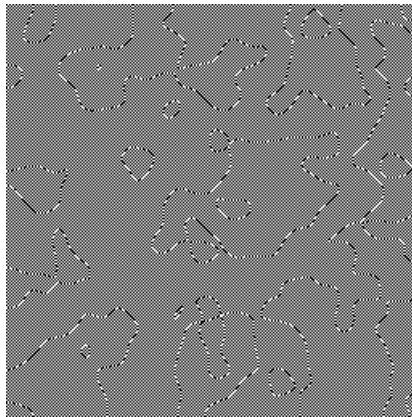**Problem H1.3:**

(a) The evolution of the mean, the maximum, the minimum and the variance is exactly what one would expect with a process of homogeneous diffusion on an image. This process gradually reduces peaks in grey values of the image so that it becomes smoother. This produces the result of a "cloudy image". This smoothing process mathematically decreases the bigger grey values in the image, while increasing the smallest. That way, peaks get smaller. This in turn means that the maximum grey value in the original image will decrease while the minimum grey value will increase. Moreover, on average the variance will become smaller, since now bigger grey values are closer to the smallest grey values or, in other words, peaks in the image are no longer as pronounced. For example, with timestep $ts = 0.24$ and iterations iter $= 100$, this is how the values evolve:

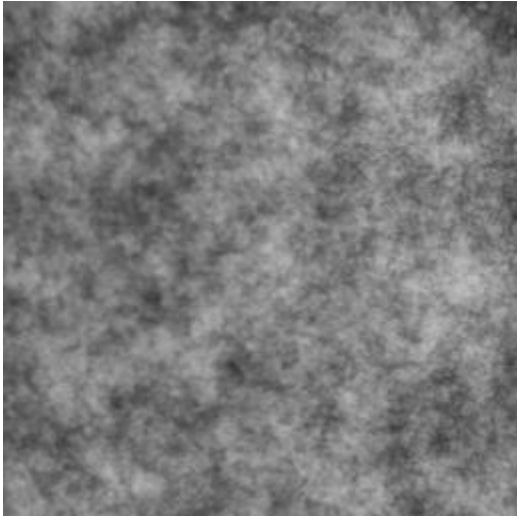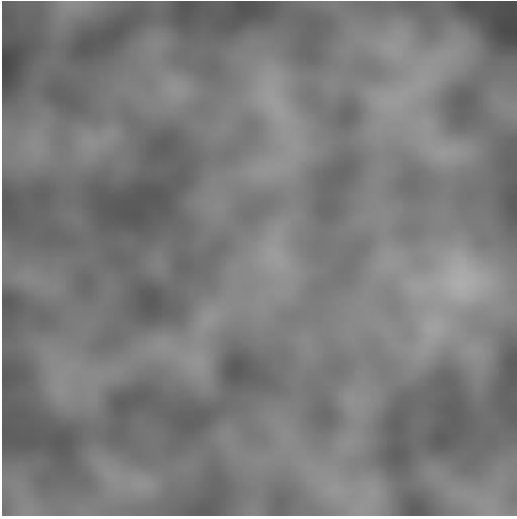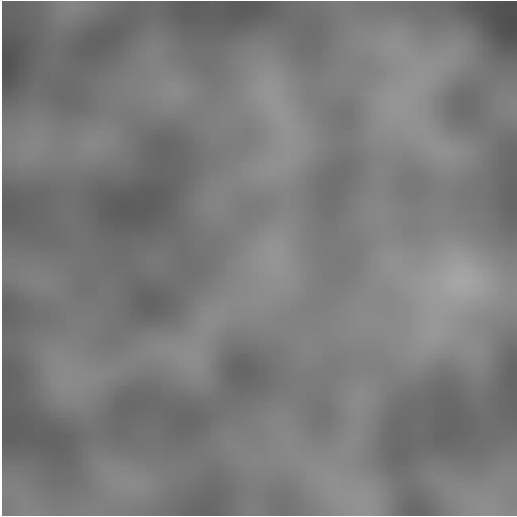| initial image		iteration:	100
minimum:	51.00	minimum:	79.95 (↑)
maximum:	191.00	maximum:	165.81 (↓)
mean:	123.79	mean:	123.79 (=)
standard dev.:	20.38	standard dev.:	12.87 (↓)

On the other hand, for values greater than $ts = 0.24$, the homogeneous diffusion explodes (does not converge) producing images like the following ($ts = 0.3$; iter $= 100$):

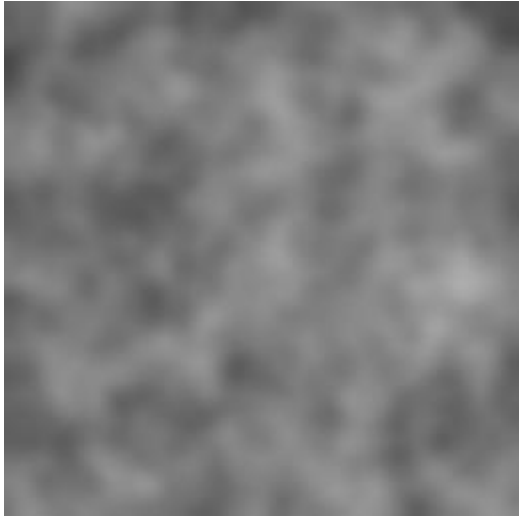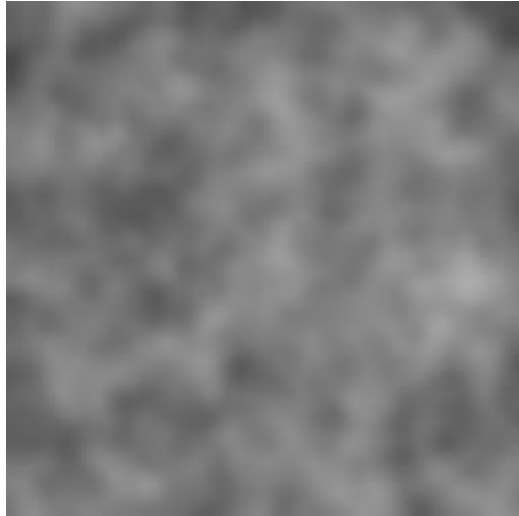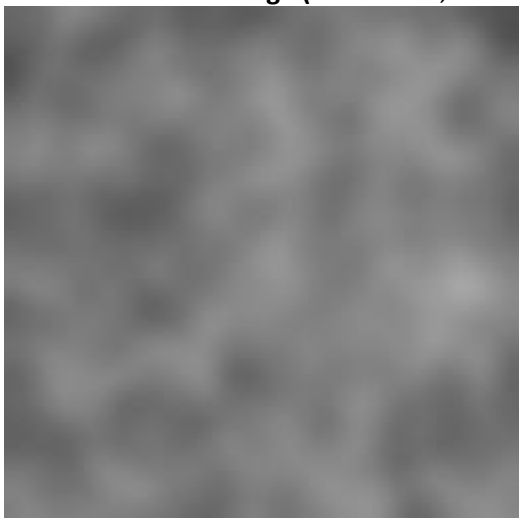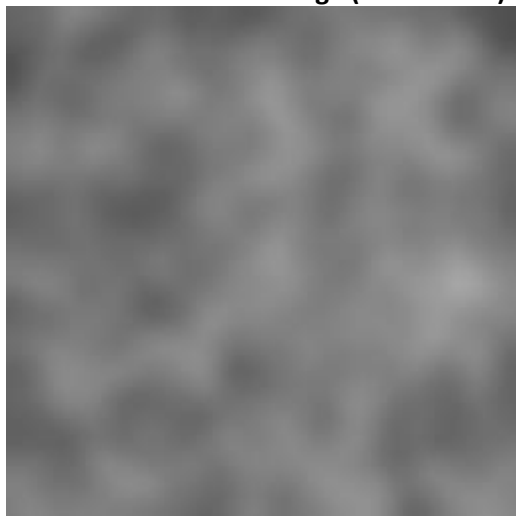And an evolution of values like the following:

initial image		iteration:	100
minimum:	51.00	minimum:	-122523368455836.78
maximum:	191.00	maximum:	121898099410075.66
mean:	123.79	mean:	123.79
standard dev.:	20.38	standard dev.:	20088437495767.09

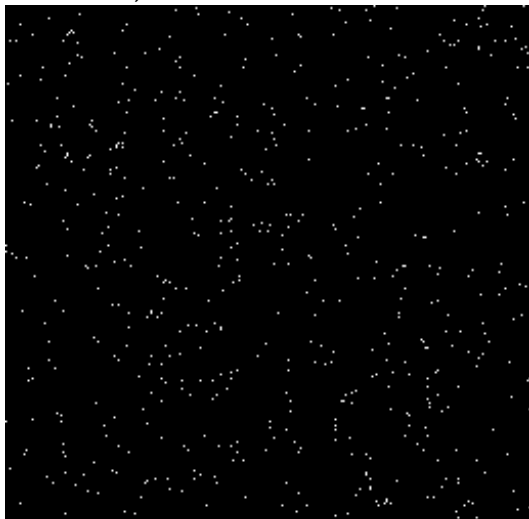Original image and the corresponding diffusion-filtered images illustrating the cloudiness at different scales:

Original Image (fabric.pgm):	Diffusion-filtered image ($ts = 0.1$; iter $= 100$):
	Diffusion-filtered image ($ts = 0.24$; iter $= 100$):

(b) The corresponding Gaussian convolution counterparts for the previous diffusion-filtered images. The standard deviation σ was calculated with the following formula:

$$t = \frac{1}{2}\sigma^2 \rightarrow ts * \text{iter} = \frac{1}{2}\sigma^2 \rightarrow \sigma = \sqrt{2ts * \text{iter}}$$

Diffusion-filtered image ($ts = 0.1$; iter $= 100$):	**Gaussian-convoluted image ($\sigma \approx 4.472$):**

Diffusion-filtered image ($ts = 0.24$; iter $= 100$):	**Gaussian-convoluted image ($\sigma \approx 6.928$):**

The difference images between the diffusion-filtered image and the corresponding gaussian-convoluted image:

$ts = 0.1$; iter $= 100 \; vs \; \sigma \approx 4.472$:	$ts = 0.24$; iter $= 100 \; vs \; \sigma \approx 6.928$: