Spectropolarimetric inversions of solar lower atmosphere

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Radiative transfer

$$\mu \frac{dI_\nu}{d\tau_\nu} = I_\nu(\tau_\nu) - S_\nu(\tau_\nu)$$

I_ν is the intensity and S_ν is the source function

$S_\nu = \epsilon_\nu / \kappa_\nu$ where ϵ_ν is the emissivity e κ_ν is the absorption matrix

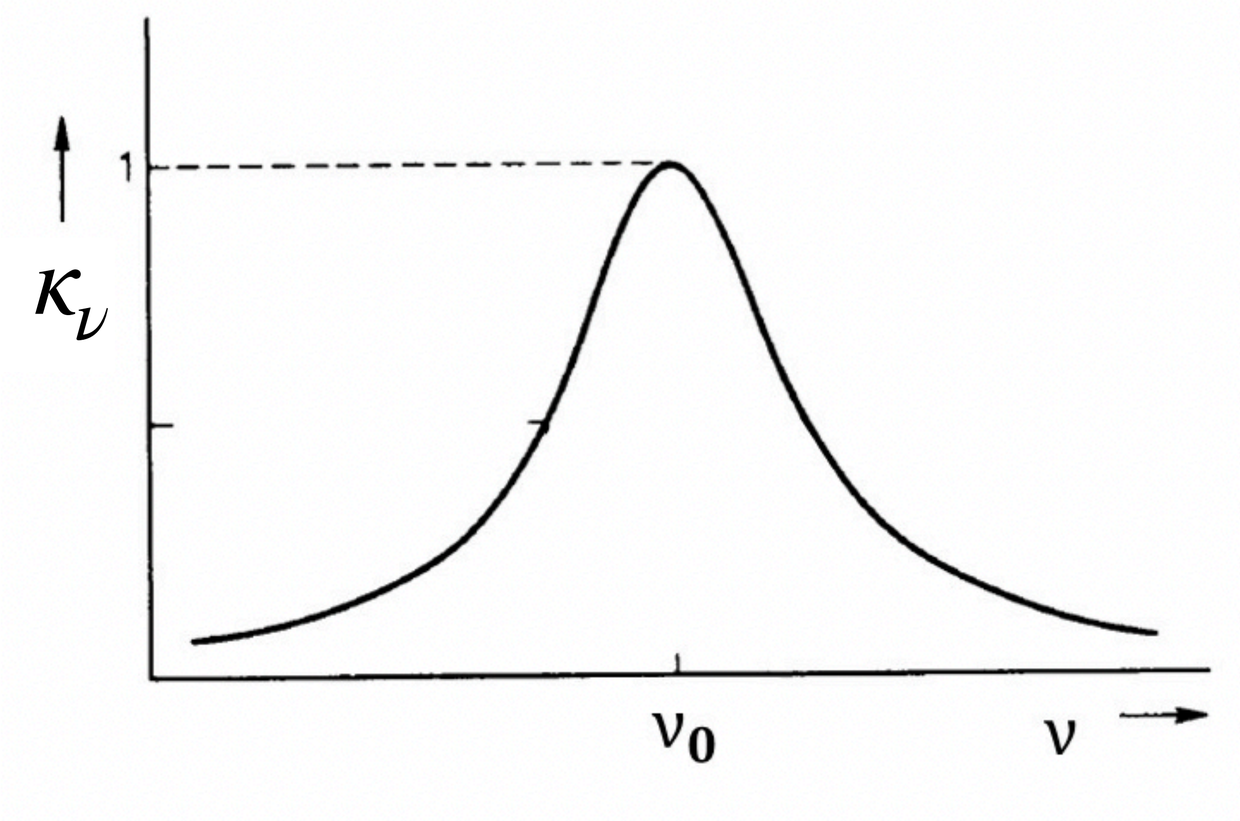
$\mu = cos\theta$ where θ is the angle of the line of sight with the center of the disk

Radiative transfer

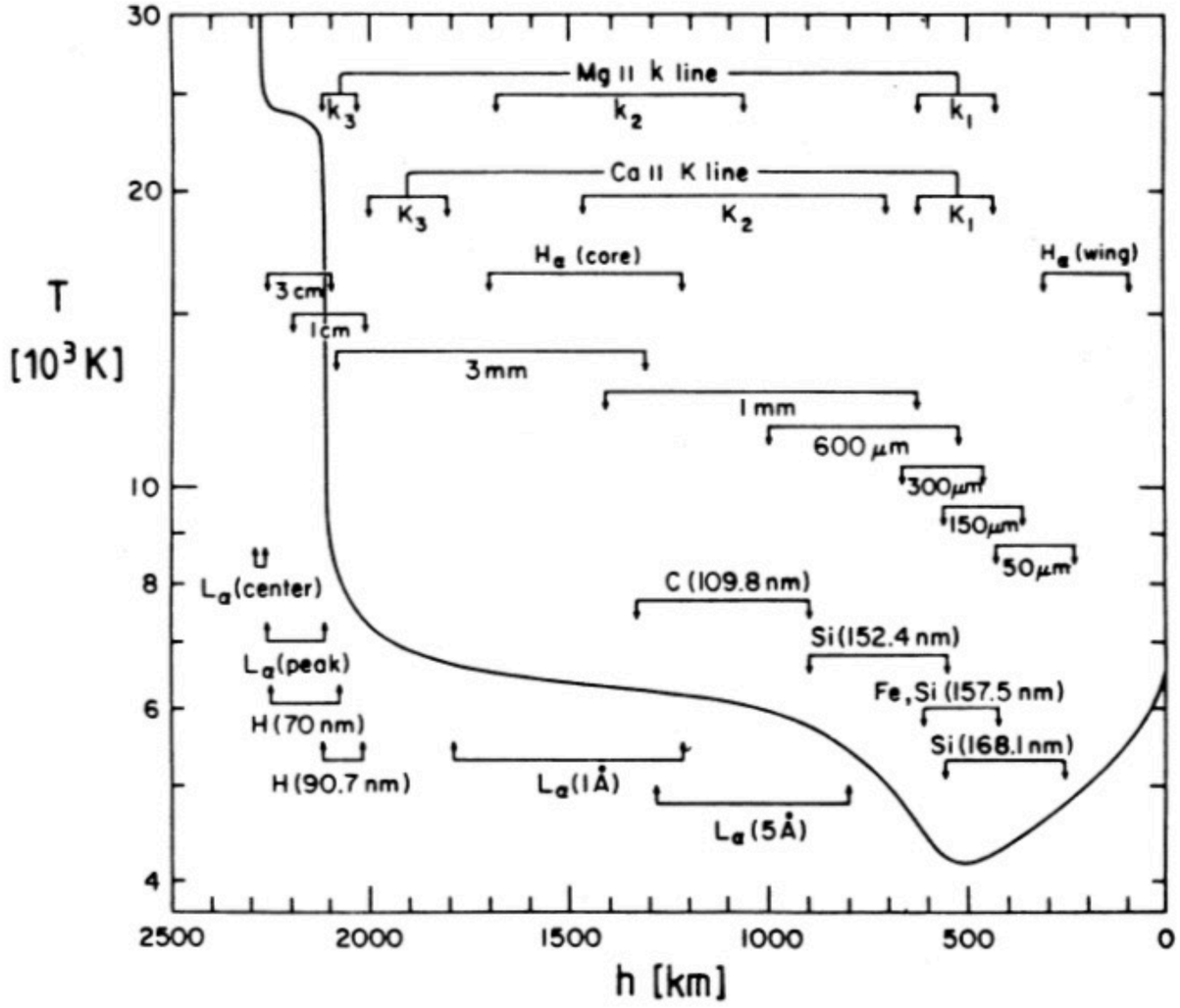
$$\mu \frac{dI_\nu}{d\tau_\nu} = I_\nu(\tau_\nu) - S_\nu(\tau_\nu)$$

Atmospheric conditions go into ϵ_ν and κ_ν, by consequence into τ_ν and S_ν. Both changes with T, p, ν and the abundances.

