Zustand feuchter Luft: p, T + 3. Größe ("Dampfanteil")

relative Feuchte φ

- Luftfeuchtigkeit

$$\varphi := \frac{p_W^*}{p_S(T)}$$

- Feuchtegehalt x

$$x := \frac{m_W}{m_L} \quad \left(\text{nicht: } \frac{m_W}{m_W + m_L} =: s\right)$$

$$x = \frac{M_W n_W}{M_L n_L} = \frac{M_W y_W}{M_L y_L} = \frac{M_W}{M_L} \frac{p_W^*/p}{p_L^*/p} = \frac{M_W}{M_L} \frac{p_W^*}{p - p_W^*}$$

$$= \frac{M_W}{M_L} \frac{\varphi p_S(T)}{p - \varphi p_S(T)}$$

$$x = 0{,}629 \frac{\varphi p_S}{p - \varphi p_S}$$

$\Downarrow$ Wasser (keine Luft) $x = \frac{m_D}{m_W + m_D}$

$M_W \approx 18 \frac{g}{mol}$ $M_L = \begin{cases} 28 \frac{g}{mol} & N_2 \\ 32 \frac{g}{mol} & O_2 \\ 29 \frac{g}{mol} \end{cases}$

Dichte feuchter Luft $\rho(p, T, \varphi)$

$$\rho = \frac{p_L^*}{R_L T} + \frac{p_v^*}{R_v T} = \frac{1}{RT}\left(M_L p_L^* + M_v p_v^*\right) = \frac{M_L}{RT}\left(p_L^* + \frac{M_v}{M_L} p_v^*\right)$$

$$= \frac{M_L}{RT}\left(p - \varphi p_S + \frac{M_v}{M_L}\varphi p_S\right) = \frac{p M_L}{RT}\left(1 - \left(1 - \frac{M_v}{M_L}\right)\varphi \frac{p_S}{p}\right)$$

$$= \rho_L\left(1 - \left(1 - \frac{M_v}{M_L}\right)\varphi \frac{p_S(T)}{p}\right)$$

$$= \rho_L\left(1 - 0.3781\, \varphi \frac{p_S(T)}{p}\right)$$

Spezifisches Volumen

$$v = \frac{V}{m_v + m_L} = \frac{1}{\rho}$$

$$v_{1+x} := \frac{V}{m_L} = \frac{V}{m_v + m_L}\,\frac{m_v + m_L}{m_L} = (1+x)\,v$$