In[651]:=
```
filelist = ("E:\\_time_varying_data\\SmokeSim\\tif\\dsSmoke." <>
      IntegerString[#, 10, 3] <> ".tif") & /@ Range[0, 499];
d = Import[filelist[[#]], "Image3D"] & /@ Range[1, 500];
```

In[653]:=
```
offset = 9;
tf = ColorData["RedGreenSplit"]
tffilelist =
  ("E:\\_time_varying_data\\SmokeSim\\DSSmokeSideways100500\\dsSmoke." <>
      IntegerString[#, 10, 3] <> ".tfi") & /@ Range[0, 499];
```

Out[654]=
```
ColorDataFunction[
```


```
]
```

In[656]:=
```
i = 160
list = d[[i - offset ;; i]];
std = ImageAdjust @@ ImageApply[StandardDeviation[{##}] &, list];
a = Flatten[ImageData[d[[i]]]];
b = Flatten[ImageData[std]];
h = HistogramList[a]
x = Take[h[[1]], Length[h[[1]]] - 1]
y = h[[2]]
p = ListLinePlot[Transpose[{x, y}], PlotRange → {{0, 1}, {0, 20 000}},
  ColorFunction → (GrayLevel[#] &), PlotLegends → "intensity histogram"]
Export[NotebookDirectory[] <> "smoke2\\" <> ToString[160] <> ".png",
  p, ImageSize → 640];
```

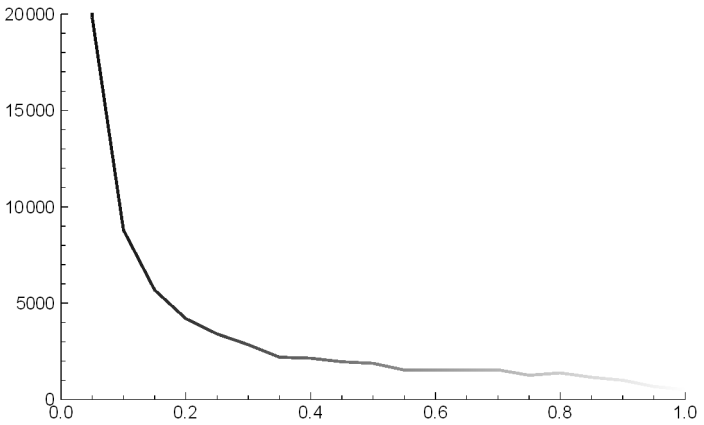
Out[656]= 160

Out[661]= $\left\{\left\{0, \frac{1}{20}, \frac{1}{10}, \frac{3}{20}, \frac{1}{5}, \frac{1}{4}, \frac{3}{10}, \frac{7}{20}, \frac{2}{5}, \frac{9}{20}, \frac{1}{2}, \frac{11}{20}, \frac{3}{5}, \frac{13}{20}, \frac{7}{10}, \frac{3}{4}, \frac{4}{5}, \frac{17}{20}, \frac{9}{10}, \frac{19}{20}, 1, \frac{21}{20}\right\}, \{934\,910, 19\,822, 8800, 5682, 4199, 3405, 2848, 2195, 2145, 1962, 1880, 1533, 1545, 1539, 1543, 1261, 1383, 1156, 1002, 677, 513\}\right\}$

Out[662]= $\left\{0, \frac{1}{20}, \frac{1}{10}, \frac{3}{20}, \frac{1}{5}, \frac{1}{4}, \frac{3}{10}, \frac{7}{20}, \frac{2}{5}, \frac{9}{20}, \frac{1}{2}, \frac{11}{20}, \frac{3}{5}, \frac{13}{20}, \frac{7}{10}, \frac{3}{4}, \frac{4}{5}, \frac{17}{20}, \frac{9}{10}, \frac{19}{20}, 1\right\}$

Out[663]= {934 910, 19 822, 8800, 5682, 4199, 3405, 2848, 2195, 2145, 1962, 1880, 1533, 1545, 1539, 1543, 1261, 1383, 1156, 1002, 677, 513}