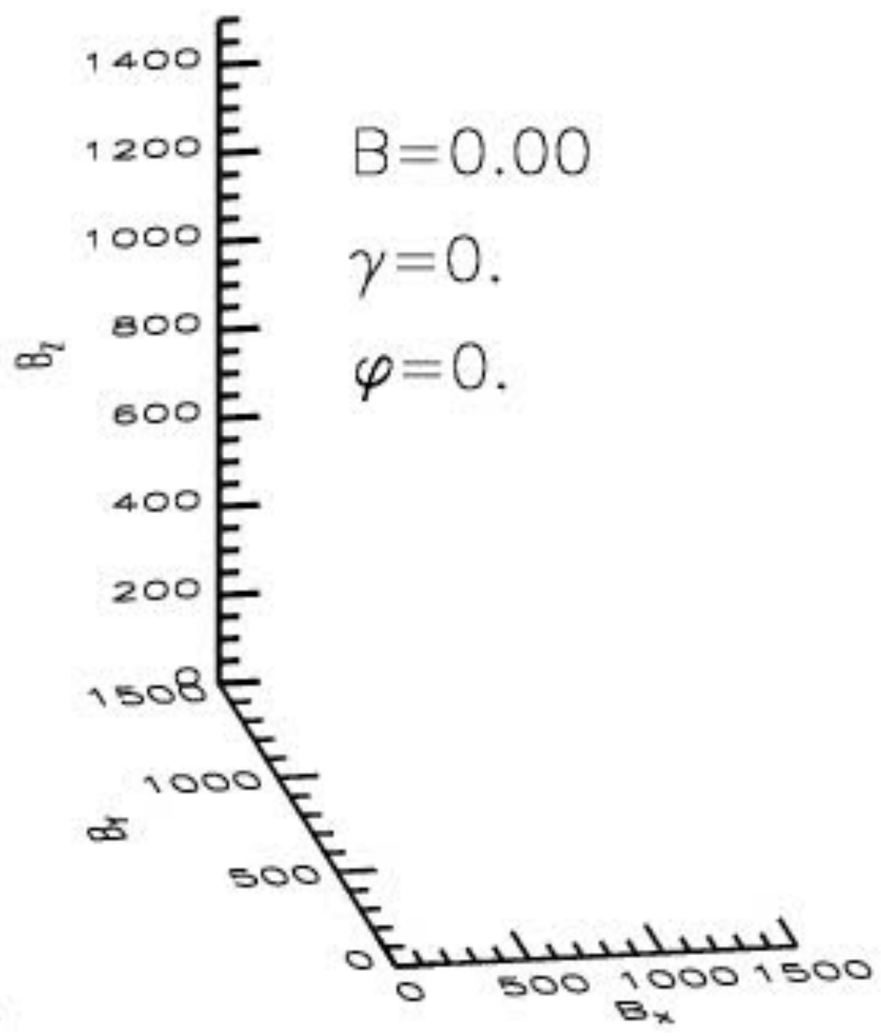
Absorption profile

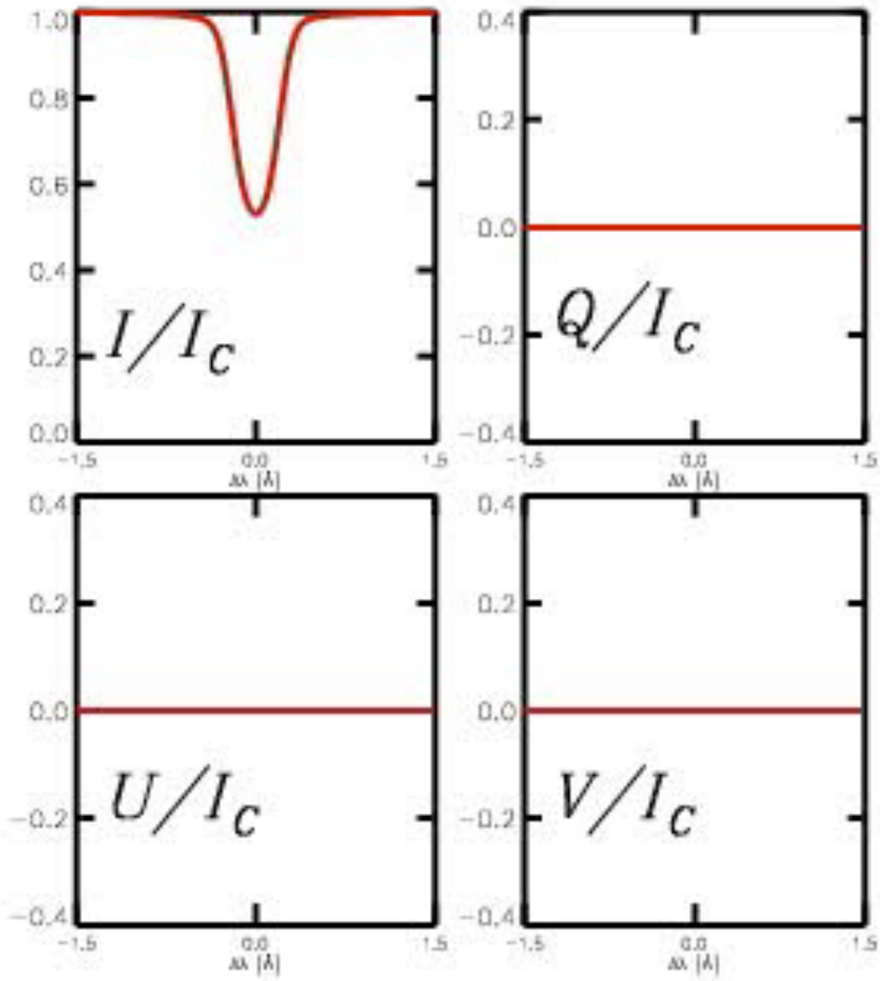


Formation height



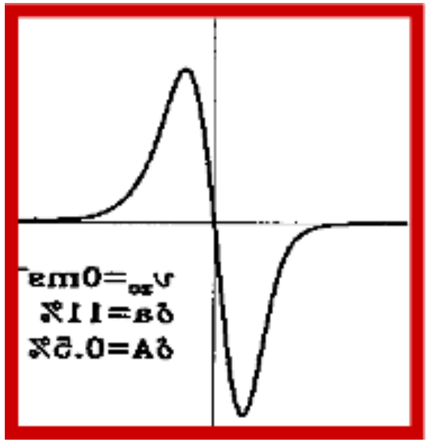
Stokes parameters (I,Q,U,V)



