fargo2python

It is a python program that post-processes the outputs of the original Fargo code, of the Dusty Fargo-ADSG code, and of the Fargo3d code.

It can be run with both python 2.x and python 3.x., although we recommend using **python 3.x** (better handling of visualisation options, including colorbars for pcolormesh plots).

The program has been written since March 2020, so it may still have bugs — please do let me know if you find some! And feel free to adapt the program to your needs.

The program requires a parameter file named **paramsf2p.dat**. The file contains a list of parameters, their value(s), followed by comments starting by a # symbol. The following slides are meant to illustrate what can be done with the program. Enjoy!

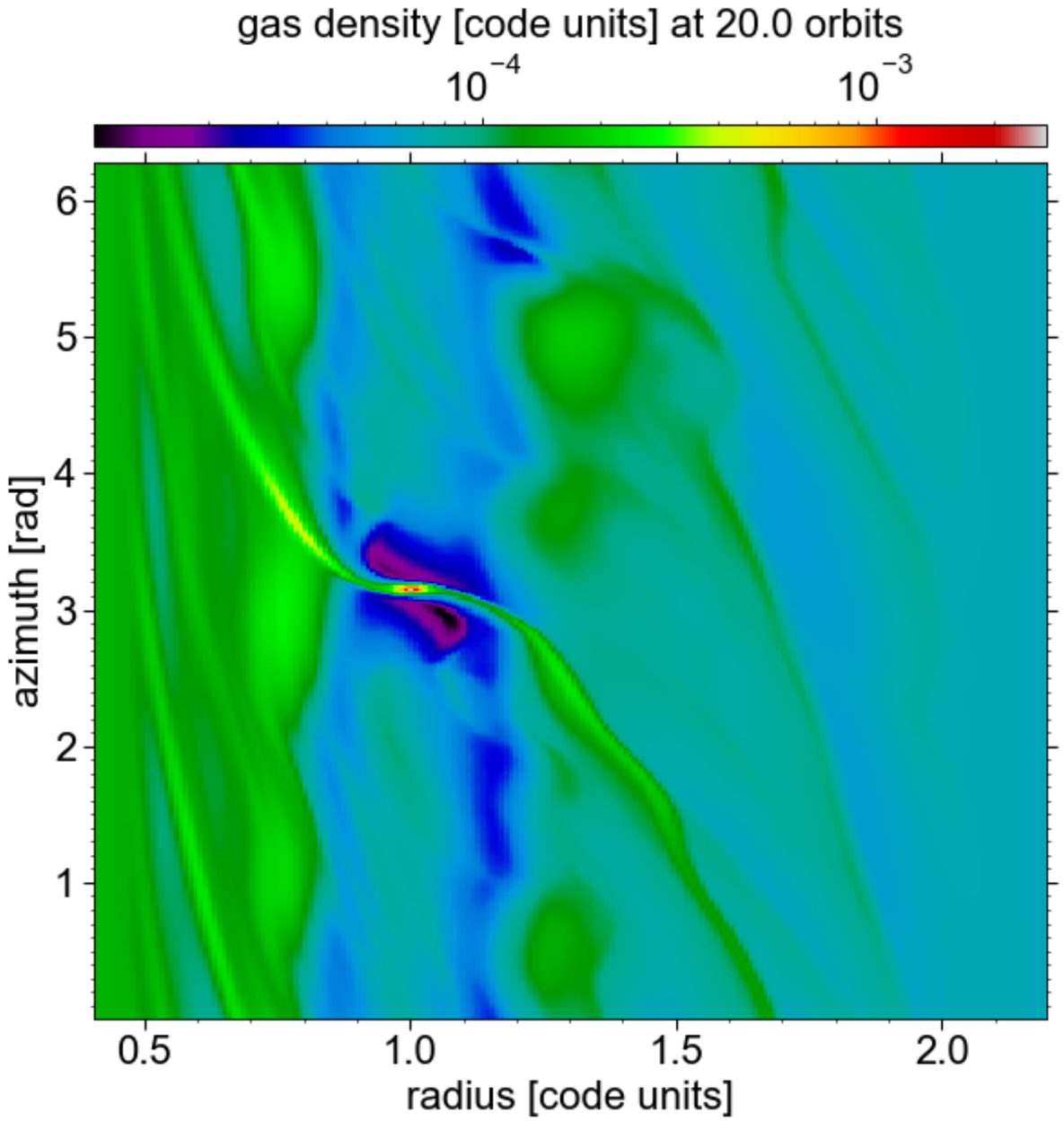
First use

After having run Dusty Fargo-ADSG with the default parameter file in/template.par, go to the ~/dustyfargoadsg directory and execute the fargo2python.py program. If you're using python as a command line on a terminal, this can be done by typing:

> python python/fargo2python.py

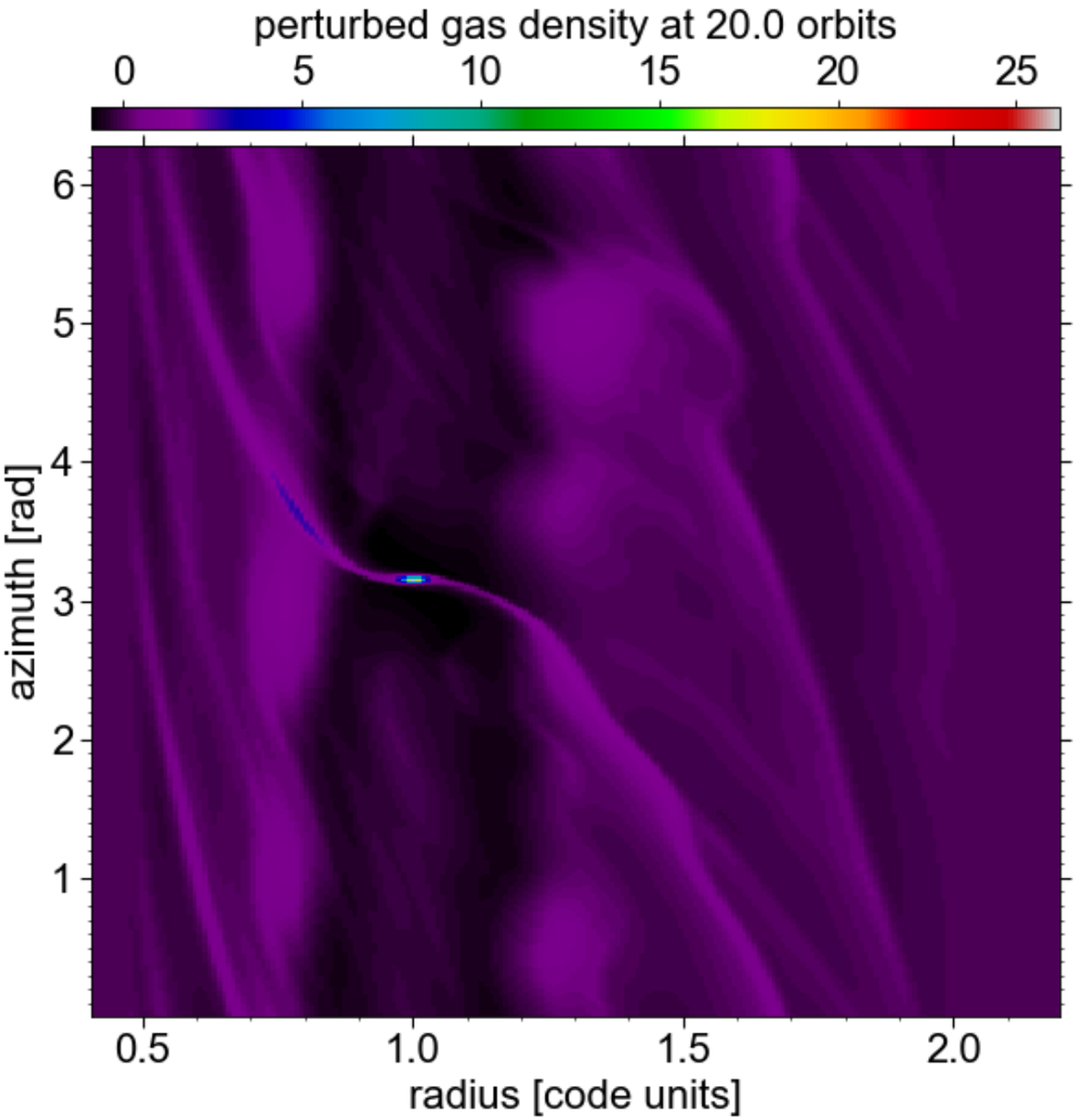
You may also use ipython if you prefer. This will produce a .png file (gas_dens_out1_polar_20.png) that looks like the screenshot on the right-hand side.

