

Supplement of

**An Estimate of Global, Regional and Seasonal Cirrus Cloud
Radiative Effects Contributed by Homogeneous Ice Nucleation**

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The following subroutine in Fortran90 was used in the CALIPSO simulation to determine D_e (retrieved median effective diameter) for a given temperature, longitude, season and land-fraction. Look-up-tables (LUTs) for D_e are embedded in the subroutine, specified by latitude and season. The D_e entries in the LUTs are separated by a temperature of 4 K, with the minimum and maximum LUT temperature being 168 and 268K (giving 25 D_e entries). After a temperature supplied by the main program is related to a given LUT (defined by season and latitude range), D_e over ocean and land are determined by interpolation between the two nearest indexed D_e values in the respective LUT. Once D_e for ocean and land are calculated (deo & del), D_e is calculated as a function of land-fraction, given by the variable luindex. Finally, when D_e lies within ± 5 degrees of a latitude boundary (used to define D_e categories), then D_e is calculated from a line equation that is defined by two latitudes ± 5 degrees latitude from the latitude being solved for. This prevents abrupt transitions in D_e from occurring between D_e -latitude categories.

The code below should be mostly self-explanatory upon inspection, given the above explanation. The temperature variable = tamb. LUTs are labeled by latitude zone, whether the zone is in the northern or southern hemisphere, whether the LUT is for land or ocean D_e values, and the season it corresponds to. For example, detab6090Nldjf indicates D_e table for 60 to 90 deg. N. latitude, land D_e values, and December-January-February. Similarly, detab6090Nojja indicates D_e table for 60 to 90 deg. N. latitude, ocean D_e values, and June-July-August. The D_e LUT values are in microns. The subroutine code is as follows:

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subroutine deitabhet(tamb, luindex, lat, lon, de)
! Provides lookup tables for CALIPSO effective diameter (de) retrievals
  real(r8), intent(in) :: tamb
  real(r8), intent(in) :: luindex
  real(r8), intent(in) :: lat
  real(r8), intent(in) :: lon
  real(r8), intent(out) :: de
  integer, parameter :: len_retab = 25
  integer, parameter :: min_index = 1
  real(r8), parameter :: min_retab = 168._r8
  real(r8), parameter :: deltatemp = 4.0_r8
  integer :: index
  real(r8) :: deo
  real(r8) :: del
  real(r8) :: de_plus5
  real(r8) :: de_minus5
  real(r8) :: de_intercept
  real(r8) :: latdeg
  real(r8) :: latdeg_plus5
  real(r8) :: latdeg_minus5
  real(r8) :: corr

! Initialization of LUTs indicating latitude zone, land vs. ocean & season
  real(r8) detab6090Nldjf(len_retab)
  real(r8) detab6090Nlmam(len_retab)
  real(r8) detab6090Nljja(len_retab)

