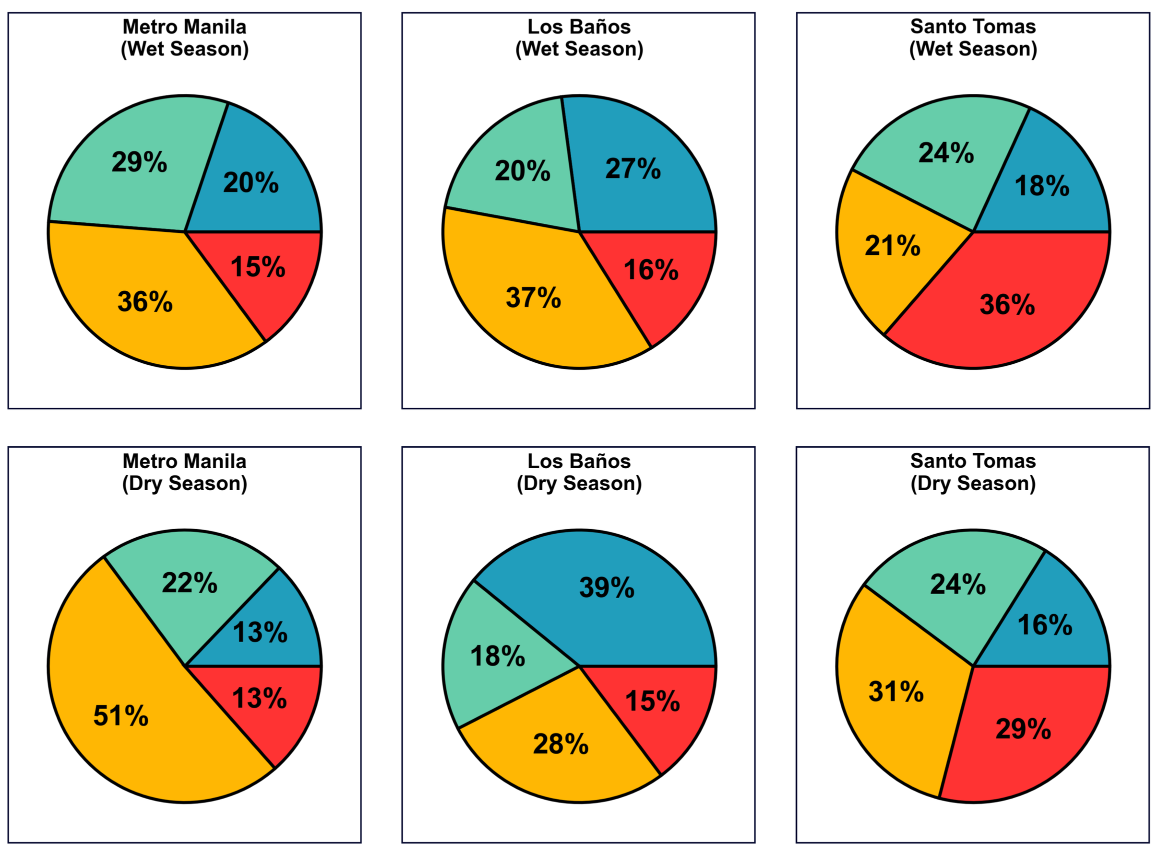

Figure 3. PMF analyses suggest that there are four-factor solutions for the aforementioned sites: sea salt, anthropogenic emissions, NH_4^+ - K^+ mix, and crustal. NH_4^+ - K^+ mix in Metro Manila and Los Baños contribute highly during the wet season while crustal for Santo Tomas. NH_4^+ - K^+ mix is also highly contributed in Metro Manila and Santo Tomas while sea salt for Los Baños.

