Effective number of meteors in reduced field of view

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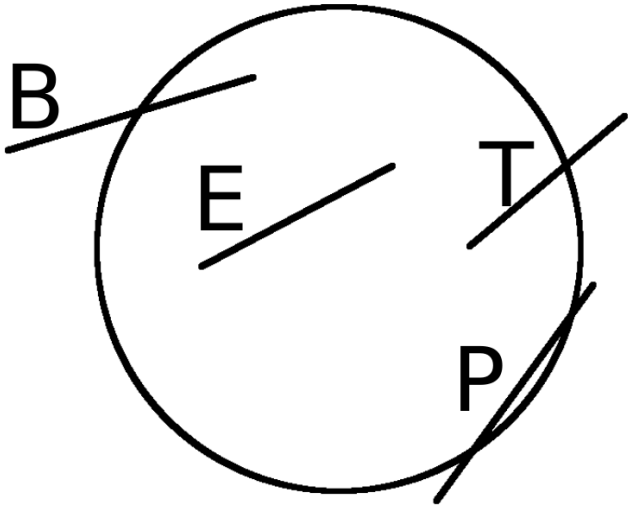
Introduction to counting problem

- Meteors are not point-like objects; they have a certain dimension.
- Position of meteor trail is not strictly defined by one point → effective number of meteors in the field of view is not equal to total number of observed meteors.
- The effective number of meteors can be described as a number of meteor trail midpoints inside the field of view.

Introduction to counting problem

- The observer does not know the position of midpoints for trails that are partially inside the field of view.
- Four classes of seen meteors:



„B“ - with beginning only

„T“ - with termination only

„E“ - entire trail

„P“ - passing across

- Analytic approach is applied for computing correction coefficients for every class of seen meteors (Kresáková, 1977.).

Simulation

- Approximations and assumptions in analytical approach.

  1) Sky is approximated as a two-dimensional plane

  2) No preferred orientation of trails direction → meteors does not belong to shower.

  3) Trails of the equal length

- Differences between simulation and analytical approach:

  2) Meteor shower orientations of trails by introducing point-like radiant.

  3) Linear dependence between meteor length and its distance from radiant.

Simulation

- Trail midpoints are generated randomly.
- Simplest - linear dependencede between length of trail and its distance from radiant:

$$L=\omega\psi$$

ω – parameter of length

ψ – distance between midpoint of trail and radiant

Simulation

- Set of geometrical requirements for recognizing meteors of certain classes:

$$(x_1 - x_f)^2 + (y_1 - y_f)^2 < (D/2)^2 \quad (1)$$

$$(x_2 - x_f)^2 + (y_2 - y_f)^2 < (D/2)^2 \quad (2)$$

$$(x_1 - x_f)^2 + (y_1 - y_f)^2 < L^2 + (D/2)^2 \quad (3)$$

$$(x_2 - x_f)^2 + (y_2 - y_f)^2 < L^2 + (D/2)^2 \quad (4)$$

$$(x_c - x_f)^2 + (y_c - y_f)^2 < (D/2)^2 \quad (5)$$

Details at poster session

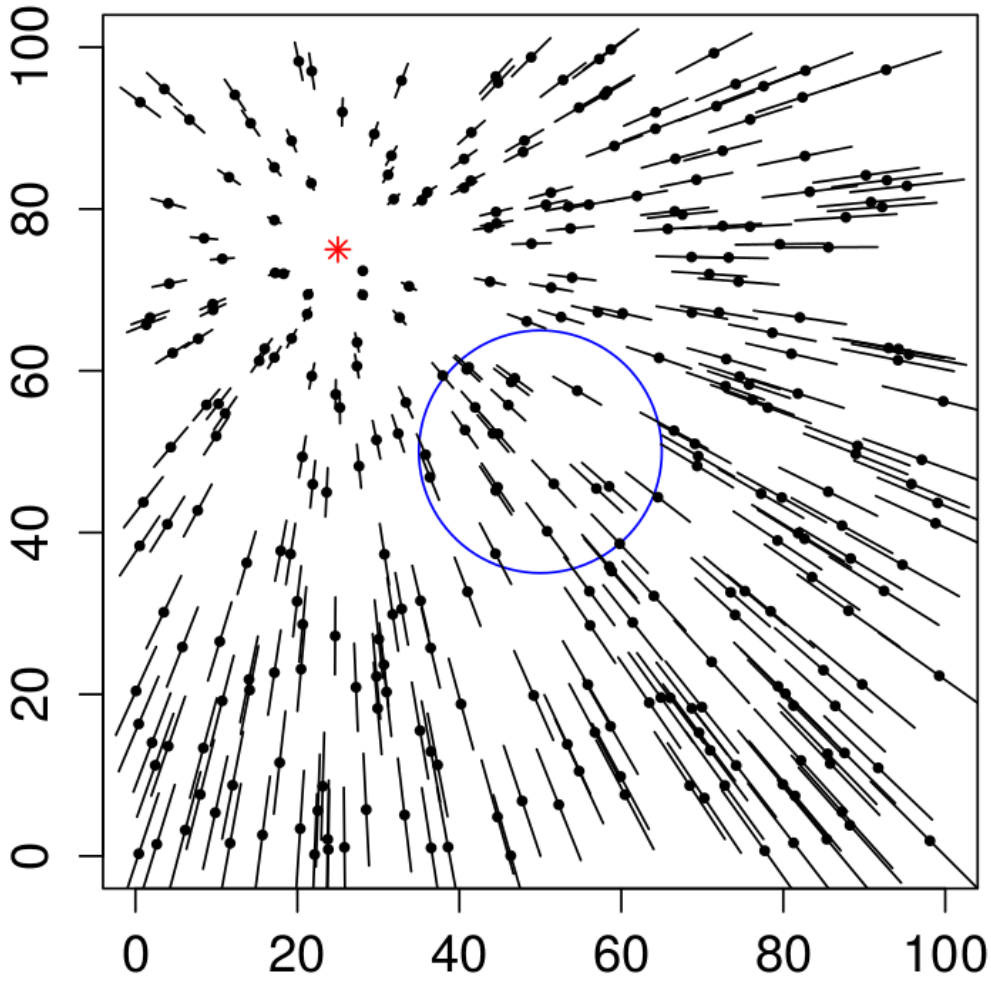
Simulation

- Correction coefficients are calculated as:

$$K_i = \frac{N_c}{N_{tot}}$$

N_c - number of seen meteors with midpoints in the field of view; N_{tot} - number of all meteors seen for giving class.

Illustration of simulation setting



Comparing results with analytic approach

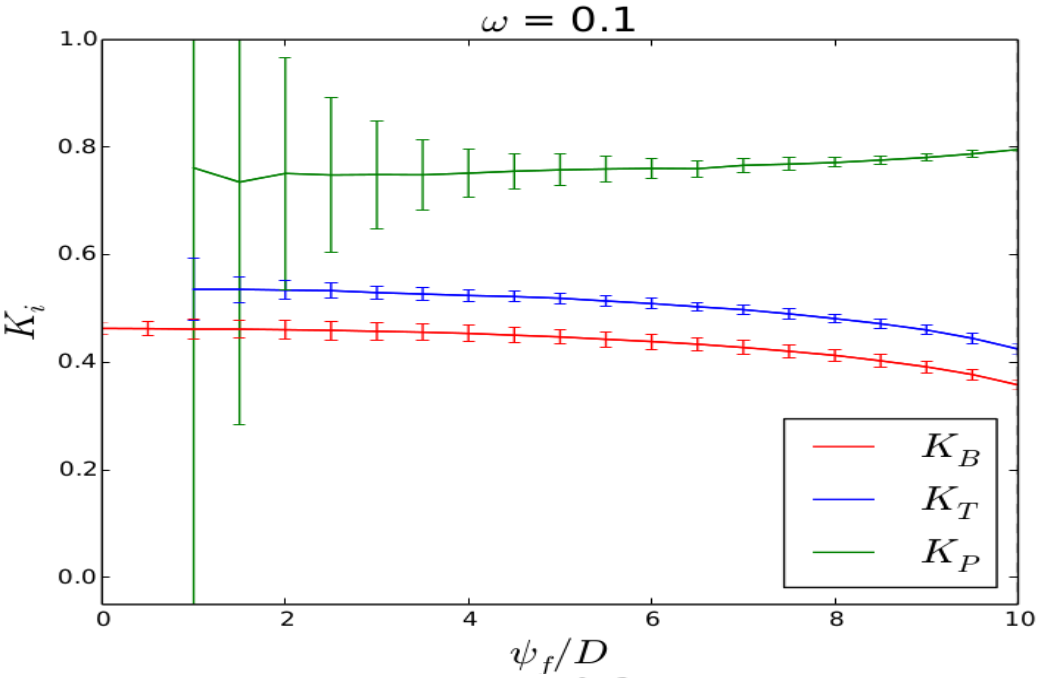
Table 1: Results of simulation in comparison with analytically computed results.

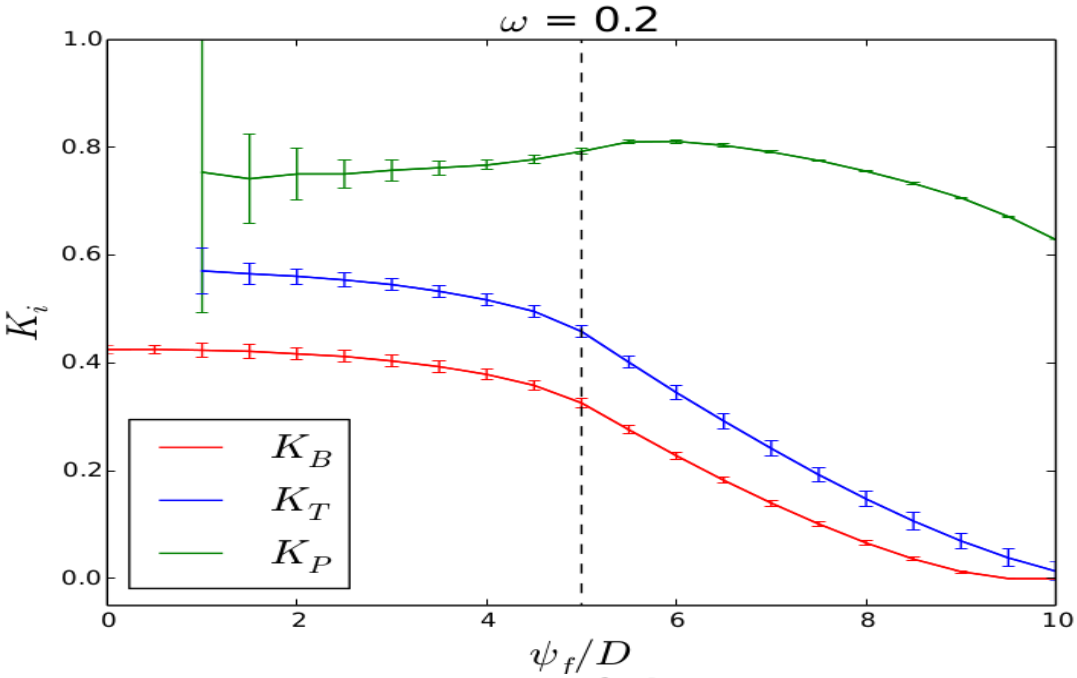
D/L	E_c	σ_{E_c}	E_c (*Kresáková*, 1977.)	Ratio of P class meteors to total. (%)
0.1	13.65	5	13.73	85.4
0.2	7.33	0.9	7.37	72.9
0.3	5.25	0.4	5.24	61.9
0.5	3.55	0.2	3.55	43.6
1	2.27	0.04	2.27	12
2	1.64	0.02	1.64	1.7
3	1.424	0.008	1.42	0.56
5	1.255	0.004	1.25	0.14
10	1.127	0.002	1.13	0.02

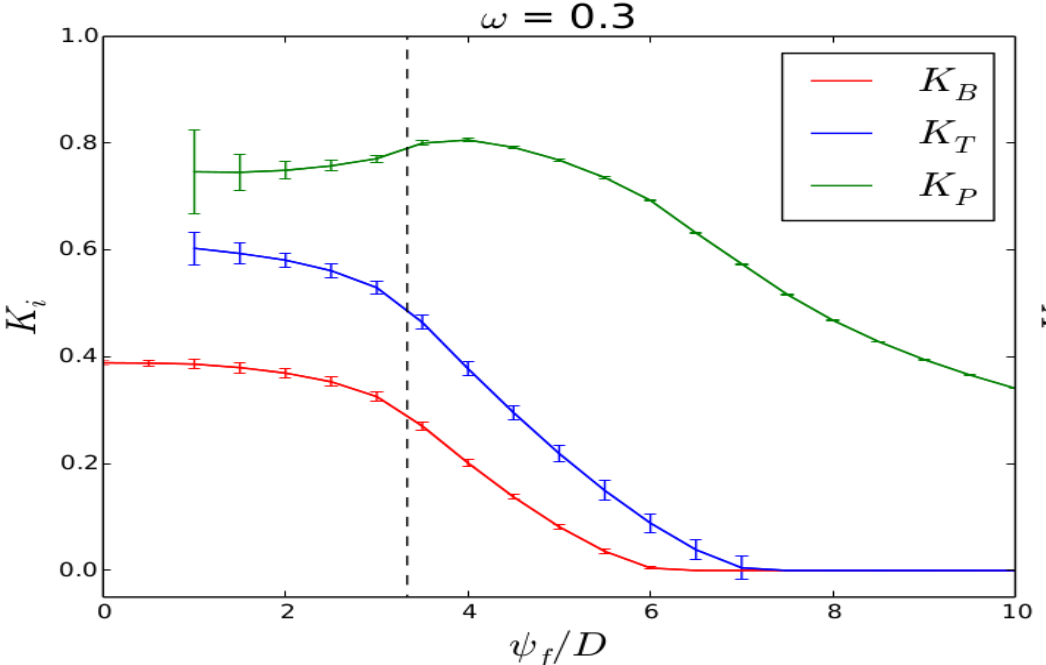
By E_c and σ_{Ec} are denoted size of effective field of view and standard deviation of its distribution computed in simulation.

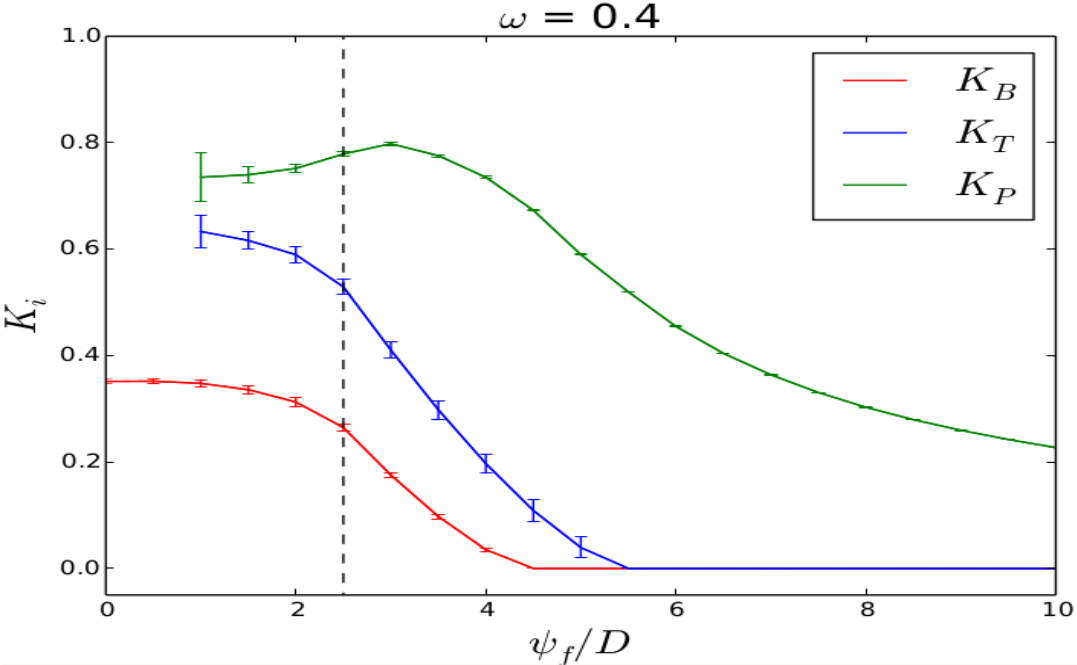
Results of simulation

Correction coefficients dependence of radiant distance and length parameter

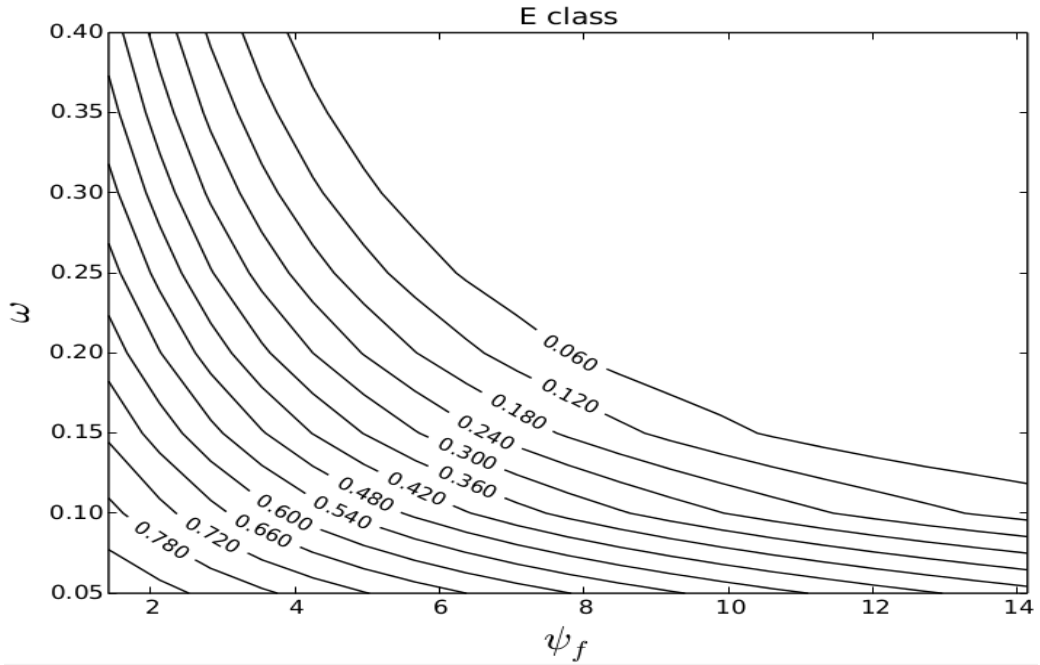


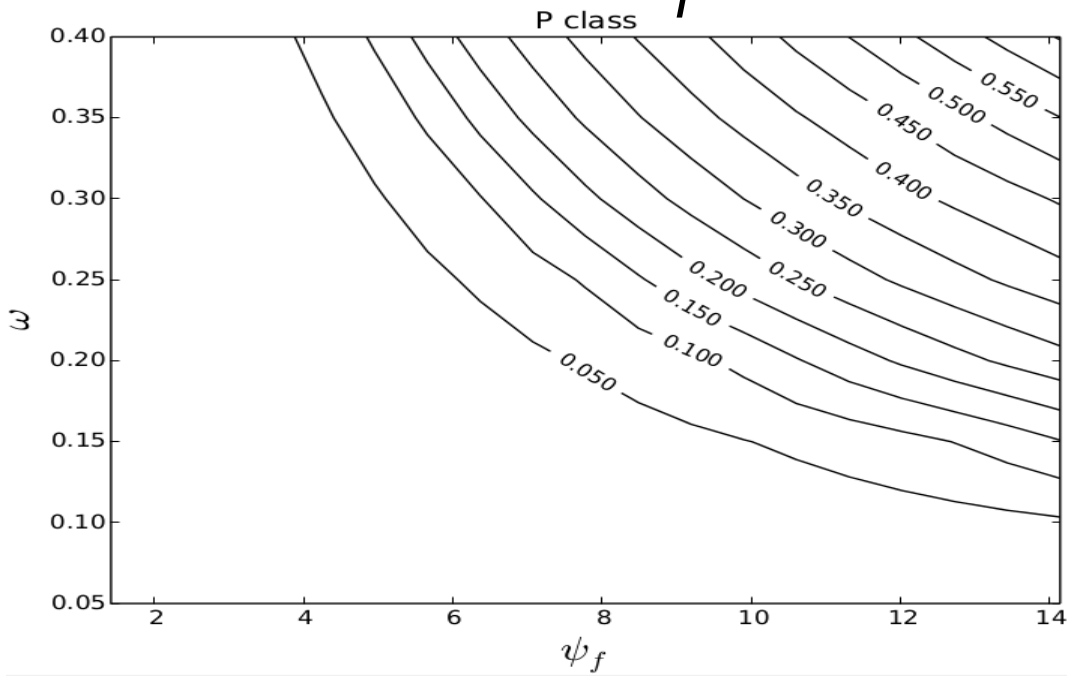


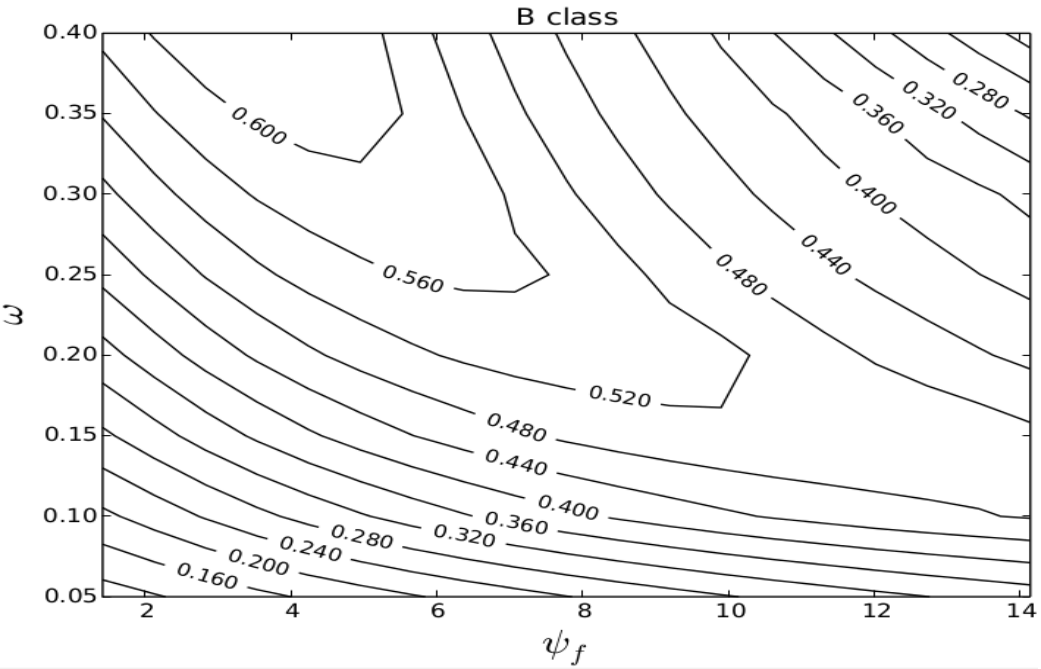


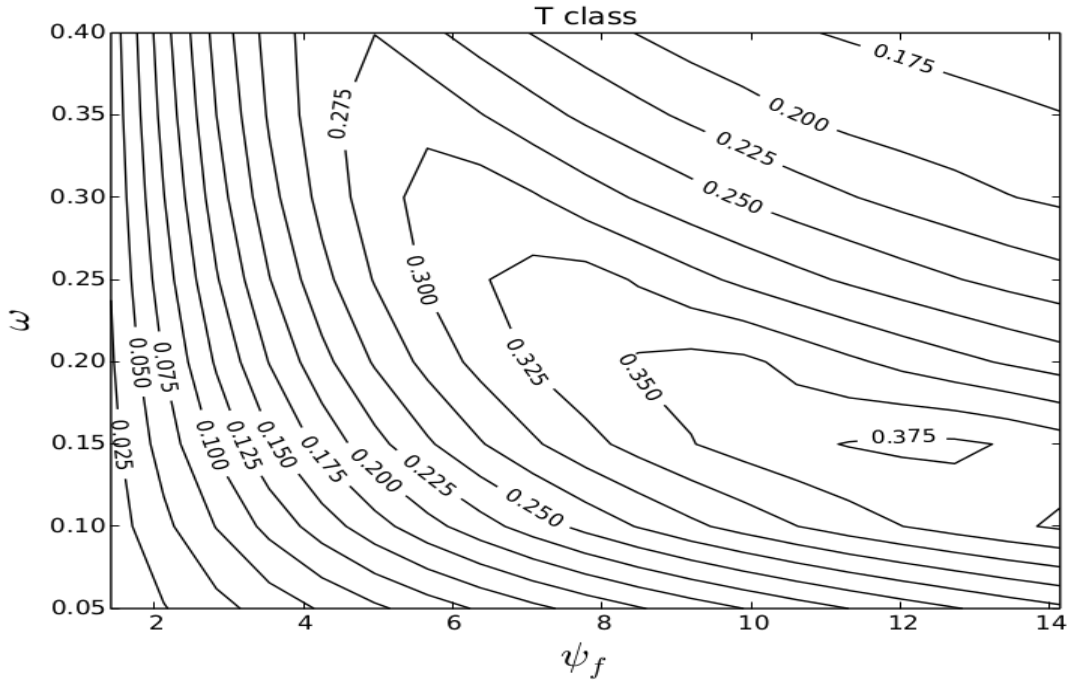


Contribution of different meteor classes to total number of seen meteors in parameter space (ψ_f; ω)

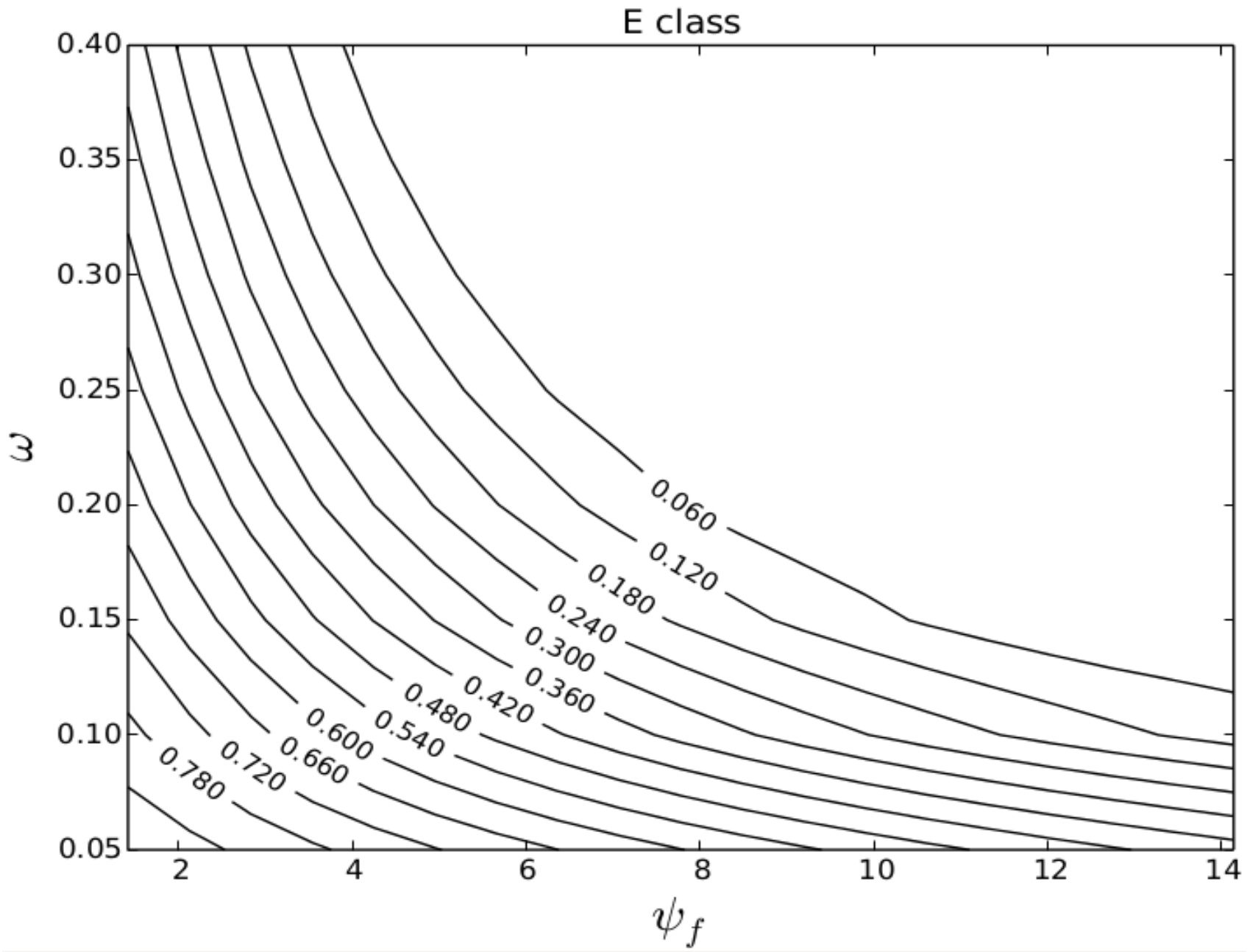




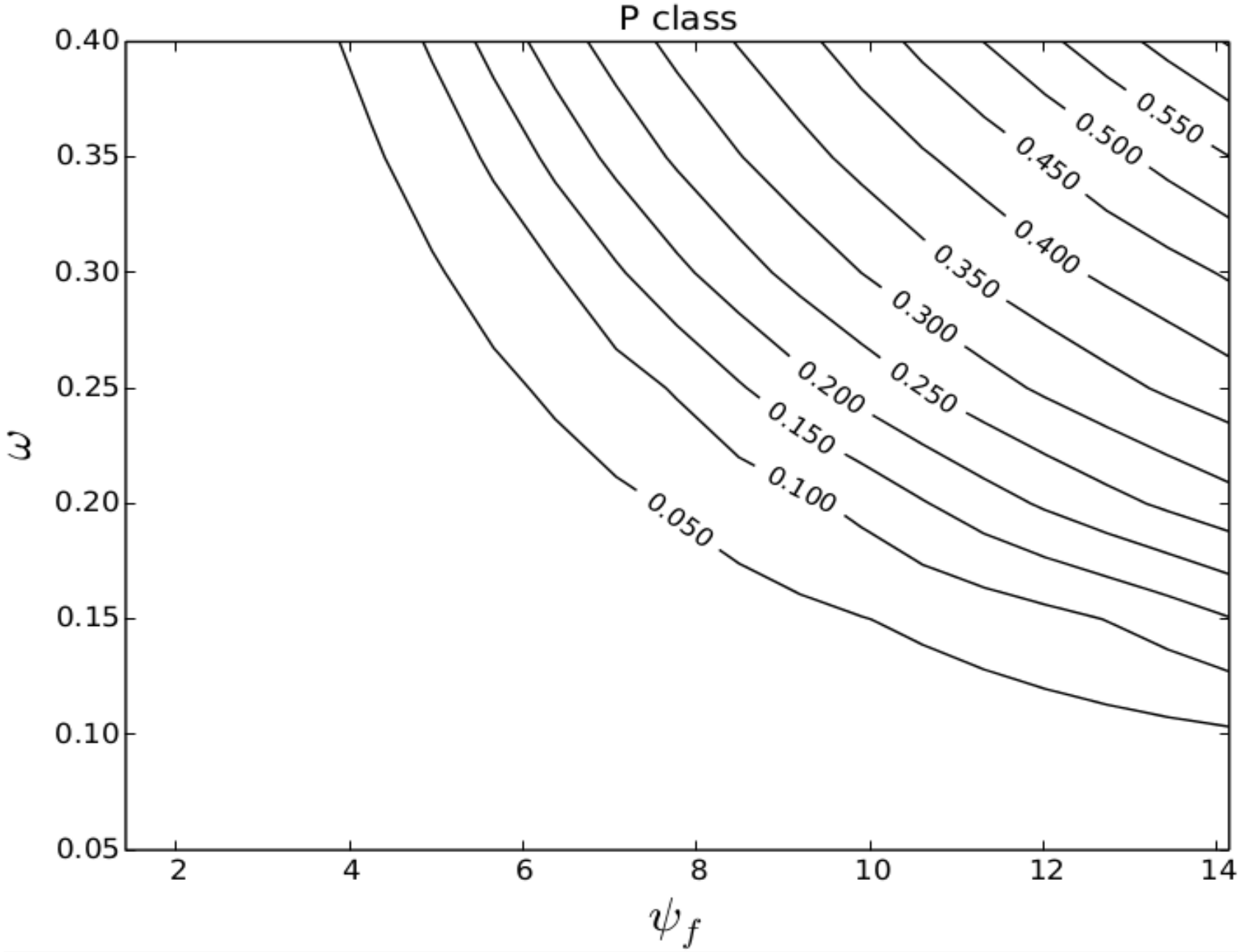




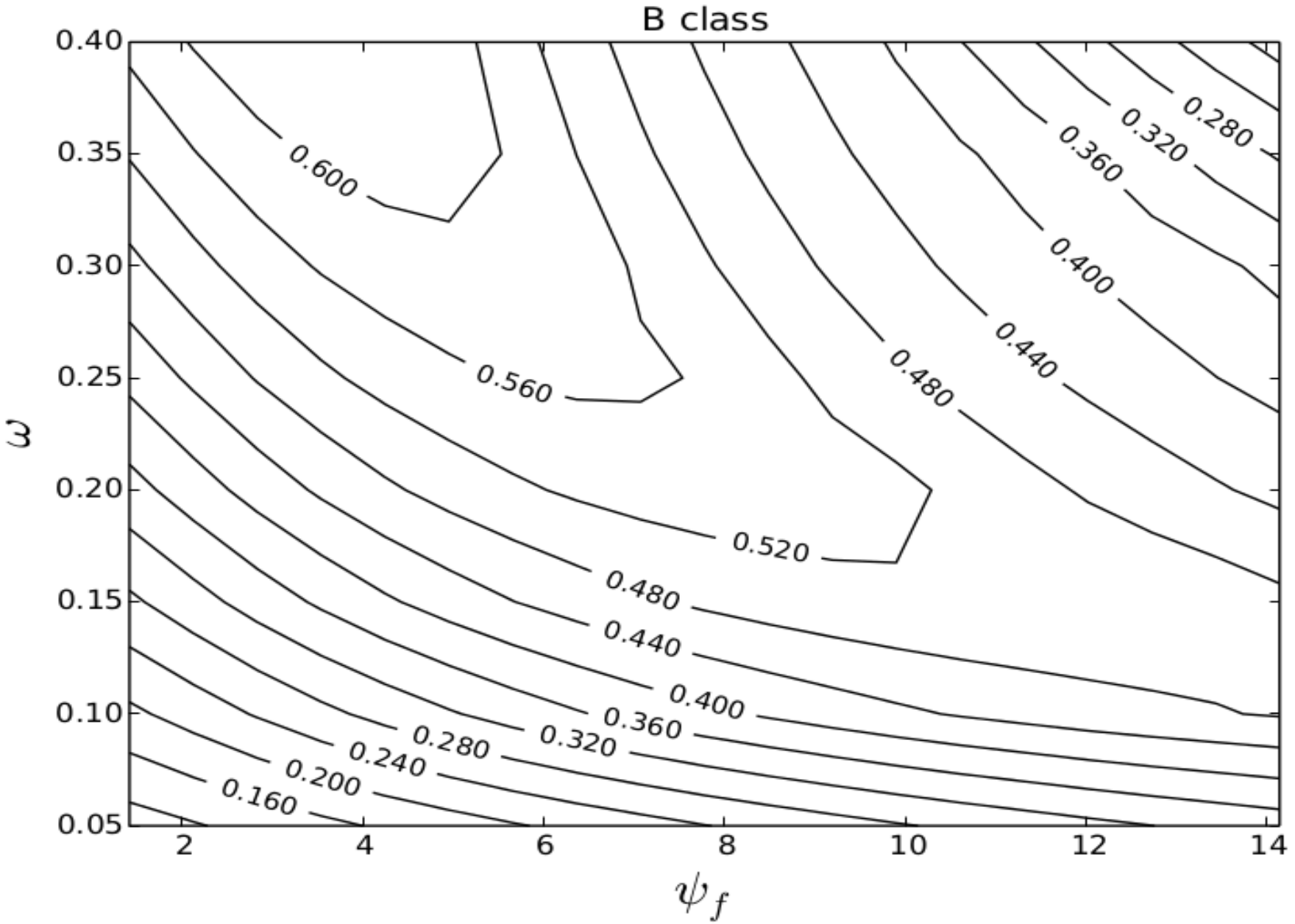
Contribution of entire meteors



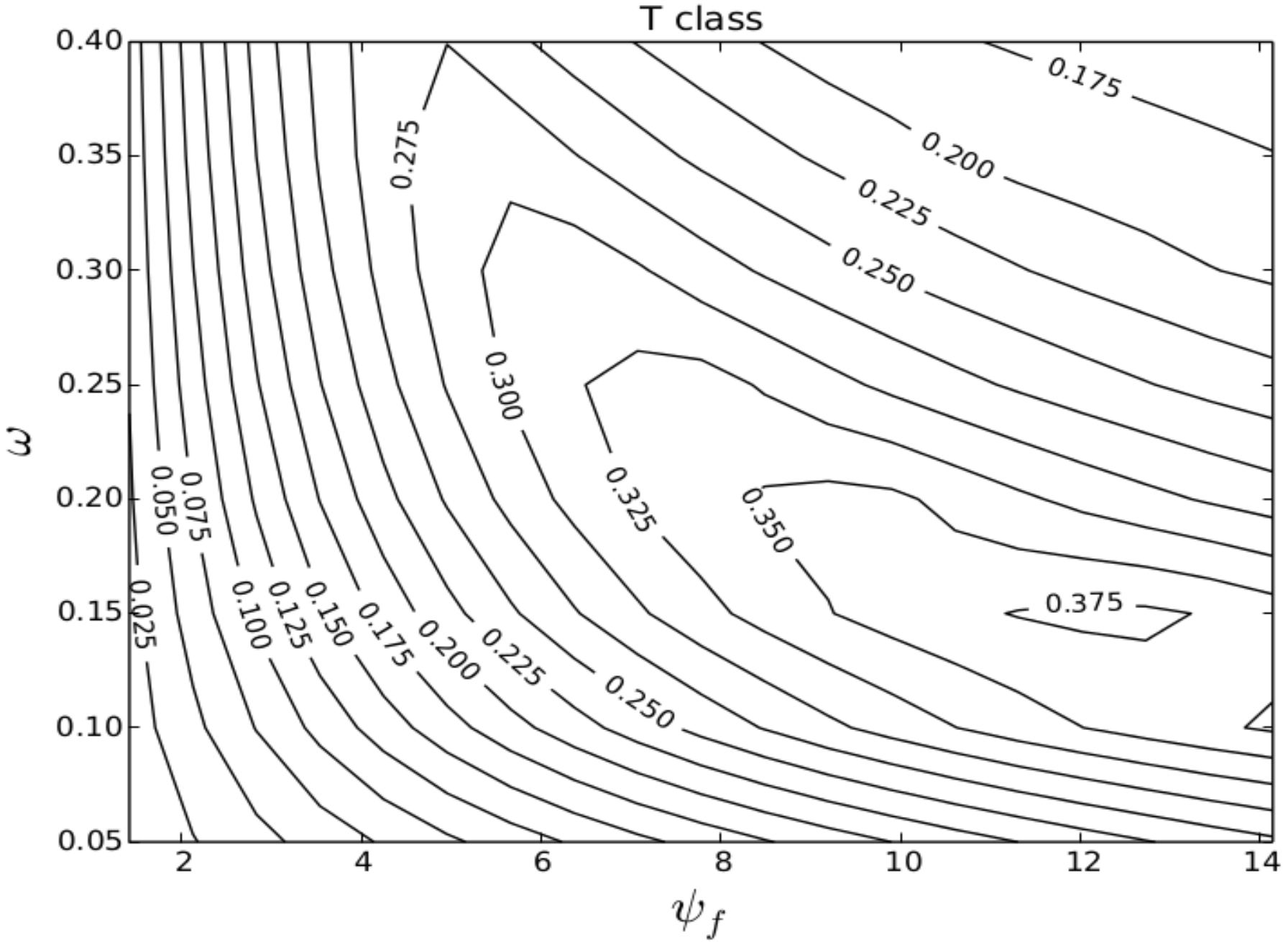
Contribution of meteors passing across the field of view



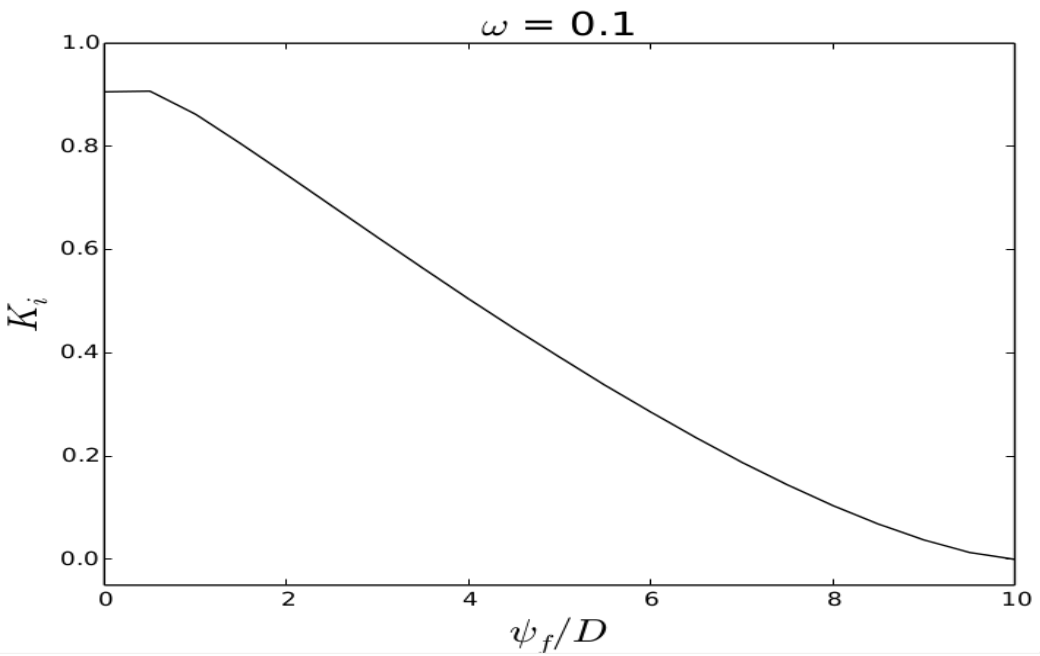
Contribution of meteors with beginnings only

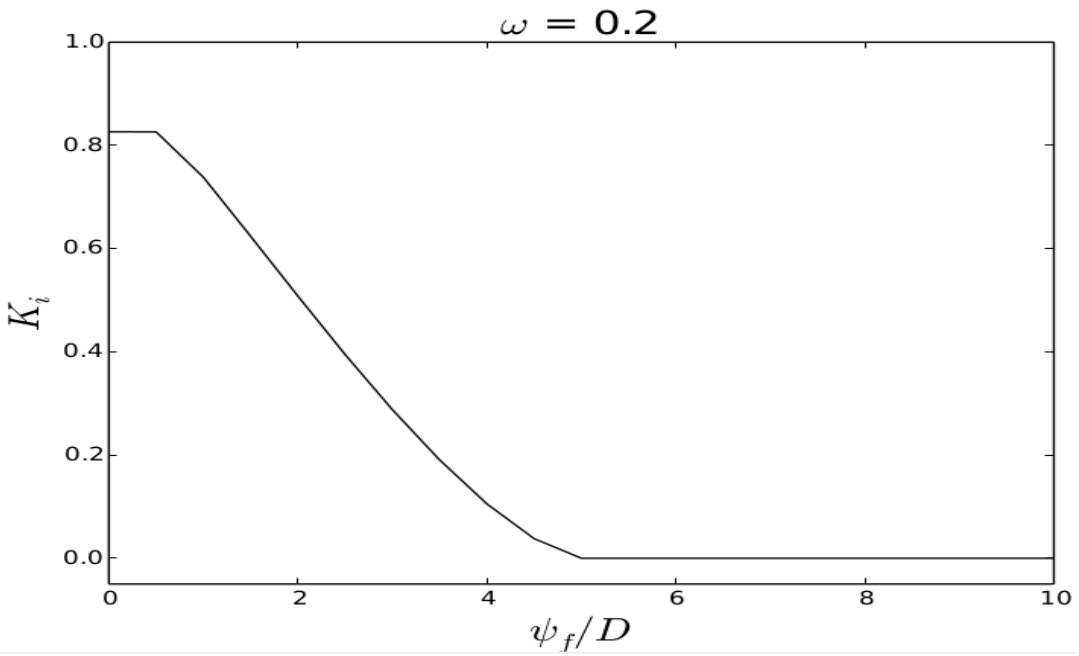


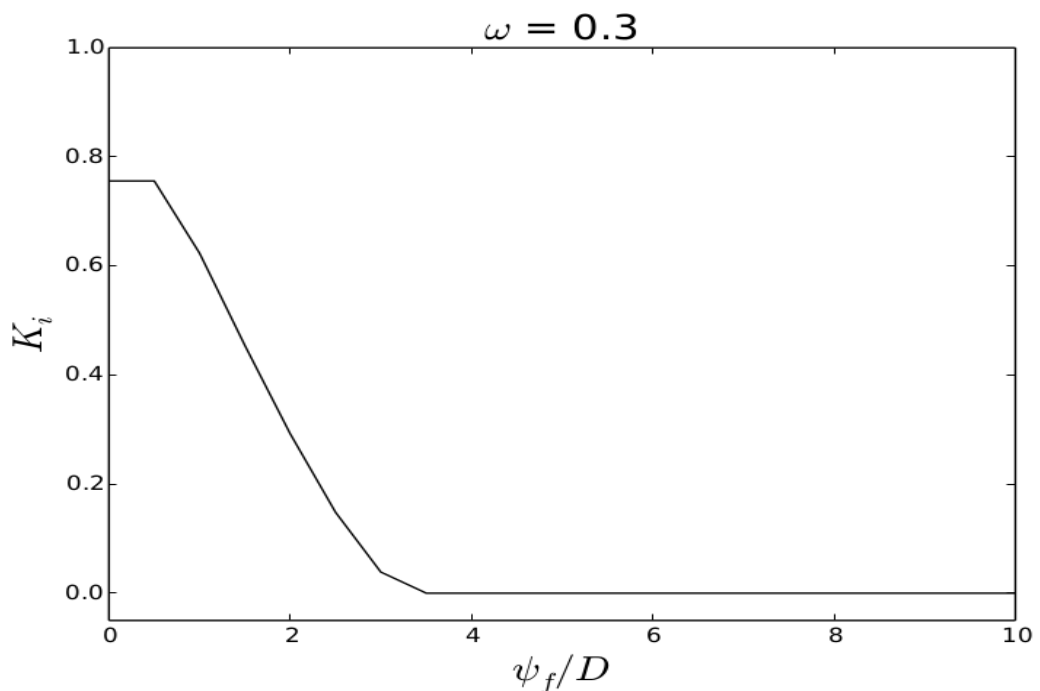
Contribution of meteors with terminations only

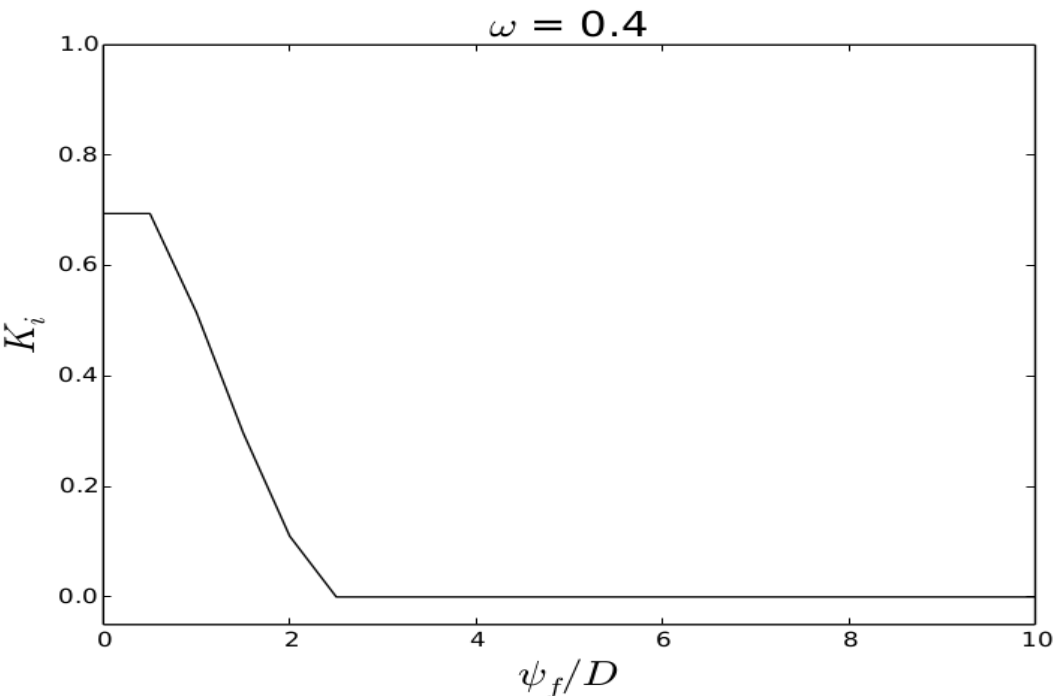


Effective field of view for entire meteors









Suggestion instead of conclusion

- Importance of research increases with growing on meteor camera networks.
- Applicability in other fields (biology: counting species in field of view of microscopes).

Suggestions for further work are welcomed at the poster session.

Thank you!