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real(r8) detab6090Nlson(len_retab)
real(r8) detab6090Nodjf(len_retab)
real(r8) detab6090Nomam(len_retab)
real(r8) detab6090Nojja(len_retab)
real(r8) detab6090Noson(len_retab)
real(r8) detab3060Nldjf(len_retab)
real(r8) detab3060Nlmam(len_retab)
real(r8) detab3060Nljja(len_retab)
real(r8) detab3060Nlson(len_retab)
real(r8) detab3060Nodjf(len_retab)
real(r8) detab3060Nomam(len_retab)
real(r8) detab3060Nojja(len_retab)
real(r8) detab3060Noson(len_retab)
! Next 4 LUTs span 30S to 30N over land:
real(r8) detabtropicsldjf(len_retab)
real(r8) detabtropicslmam(len_retab)
real(r8) detabtropicsljja(len_retab)
real(r8) detabtropicslson(len_retab)
! Next 4 LUTs span 30S to 30N over ocean:
real(r8) detabtropicsodjf(len_retab)
real(r8) detabtropicsomam(len_retab)
real(r8) detabtropicsojja(len_retab)
real(r8) detabtropicsoson(len_retab)
! Next 4 LUTs are for 30S to 60S over land:
real(r8) detab6030Sldjf(len_retab)
real(r8) detab6030Slmam(len_retab)
real(r8) detab6030Sljja(len_retab)
real(r8) detab6030Slson(len_retab)
! Next 4 LUTs are for 30S to 60S over ocean:
real(r8) detab6030Sodjf(len_retab)
real(r8) detab6030Somam(len_retab)
real(r8) detab6030Sojja(len_retab)
real(r8) detab6030Soson(len_retab)
! Next 8 LUTs are for Antarctic region, land & ocean
real(r8) detab9060Sldjf(len_retab)
real(r8) detab9060Slmam(len_retab)
real(r8) detab9060Sljja(len_retab)
real(r8) detab9060Slson(len_retab)
real(r8) detab9060Sodjf(len_retab)
real(r8) detab9060Somam(len_retab)
real(r8) detab9060Sojja(len_retab)
real(r8) detab9060Soson(len_retab)
!
! Tabulated values of de(T) in the temperature interval
! 168 K -- 268 K; Data from CALIPSO retrievals of Mitchell et al.
! (2018, ACP), using SPAunm and TC40 for the tropics (30S-30N).

! 60-90 land DJF
data detab6090Nldjf /&
12.5515_r8, 12.5515_r8, 12.5515_r8, 12.5515_r8, 12.5515_r8, 12.5515_r8,&
12.5515_r8, 17.5453_r8, 23.8062_r8, 26.1120_r8, 32.3936_r8, 37.8814_r8,&
46.1767_r8, 50.7154_r8, 52.1177_r8, 53.7659_r8, 53.7659_r8, 53.7659_r8,&
53.7659_r8, 53.7659_r8, 53.7659_r8, 53.7659_r8, 53.7659_r8, 53.7659_r8,&
53.7659_r8/

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save detab6090Nldjf

! 60-90 land MAM
  data detab6090Nlmam /&
31.3916_r8, 31.3916_r8, 31.3916_r8, 31.3916_r8, 31.3916_r8, 31.3916_r8,&
31.3916_r8, 31.3916_r8, 31.3916_r8, 31.3916_r8, 29.8408_r8, 35.5569_r8,&
42.8987_r8, 48.5698_r8, 51.8230_r8, 51.8230_r8, 51.8230_r8, 51.8230_r8,&
51.8230_r8, 51.8230_r8, 51.8230_r8, 51.8230_r8, 51.8230_r8, 51.8230_r8,&
51.8230_r8/
  save detab6090Nlmam

! 60-90 land JJA
  data detab6090Nljja /&
35.4264_r8, 35.4264_r8, 35.4264_r8, 35.4264_r8, 35.4264_r8, 35.4264_r8,&
35.4264_r8, 35.4264_r8, 35.4264_r8, 35.4264_r8, 35.4264_r8, 45.1069_r8,&
50.5470_r8, 54.5277_r8, 56.2471_r8, 56.2471_r8, 56.2471_r8, 56.2471_r8,&
56.2471_r8, 56.2471_r8, 56.2471_r8, 56.2471_r8, 56.2471_r8, 56.2471_r8,&
56.2471_r8/
  save detab6090Nljja

! 60-90 land SON
  data detab6090Nlson /&
15.1583_r8, 15.1583_r8, 15.1583_r8, 15.1583_r8, 15.1583_r8, 15.1583_r8,&
15.1583_r8, 15.1583_r8, 15.1583_r8, 15.1583_r8, 29.7252_r8, 34.3148_r8,&
38.9208_r8, 47.8403_r8, 48.7599_r8, 53.5761_r8, 53.5761_r8, 53.5761_r8,&
53.5761_r8, 53.5761_r8, 53.5761_r8, 53.5761_r8, 53.5761_r8, 53.5761_r8,&
53.5761_r8/
  save detab6090Nlson

