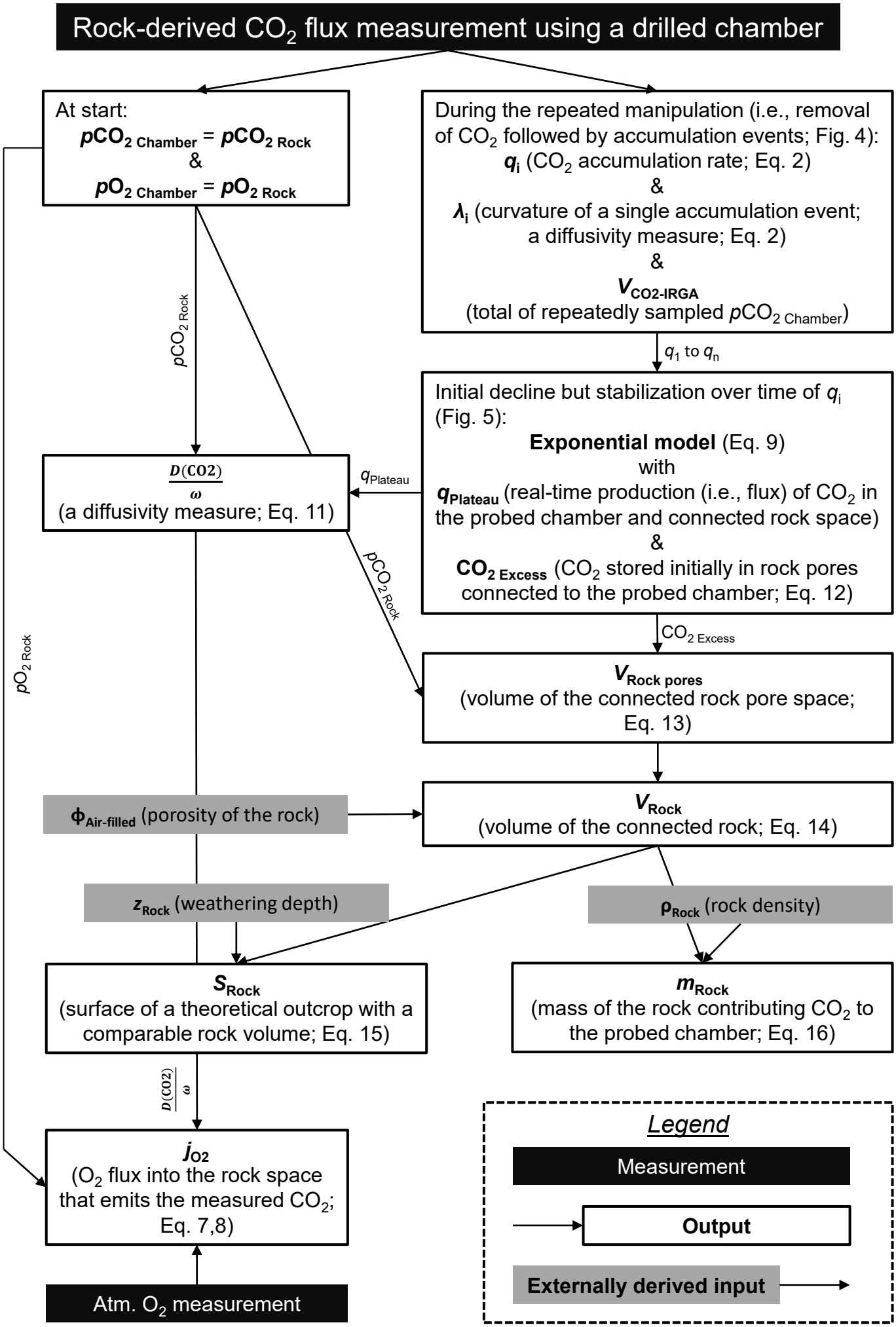
Rock-derived CO_2 flux measurement using a drilled chamber
At start:
$pCO_{2\ Chamber} = pCO_{2\ Rock}$
&
$pO_{2\ Chamber} = pO_{2\ Rock}$
During the repeated manipulation (i.e., removal of CO_2 followed by accumulation events; Fig. 4):
q_i (CO_2 accumulation rate; Eq. 2)
&
λ_i (curvature of a single accumulation event; a diffusivity measure; Eq. 2)
&
$V_{CO2\text{-}IRGA}$
(total of repeatedly sampled $pCO_{2\ Chamber}$)
q_1 to q_n
Initial decline but stabilization over time of q_i (Fig. 5):
Exponential model (Eq. 9)
with
$q_{Plateau}$ (real-time production (i.e., flux) of CO_2 in the probed chamber and connected rock space)
&
$CO_{2\ Excess}$ (CO_2 stored initially in rock pores connected to the probed chamber; Eq. 12)
$pCO_{2\ Rock}$
$\frac{D(CO2)}{\omega}$
(a diffusivity measure; Eq. 11)
$q_{Plateau}$
$pCO_{2\ Rock}$
$CO_{2\ Excess}$
$pO_{2\ Rock}$
$V_{Rock\ pores}$
(volume of the connected rock pore space; Eq. 13)
$\phi_{Air\text{-}filled}$ (porosity of the rock)
V_{Rock}
(volume of the connected rock; Eq. 14)
z_{Rock} (weathering depth)
ρ_{Rock} (rock density)
S_{Rock}
(surface of a theoretical outcrop with a comparable rock volume; Eq. 15)
m_{Rock}
(mass of the rock contributing CO_2 to the probed chamber; Eq. 16)
$\frac{D(CO2)}{\omega}$
j_{O2}
(O_2 flux into the rock space that emits the measured CO_2; Eq. 7,8)
Atm. O_2 measurement
Legend
Measurement
Output
Externally derived input