UWIS, Atmosphärenphysik, Übung 3

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1.1 Kritischer Radius und Sättigungsverhältnis

$$
\begin{aligned}
T &= 275\ \mathrm{K} \\
a &= \frac{2\sigma}{\varrho_w R_v T} = \frac{3.3 \cdot 10^{-7}}{T} = 1.2 \cdot 10^{-9}\,\mathrm{m} \\
i &= 2 \\
m &= 10^{-14}\,\mathrm{g} \\
M_s &= \\
b &= \frac{3 i M_w}{4\pi \varrho_w M_s} \approx \frac{4.3 \cdot 10^{-6} i m}{M_s} =
\end{aligned}
$$

Kritischer Radius (r^*)

$$
r^* = \sqrt{\frac{3b}{a}} = \begin{cases} 1.918 \cdot 10^{-6}\,\mathrm{m} & \text{Seesalz} \\ 1.276 \cdot 10^{-6}\,\mathrm{m} & \text{Ammoniumsulfat} \end{cases}
$$

Kritische Sättigungsverhältnis

$$
S^* = \sqrt{\frac{4a^3}{27b}} = \begin{cases} 4.171 \cdot 10^{-4}\,[] & \text{Seesalz} \\ 6.272 \cdot 10^{-4}\,[] & \text{Ammoniumsulfat} \end{cases}
$$

1.2 Monoton abnehmend

1.2.1 Maple

```
> restart;
> S_ver := (1-b_2/r_2^3)/(1-b_1/r_1^3);
```

$$S\_ver := \left(1 - \frac{b\_2}{r\_2^3}\right)\left(1 - \frac{b\_1}{r\_1^3}\right)^{-1}$$

```
> b_1 := 1.47e-21;
```

$$b\_1 := 1.47 \times 10^{-21}$$

```
> b_2 := 6.508e-22;
```

$$b\_2 := 6.508 \times 10^{-22}$$

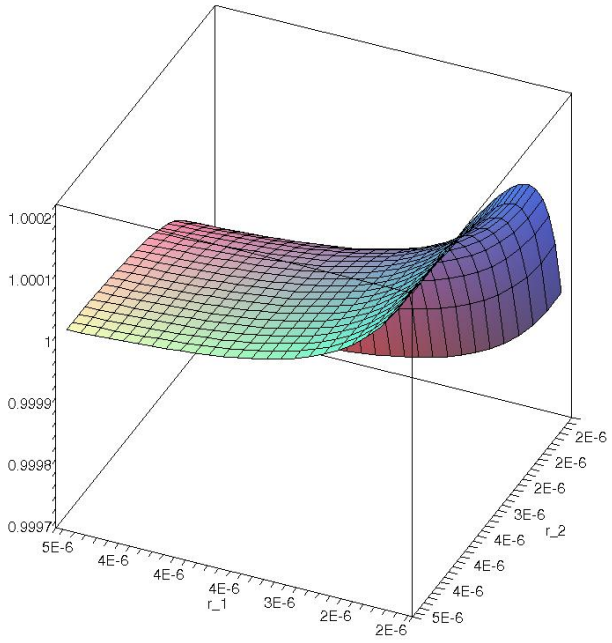
```
> r_1_0 := 1.918e-6;
```

$$r\_1\_0 := 0.000001918$$

```
> r_2_0 := 1.276e-6;
```

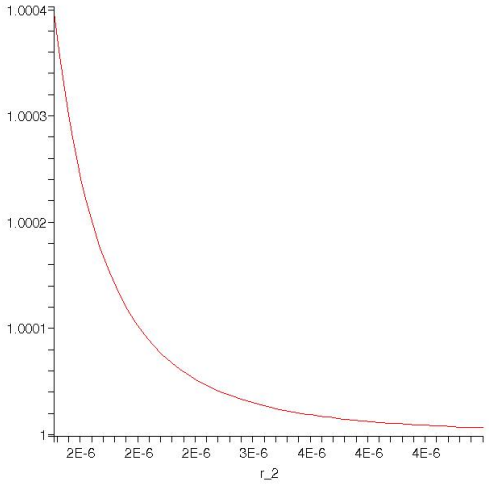
$$r\_2\_0 := 0.000001276$$

```
> plot3d(S_ver, r_1=r_1_0..5e-6, r_2=r_2_0..5e-6);
```




```
> r_1:=r_2; plot(S_ver, r_2=r_2_0..5e-6);
```

$$r\_1 := r\_2$$



1.2.2 Limes bilden

$$S = \frac{e^*}{e_{sat}(\infty)} = 1 - \frac{b}{r^3}$$

$$\frac{S_2}{S_1} = \frac{1 - \frac{k_2}{r_2^3}}{1 - \frac{k_1}{r_1^3}} \Rightarrow \lim_{r\to\infty} \frac{1 - \frac{k_2}{r_2^3}}{1 - \underbrace{\frac{k_1}{r_1^3}}_{\to 0}} = 1$$

oder auch mit:

$$S = \frac{e^*(r)}{e_s(\infty)} = \left(1 - \frac{b}{r^3}\right) \exp(\frac{a}{r})$$

$$\frac{S_2}{S_1} = \frac{\left(1 - \frac{k_{21}}{r^3}\right) \exp\left(\frac{k_{22}}{r}\right)}{\left(1 - \frac{k_{11}}{r^3}\right) \exp\left(\frac{k_{12}}{r}\right)} \Rightarrow \lim_{r\to\infty} \frac{\left(1 - \frac{k_{21}}{r^3}\right) \exp\left(\frac{k_{22}}{r}\right)}{\underbrace{\left(1 - \frac{k_{11}}{r^3}\right) \exp\left(\underbrace{\frac{k_{12}}{r}}_{\to 0}\right)}_{\to 1}} = 1$$

$$\lim_{r\to\infty} S_x = 1 \Rightarrow S_2 - S_1 = 1 - 1 = 0$$