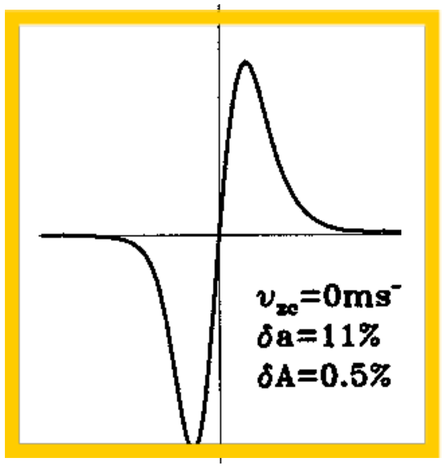


Filing factor

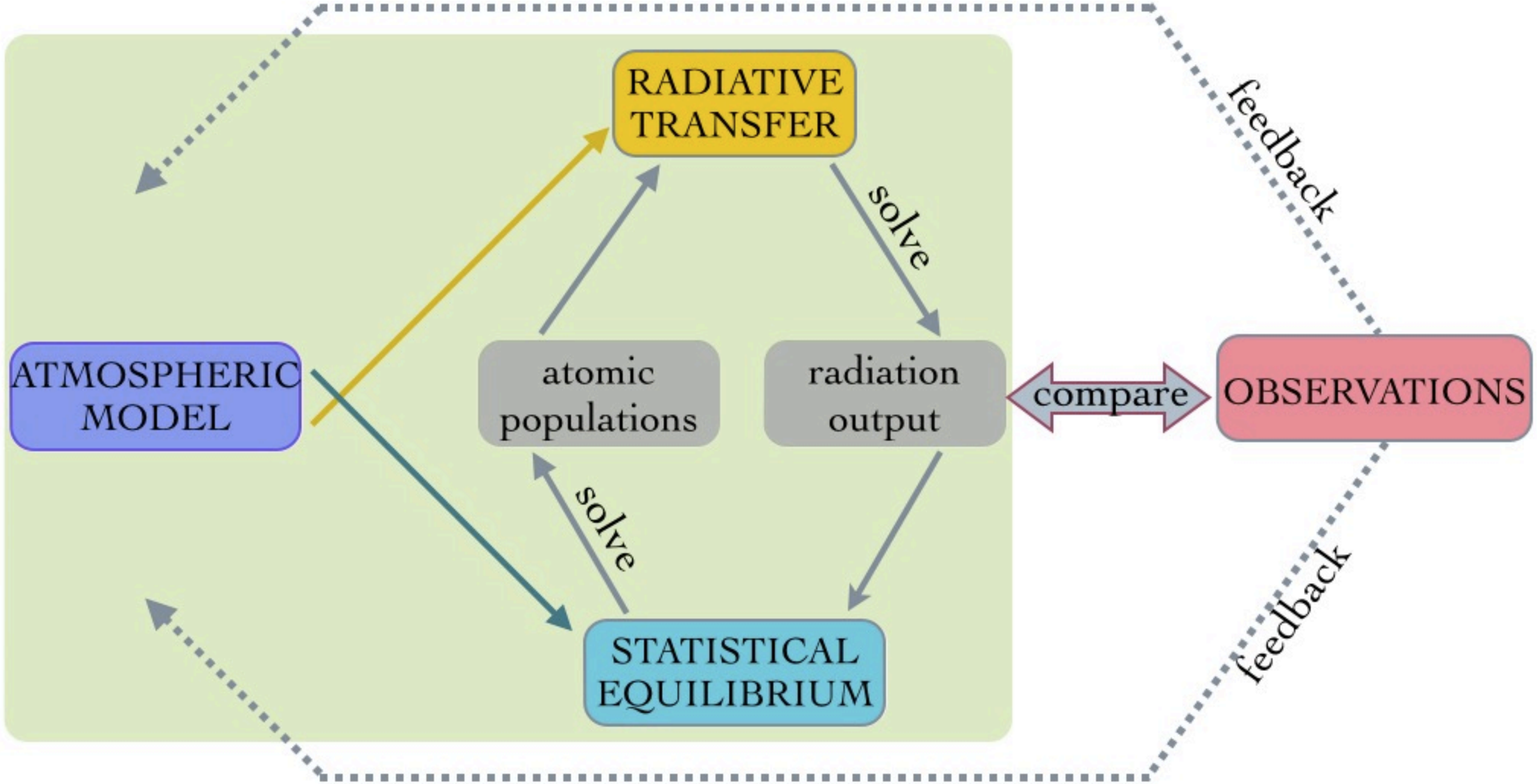
Positive polarity



Negative polarity

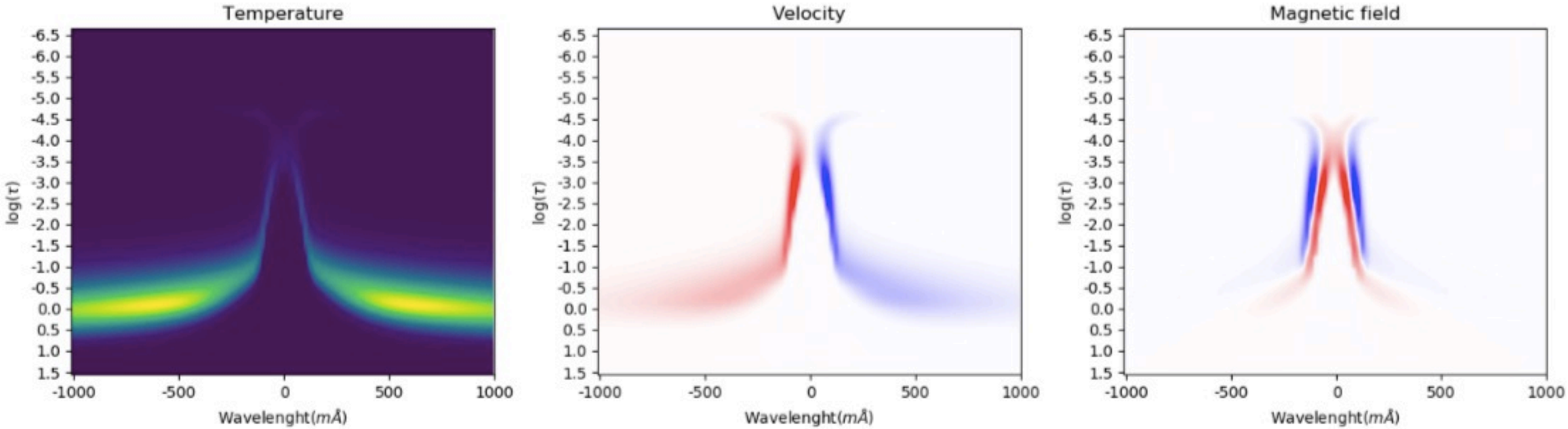


Inversion of the radiative transfer equation

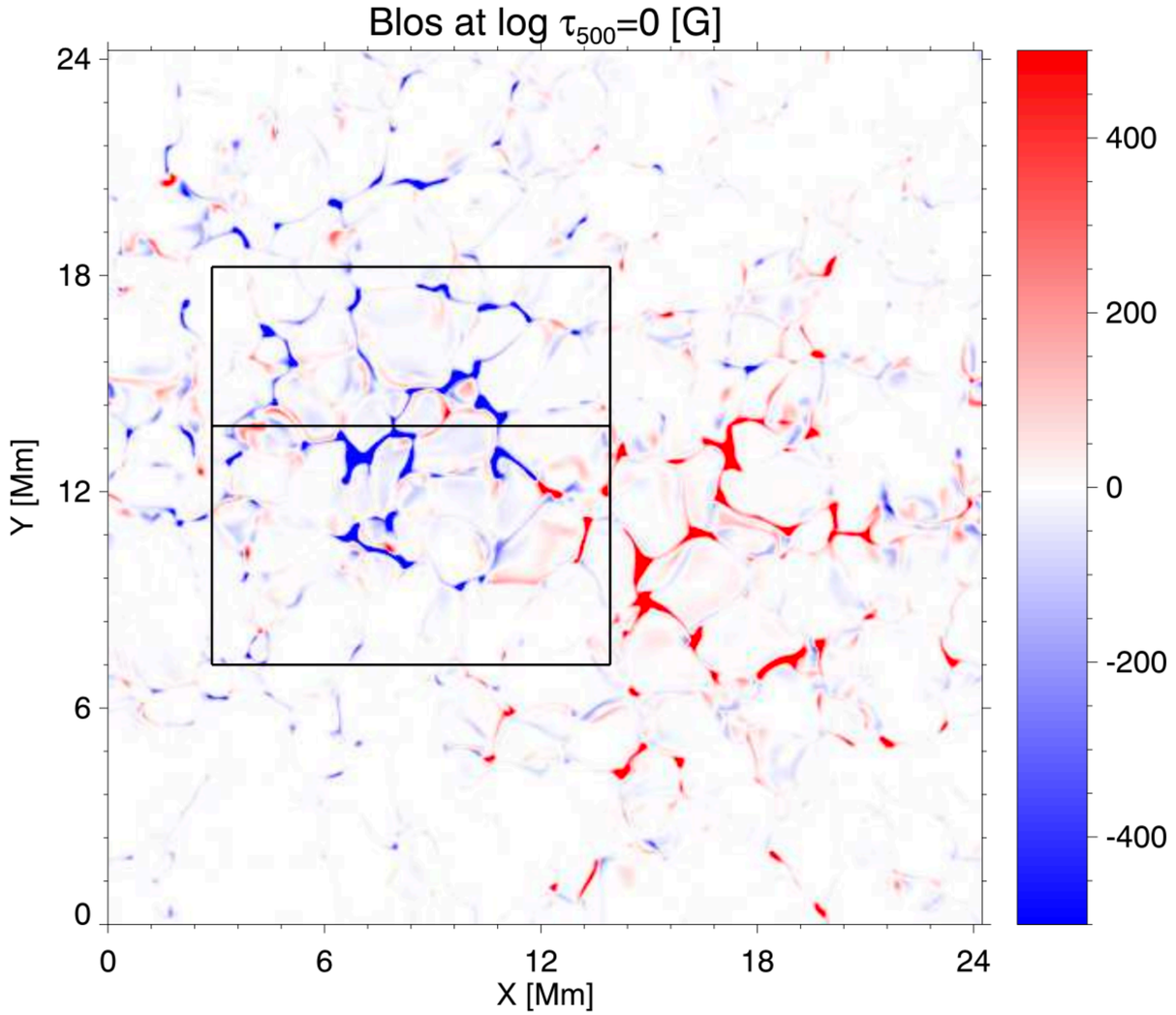


Inversions of solar parameters

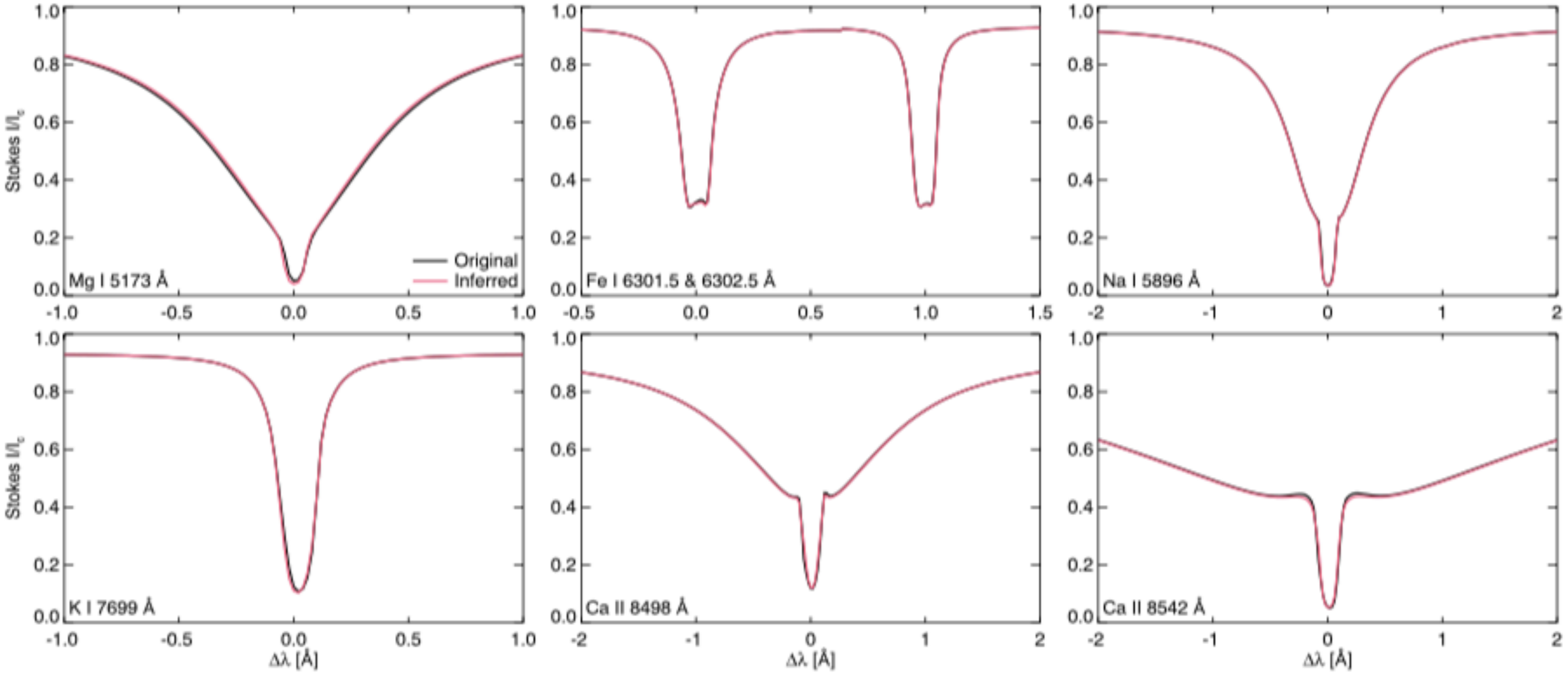
Response function



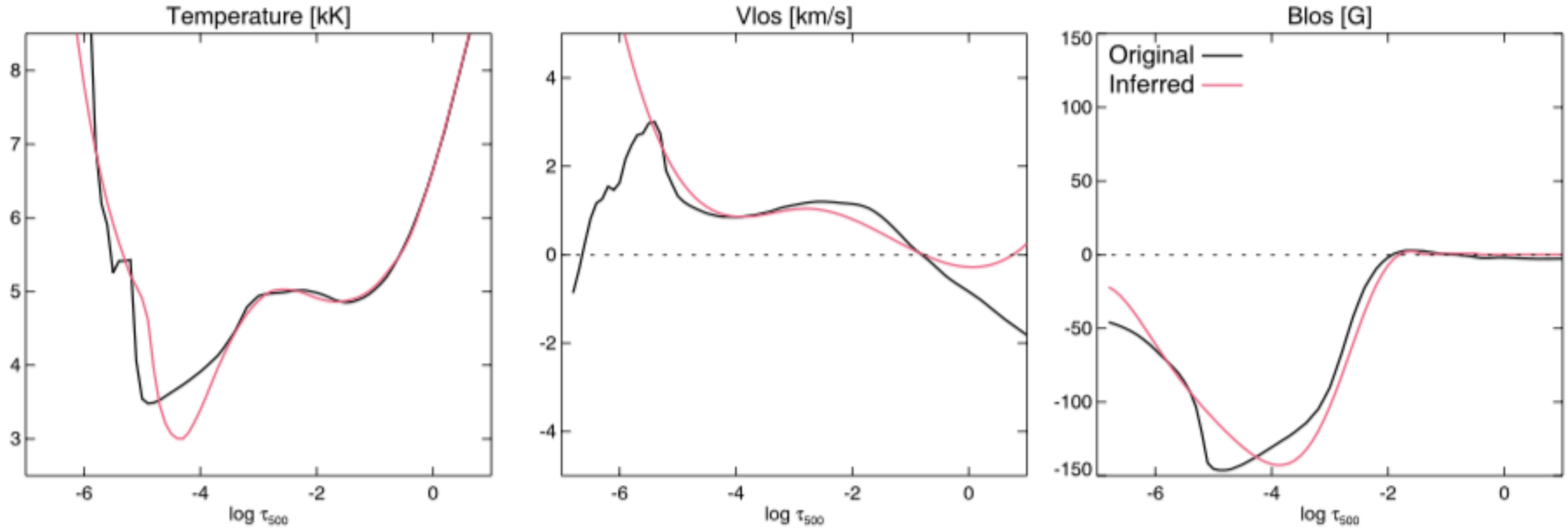
How well can we retrieve the “real” solar atmosphere