! 60-90 ocean DJF
  data detab6090Nodjff /&
24.5915_r8, 24.5915_r8, 24.5915_r8, 24.5915_r8, 24.5915_r8, 24.5915_r8,&
24.5915_r8, 24.5915_r8, 32.8914_r8, 33.5891_r8, 38.8793_r8, 41.5984_r8,&
49.5036_r8, 56.6347_r8, 58.1320_r8, 58.1320_r8, 58.1320_r8, 58.1320_r8,&
58.1320_r8, 58.1320_r8, 58.1320_r8, 58.1320_r8, 58.1320_r8, 58.1320_r8,&
58.1320_r8/
  save detab6090Nodjff

! 60-90 ocean MAM
  data detab6090Nomam /&
23.0161_r8, 23.0161_r8, 23.0161_r8, 23.0161_r8, 23.0161_r8, 23.0161_r8,&
23.0161_r8, 23.0161_r8, 23.0161_r8, 23.0161_r8, 25.9148_r8, 43.3420_r8,&
48.9045_r8, 54.4704_r8, 58.1393_r8, 70.3760_r8, 70.3760_r8, 70.3760_r8,&
70.3760_r8, 70.3760_r8, 70.3760_r8, 70.3760_r8, 70.3760_r8, 70.3760_r8,&
70.3760_r8/
  save detab6090Nomam

! 60-90 ocean JJA
  data detab6090Nojja /&
25.0766_r8, 25.0766_r8, 25.0766_r8, 25.0766_r8, 25.0766_r8, 25.0766_r8,&
25.0766_r8, 25.0766_r8, 25.0766_r8, 25.0766_r8, 25.0766_r8, 25.0766_r8,&
40.0769_r8, 52.0571_r8, 56.8702_r8, 56.8702_r8, 56.8702_r8, 56.8702_r8,&
56.8702_r8, 56.8702_r8, 56.8702_r8, 56.8702_r8, 56.8702_r8, 56.8702_r8,&
56.8702_r8/

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save detab6090Nojja

! 60-90 ocean SON
  data detab6090Noson /&
17.5430_r8, 17.5430_r8, 17.5430_r8, 17.5430_r8, 17.5430_r8, 17.5430_r8,&
17.5430_r8, 17.5430_r8, 17.5430_r8, 28.0634_r8, 34.9437_r8, 40.9240_r8,&
45.5826_r8, 52.0371_r8, 55.6067_r8, 55.6067_r8, 55.6067_r8, 55.6067_r8,&
55.6067_r8, 55.6067_r8, 55.6067_r8, 55.6067_r8, 55.6067_r8, 55.6067_r8,&
55.6067_r8/
  save detab6090Noson

! 30-60 land DJF
  data detab3060Nldjf /&
13.7516_r8, 13.7516_r8, 13.7516_r8, 13.7516_r8, 13.7516_r8, 13.7516_r8,&
13.7516_r8, 13.7516_r8, 24.7085_r8, 26.9770_r8, 34.6243_r8, 42.6144_r8,&
48.3151_r8, 53.9897_r8, 55.4510_r8, 55.6016_r8, 55.6016_r8, 55.6016_r8,&
55.6016_r8, 55.6016_r8, 55.6016_r8, 55.6016_r8, 55.6016_r8, 55.6016_r8,&
55.6016_r8/
  save detab3060Nldjf

! 30-60 land MAM
  data detab3060Nlmam /&
22.4826_r8, 22.4826_r8, 22.4826_r8, 22.4826_r8, 22.4826_r8, 22.4826_r8,&
22.4826_r8, 22.4826_r8, 22.4826_r8, 30.5000_r8, 41.7793_r8, 49.3616_r8,&
54.9672_r8, 60.5807_r8, 61.9360_r8, 61.9360_r8, 61.9360_r8, 61.9360_r8,&
61.9360_r8, 61.9360_r8, 61.9360_r8, 61.9360_r8, 61.9360_r8, 61.9360_r8,&
61.9360_r8/
  save detab3060Nlmam