Out[664]=



In[666]:=
```
bins = ConstantArray[0, Length[y]]
sumstd = ConstantArray[0, Length[y]]
Table[j = IntegerPart[a[[i]] * 20] + 1;
  bins[[j]]++;
  sumstd[[j]] += b[[i]], {i, 1, Length[a]}];
bins
sumstd
stds = sumstd / bins
p2 = ListLinePlot[Transpose[{x, stds}],
  ColorFunction → (GrayLevel[#] &), PlotLegends → "volatility histogram"]
Export[NotebookDirectory[] <> "smoke2\\" <> ToString[160] <> "_std.png",
  p2, ImageSize → 640];
```

Out[666]= {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}

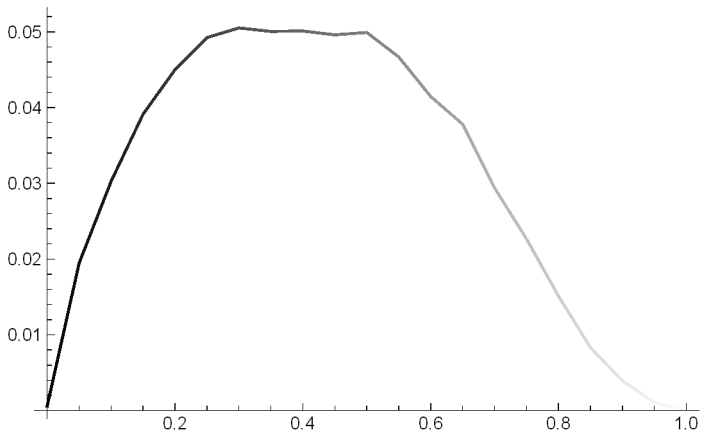
Out[667]= {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}

Out[669]= {934 910, 19 822, 8800, 5682, 4199, 3405, 2848, 2195, 2145, 1962,
1880, 1533, 1545, 1539, 1543, 1261, 1383, 1156, 1002, 677, 513}

Out[670]= {554.11, 386.004, 266.243, 222.243, 188.902, 167.631,
143.827, 109.843, 107.451, 97.298, 93.8196, 71.5451, 64.0431,
58.1647, 45.3137, 28.549, 20.8863, 9.60392, 3.93333, 0.721569, 0.}

Out[671]= {0.000592688, 0.0194735, 0.0302549, 0.0391135, 0.0449874, 0.0492309, 0.0505012,
0.0500424, 0.0500937, 0.0495913, 0.049904, 0.04667, 0.0414519, 0.0377938,
0.0293673, 0.02264, 0.0151022, 0.00830789, 0.00392548, 0.00106583, 0.}

Out[672]=



In[674]:=
```
i
tf = Import[tffilelist[[i]], "XML"];
intensity = ToExpression@
    Cases[tf, XMLElement["intensity", {"value" → atrib_, ___}, ___] :→ atrib, ∞];
r = ToExpression@Cases[tf, XMLElement["colorL", {"r" → atrib_, ___}, ___] :→ atrib,
     ∞];
g = ToExpression@Cases[tf, XMLElement["colorL",
       {___, "g" → atrib_, ___}, ___] :→ atrib, ∞];
b = ToExpression@Cases[tf, XMLElement["colorL",
       {___, "b" → atrib_, ___}, ___] :→ atrib, ∞];
a = ToExpression@Cases[tf, XMLElement["colorL", {___, "a" → atrib_}, ___] :→ atrib,
     ∞];
rgba = (# / 255. &) /@ Transpose[{r, g, b, a}];
colors = RGBColor /@ rgba;
intensitycolors = Transpose[{intensity, colors}]
defaultcolorfunction =
  (Blend[{{0., RGBColor[0.05635, 0.081, 0.07687, 0.0166234]},
       {0.1, RGBColor[0.8877, 0.2636, 0., 0.114961]},
       {0.66, RGBColor[1., 0.9658, 0.4926, 0.665652]},
       {1., RGBColor[1., 0.6436, 0.03622, 1.]}}, #1] &);
colorfunction = (Blend[intensitycolors, #1] &)
rgb = (# / 255. &) /@ Transpose[{r, g, b}];
colors2 = RGBColor /@ rgb;
intensitycolors2 = Transpose[{intensity, colors2}]
colorfunction2 = (Blend[intensitycolors2, #1] &)
opacity = (# / 255. &) /@ a;
ListLinePlot[Transpose[{intensity, opacity}], PlotRange → {{0, 1}, {0, 1}},
 ColorFunction → colorfunction2, PlotLegends → "transfer function"]
Image3D[d[[i]], ColorFunction → colorfunction]
ImageHistogram[d[[i]]]
```

Out[674]= 160

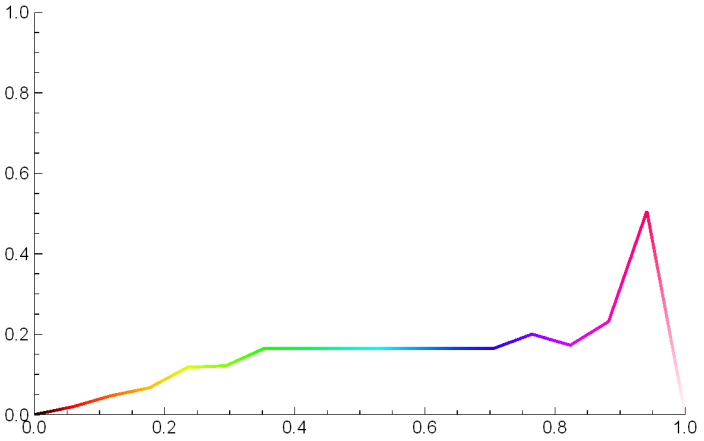
Out[683]= {{0, ■}, {0.0588235, ■}, {0.117647, ■}, {0.176471, ■}, {0.235294, ■},
{0.294118, ■}, {0.352941, ■}, {0.411765, ■}, {0.470588, ■},
{0.529412, ■}, {0.588235, ■}, {0.647059, ■}, {0.705882, ■},
{0.764706, ■}, {0.823529, ■}, {0.882353, ■}, {0.941176, ■}, {1, ■}}

Out[685]= Blend[intensitycolors, #1] &

Out[688]= {{0, ■}, {0.0588235, ■}, {0.117647, ■}, {0.176471, ■}, {0.235294, ■},
{0.294118, ■}, {0.352941, ■}, {0.411765, ■}, {0.470588, ■},
{0.529412, ■}, {0.588235, ■}, {0.647059, ■}, {0.705882, ■},
{0.764706, ■}, {0.823529, ■}, {0.882353, ■}, {0.941176, ■}, {1, □}}

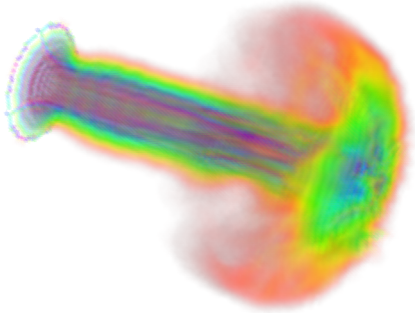
Out[689]= Blend[intensitycolors2, #1] &

Out[691]=

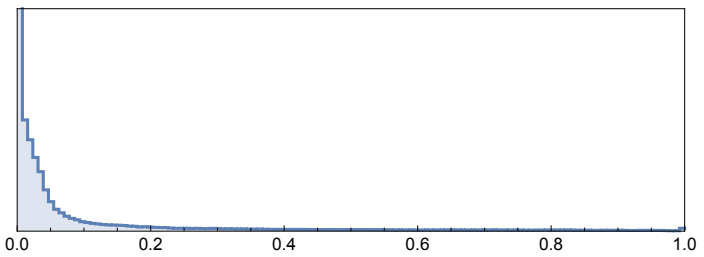


transfer function

Out[692]=



Out[693]=



In[694]:=
```
list = Range[0, 1, 1/255]
Length[list]
```

Out[694]=
$$\left\{0, \frac{1}{255}, \frac{2}{255}, \frac{1}{85}, \frac{4}{255}, \frac{1}{51}, \frac{2}{85}, \frac{7}{255}, \frac{8}{255}, \frac{3}{85}, \frac{2}{51}, \frac{11}{255}, \frac{4}{85}, \frac{13}{255}, \frac{14}{255}, \frac{1}{17}, \right.$$
$$\frac{16}{255}, \frac{1}{15}, \frac{6}{85}, \frac{19}{255}, \frac{4}{51}, \frac{7}{85}, \frac{22}{255}, \frac{23}{255}, \frac{8}{85}, \frac{5}{51}, \frac{26}{255}, \frac{9}{85}, \frac{28}{255}, \frac{29}{255}, \frac{2}{17},$$
$$\frac{31}{255}, \frac{32}{255}, \frac{11}{85}, \frac{2}{15}, \frac{7}{51}, \frac{12}{85}, \frac{37}{255}, \frac{38}{255}, \frac{13}{85}, \frac{8}{51}, \frac{41}{255}, \frac{14}{85}, \frac{43}{255}, \frac{44}{255}, \frac{3}{17},$$
$$\frac{46}{255}, \frac{47}{255}, \frac{16}{85}, \frac{49}{255}, \frac{10}{51}, \frac{1}{5}, \frac{52}{255}, \frac{53}{255}, \frac{18}{85}, \frac{11}{51}, \frac{56}{255}, \frac{19}{85}, \frac{58}{255}, \frac{59}{255}, \frac{4}{17},$$
$$\frac{61}{255}, \frac{62}{255}, \frac{21}{85}, \frac{64}{255}, \frac{13}{51}, \frac{22}{85}, \frac{67}{255}, \frac{4}{15}, \frac{23}{85}, \frac{14}{51}, \frac{71}{255}, \frac{24}{85}, \frac{73}{255}, \frac{74}{255}, \frac{5}{17},$$
$$\frac{76}{255}, \frac{77}{255}, \frac{26}{85}, \frac{79}{255}, \frac{16}{51}, \frac{27}{85}, \frac{82}{255}, \frac{83}{255}, \frac{28}{85}, \frac{1}{3}, \frac{86}{255}, \frac{29}{85}, \frac{88}{255}, \frac{89}{255}, \frac{6}{17},$$
$$\frac{91}{255}, \frac{92}{255}, \frac{31}{85}, \frac{94}{255}, \frac{19}{51}, \frac{32}{85}, \frac{97}{255}, \frac{98}{255}, \frac{33}{85}, \frac{20}{51}, \frac{101}{255}, \frac{2}{5}, \frac{103}{255}, \frac{104}{255}, \frac{7}{17},$$
$$\frac{106}{255}, \frac{107}{255}, \frac{36}{85}, \frac{109}{255}, \frac{22}{51}, \frac{37}{85}, \frac{112}{255}, \frac{113}{255}, \frac{38}{85}, \frac{23}{51}, \frac{116}{255}, \frac{39}{85}, \frac{118}{255}, \frac{7}{15}, \frac{8}{17},$$
$$\frac{121}{255}, \frac{122}{255}, \frac{41}{85}, \frac{124}{255}, \frac{25}{51}, \frac{42}{85}, \frac{127}{255}, \frac{128}{255}, \frac{43}{85}, \frac{26}{51}, \frac{131}{255}, \frac{44}{85}, \frac{133}{255}, \frac{134}{255}, \frac{9}{17},$$
$$\frac{8}{15}, \frac{137}{255}, \frac{46}{85}, \frac{139}{255}, \frac{28}{51}, \frac{47}{85}, \frac{142}{255}, \frac{143}{255}, \frac{48}{85}, \frac{29}{51}, \frac{146}{255}, \frac{49}{85}, \frac{148}{255}, \frac{149}{255}, \frac{10}{17},$$
$$\frac{151}{255}, \frac{152}{255}, \frac{3}{5}, \frac{154}{255}, \frac{31}{51}, \frac{52}{85}, \frac{157}{255}, \frac{158}{255}, \frac{53}{85}, \frac{32}{51}, \frac{161}{255}, \frac{54}{85}, \frac{163}{255}, \frac{164}{255}, \frac{11}{17},$$
$$\frac{166}{255}, \frac{167}{255}, \frac{56}{85}, \frac{169}{255}, \frac{2}{3}, \frac{57}{85}, \frac{172}{255}, \frac{173}{255}, \frac{58}{85}, \frac{35}{51}, \frac{176}{255}, \frac{59}{85}, \frac{178}{255}, \frac{179}{255}, \frac{12}{17},$$
$$\frac{181}{255}, \frac{182}{255}, \frac{61}{85}, \frac{184}{255}, \frac{37}{51}, \frac{62}{85}, \frac{11}{15}, \frac{188}{255}, \frac{63}{85}, \frac{38}{51}, \frac{191}{255}, \frac{64}{85}, \frac{193}{255}, \frac{194}{255}, \frac{13}{17},$$
$$\frac{196}{255}, \frac{197}{255}, \frac{66}{85}, \frac{199}{255}, \frac{40}{51}, \frac{67}{85}, \frac{202}{255}, \frac{203}{255}, \frac{4}{5}, \frac{41}{51}, \frac{206}{255}, \frac{69}{85}, \frac{208}{255}, \frac{209}{255}, \frac{14}{17},$$
$$\frac{211}{255}, \frac{212}{255}, \frac{71}{85}, \frac{214}{255}, \frac{43}{51}, \frac{72}{85}, \frac{217}{255}, \frac{218}{255}, \frac{73}{85}, \frac{44}{51}, \frac{13}{15}, \frac{74}{85}, \frac{223}{255}, \frac{224}{255}, \frac{15}{17},$$
$$\frac{226}{255}, \frac{227}{255}, \frac{76}{85}, \frac{229}{255}, \frac{46}{51}, \frac{77}{85}, \frac{232}{255}, \frac{233}{255}, \frac{78}{85}, \frac{47}{51}, \frac{236}{255}, \frac{79}{85}, \frac{14}{15}, \frac{239}{255}, \frac{16}{17},$$
$$\left.\frac{241}{255}, \frac{242}{255}, \frac{81}{85}, \frac{244}{255}, \frac{49}{51}, \frac{82}{85}, \frac{247}{255}, \frac{248}{255}, \frac{83}{85}, \frac{50}{51}, \frac{251}{255}, \frac{84}{85}, \frac{253}{255}, \frac{254}{255}, 1\right\}$$

Out[695]= 256

In[696]:=
```
(*start=1+offset;end=500;step=20;
Do[
 end2=Min[j+step-1,end];
 Module[{list,std,a,b,h,x,y,bins,sumstd,stds},
  Table[
   list=d[[i-offset;;i]];
   std=ImageAdjust@@ImageApply[StandardDeviation[{##}]&,list];
   a=Flatten[ImageData[d[[i]]]];
   b=Flatten[ImageData[std]];
   h=HistogramList[a];
   x=Take[h[[1]],Length[h[[1]]]-1];
   y=h[[2]];
   ListLinePlot[Transpose[{x,y}],PlotRange→{{0,1},{0,20000}},
     ColorFunction→(GrayLevel[#]&),PlotLegends→"intensity histogram"]//
    Export[NotebookDirectory[]<>"smoke2\\"<>ToString[i]<>".png",
      #,ImageSize→{640,280}]&;
   bins=ConstantArray[0,Length[y]];
   sumstd=ConstantArray[0,Length[y]];
   Table[n=IntegerPart[a[[m]]*20]+1;
    bins[[n]]++;
    sumstd[[n]]+=b[[m]],{m,1,Length[a]}];
   stds=sumstd/bins;
   ListLinePlot[Transpose[{x,stds}],
     ColorFunction→(GrayLevel[#]&),PlotLegends→"volatility histogram"]//
    Export[NotebookDirectory[]<>"smoke2_std\\"<>ToString[i]<>".png",
      #,ImageSize→{640,280}]&
   ,{i,j,end2}]
 ]
 ,{j,start,end,step}]*)
```