Dispersal Phase Diagrams From The Cloud
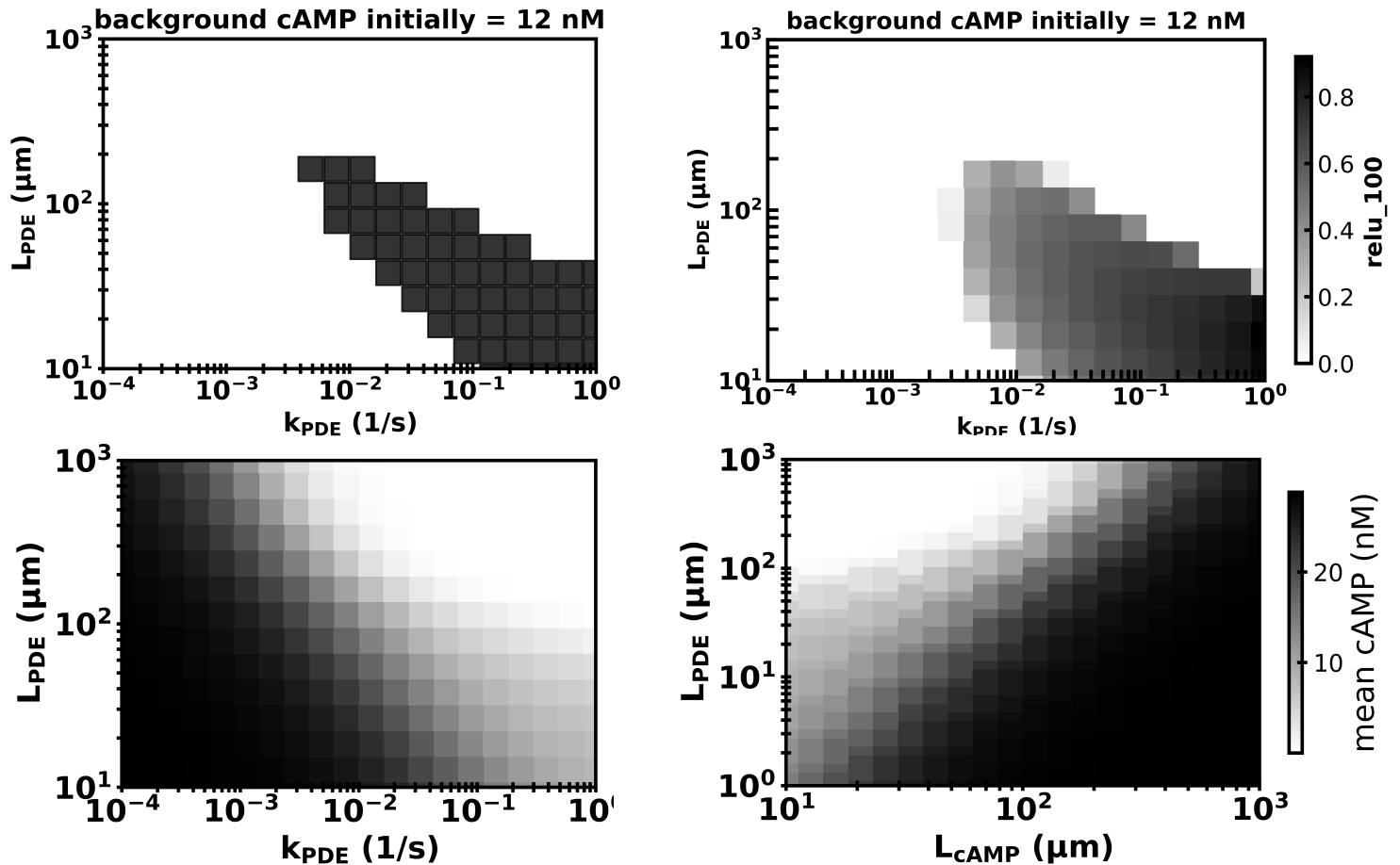

Fig. X (top left) Dispersal is supported despite cAMP signalling at a period of T = 21 minutes (left) shaded region represents
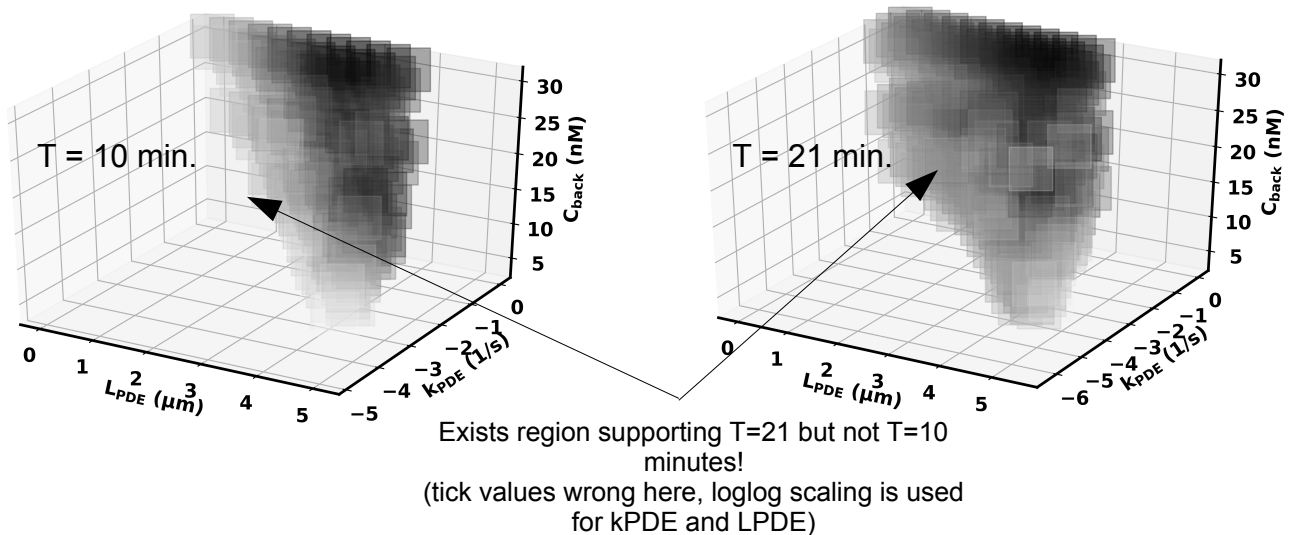
New features
(top right) the blackest shading indicates the time-averaged outward cell direction takes a value of 1. (bottom left/right) Mean cAMP concentration (nM), which I approached analytically using mean field theory.

TODO: update figures for the manuscript!

Potential next steps on the cloud:
Repeat the simulation (1-2 hour run time) for PDE7, PDE1, and PDE4 according to degradation modeled by the empirical Hill functions.

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The shaded region supports dispersal at ranges closer than 300μm. Cell direction was averaged over the seventh cAMP pulse *in silico.*

T = 10 min.

T = 21 min.

Exists region supporting T=21 but not T=10 minutes!
(tick values wrong here, loglog scaling is used for kPDE and LPDE)

We observe from the following a particular minimum background cAMP concentration that can support dispersal that is independent of signaling period T.