It shows the gas surface density with polar coordinates, after 20 outputs. A logarithmic color scale is used. The field value is shown in every grid cell (we're not using contour plots).

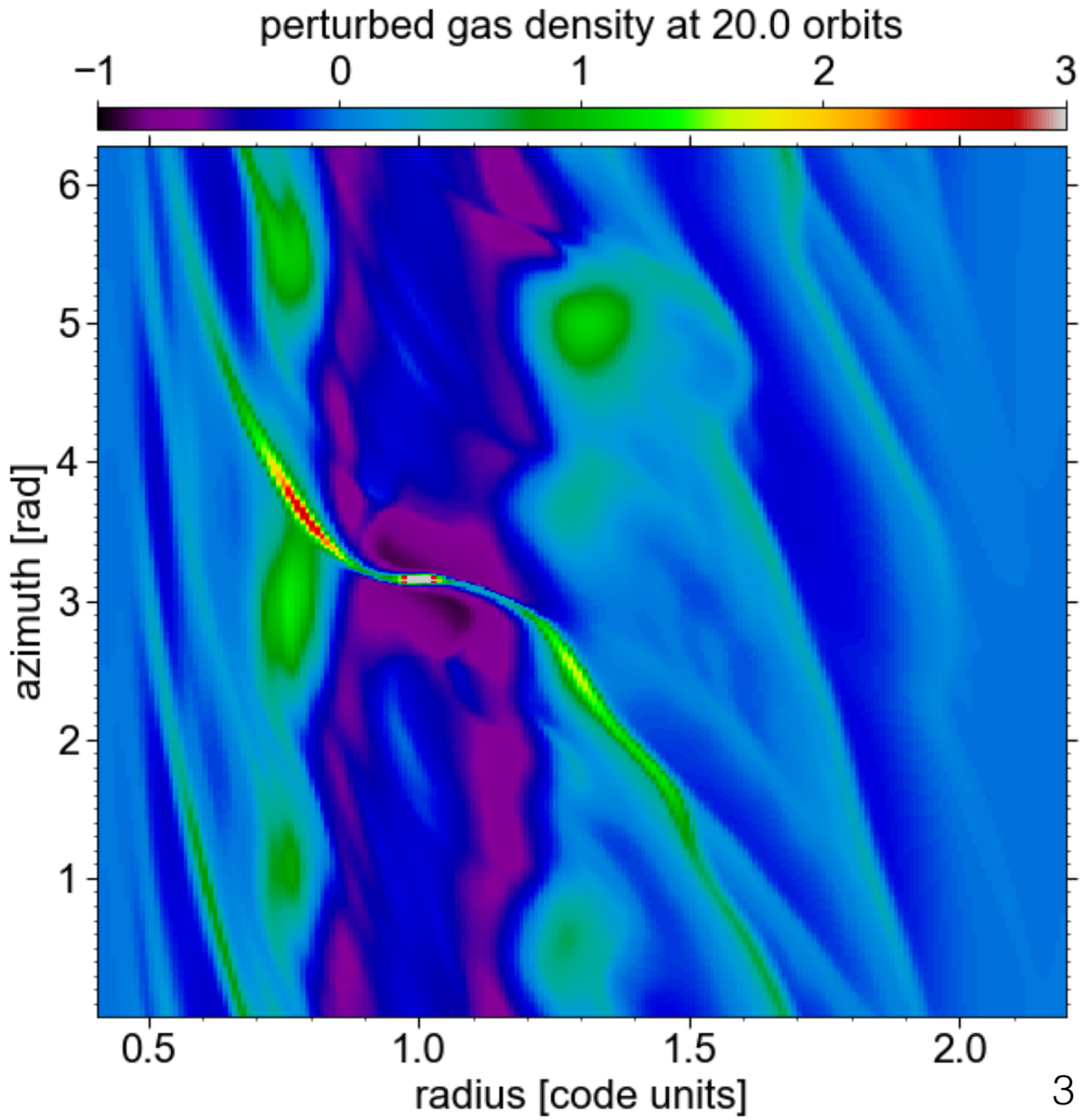


Exploring parameters

If you want to display the gas density perturbation relative to its initial value Σ_0, that is $(\Sigma - \Sigma_0)/\Sigma_0$, just set both **nodiff** and **log_colorscale** to No in paramsf2p.dat:

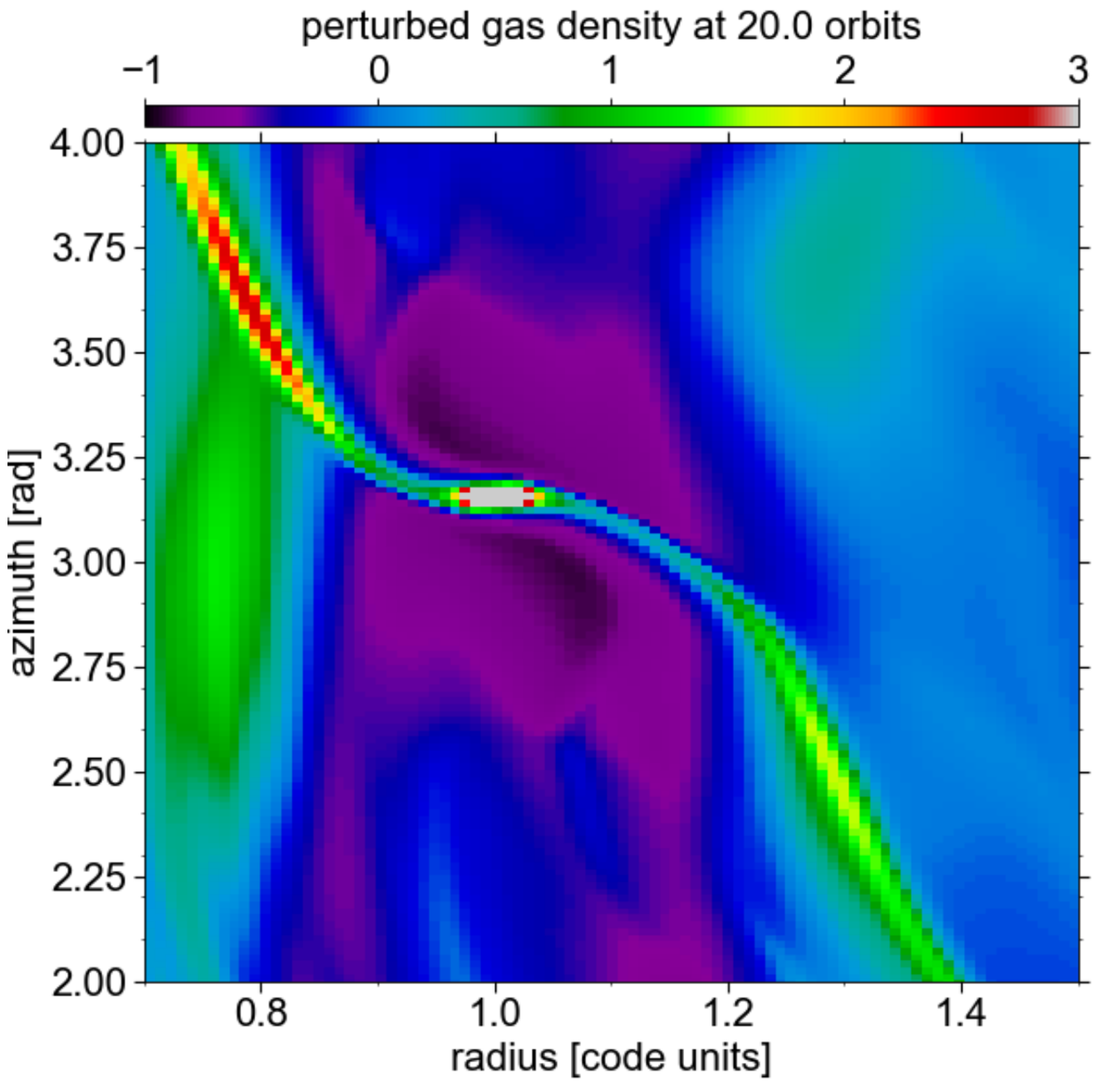


You may adjust the colorscale by specifying **fieldmin** and **fieldmax** in paramsf2p.dat. For instance, with fieldmin=-1 and fieldmax=3, this is what you get:

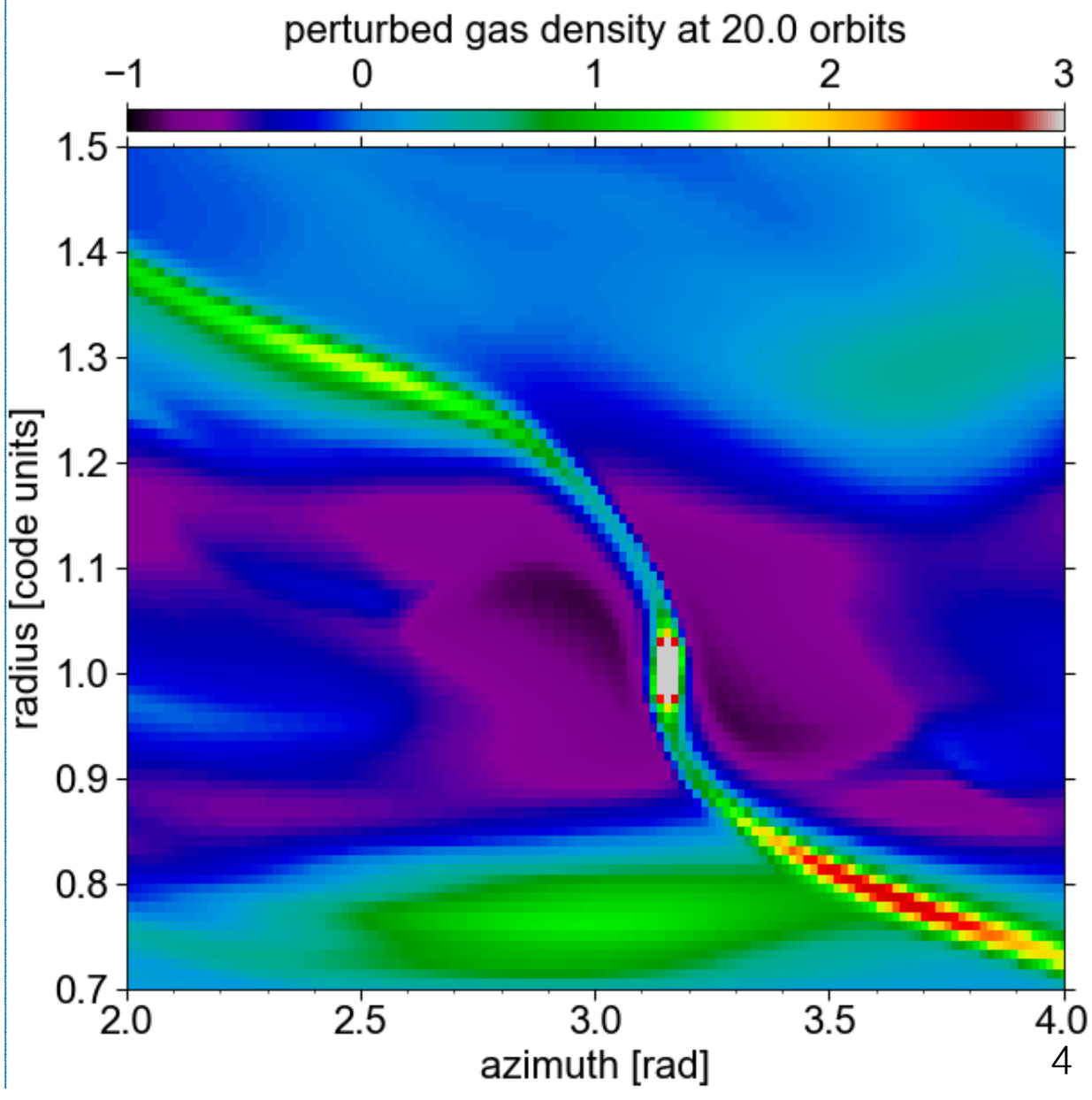


Exploring parameters

Just change **myrmin**, **myrmax**, **myphimin** and/or **myphimax** to adjust the range of radii and azimuths; e.g., with myrmin=0.7, myrmax=1.5, myphimin=2 and myphimax=4:

