6.3732 PSet 5 Part 2

Stephen Andrews

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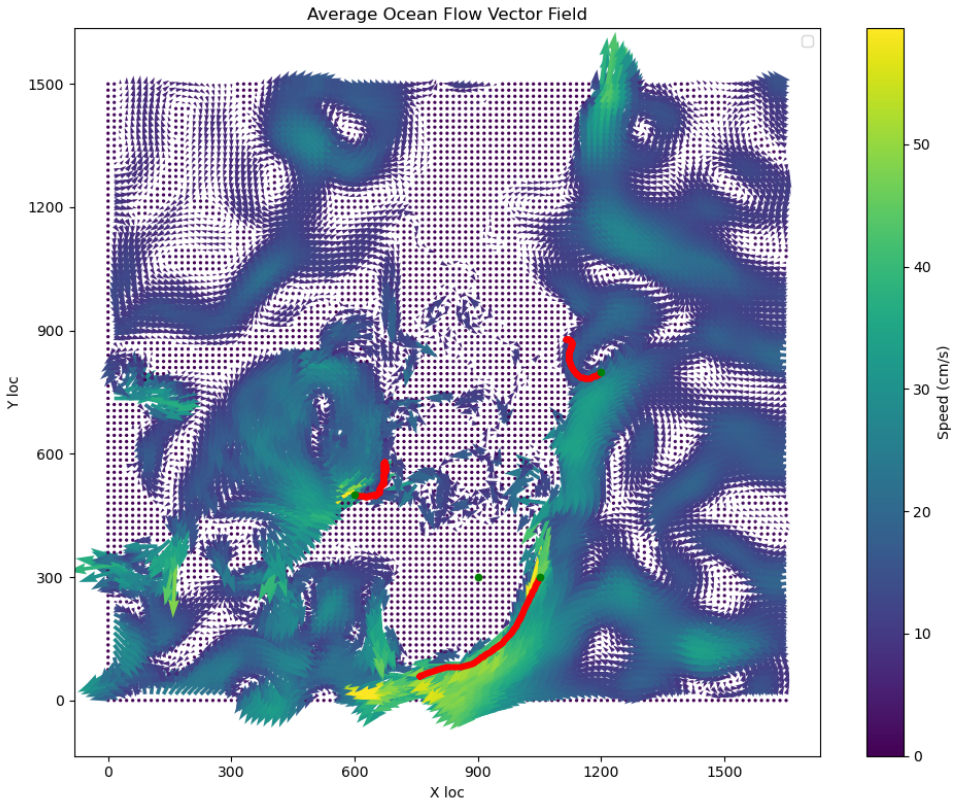
5.2:

a)

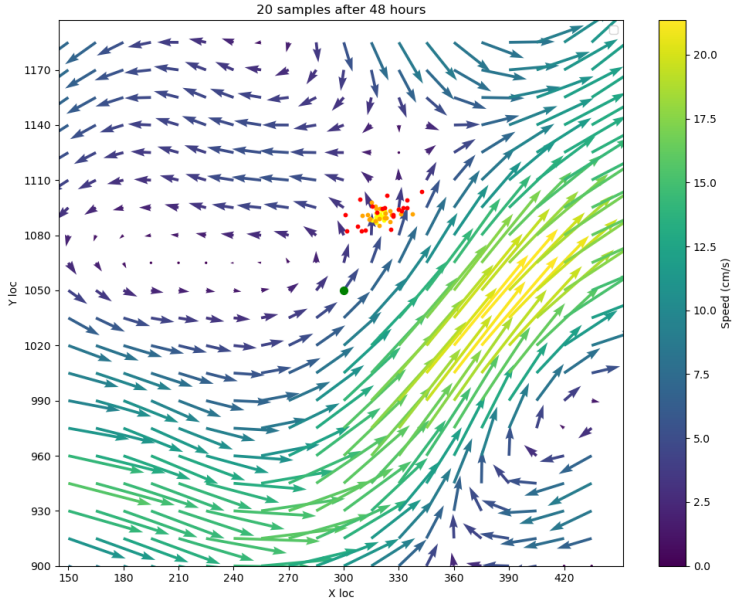
We use a similar approach to the one described in the pset. We make a lattice on top of the plane with spacing of 3km, so that each square corresponds to one entry in each of our data matrices. For example, any location within the box with corners at (0km, 0km), (0km, 3km), (3km, 0km), (3km, 3km) will use flows from the (0,0) entries of the matrix. What we will do is then give our particle the velocity of this cell until we reach one of the grid lines, or the particle has traveled for three hours. At which point we record that point and update the velocity based on the new location/flow.

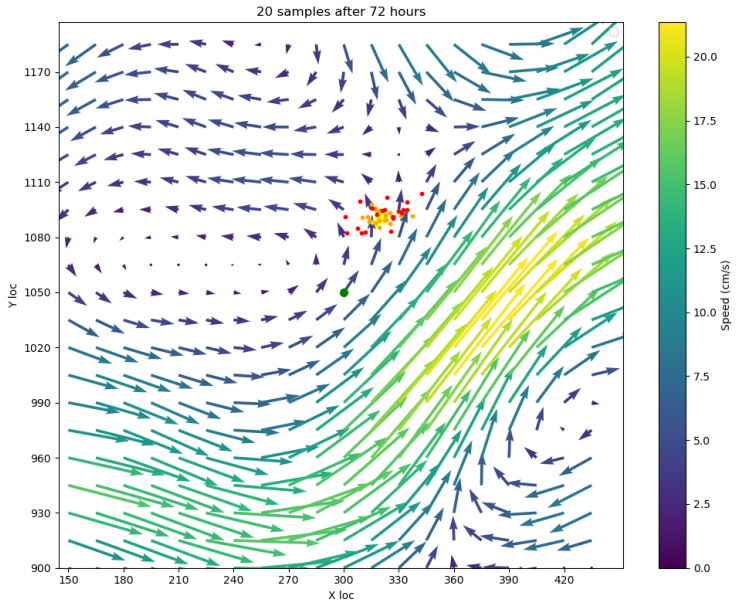
As we can see, from testing the various starting points, $(1050, 300), (1200, 800), (600, 500), (900, 300)$ our procedure works as expected as we are following the flow of the map. A few things to note, is that the green points in each trail is the starting point and the point $(900, 300)$ does not move because it is on land.

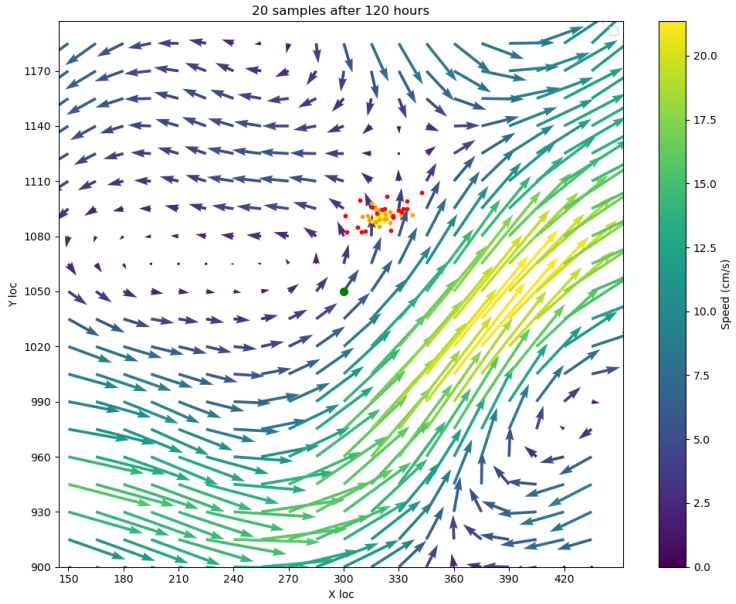


b)

As a general guess, we know that the parts will be to the northeast of the crash site based on simply looking at the flows from that location. For each of the 3 times, we test variances in the starting locations of 4, 16, 49 with samples each. This yields the following three plots:







In each of the graphs, the green point is the mean of the possible crash site locations, the 20 yellow points are samples of debris location with $\sigma^2 = 4$, the 20 orange points are samples of debris location with $\sigma^2 = 16$, and the 20 red points are samples of debris location with $\sigma^2 = 49$. There are a few observations we can make from these results. The first is that as we increase the hours, the increasing the variance of the crash site also increases the variance of the debris ending location, as expected. In addition, just based on visual inspection, there is somewhat less variance in the 48 hours case as we would also expect. Also note that regardless of the variation of the crash site, for whichever time frame we look at, the mean location of the debris final location stays pretty similar. This tells us that the debris dispersion is not too sensitive. Specifically, by looking at the means, we get that if it is 48 hours after the crash we should search $(310, 1070)$, 72 hours $(315, 1080)$, and 120 hours $(320, 1090)$.