

Physics 535 – Lecture 16

Physics of Lightning

Storm Simulator Homework #5

2/24/16

Richard Sonnenfeld

**Physics Department &
Langmuir Laboratory for Atmospheric Physics
New Mexico Institute of Mining and Technology**

(Photo courtesy of Harald Edens)

Problem 5-1

Calculate relaxation time for a medium
with uniform conductivity

Homework 4 and 5

MODEL

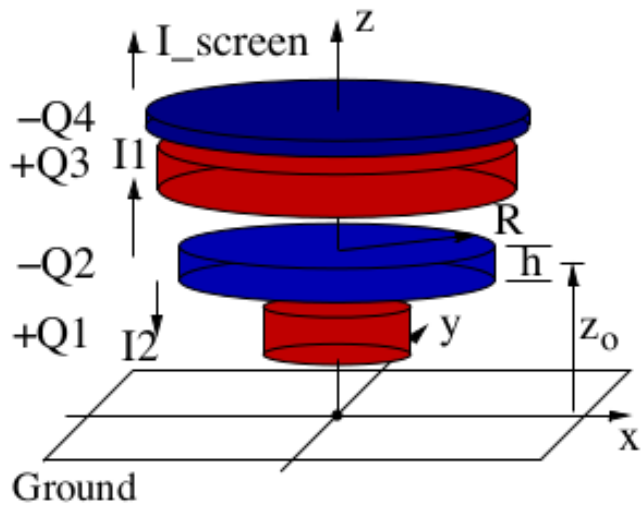
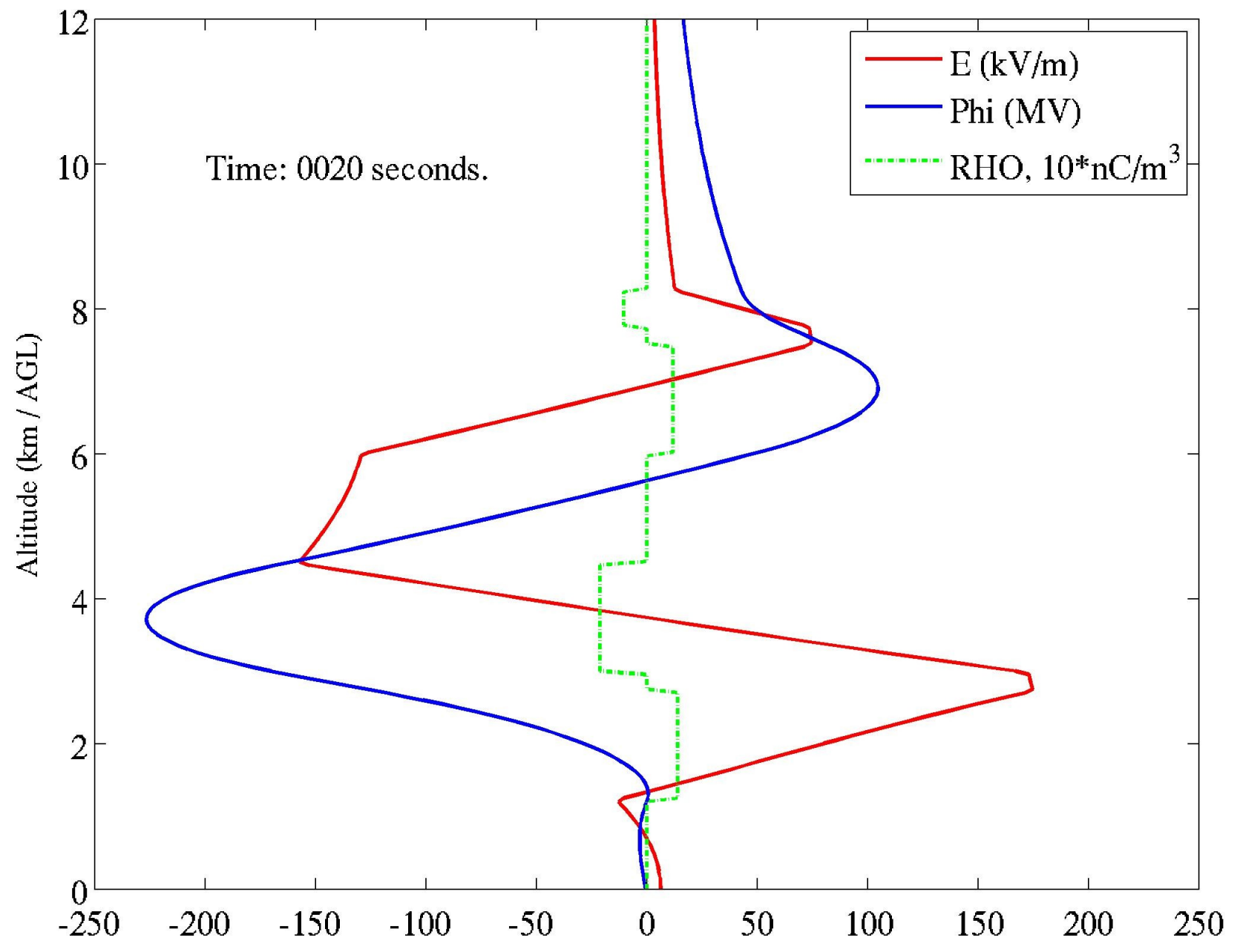


