A) Input:
- Hourly Model file
- Obs files: L2 + L1b (prior)

B) Horizontal IDW (5 grid cells) to station location:
- CO_2 and components: Anthr, BG, RA, GPP
- Air density ρ

C) Vertical interpolation & extrapolation

Total XCO_2
- Linear interpolation between model layers
- Below model layers: constant, first layer value
- Above model layers: use prior profile

Anthr., RA, GPP XCO_2
- Linear interpolation
- Above model: linear extrapolation
- No prior

BG XCO_2
- No vertical interpolation
- Computed as Total - Anthr - RA + GPP

Air density ρ
- computed and interpolated to AK heights above ground

D–F) XCO_2 computation

Compute $XCO_{2,total}$
$$\frac{\sum(\rho\,dz\,[X_{prior} + AK \cdot (X_{model} - X_{prior})])}{\sum(\rho\,dz)}$$

Compute layer fractions
$$f_{comp} = \frac{X_{comp}}{X_{total}}$$

Compute $XCO_{2,components}$
$$\frac{\sum(\rho\,dz\,f_{comp}\,[X_{prior} + AK \cdot (X_{total} - X_{prior})])}{\sum(\rho\,dz)}$$

Return dictionary:
- Obs XCO2
- Mod XCO2 (Total/Anthr/BG/RA/GPP)
- Meta data (date, station name, topography, etc.)