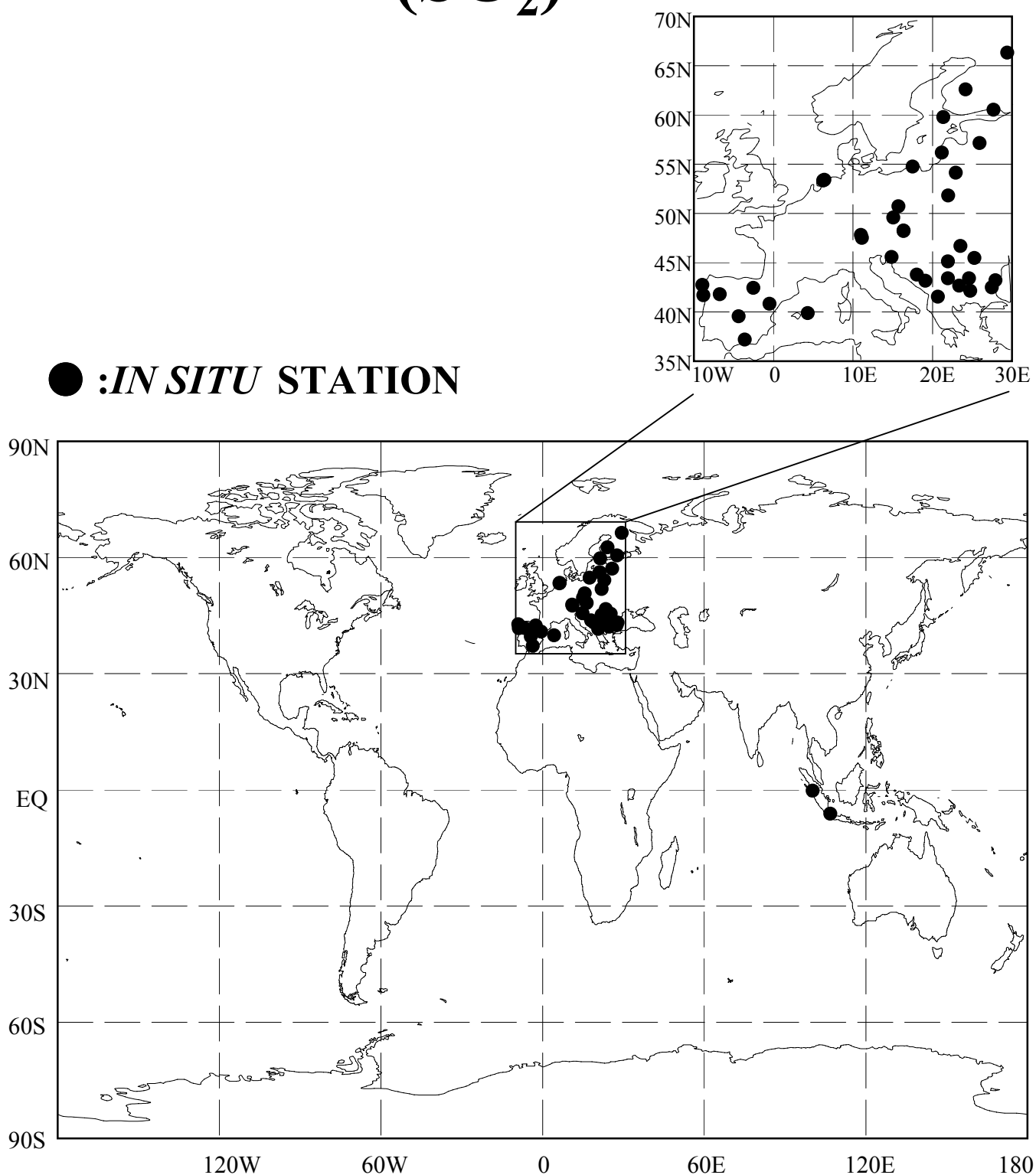


10.

SULFUR DIOXIDE (SO₂)

● : *IN SITU* STATION



10. Sulfur Dioxide (SO₂)

Sulfur dioxide (SO₂) is not a greenhouse gas but is a precursor of atmospheric sulfuric acid (H₂SO₄) or sulfate as an aerosol. SO₂ is oxidized by hydroxyl radicals (OH) to form sulfuric acid, which then produces aerosol through photochemical gas-to-particle conversion. While the reaction with OH is much slower than the corresponding one for NO₂, SO₂ dissolves easily in suspended droplets in the atmosphere, unlike NO_x.

Sources of SO₂ include fossil fuel combustion by industries, biomass burning, volcanoes and the oxidation of dimethylsulfide (DMS) from oceans (IPCC, 2001). Major SO₂ sinks are oxidation by OH and deposition onto wet surfaces. Anthropogenic SO₂ has caused acid rain and deposition throughout industrial times. SO₂ has large variability in space and time because of its short life time and localized anthropogenic sources.

Observation stations that submitted data for SO₂ to the WDCGG are shown in the map at the top page of this chapter. Most of the contributing stations are located in Europe. Figure 10.1 illustrates the time series of monthly mean concentrations of SO₂ for individual stations in colors that change with the concentration. Please note that data for SO₂ are reported in various units, i.e., ppb, µg/m³, mg/m³ and µgS/m³, and that it can be converted to a single unit of ppb as follows:

$$\begin{aligned}X_p [\text{ppb}] &= (R * T / M / P_0) * 10 * X_g [\mu\text{g}/\text{m}^3] \\X_p [\text{ppb}] &= (R * T / M / P_0) * 10^4 * X_g [\text{mg}/\text{m}^3] \\X_p [\text{ppb}] &= (R * T / M_s / P_0) * 10 * X_g [\mu\text{gS}/\text{m}^3]\end{aligned}$$

where R is the molar gas constant, which is 8.31451 [J/K/mol],
 T is the absolute temperature reported from an individual station,
 M is the molecular weight of SO₂, which is 64.0648,
 M_s is the atomic weight of S, which is 32.066 and
 P_0 is the standard pressure, which is 1013.25 [hPa].

Generally, SO₂ concentrations are higher in southern regions than in northern regions in Europe. But, it is difficult to identify an increasing or decreasing trend for SO₂ concentrations.