Figure 1. 4-charge disk model. Each disk is specified by z_0 , h , R , and Q . Current I_1 increases the main negative and upper positive charges, while I_2 increases the lower positive and main negative charges.

Problem 5-2

Add charging currents, submit 3 figures

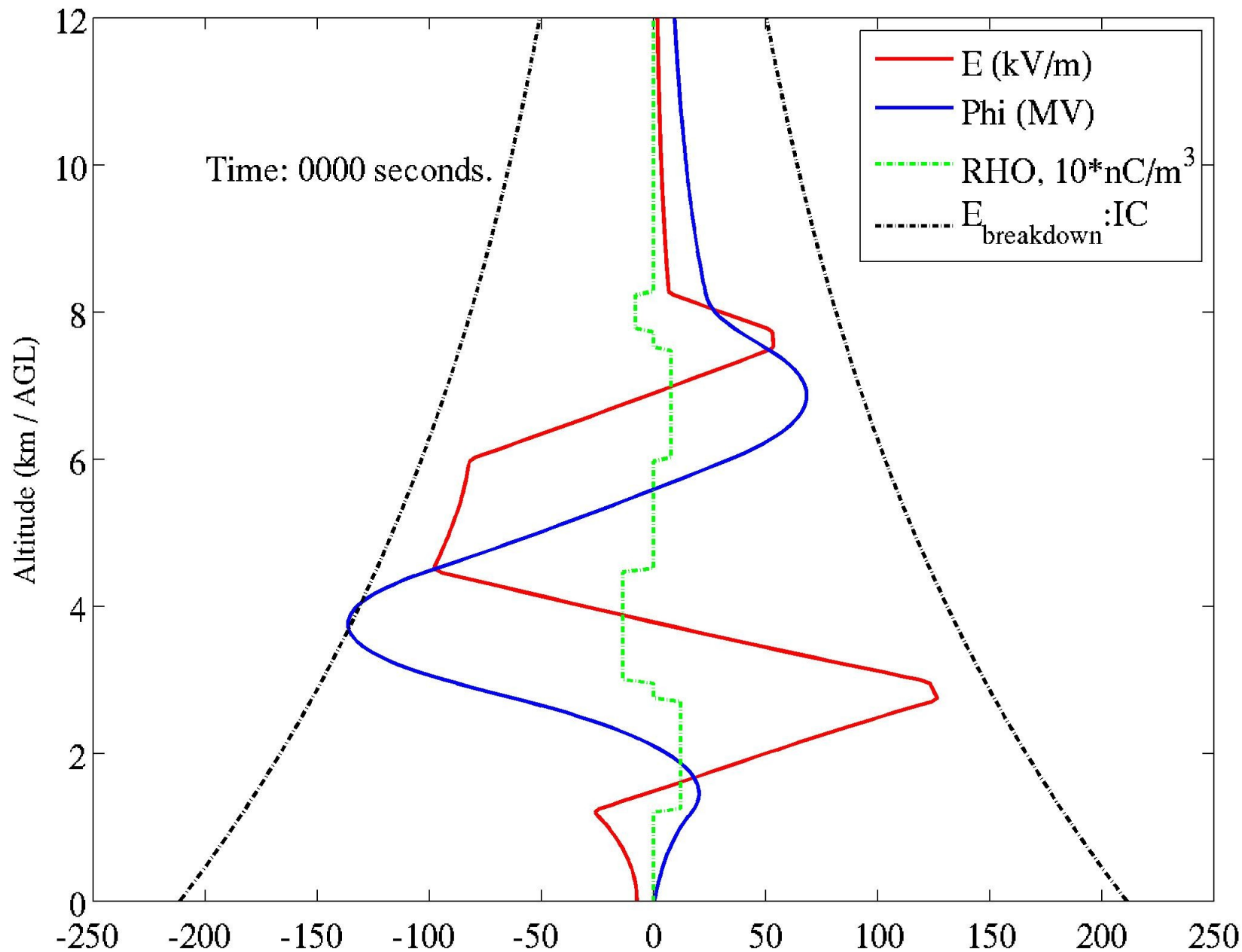
No lightning.



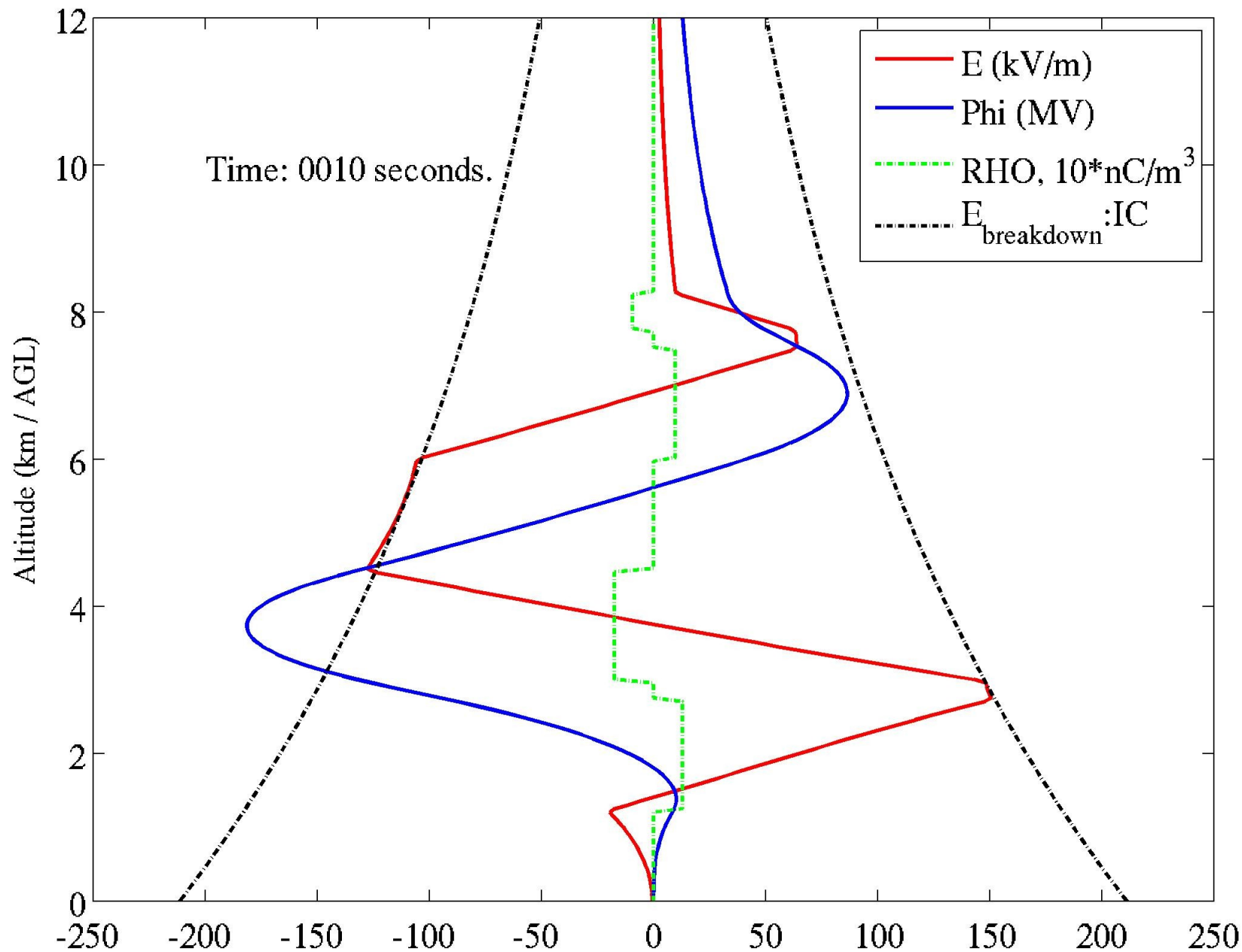
Problem 5-3

Add breakdown field.

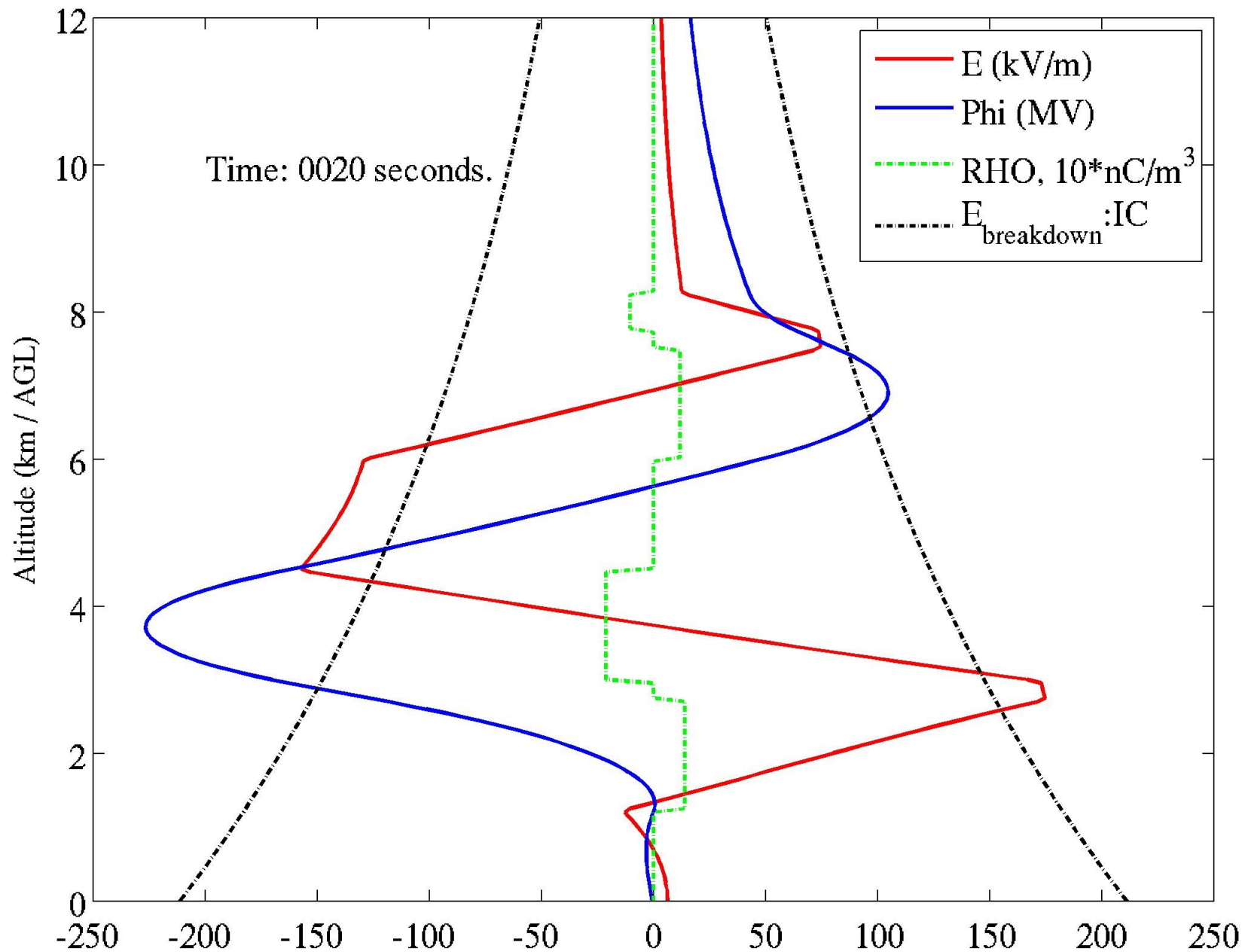
No lightning.



No lightning.



No lightning.



Problem 5-4

Add log

STORM SIMULATOR

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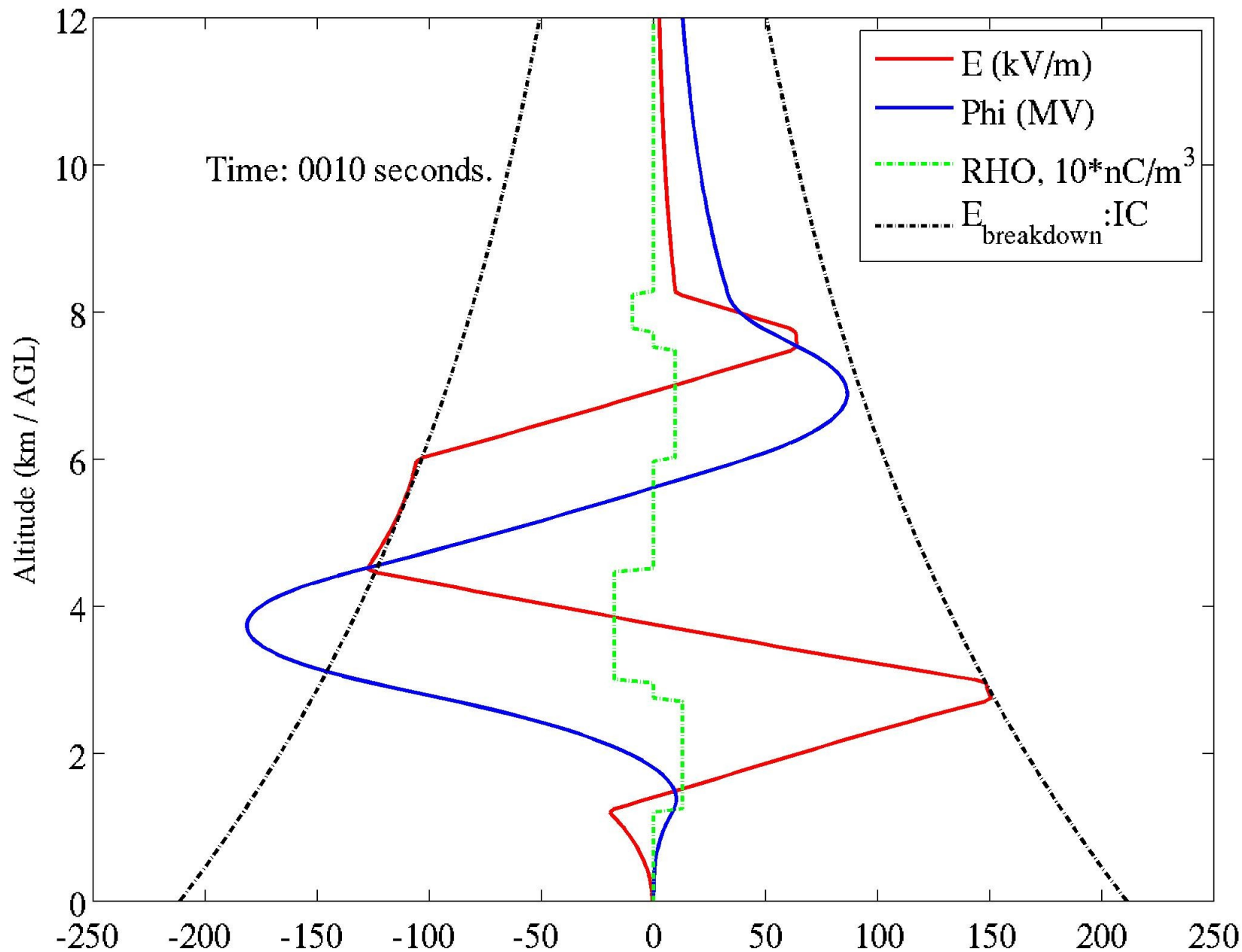
Time (s)	Flash type	Alt (km)	Q_LP (C)	Q_MN (C)	Q_UP (C)	Q_SC (C)	Q_gnd (Amp)	I_scrn
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0000	NF	0.0	13.0	-58.0	60.00	-20.0	0.0	0.000
0010	NF	0.0	14.0	-74.0	75.00	-23.1	0.0	0.000
0020	NF	0.0	15.0	-90.0	90.00	-26.2	0.0	0.000
0030	NF	0.0	16.0	-106.0	105.00	-29.3	0.0	0.000
0040	NF	0.0	17.0	-122.0	120.00	-32.4	0.0	0.000
0050	NF	0.0	18.0	-138.0	135.00	-35.5	0.0	0.000
0060	NF	0.0	19.0	-154.0	150.00	-38.6	0.0	0.000
0070	NF	0.0	20.0	-170.0	165.00	-41.7	0.0	0.000
0080	NF	0.0	21.0	-186.0	180.00	-44.8	0.0	0.000
0090	NF	0.0	22.0	-202.0	195.00	-47.9	0.0	0.000

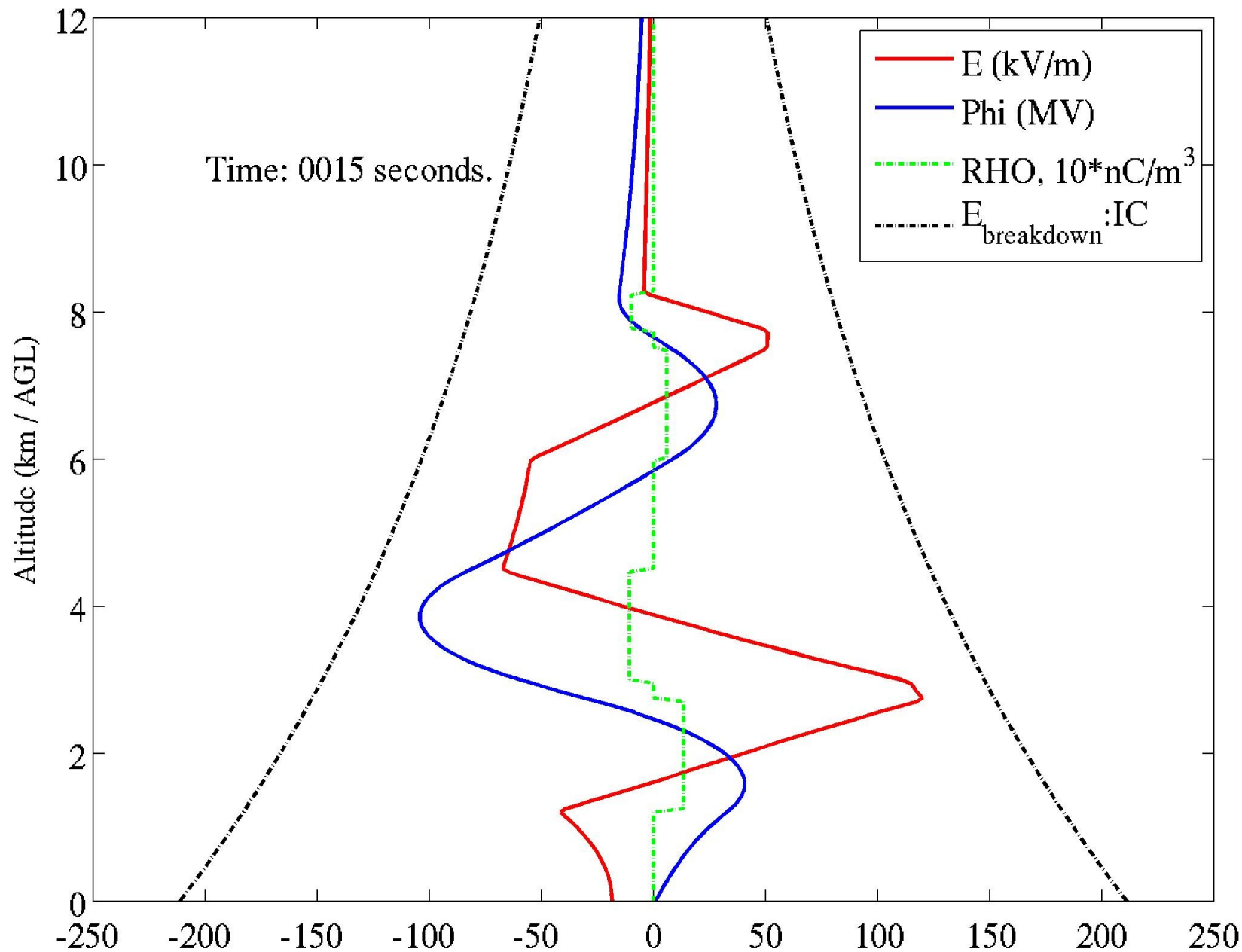
Problem 5-5

Detect flashes, change charges

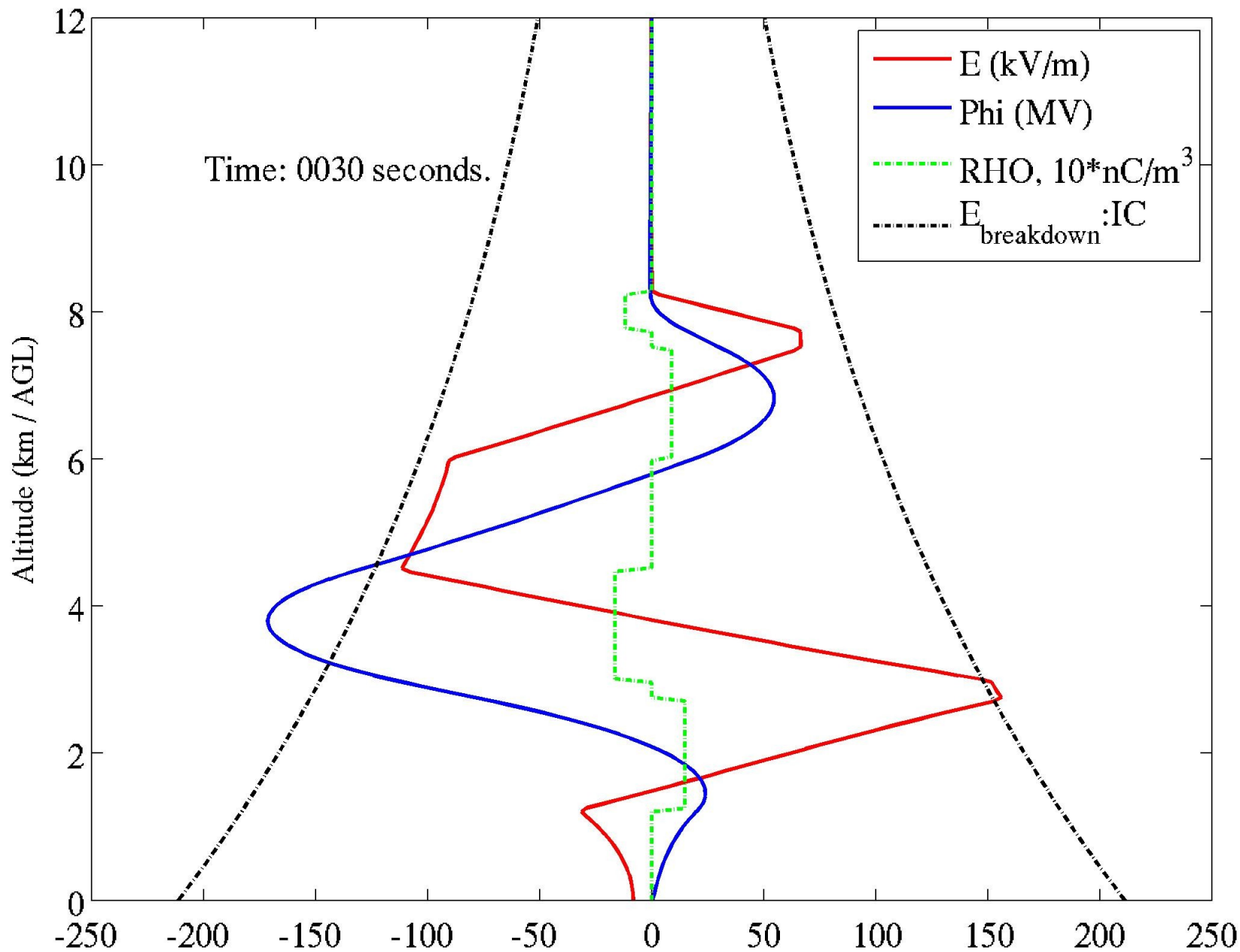
Intra-cloud flash



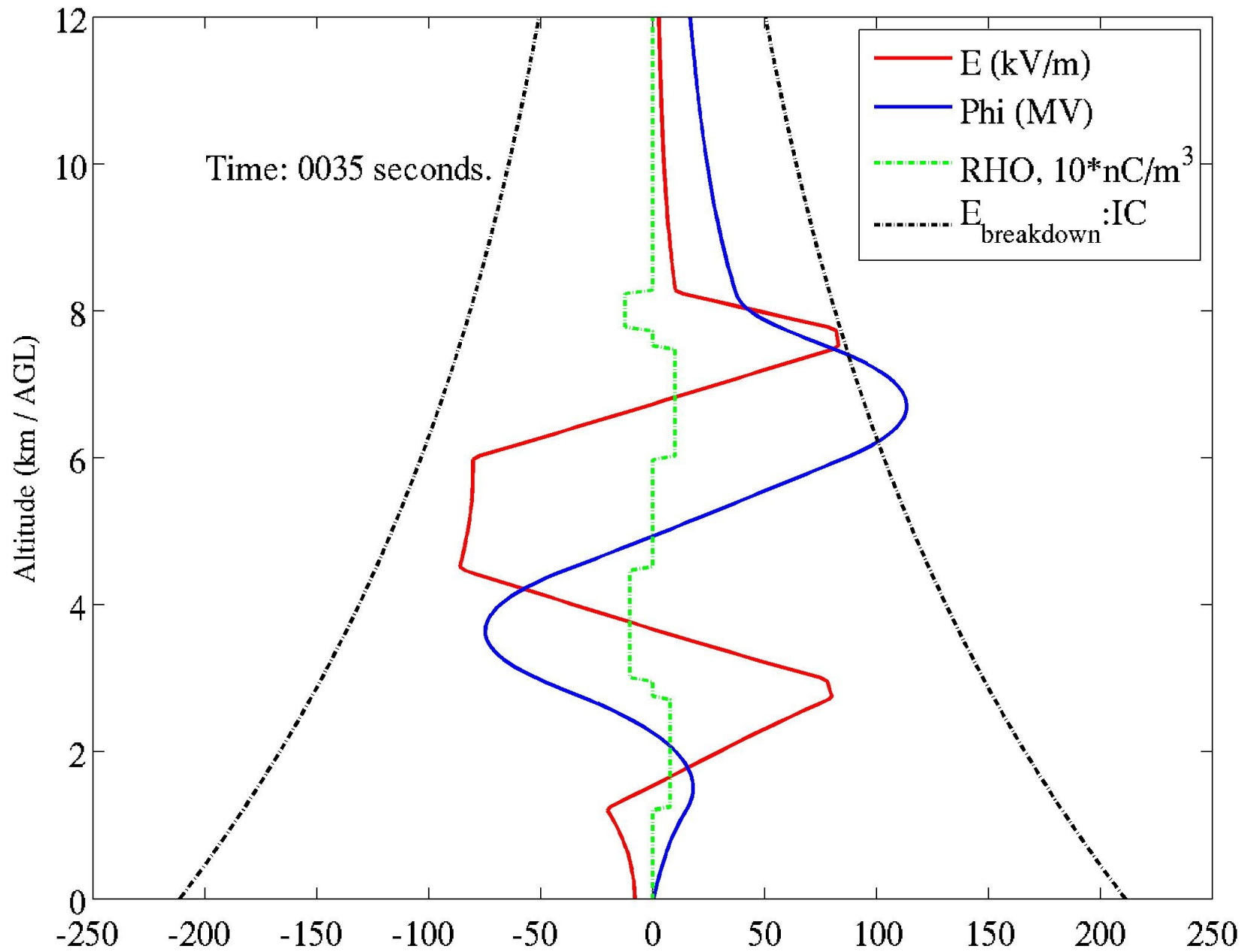
No lightning.



Cloud-to-ground flash



No lightning.



Problem 5-6

Make screening currents depend on field,
add relaxation

Problem 5-6

Make screening currents depend on field, add relaxation

STORM SIMULATOR

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Time (s)	Flash type	Alt (km)	Q_LP (C)	Q_MN (C)	Q_UP (C)	Q_SC (C)	Q_gnd (Amp)	I_scrn
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0000	NF	0.0	13.0	-58.0	60.00	-20.0	0.0	0.000
0005	NF	0.0	13.5	-66.0	67.50	-18.8	0.0	-0.094
0010	NF	0.0	14.0	-74.0	75.00	-18.0	0.0	-0.158
0015	IC	6.0	14.5	-45.0	45.50	-17.6	0.0	-0.215
0020	NF	0.0	15.0	-53.0	53.00	-16.3	0.0	-0.040
0090	IC	6.0	13.0	-37.9	62.53	-17.1	0.0	-0.400
0095	NF	0.0	13.5	-45.9	70.03	-16.9	0.0	-0.252