Some statistics
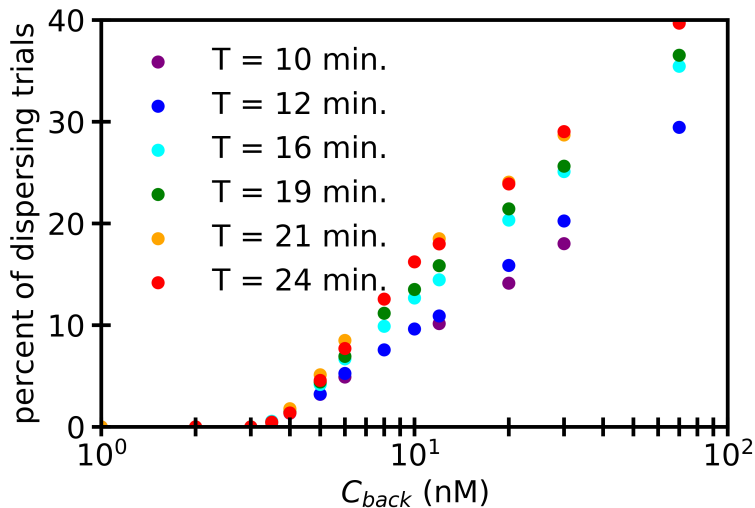
The slope's slope dm/dT takes an approximate constant value of 0.378 ± 0.078 (1 std_err) per minute, which is significanty nonzero (p = 0.0404, N=4) according to a Wald test against the null hypothesis of no T dependence of the slope m (left). The intercept is such that m(T') = 0 is calculated to be T' = 9.706 minutes.
sample size N is 4.
R-squared: 0.921

Here I used a two-sided p-value for a hypothesis test whose null hypothesis is that the slope is zero, using a Wald Test with a t-distribution of the test statistic.

Apparently, for
y = the percent of dispersing trials
    \propto the shaded area in
(k_{PDE},L_{PDE}) parameter space

We have

$$y = m(T)*(ln(C_{back}/C_{cutoff})-1)$$

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Dispersal also appears insensitive to the cycle number we choose to draw inferences.
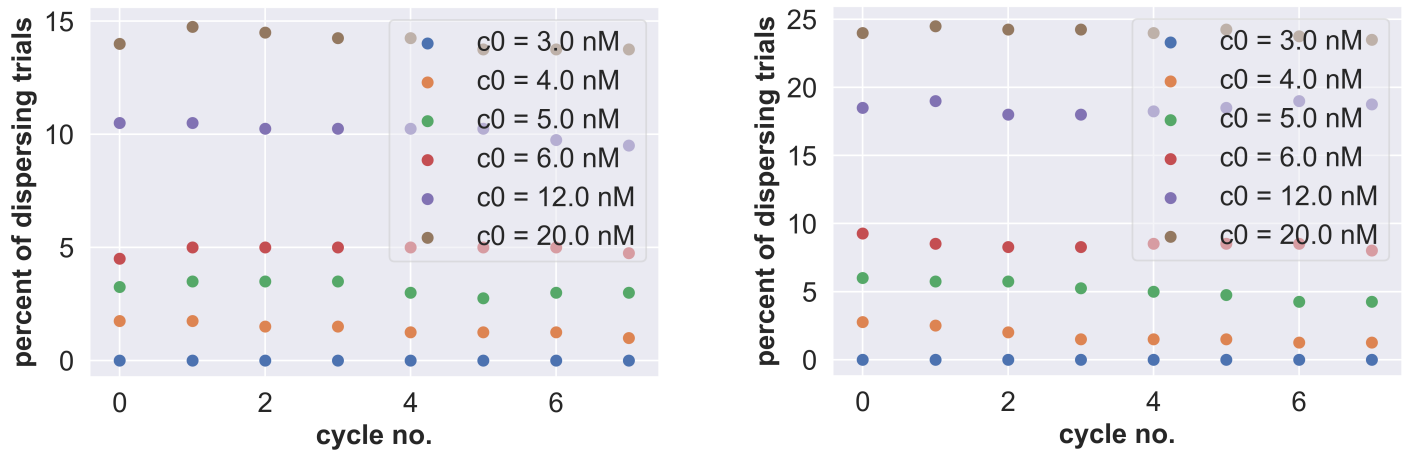

Fig. X Percent of trials that were dispersing at ranges closer than 300μm versus cycle number for various initial background concentrations of cAMP are plotted for cAMP signalling at a period of (left) T=10 minutes and (right) T=21 minutes. Each panel has N=400.

Key Results
- Dispersal scales linearly with the log background cAMP concentration.
- Dispersal occurrence appears insensitive to cycle no. (and period)
- Minimum background cAMP that supports dispersal is between C_{cutoff} = 3 - 4 nM, and the precise value does not appear to depend on period, but could depend somewhat on cycle number.

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