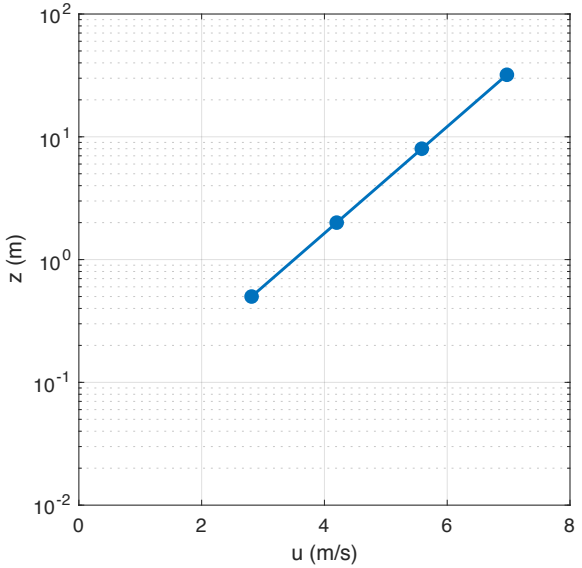
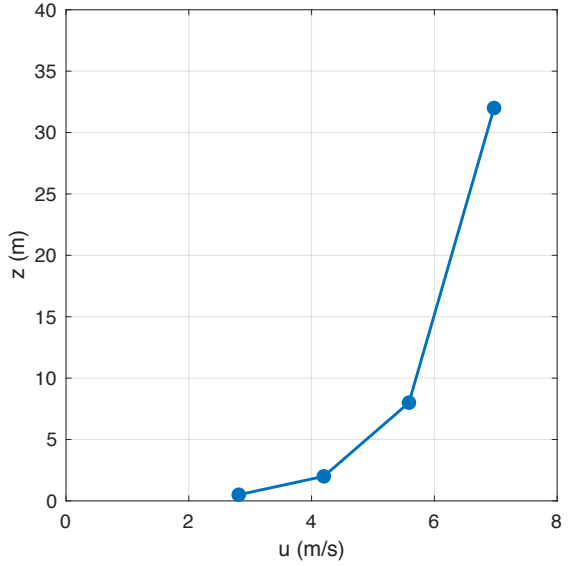
Meteorology 5300
Surface Layer Wind Profiles

Find u_* and z_0 from the following wind profile measurements made during statically neutral conditions at sunset:

z (m)	$\bar{u}$ (m/s)
0.5	2.8.
2	4.2.
8	5.6.
32	7.0





Meteorology 5300
Surface Layer Wind Profiles

Find u_* and z_0 from the following wind profile measurements made during statically neutral conditions at sunset:

z (m)	$\bar{u}$ (m/s)
0.5	2.8.
2	4.2.
8	5.6.
32	7.0

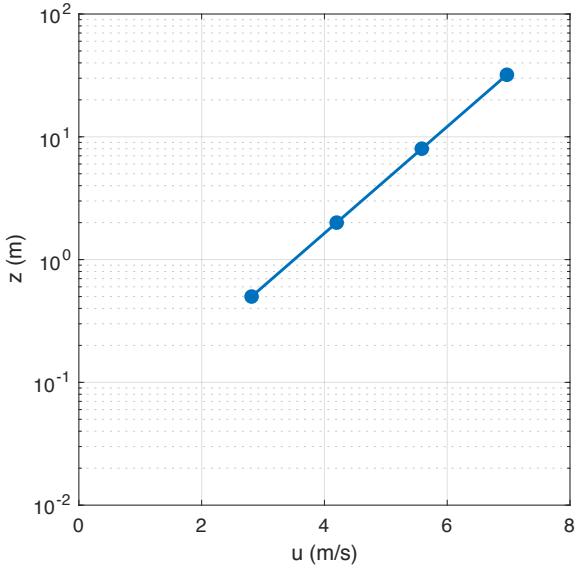
To calculate u_*, apply the log wind profile

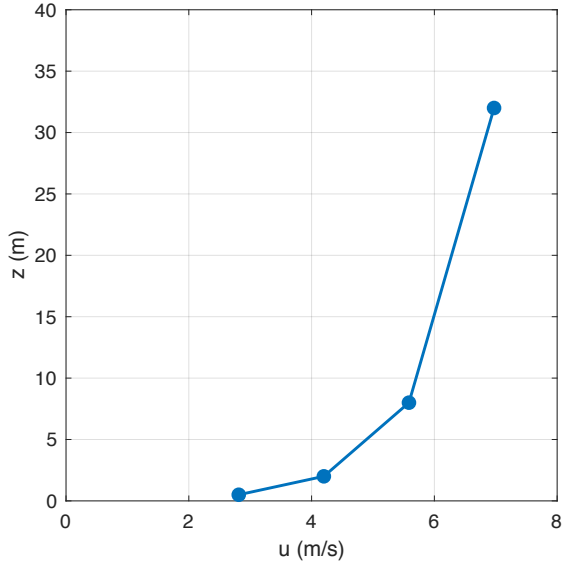
$$u = u_*/k \log(z/z_0),$$

at any two heights z_1 and z_2 to obtain

$$u(z_2) - u(z_1) = u_*/k \log(z_2/z_1),$$

log(z2/z0) - log(z1/z0) = log((z2/z0)/(z1/z0))=log(z2/z1)





Meteorology 5300
Surface Layer Wind Profiles

Find u_* and z_0 from the following wind profile measurements made during statically neutral conditions at sunset:

z (m)	$\bar{u}$ (m/s)
0.5	2.8.
2	4.2.
8	5.6.
32	7.0

To calculate u_*, apply the log wind profile

$$u = u_*/k \log(z/z_0),$$

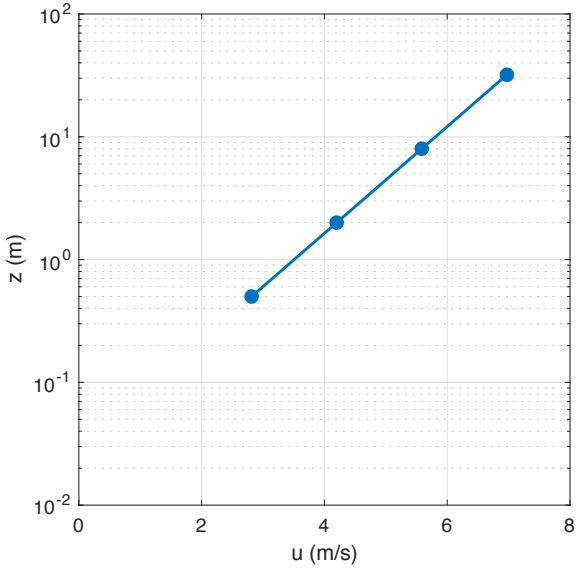
at any two heights z_1 and z_2 to obtain

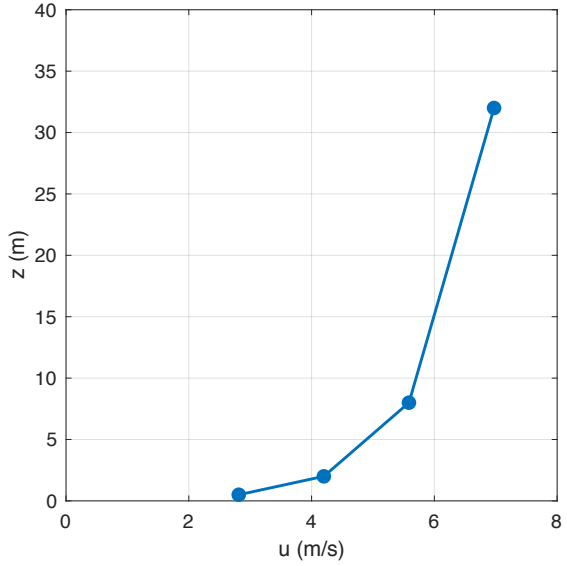
$$u(z_2) - u(z_1) = u_*/k \log(z_2/z_1),$$

then solve for u_*:

$$u_* = k\frac{u(z_2) - u(z_1)}{\log(z_2/z_1)}.$$

0.4 (6.9-4.2)/log(32/2)=
0.4 *(2.7) / log(16) = 0.3895





Meteorology 5300
Surface Layer Wind Profiles

Find u_* and z_0 from the following wind profile measurements made during statically neutral conditions at sunset:

z (m)	$\bar{u}$ (m/s)
0.5	2.8.
2	4.2.
8	5.6.
32	7.0

To calculate u_*, apply the log wind profile

$$u = u_*/k \log(z/z_0),$$

at any two heights z_1 and z_2 to obtain

$$u(z_2) - u(z_1) = u_*/k \log(z_2/z_1),$$

then solve for u_*:

$$u_* = k\frac{u(z_2) - u(z_1)}{\log(z_2/z_1)}.$$

To calculate z_0, solve the log wind profile at any height z for z_0:

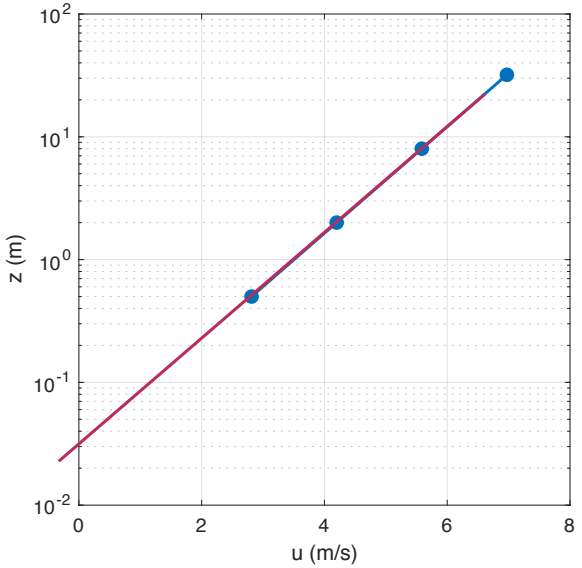
$$z_0 = z \exp(-ku(z)/u_*).$$

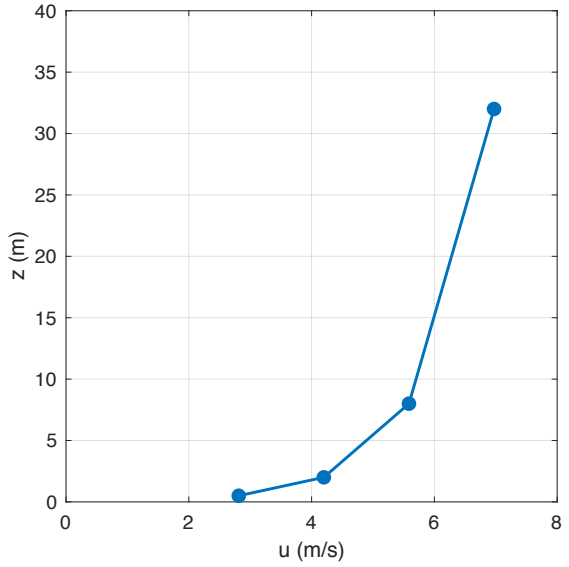
log(z/z0) = k u/u*

z/z0 = exp(ku/u*)

z0 = z exp(-ku/u*)

z0 = 8 * exp(-0.4 * 5.6/0.4)=0.0296





Meteorology 5300
Surface Layer Wind Profiles

Find u_* and z_0 from the following wind profile measurements made during statically neutral conditions at sunset:

z (m)	$\bar{u}$ (m/s)
0.5	2.8.
2	4.2.
8	5.6.
32	7.0

To calculate u_*, apply the log wind profile

$$u = u_*/k \log(z/z_0),$$

at any two heights z_1 and z_2 to obtain

$$u(z_2) - u(z_1) = u_*/k \log(z_2/z_1),$$

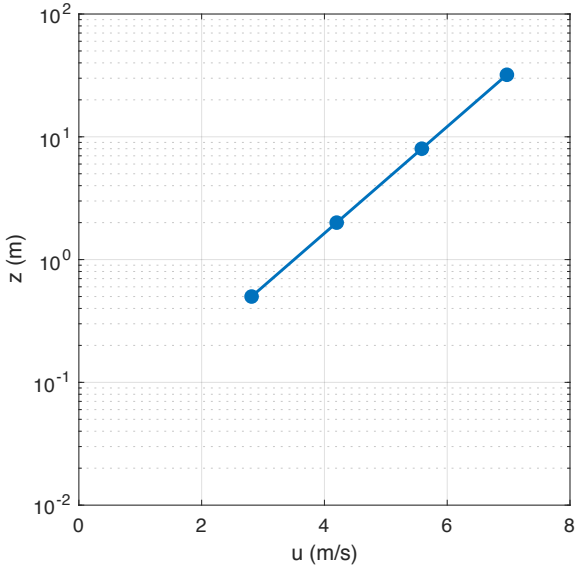
then solve for u_*:

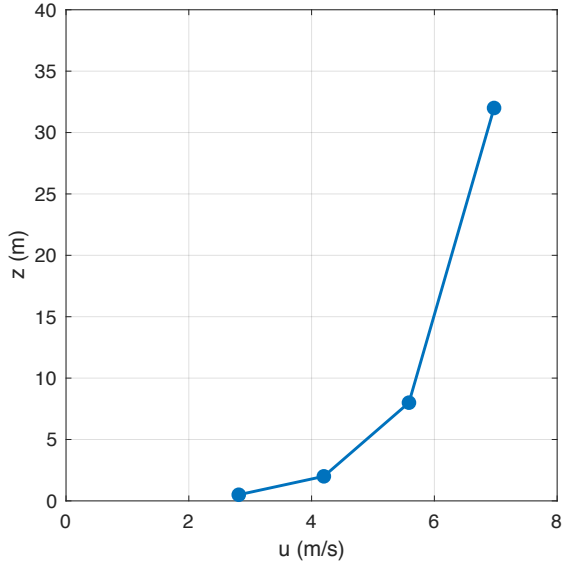
$$u_* = k\frac{u(z_2) - u(z_1)}{\log(z_2/z_1)}.$$

To calculate z_0, solve the log wind profile at any height z for z_0:

$$z_0 = z \exp(-ku(z)/u_*).$$

The graphical solution method is to plot the wind profile u versus $\log z$, then extrapolate the profile to $u = 0$. The height at which $u =$ is z_0.





Meteorology 5300
Surface Layer Wind Profiles

Find u_* and z_0 from the following wind profile measurements made during statically neutral conditions at sunset:

z (m)	$\bar{u}$ (m/s)
0.5	2.8.
2	4.2.
8	5.6.
32	7.0

To calculate u_*, apply the log wind profile

$$u = u_*/k \log(z/z_0),$$

at any two heights z_1 and z_2 to obtain

$$u(z_2) - u(z_1) = u_*/k \log(z_2/z_1),$$

then solve for u_*:

$$u_* = k\frac{u(z_2) - u(z_1)}{\log(z_2/z_1)}.$$

To calculate z_0, solve the log wind profile at any height z for z_0:

$$z_0 = z \exp(-ku(z)/u_*).$$

The graphical solution method is to plot the wind profile u versus $\log z$, then extrapolate the profile to $u = 0$. The height at which $u =$ is z_0.

Answer:
$u_* = 0.4$ m/s, $z_0 = 0.03$ m.