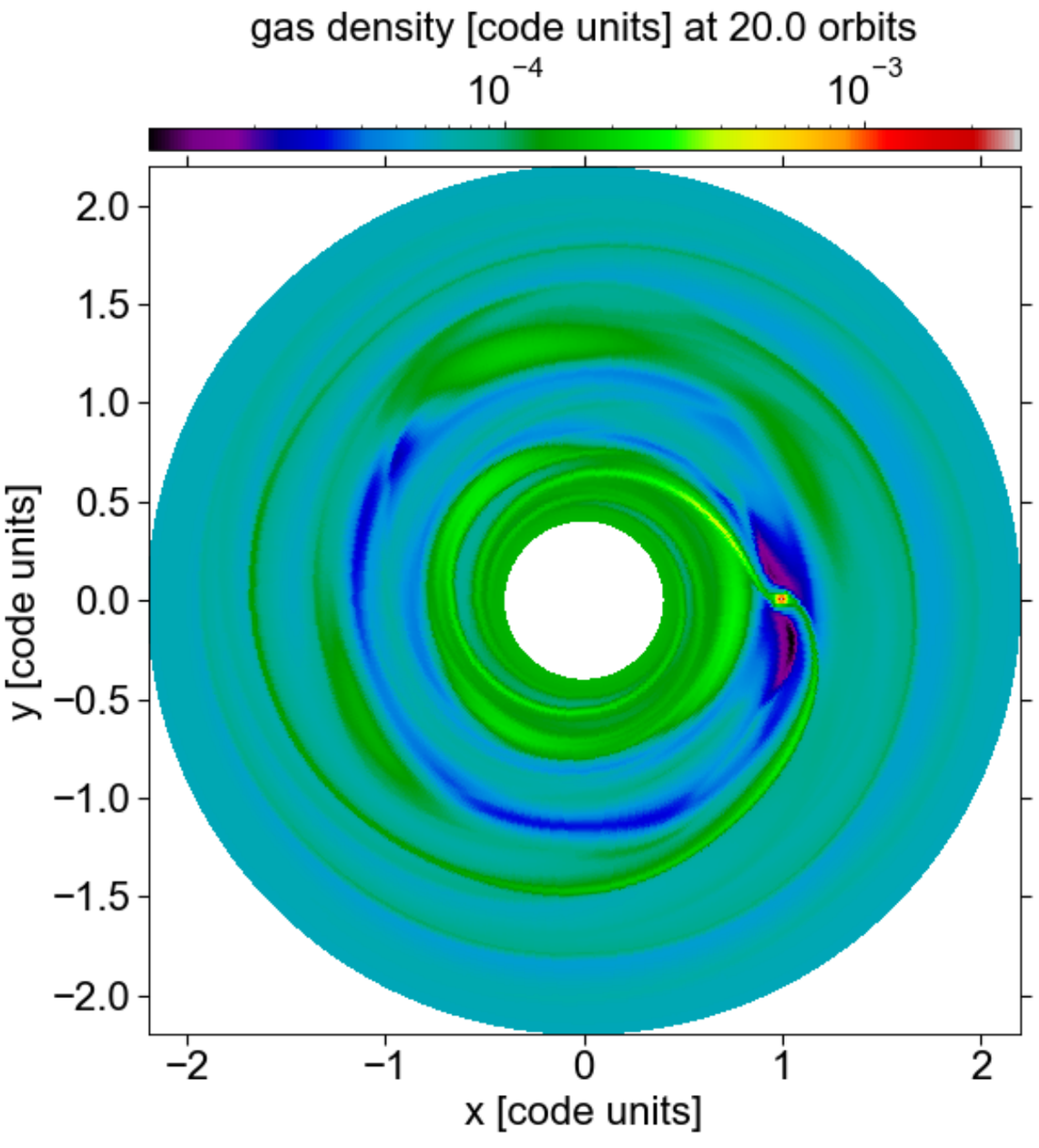


If you prefer having radius shown as a function of azimuth, just set **rvsphi** to Yes. With the previous example:

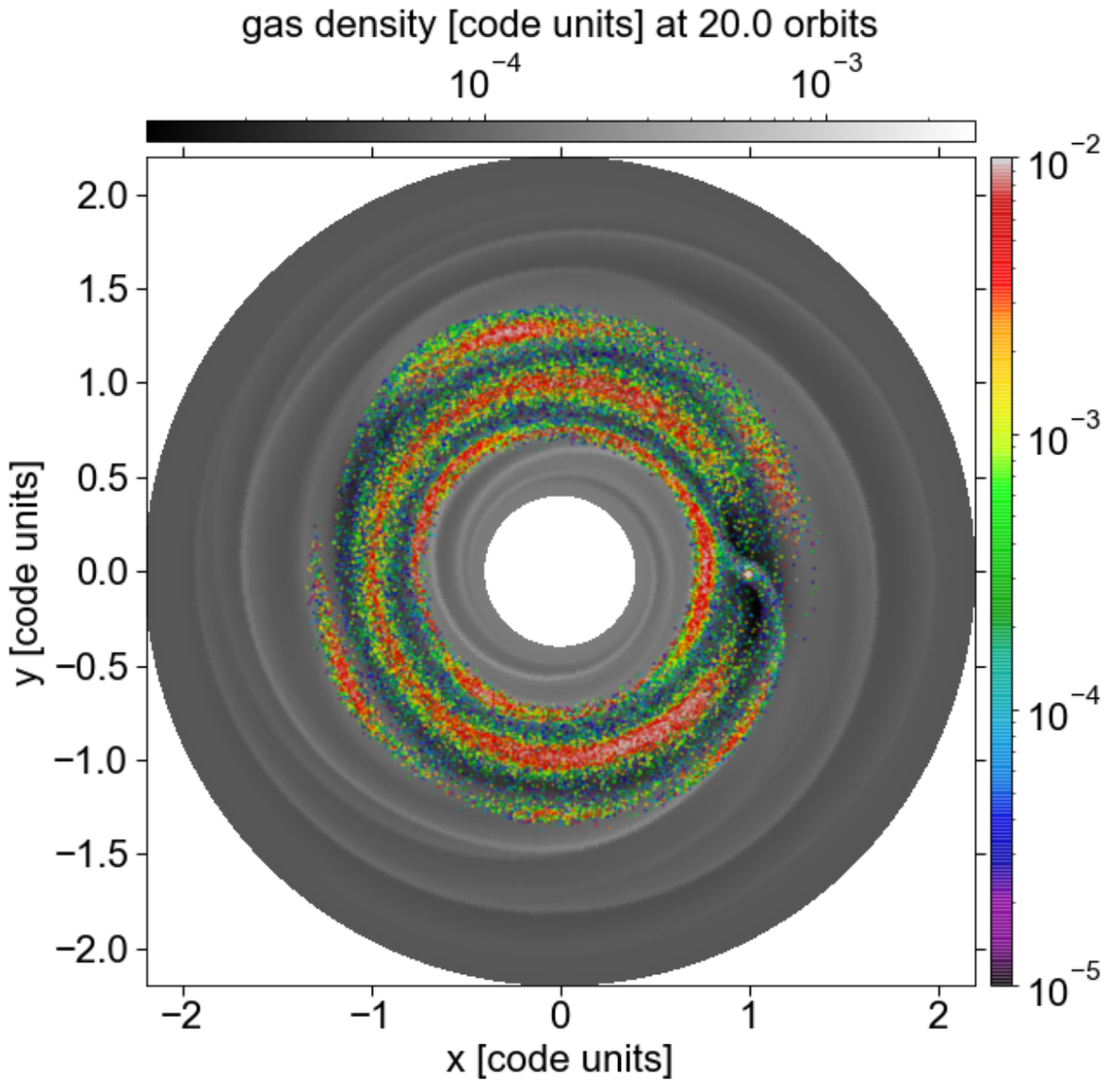


Exploring parameters

You may also display fields with a cartesian field of view by setting **fieldofview** to cart. With the original paramsf2p.dat:

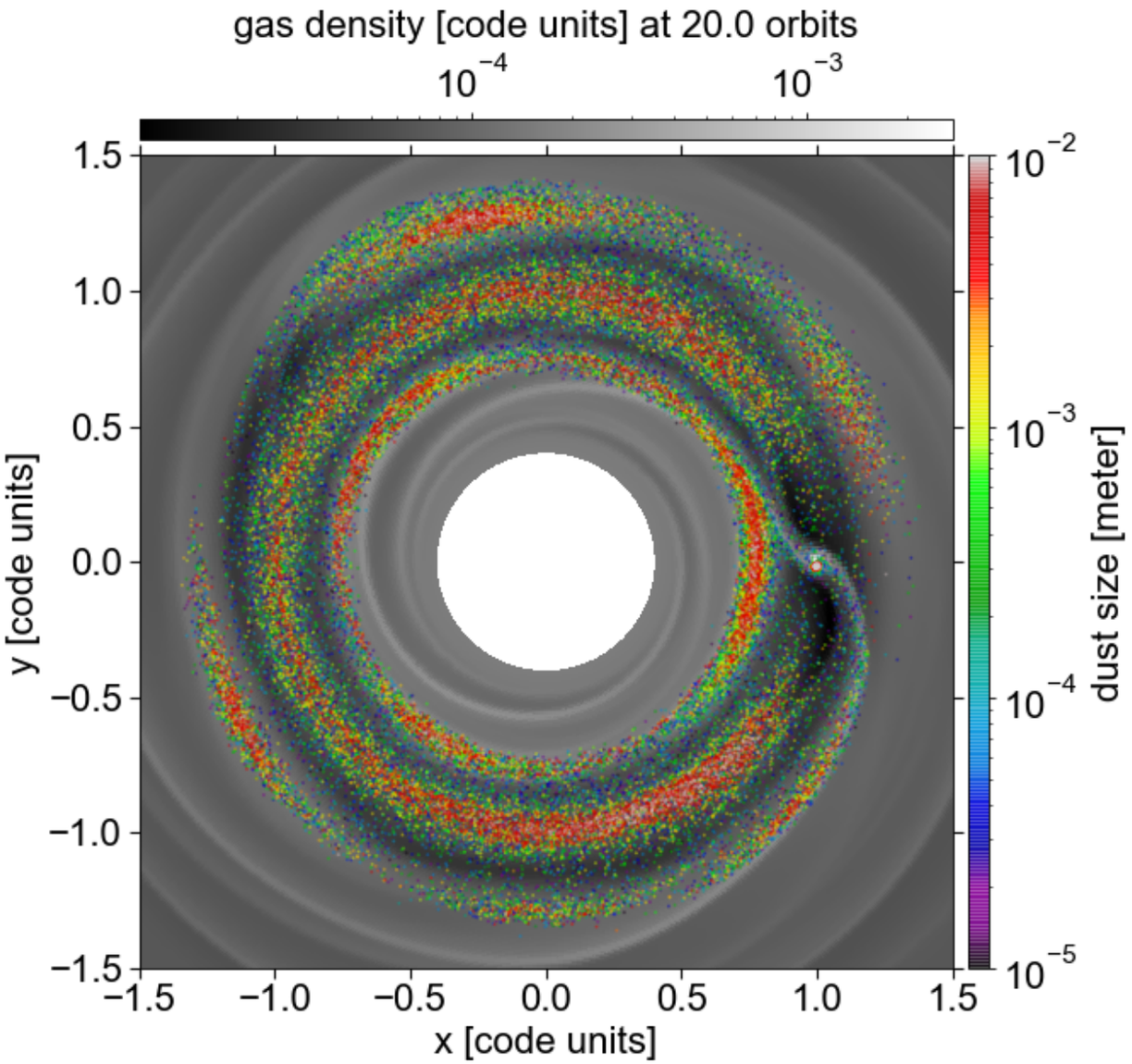


OK, time to display the dust particles! Just set **showdust** to Yes. Here you go:

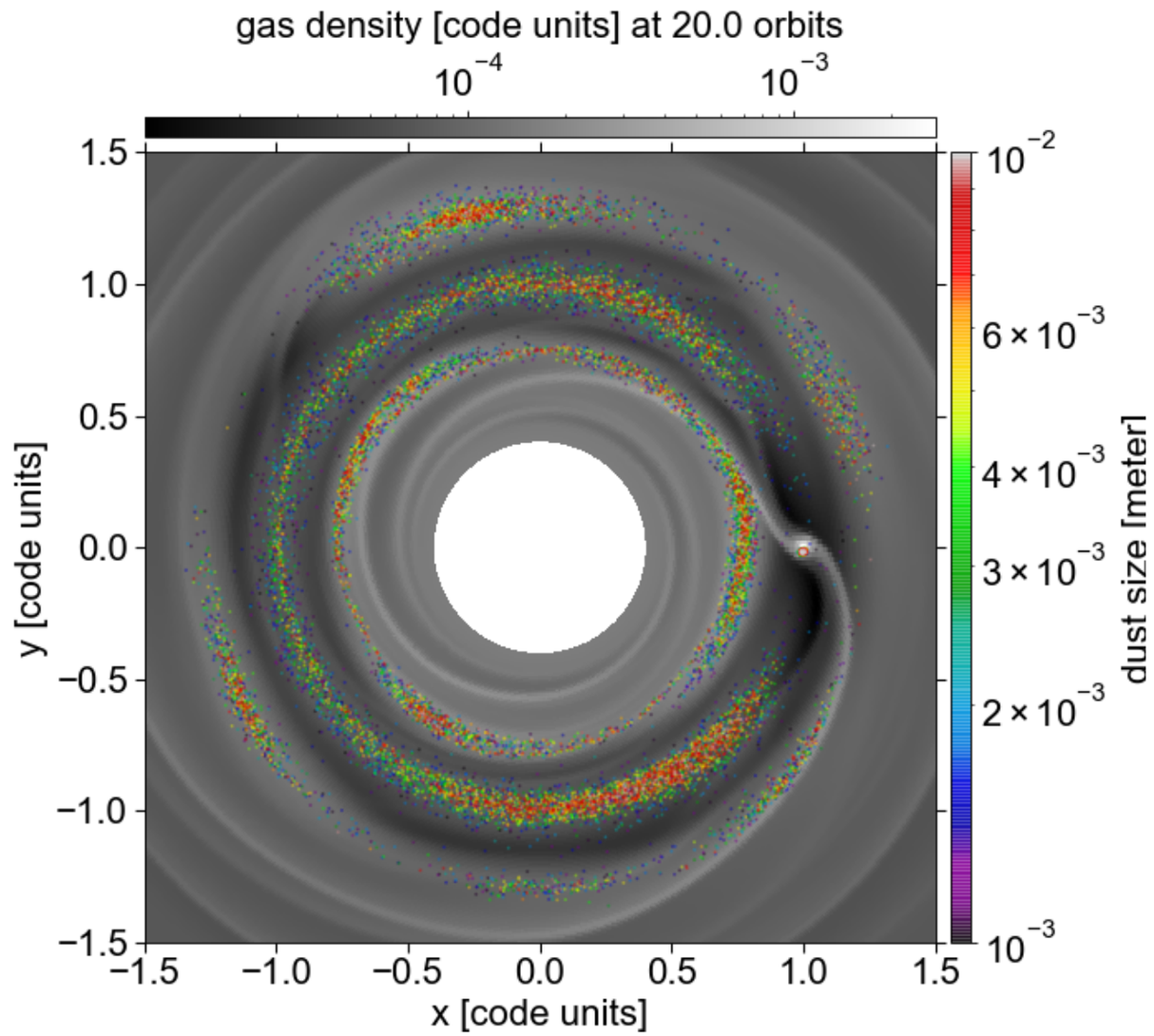


Exploring parameters

From the previous plot you can zoom in cartesian coordinates by adjusting **myrmax**. Setting the latter to 1.5 will give you:

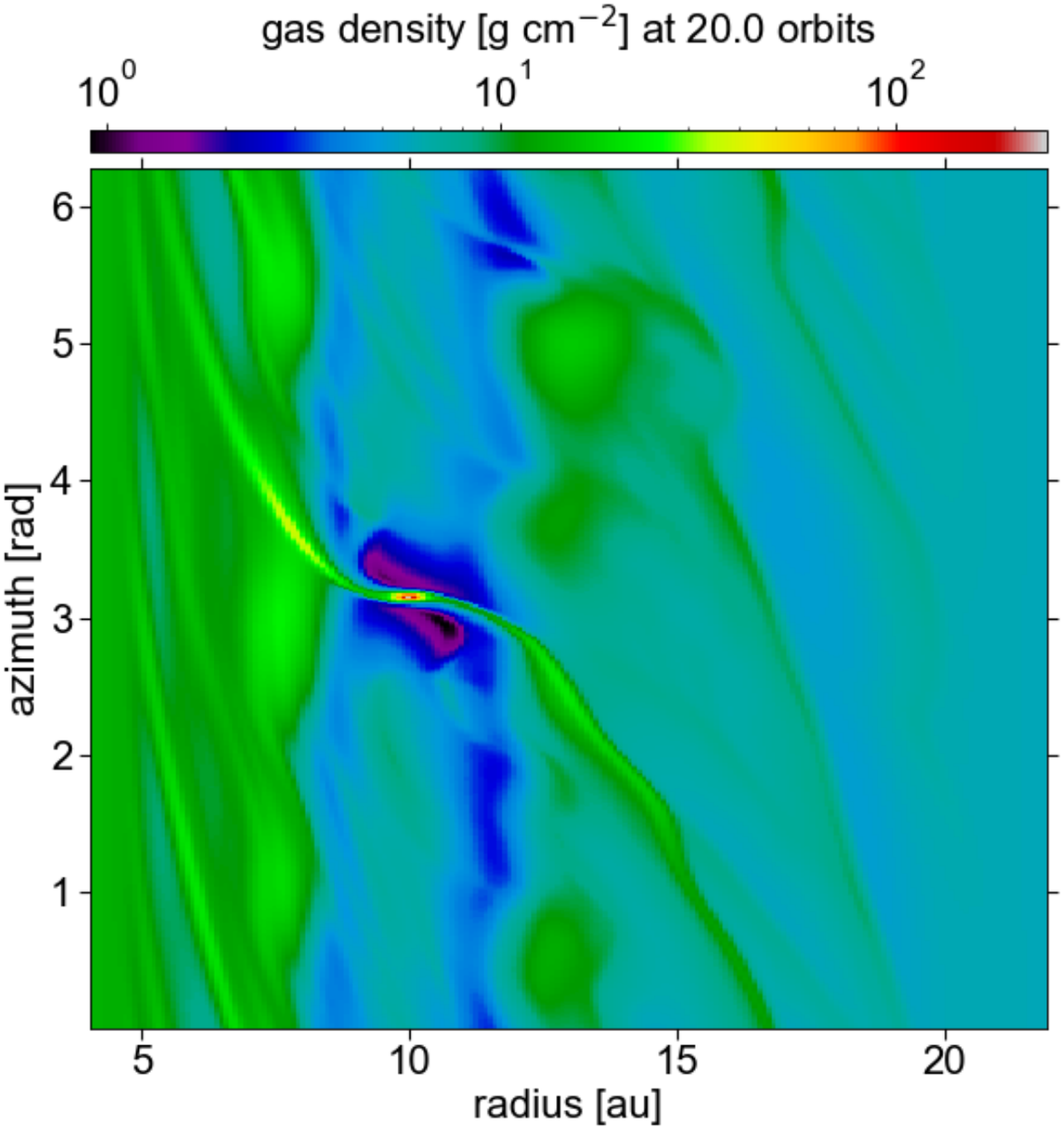


You can also adjust the particles size range (colorbar on the right-hand side) via **sizemin** and **sizemax**. For sizemin=1e-3 and sizemax=1e-2:

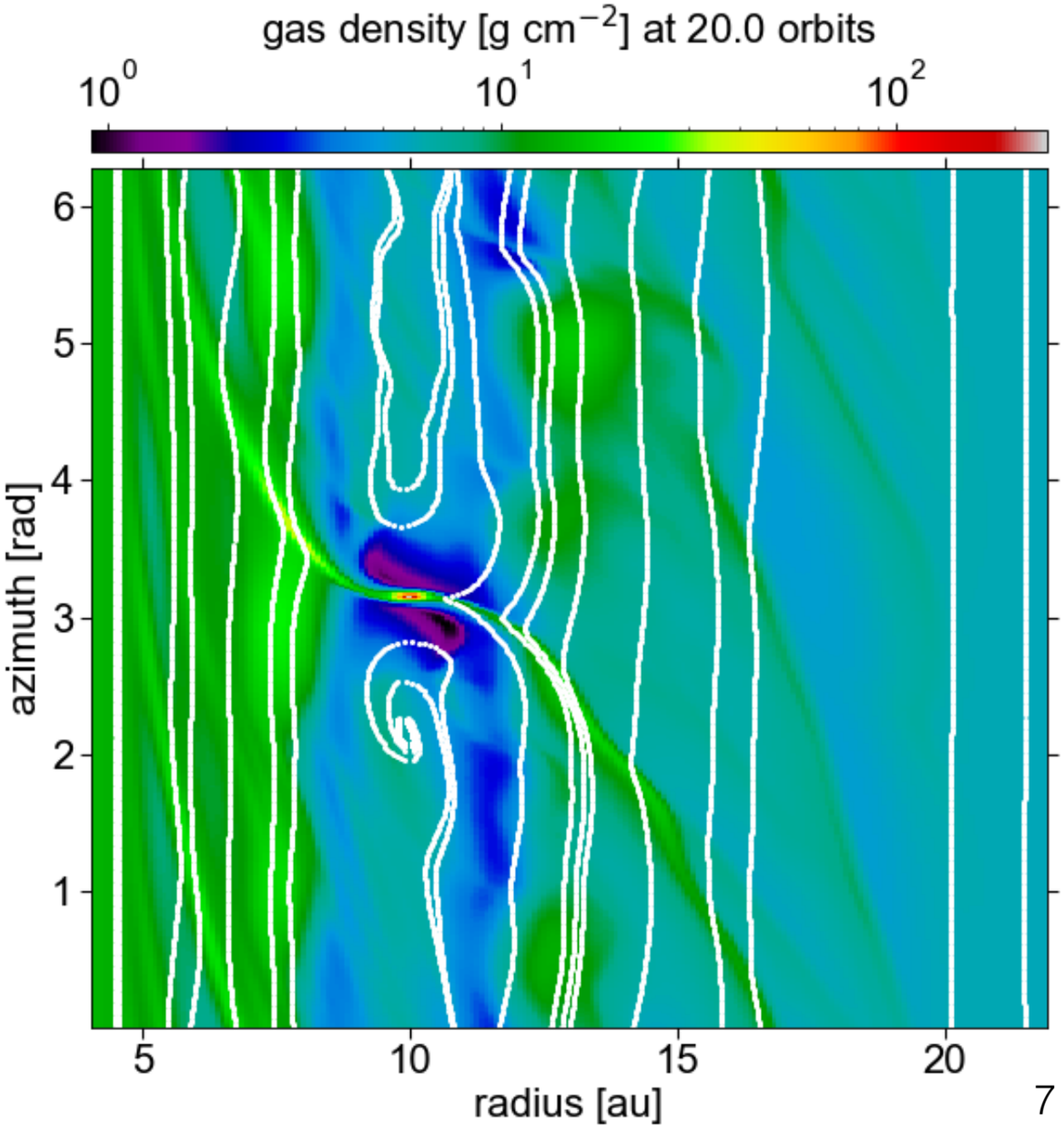


Exploring parameters

You can display results in physical units according to the set of units used in the simulation. This requires to set **physical_units** to Yes. With the original paramsf2p.dat file:

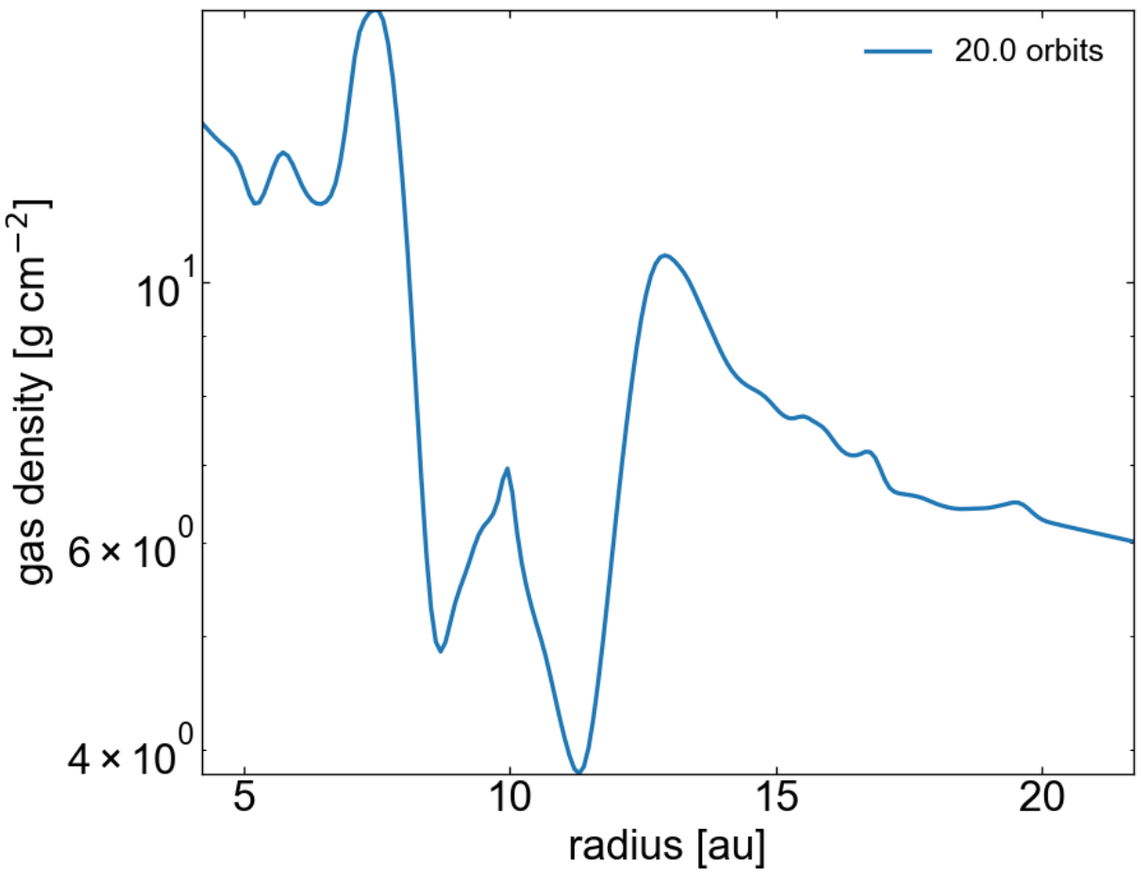


Streamlines may be overplotted by setting **streamlines** to Yes. The number of streamlines can be varied via **nstreamlines**. With the previous example and 20 streamlines:

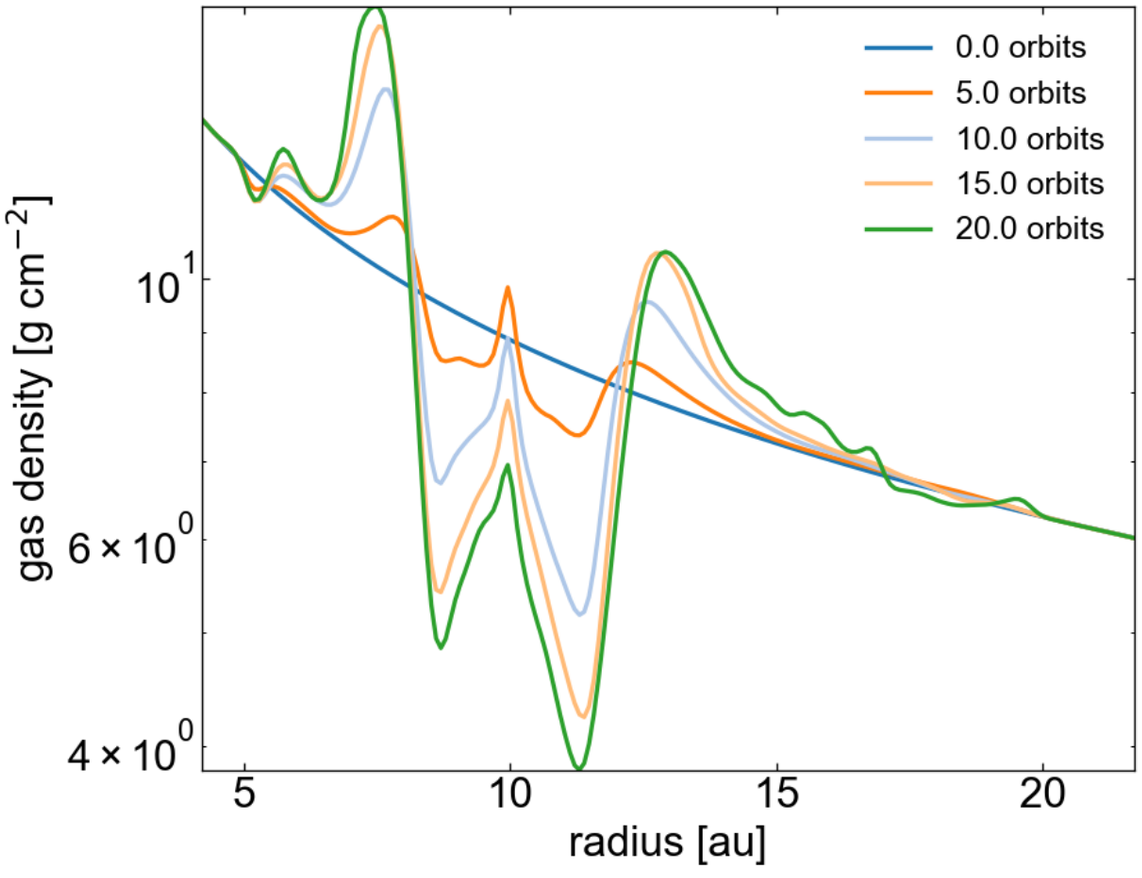


Exploring parameters

1D, azimuthally-averaged profiles can be displayed by setting **onedprofile** to Yes. Here is an example with the original paramsf2p.dat file and **physical_units** set to Yes:



Several directories and/or several output numbers may be specified. Setting **on** to 0,5,10,15,20 will give you for the previous example:



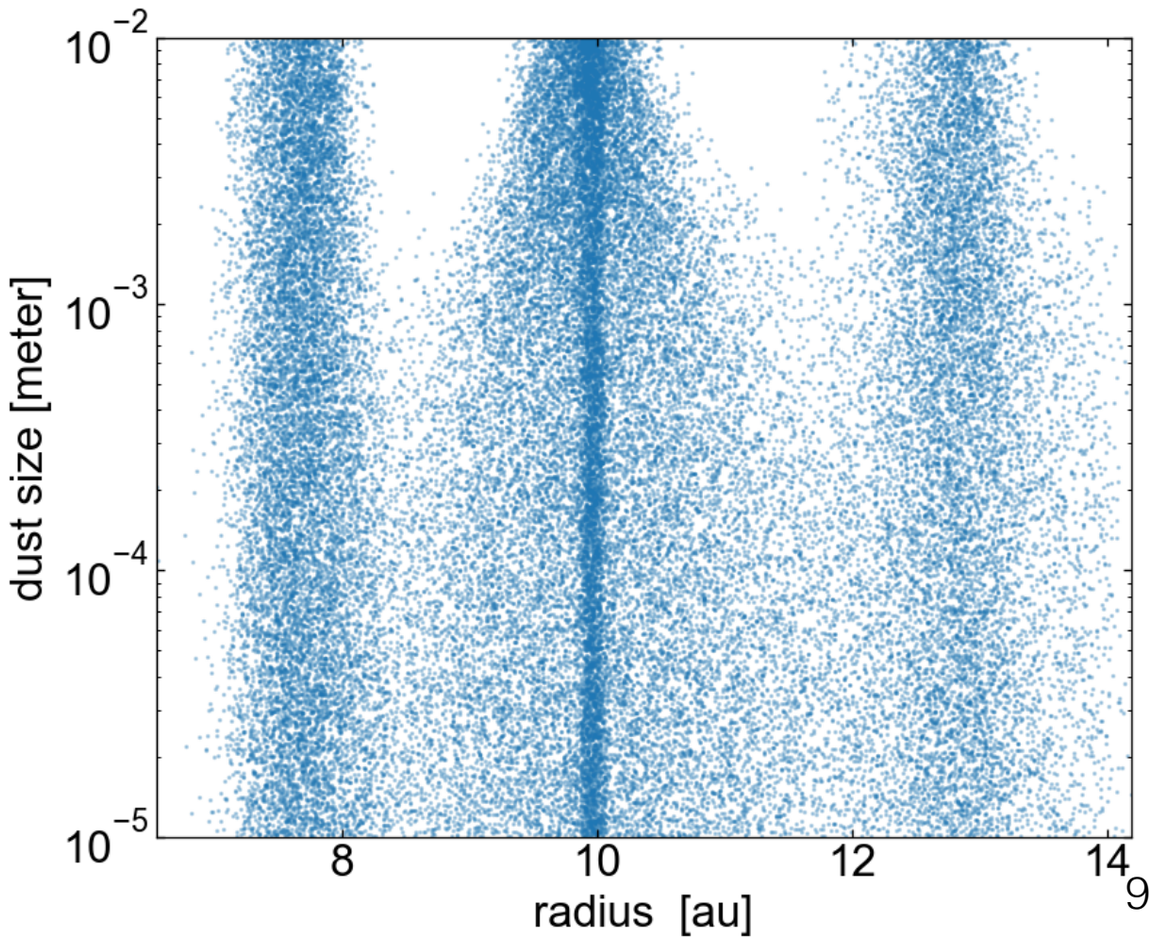
Note that previous options like **myrmin**, **myrmax**, **fieldmin**, **fieldmax** etc. can be used as well.

Exploring parameters

Gif animations, either of 2D or 1D fields, can be made by setting **movie** to Yes. In this case, you'll need to specify the **first** and **last** output numbers for the animation in **on** as two integers separated by a **comma** (,). For instance: 0,20 for the default run and paramsf2p.dat will produce a movie of the gas surface density up to the planet's 20th orbit.

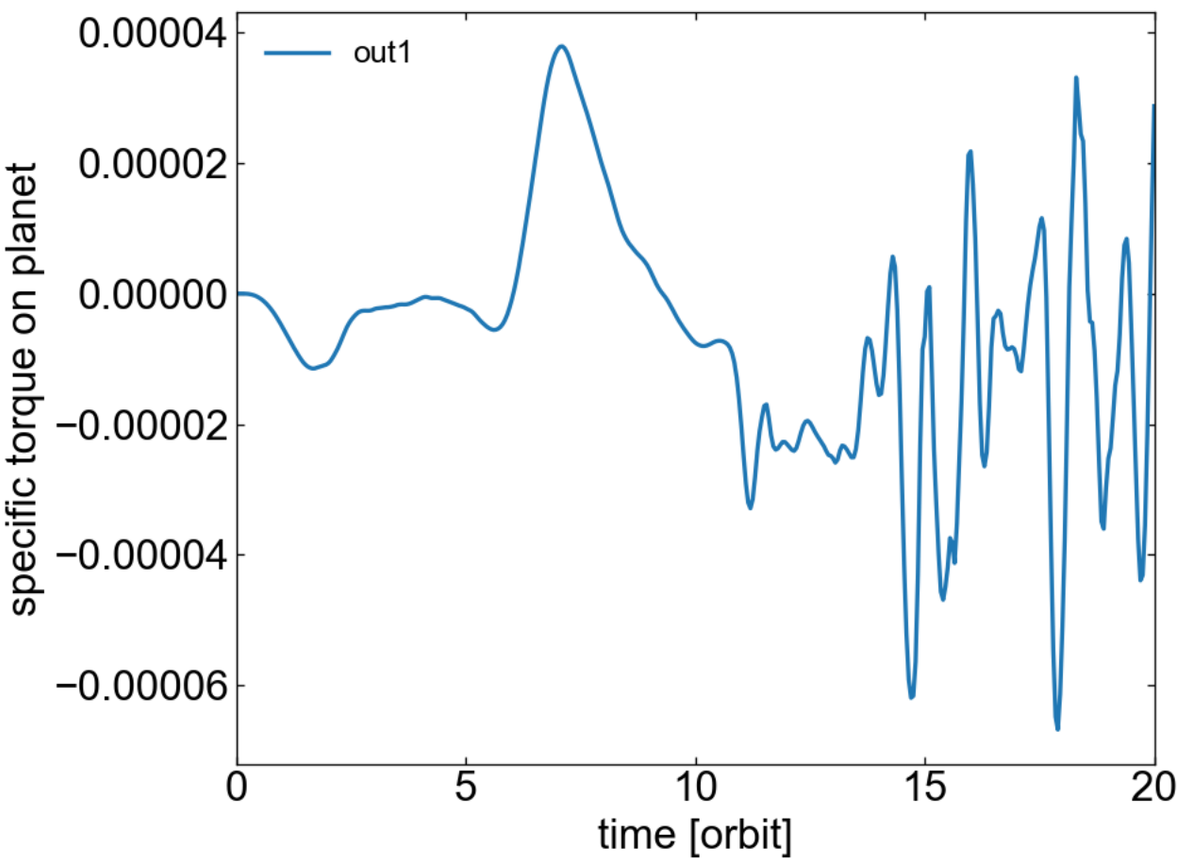
So far we've focused on the gas surface density, but there are many other fields that can be displayed from the simulations outputs. The list can be found in the comment related to the **whatfield** entry.

The **plot_dust** entry allows to display plots of the dust quantities. This requires to set plot_dust as x,y where x can be r (particles orbital radius) or phi (azimuth), and y can be phi, size (particles size), Stokes (Stokes number), vr (radial velocity), or vphi (azimuthal velocity). For plot_dust = r,size and myrmin=7, myrmax=14:



Exploring parameters

The **plot_tqwk** entry allows to display the time evolution of the specific torque or the specific power of the force exerted by the disc on the planet. The running-time average of these quantities can be shown instead (see related comment in paramsf2p.dat). For plot_tqwk set to torque:



The **plot_planet** entry allows to display plots of the planet quantities. This requires to set plot_planet as x,y where x can be a (semi-major axis) or t (time), and y can be a, e (eccentricity), r (orbital radius), m (mass) or p (orbital period ratio if several planets). For plot_planet = t,r: