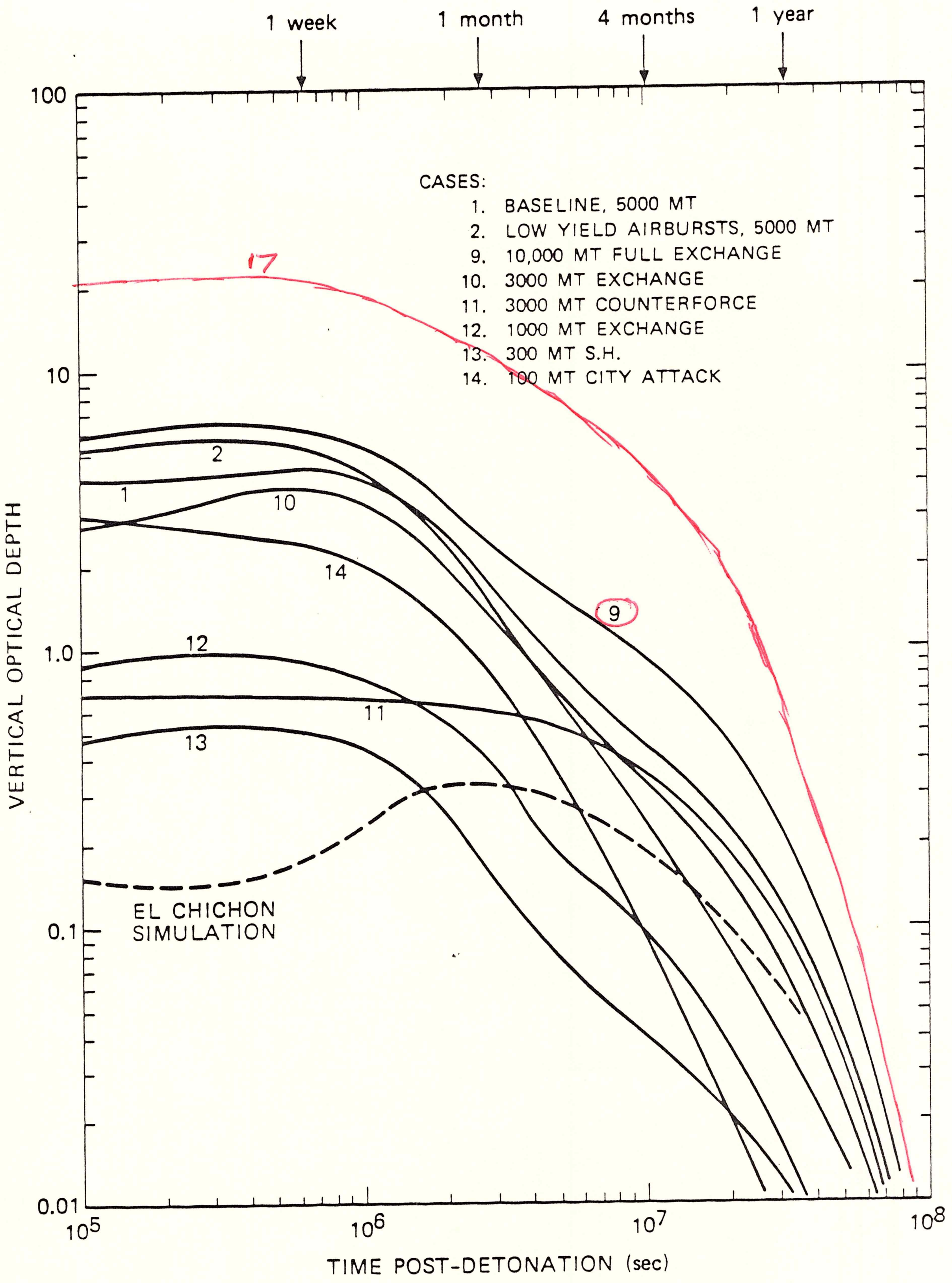


1 week
1 month
4 months
1 year
100
10
1.0
0.1
0.01
VERTICAL OPTICAL DEPTH
CASES:
1. BASELINE, 5000 MT
2. LOW YIELD AIRBURSTS, 5000 MT
9. 10,000 MT FULL EXCHANGE
10. 3000 MT EXCHANGE
11. 3000 MT COUNTERFORCE
12. 1000 MT EXCHANGE
13. 300 MT S.H.
14. 100 MT CITY ATTACK
17
2
1
10
14
9
12
11
13
EL CHICHON
SIMULATION
10^5
10^6
10^7
10^8
TIME POST-DETONATION (sec)

FIGURE 1

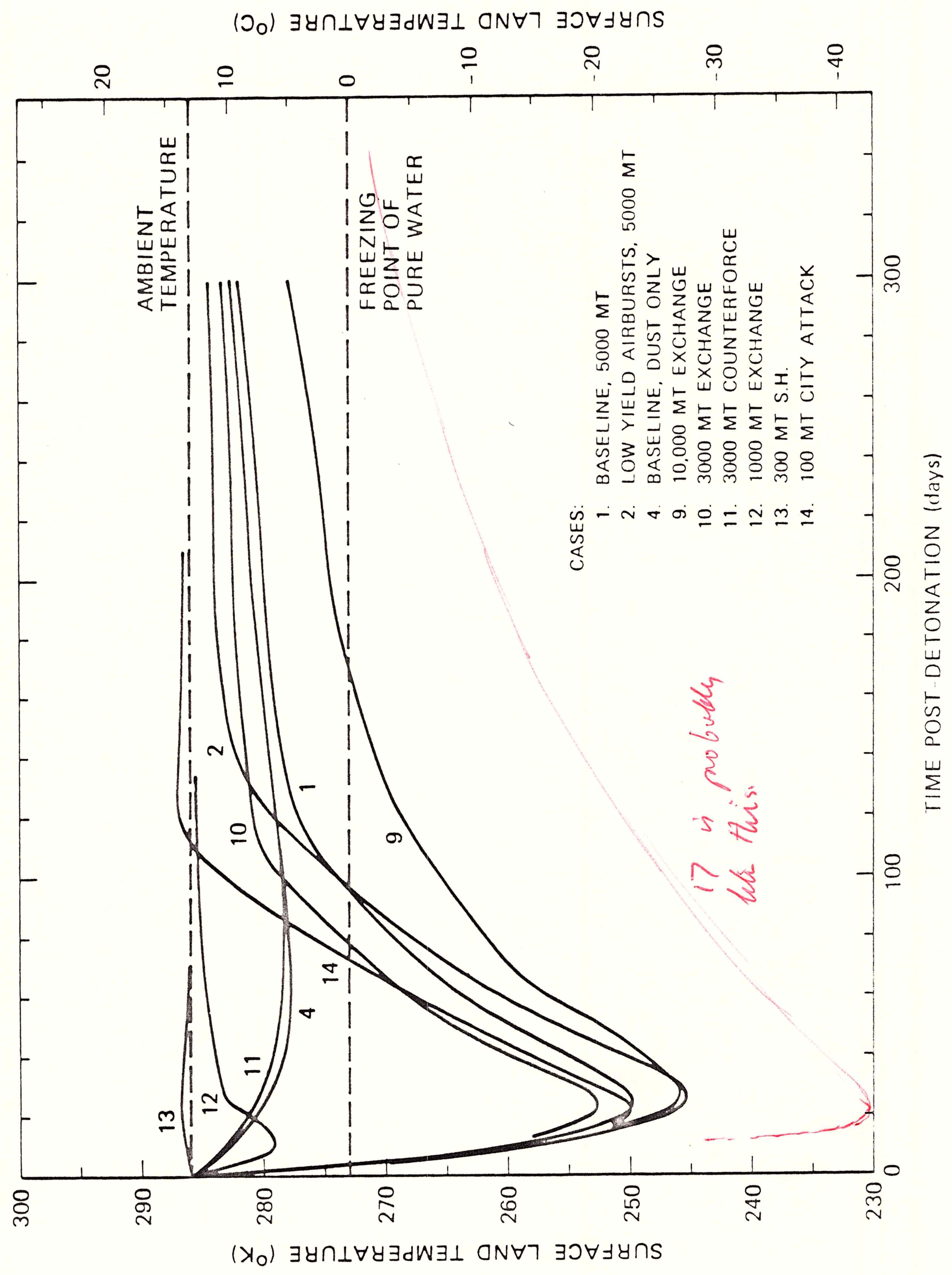

SURFACE LAND TEMPERATURE (°K)
SURFACE LAND TEMPERATURE (°C)
TIME POST-DETONATION (days)
AMBIENT TEMPERATURE
FREEZING POINT OF PURE WATER
CASES:
1. BASELINE, 5000 MT
2. LOW YIELD AIRBURSTS, 5000 MT
4. BASELINE, DUST ONLY
9. 10,000 MT EXCHANGE
10. 3000 MT EXCHANGE
11. 3000 MT COUNTERFORCE
12. 1000 MT EXCHANGE
13. 300 MT S.H.
14. 100 MT CITY ATTACK
17 is probably like this

FIGURE 2

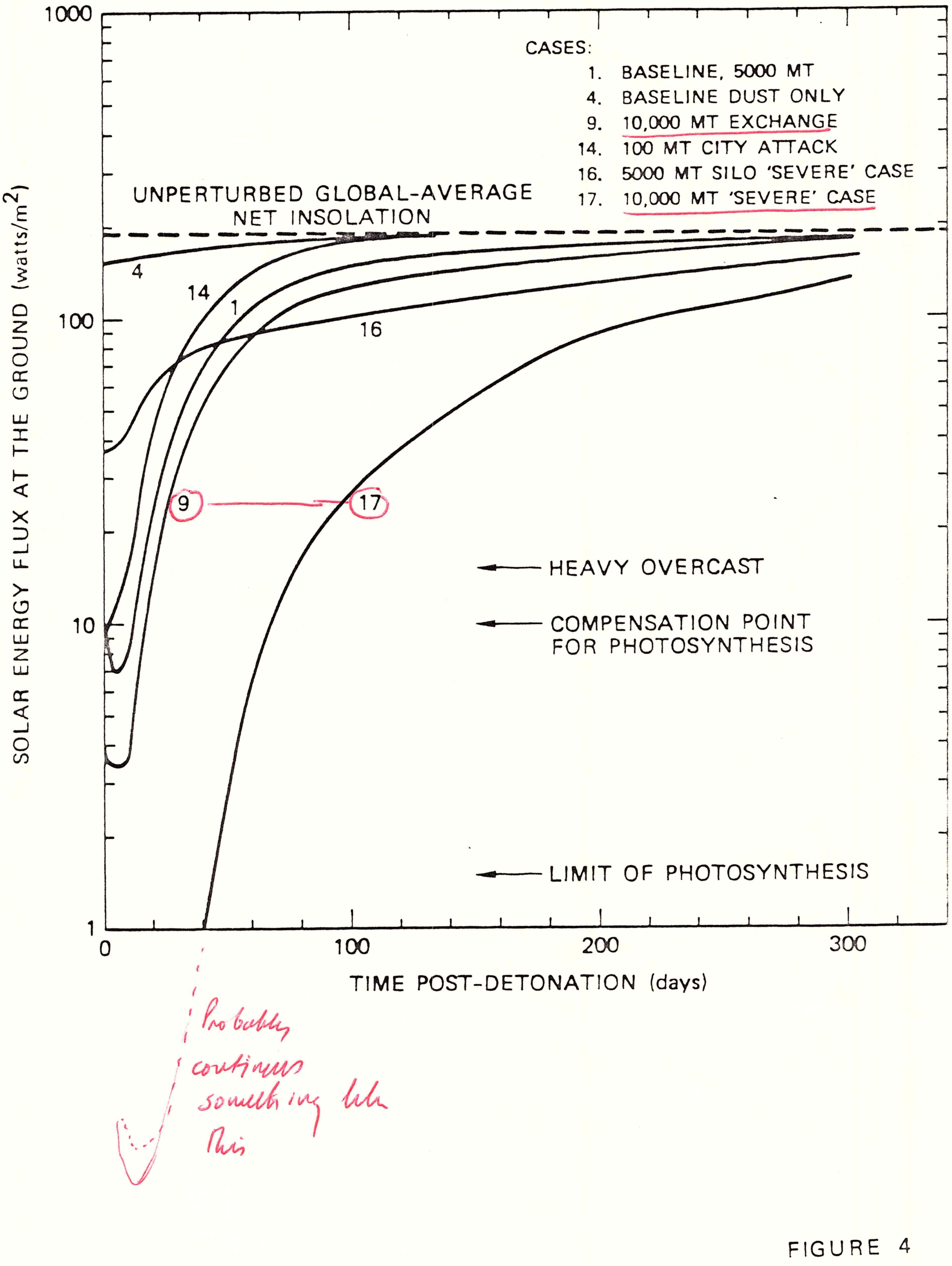
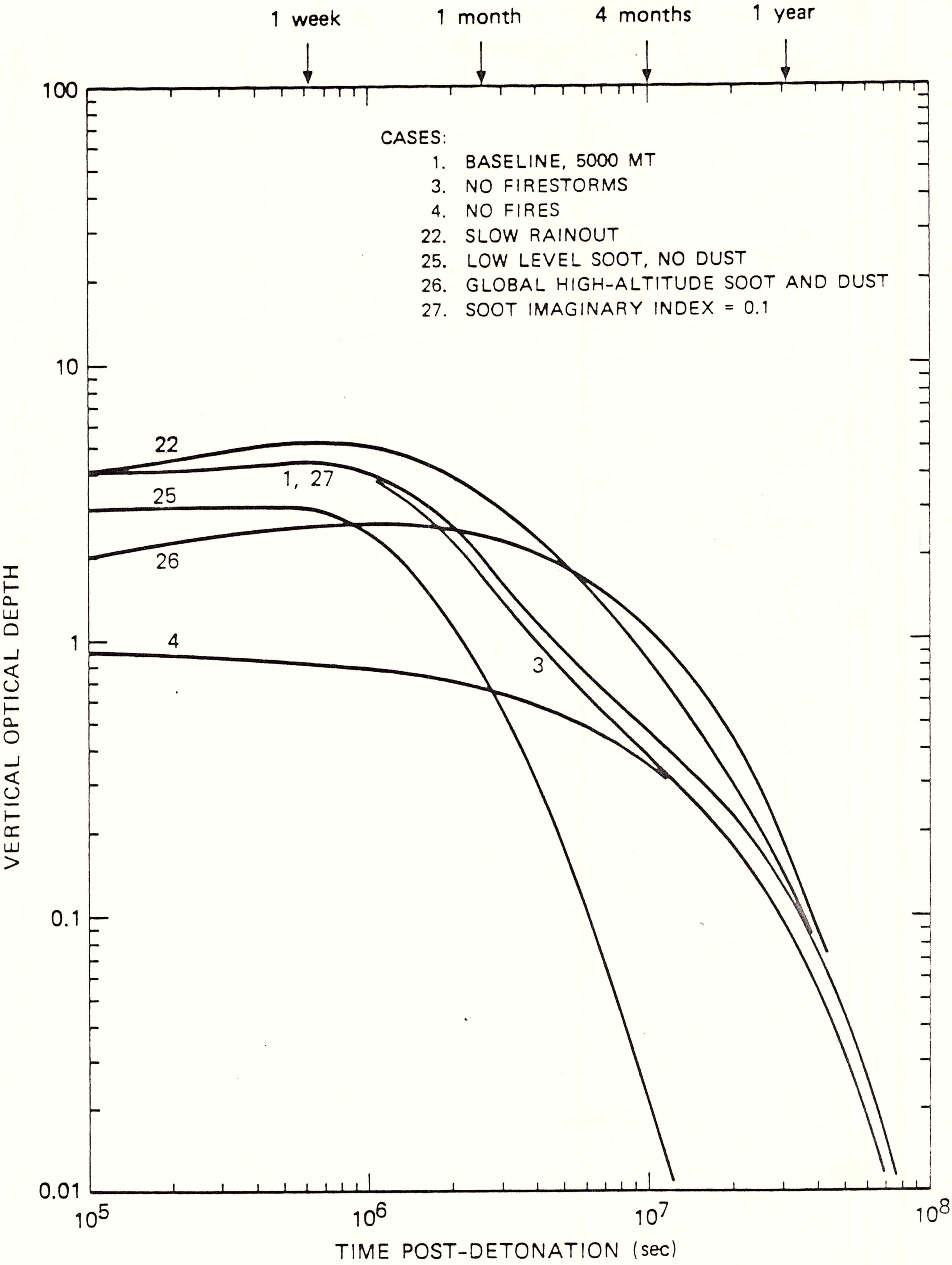

1000
100
10
1
0
100
200
300
SOLAR ENERGY FLUX AT THE GROUND (watts/m2)
TIME POST-DETONATION (days)
CASES:
1. BASELINE, 5000 MT
4. BASELINE DUST ONLY
9. 10,000 MT EXCHANGE
14. 100 MT CITY ATTACK
16. 5000 MT SILO 'SEVERE' CASE
17. 10,000 MT 'SEVERE' CASE
UNPERTURBED GLOBAL-AVERAGE NET INSOLATION
4
14
1
16
9
17
HEAVY OVERCAST
COMPENSATION POINT FOR PHOTOSYNTHESIS
LIMIT OF PHOTOSYNTHESIS
Probably continues something like this

FIGURE 4



1 week
1 month
4 months
1 year
100
10
1
0.1
0.01
CASES:
1. BASELINE, 5000 MT
3. NO FIRESTORMS
4. NO FIRES
22. SLOW RAINOUT
25. LOW LEVEL SOOT, NO DUST
26. GLOBAL HIGH-ALTITUDE SOOT AND DUST
27. SOOT IMAGINARY INDEX = 0.1
22
1, 27
25
26
4
3
VERTICAL OPTICAL DEPTH
10^5
10^6
10^7
10^8
TIME POST-DETONATION (sec)

FIGURE 5

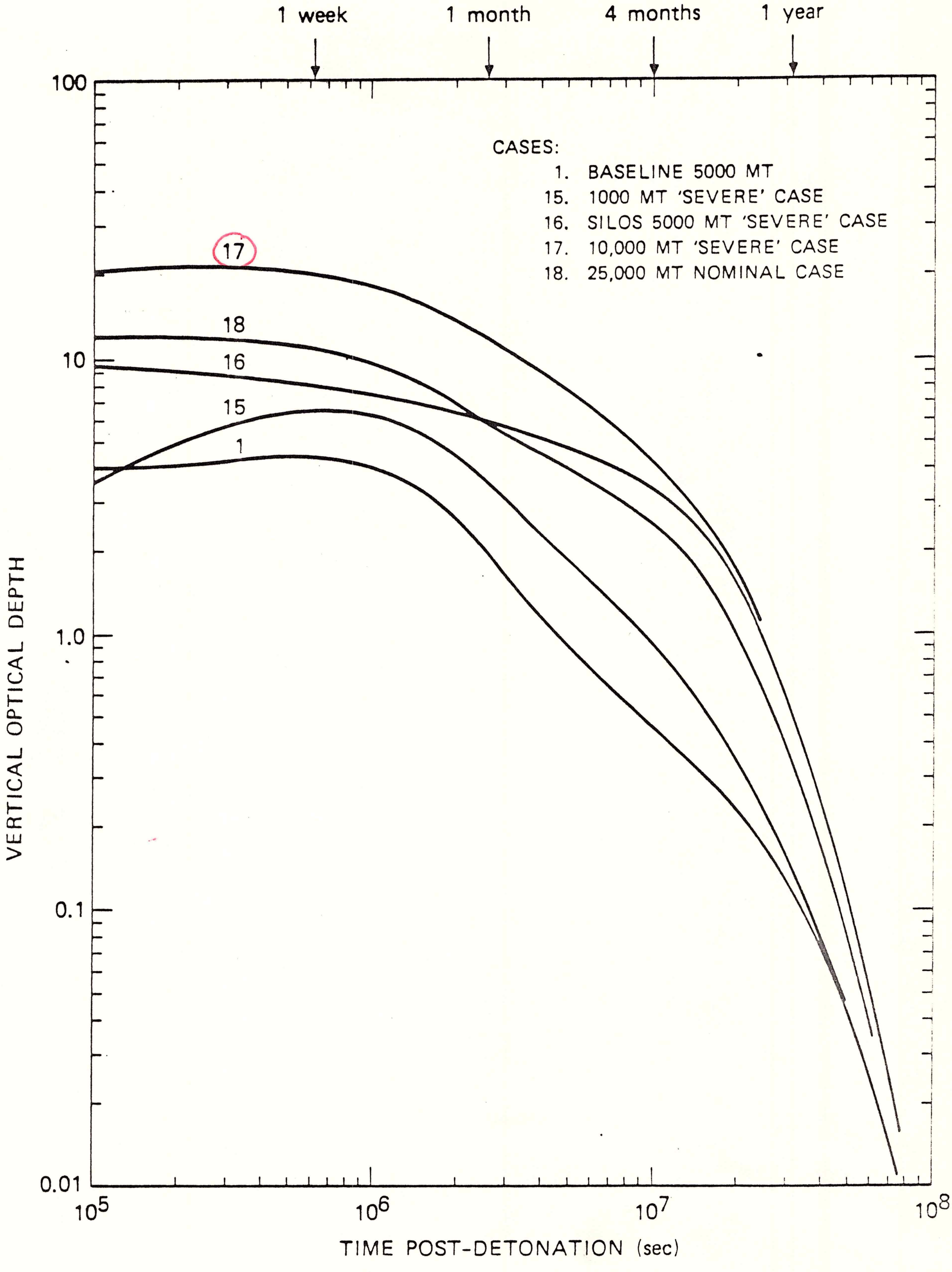

1 week
1 month
4 months
1 year
CASES:
1. BASELINE 5000 MT
15. 1000 MT 'SEVERE' CASE
16. SILOS 5000 MT 'SEVERE' CASE
17. 10,000 MT 'SEVERE' CASE
18. 25,000 MT NOMINAL CASE
17
18
16
15
1
100
10
1.0
0.1
0.01
VERTICAL OPTICAL DEPTH
10^5
10^6
10^7
10^8
TIME POST-DETONATION (sec)

FIGURE 6

FIGURE CAPTIONS

1. Time-dependent hemispherically-averaged vertical optical depths (scattering plus absorption) of nuclear dust and smoke clouds at 550 nm wavelength. Optical depths $\lesssim 0.1$ are negligible, ~1 are significant, and ~10 imply possible major consequences. The transmission of sunlight becomes highly nonlinear at optical depths $\gtrsim 1$. Results are given for several of the scenarios listed in Table 1. Calculated optical depths for the expanding El Chichon eruption cloud are offered for comparison (53).
2. Hemispherically-averaged surface temperature variations following a nuclear exchange. Results are shown for several of the scenarios in Table 1. (Note the linear timescale, unlike that in Figure 1). The temperatures generally apply to the interior of continental land masses. Only in Cases 4 and 11, are the effects of fires neglected.
3. Northern Hemisphere troposphere and stratosphere temperature perturbations in K (1K = 1°C) following the baseline nuclear exchange (Case 1). The cross-hatched area indicates cooling. Ambient pressure levels in millibars are also given.
4. Solar energy fluxes at the ground over the Northern Hemisphere in the aftermath of a nuclear exchange. Results are given for several of the scenarios in Table 1. (Note the linear timescale.) The solar fluxes are averaged over the diurnal cycle and over the hemisphere. Cases 4 and 16 neglect fires. Also indicated on the figure are the approximate flux levels at

which photosynthesis cannot keep pace with plant respiration (compensation point), and at which photosynthesis ceases. These limits vary for different species.

5. Time-dependent vertical optical depths (absorption plus scattering at 550 nm) of nuclear smoke clouds, in a sensitivity analysis. The optical depths are average values for the Northern Hemisphere. All cases shown correspond to parameter variations of the baseline model and all include dust appropriate to that case (Case 1): 3, no firestorms; 4, no fires; 22, smoke rainout rate decreased by a factor of 3; 25, smoke initially confined to the lowest 3 km of the atmosphere; 26, smoke initially distributed between 13 and 19 km over the entire globe; 27, smoke imaginary part of refractive index reduced from 0.3 to 0.1. For comparison, in Case 4, only dust from the baseline model is considered (fires are ignored).

6. Time-dependent vertical optical depths (absorption plus scattering at 550 nm) for enhanced cases of explosion yield or nuclear dust and smoke production. The conditions are detailed elsewhere (15). The weapon yield inventories are identical to the nominal cases of the same total yield described in Table 1 (Cases 16 and 18 are listed there). The "severe" cases generally include a sixfold increase in the fine dust injection, and a doubling of the smoke emission. In Cases 15, 17 and 18, smoke causes most of the opacity during the first 1-2 months. In Cases 17 and 18, dust makes a major contribution to the optical effects beyond 1-2 months. In Case 16, fires are neglected and dust from surface bursts produces all of the opacity.