POTENTIAL SOURCE CONTRIBUTION FUNCTION (PSCF)

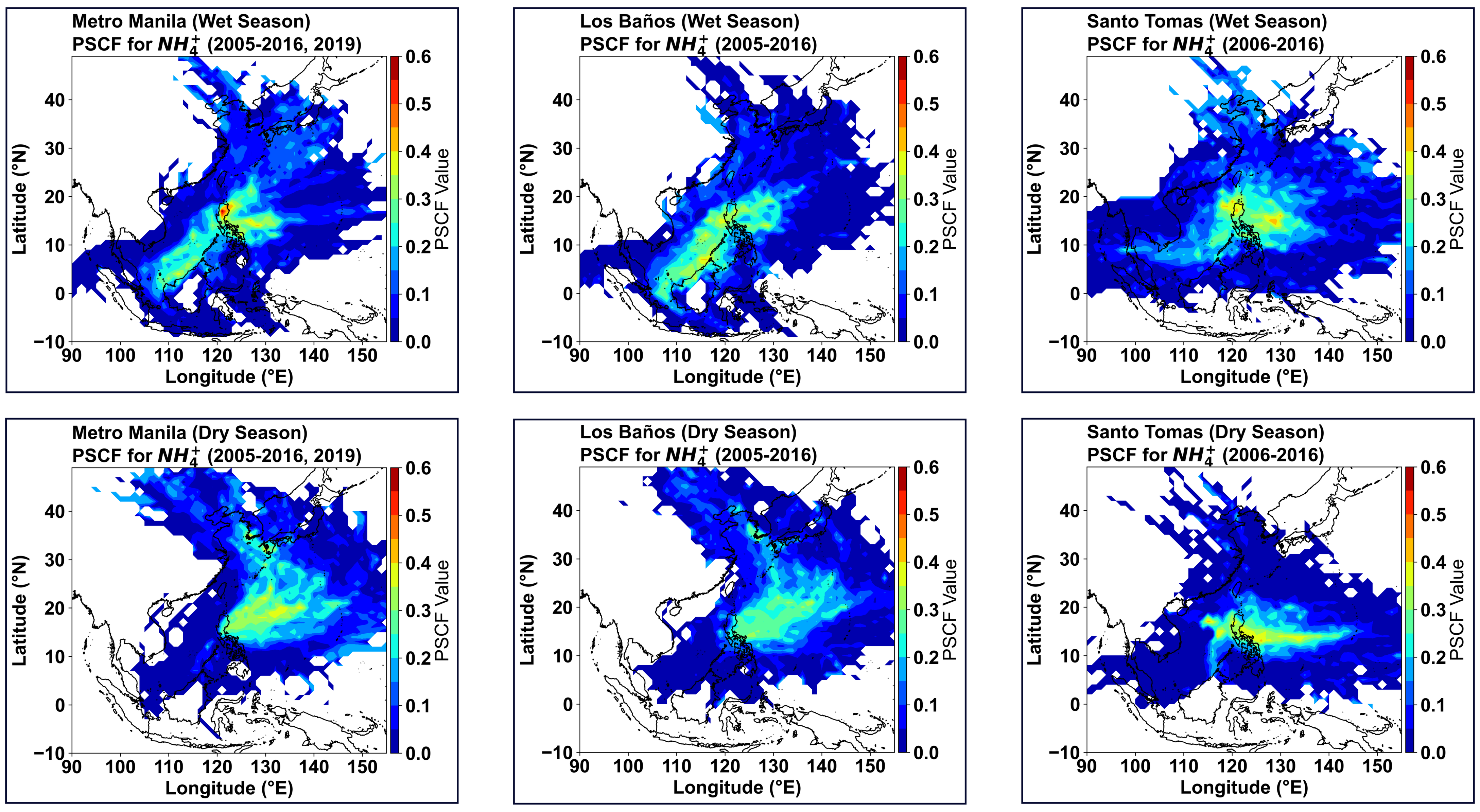

Figure 4. The potential source areas contribute to the water-soluble (NH_4^+) ions in the rainwater in three sampling sites. The results showed high PSCF values coming from both southwest and around the vicinity of the Philippines during the wet season. Additionally, high PSCF values during the dry season are coming from the northeast of the Philippines.