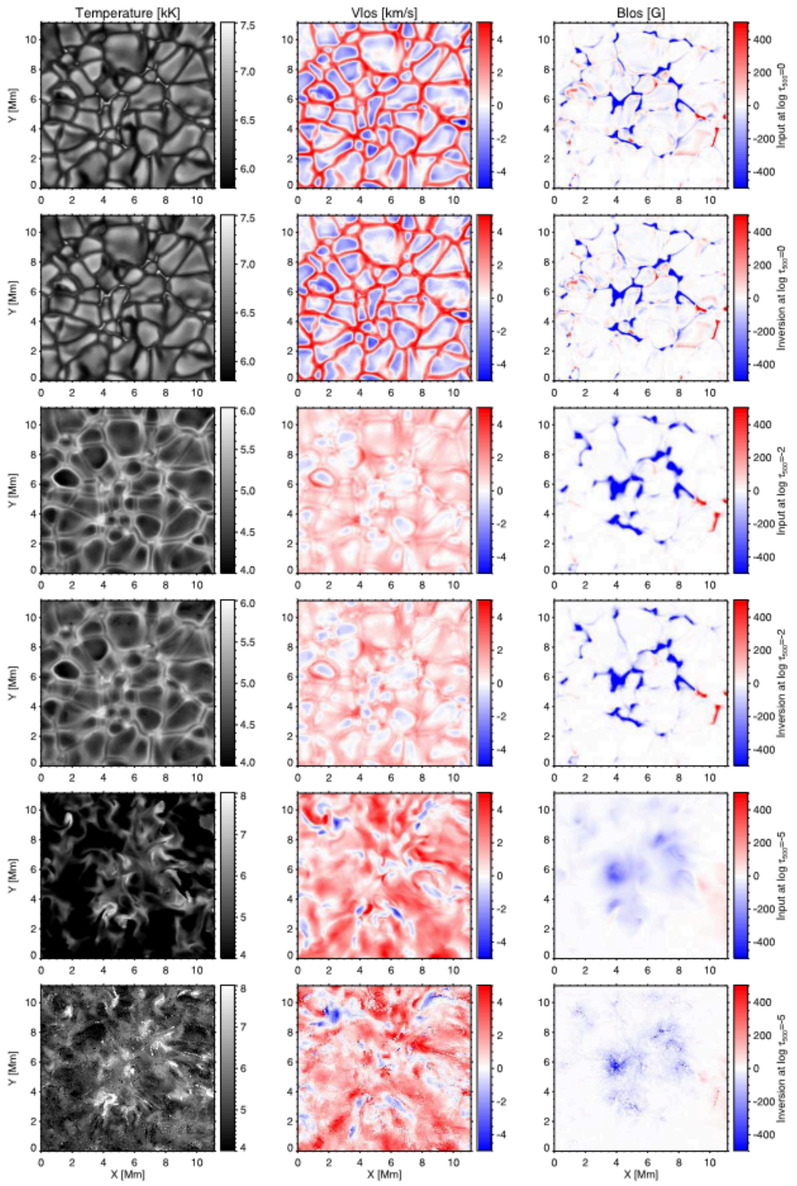
Inversions of solar parameters



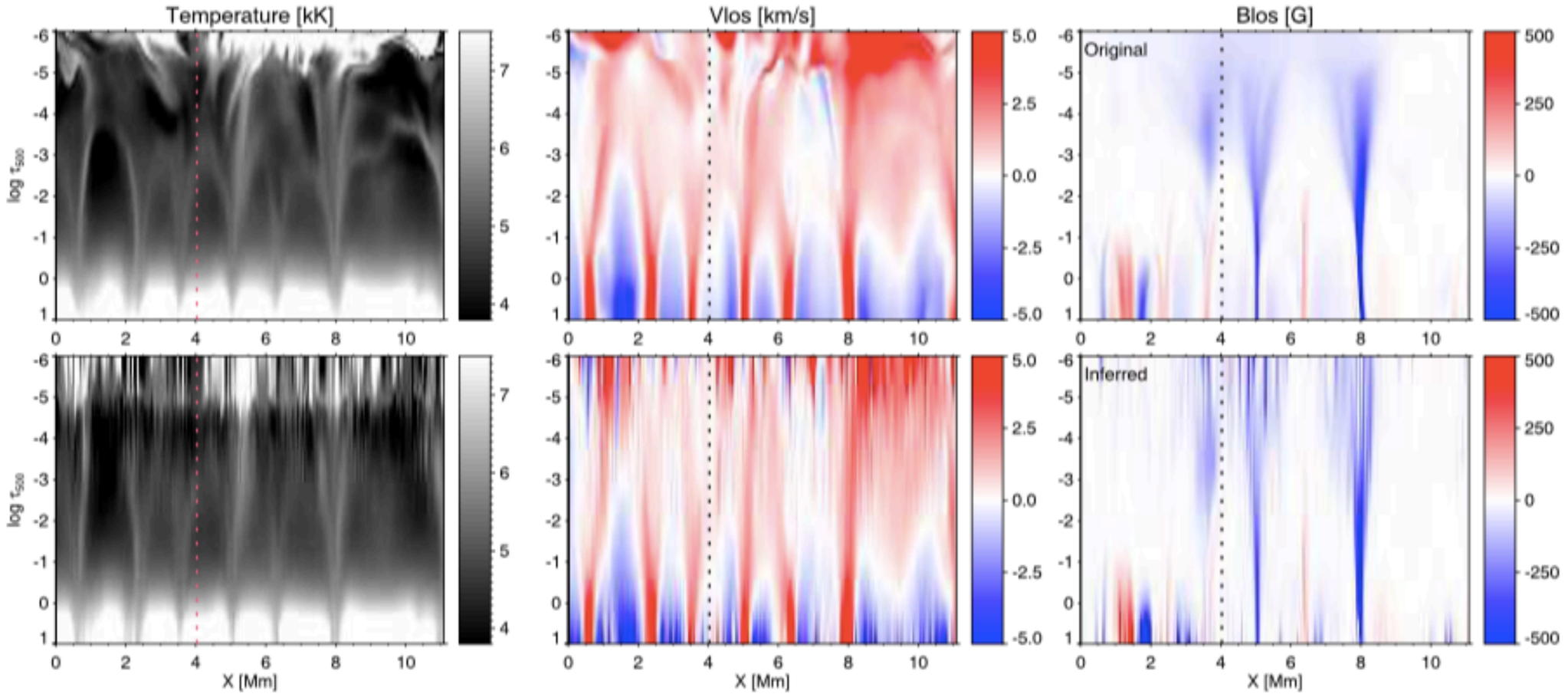
Inversions of solar parameters



Inversions of solar parameters



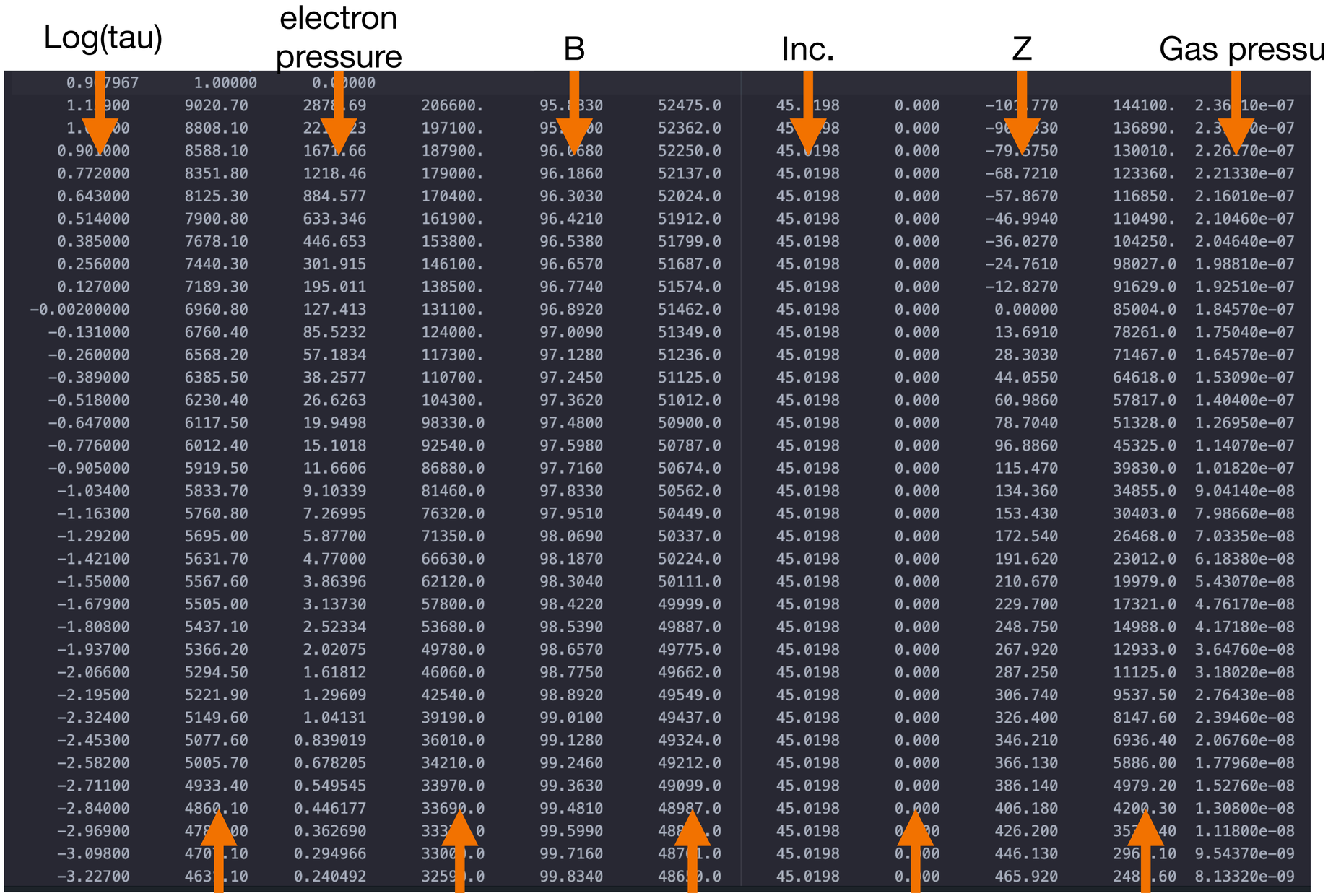
Inversions of solar parameters



Original

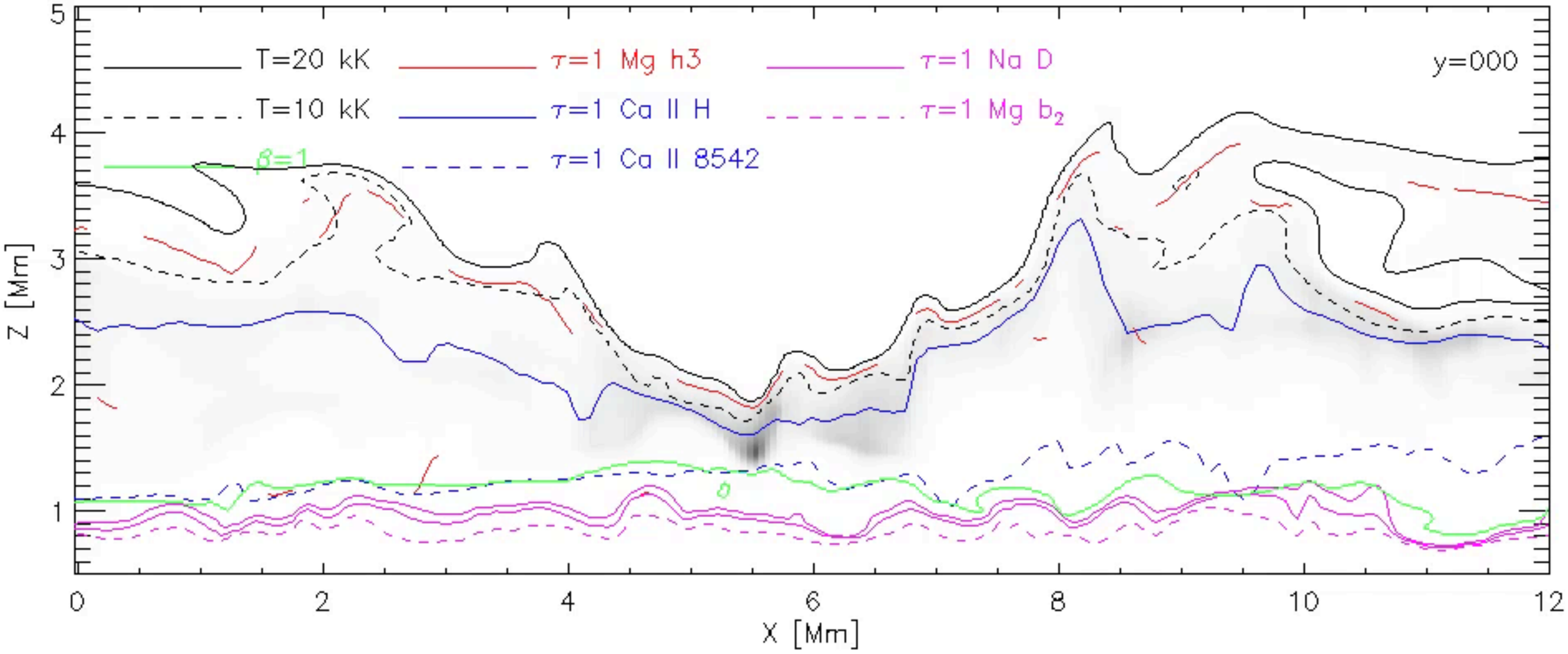
Estimada

Model atmosphere



Log(tau)	Temperature	electron pressure	Mic. Turbulence	B	V	Inc.	Azim.	Z	Gas pressure	Gas density
0.9[illegible]7967	1.00000	0.[illegible]0000								
1.1[illegible]900	9020.70	287[illegible].69	206600.	95.[illegible]330	52475.0	45.[illegible]198	0.000	−101.[illegible]770	144100.	2.36[illegible]10e−07
1.[illegible]00	8808.10	221[illegible]23	197100.	95[illegible]00	52362.0	45[illegible]98	0.000	−9[illegible]330	136890.	2.3[illegible]0e−07
0.901000	8588.10	1671.66	187900.	96.0680	52250.0	45.0198	0.000	−79.5750	130010.	2.26170e−07
0.772000	8351.80	1218.46	179000.	96.1860	52137.0	45.0198	0.000	−68.7210	123360.	2.21330e−07
0.643000	8125.30	884.577	170400.	96.3030	52024.0	45.0198	0.000	−57.8670	116850.	2.16010e−07
0.514000	7900.80	633.346	161900.	96.4210	51912.0	45.0198	0.000	−46.9940	110490.	2.10460e−07
0.385000	7678.10	446.653	153800.	96.5380	51799.0	45.0198	0.000	−36.0270	104250.	2.04640e−07
0.256000	7440.30	301.915	146100.	96.6570	51687.0	45.0198	0.000	−24.7610	98027.0	1.98810e−07
0.127000	7189.30	195.011	138500.	96.7740	51574.0	45.0198	0.000	−12.8270	91629.0	1.92510e−07
−0.00200000	6960.80	127.413	131100.	96.8920	51462.0	45.0198	0.000	0.00000	85004.0	1.84570e−07
−0.131000	6760.40	85.5232	124000.	97.0090	51349.0	45.0198	0.000	13.6910	78261.0	1.75040e−07
−0.260000	6568.20	57.1834	117300.	97.1280	51236.0	45.0198	0.000	28.3030	71467.0	1.64570e−07
−0.389000	6385.50	38.2577	110700.	97.2450	51125.0	45.0198	0.000	44.0550	64618.0	1.53090e−07
−0.518000	6230.40	26.6263	104300.	97.3620	51012.0	45.0198	0.000	60.9860	57817.0	1.40400e−07
−0.647000	6117.50	19.9498	98330.0	97.4800	50900.0	45.0198	0.000	78.7040	51328.0	1.26950e−07
−0.776000	6012.40	15.1018	92540.0	97.5980	50787.0	45.0198	0.000	96.8860	45325.0	1.14070e−07
−0.905000	5919.50	11.6606	86880.0	97.7160	50674.0	45.0198	0.000	115.470	39830.0	1.01820e−07
−1.03400	5833.70	9.10339	81460.0	97.8330	50562.0	45.0198	0.000	134.360	34855.0	9.04140e−08
−1.16300	5760.80	7.26995	76320.0	97.9510	50449.0	45.0198	0.000	153.430	30403.0	7.98660e−08
−1.29200	5695.00	5.87700	71350.0	98.0690	50337.0	45.0198	0.000	172.540	26468.0	7.03350e−08
−1.42100	5631.70	4.77000	66630.0	98.1870	50224.0	45.0198	0.000	191.620	23012.0	6.18380e−08
−1.55000	5567.60	3.86396	62120.0	98.3040	50111.0	45.0198	0.000	210.670	19979.0	5.43070e−08
−1.67900	5505.00	3.13730	57800.0	98.4220	49999.0	45.0198	0.000	229.700	17321.0	4.76170e−08
−1.80800	5437.10	2.52334	53680.0	98.5390	49887.0	45.0198	0.000	248.750	14988.0	4.17180e−08
−1.93700	5366.20	2.02075	49780.0	98.6570	49775.0	45.0198	0.000	267.920	12933.0	3.64760e−08
−2.06600	5294.50	1.61812	46060.0	98.7750	49662.0	45.0198	0.000	287.250	11125.0	3.18020e−08
−2.19500	5221.90	1.29609	42540.0	98.8920	49549.0	45.0198	0.000	306.740	9537.50	2.76430e−08
−2.32400	5149.60	1.04131	39190.0	99.0100	49437.0	45.0198	0.000	326.400	8147.60	2.39460e−08
−2.45300	5077.60	0.839019	36010.0	99.1280	49324.0	45.0198	0.000	346.210	6936.40	2.06760e−08
−2.58200	5005.70	0.678205	34210.0	99.2460	49212.0	45.0198	0.000	366.130	5886.00	1.77960e−08
−2.71100	4933.40	0.549545	33970.0	99.3630	49099.0	45.0198	0.000	386.140	4979.20	1.52760e−08
−2.84000	4860.10	0.446177	33690.0	99.4810	48987.0	45.0198	0.000	406.180	4200.30	1.30800e−08
−2.96900	478[illegible].00	0.362690	333[illegible].0	99.5990	488[illegible].0	45.0198	0[illegible].00	426.200	35[illegible].40	1.11800e−08
−3.09800	470[illegible].10	0.294966	3300[illegible].0	99.7160	4870[illegible].0	45.0198	0.[illegible]00	446.130	296[illegible].10	9.54370e−09
−3.22700	463[illegible].10	0.240492	3259[illegible].0	99.8340	4869[illegible].0	45.0198	0.[illegible]00	465.920	248[illegible].60	8.13320e−09

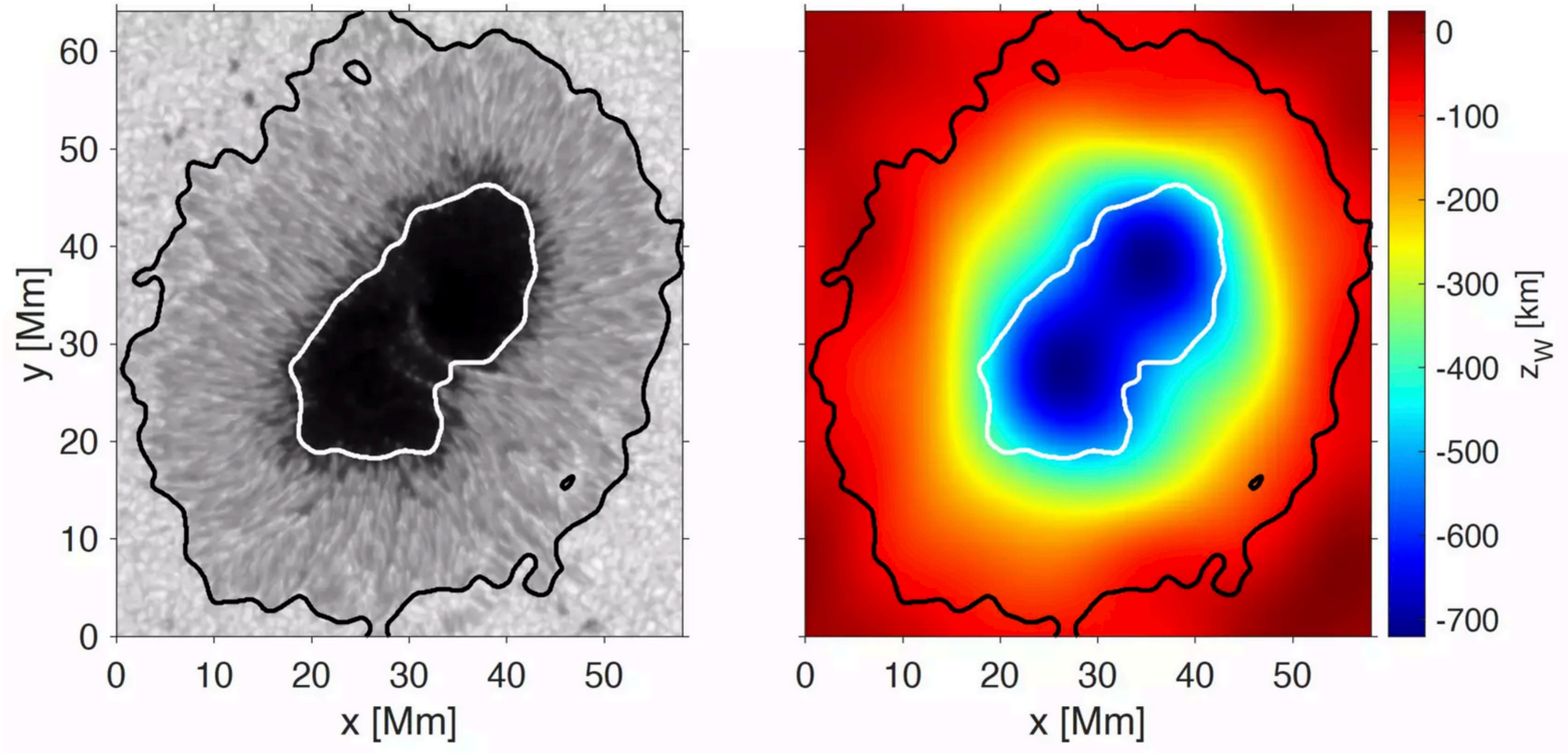
Formation height



Mats Carlsson, Oslo

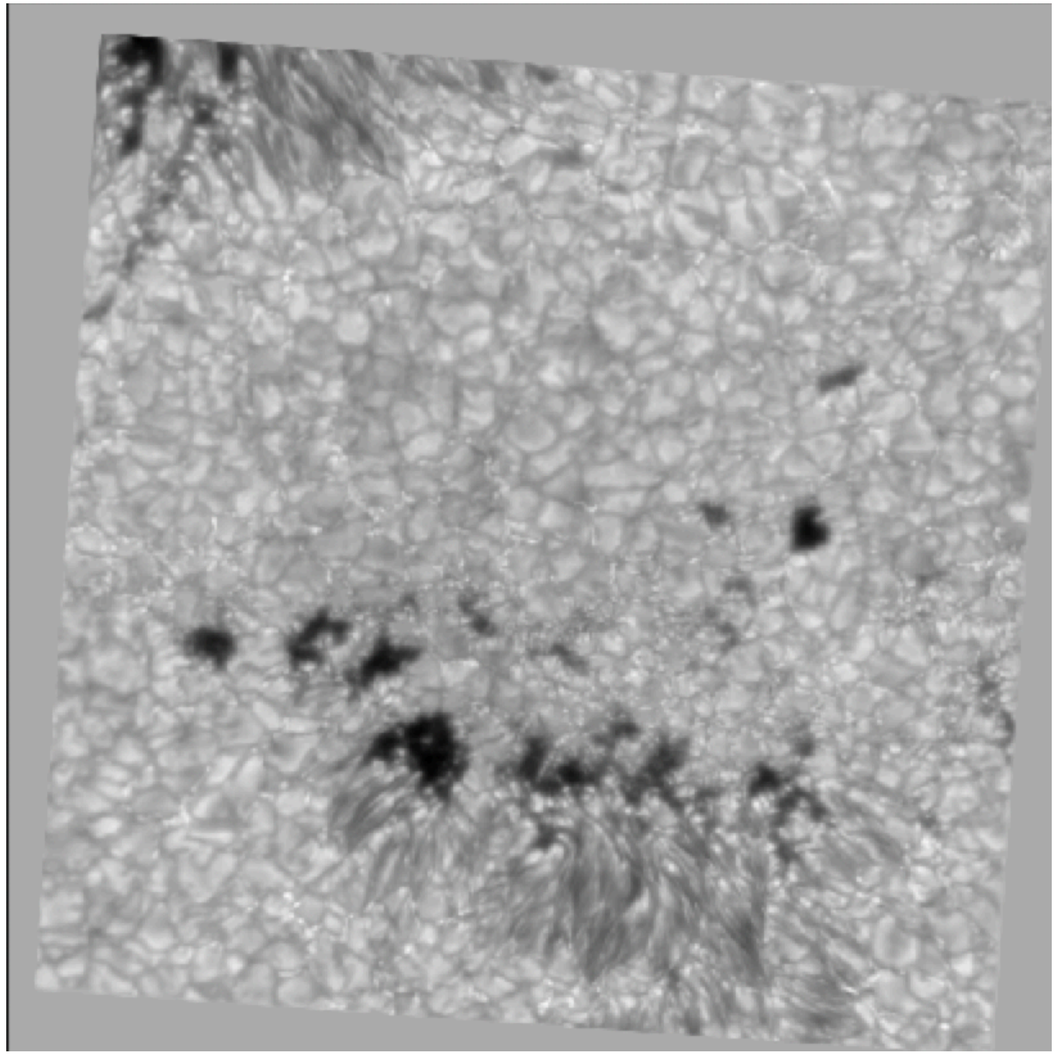
Optical depth to geometrical scale

Method based on the minimizing the divergence of the magnetic field vector derived from spectropolarimetric observations

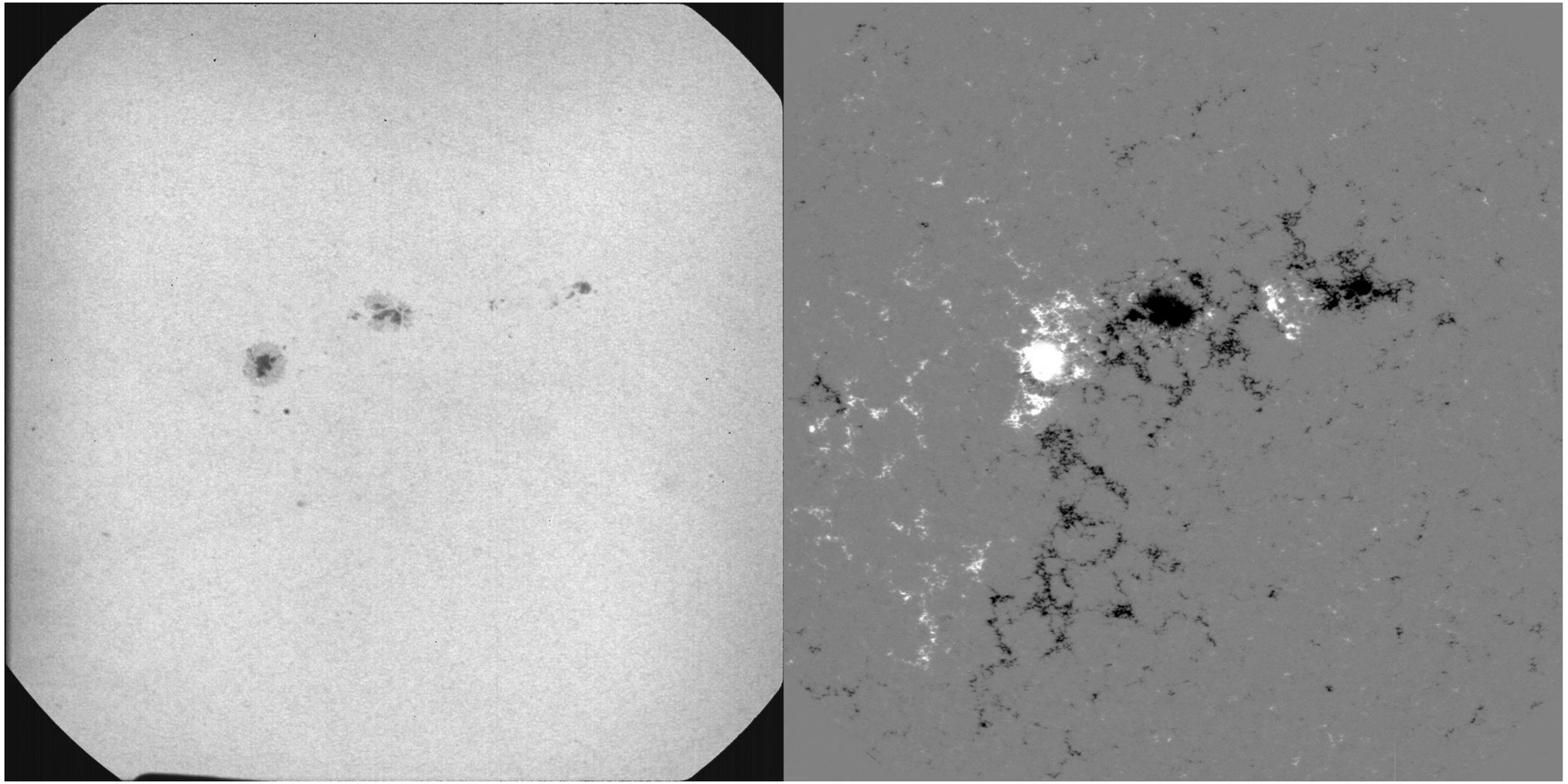


See B. Löptien 2018 for more details

Possible spectropolarimetric observations



Possible spectropolarimetric observations



Thanks of your attention