! 30-60 land JJA
  data detab3060Nljja /&
27.9527_r8, 27.9527_r8, 27.9527_r8, 27.9527_r8, 27.9527_r8, 27.9527_r8,&
27.9527_r8, 27.9527_r8, 39.8649_r8, 47.3965_r8, 51.3956_r8, 52.4833_r8,&
56.2833_r8, 62.9856_r8, 66.0834_r8, 67.4987_r8, 83.3788_r8, 83.3788_r8,&
83.3788_r8, 83.3788_r8, 83.3788_r8, 83.3788_r8, 83.3788_r8, 83.3788_r8,&
83.3788_r8/
  save detab3060Nljja

! 30-60 land SON
  data detab3060Nlson /&
23.9838_r8, 23.9838_r8, 23.9838_r8, 23.9838_r8, 23.9838_r8, 23.9838_r8,&
23.9838_r8, 23.9838_r8, 23.9838_r8, 24.5728_r8, 33.9347_r8, 42.8478_r8,&
51.3945_r8, 56.6141_r8, 59.9297_r8, 59.9297_r8, 59.9297_r8, 59.9297_r8,&
59.9297_r8, 59.9297_r8, 59.9297_r8, 59.9297_r8, 59.9297_r8, 59.9297_r8,&
59.9297_r8/
  save detab3060Nlson

! 30-60 ocean DJF
  data detab3060Nodjf /&
23.0164_r8, 23.0164_r8, 23.0164_r8, 23.0164_r8, 23.0164_r8, 23.0164_r8,&
23.0164_r8, 23.0164_r8, 28.7222_r8, 35.0160_r8, 42.4562_r8, 48.0642_r8,&
53.1924_r8, 57.9852_r8, 61.3784_r8, 61.3784_r8, 61.3784_r8, 61.3784_r8,&
61.3784_r8, 61.3784_r8, 61.3784_r8, 61.3784_r8, 61.3784_r8, 61.3784_r8,&
61.3784_r8/

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save detab3060Nodjf

! 30-60 ocean MAM
  data detab3060Nomam /&
25.2382_r8, 25.2382_r8, 25.2382_r8, 25.2382_r8, 25.2382_r8, 25.2382_r8,&
25.2382_r8, 25.2382_r8, 25.2382_r8, 37.0475_r8, 42.2693_r8, 49.3426_r8,&
55.5881_r8, 61.8791_r8, 62.8743_r8, 69.7545_r8, 69.7545_r8, 69.7545_r8,&
69.7545_r8, 69.7545_r8, 69.7545_r8, 69.7545_r8, 69.7545_r8, 69.7545_r8,&
69.7545_r8/
  save detab3060Nomam

! 30-60 ocean JJA
  data detab3060Nojja /&
31.5030_r8, 31.5030_r8, 31.5030_r8, 31.5030_r8, 31.5030_r8, 31.5030_r8,&
31.5030_r8, 31.5030_r8, 31.5030_r8, 48.4480_r8, 53.0315_r8, 54.8413_r8,&
57.3852_r8, 62.4347_r8, 66.9753_r8, 66.6357_r8, 66.6357_r8, 66.6357_r8,&
66.6357_r8, 66.6357_r8, 66.6357_r8, 66.6357_r8, 66.6357_r8, 66.6357_r8,&
66.6357_r8/
  save detab3060Nojja

! 30-60 ocean SON
  data detab3060Noson /&
25.3306_r8, 25.3306_r8, 25.3306_r8, 25.3306_r8, 25.3306_r8, 25.3306_r8,&
25.3306_r8, 25.3306_r8, 35.4344_r8, 39.0768_r8, 47.1180_r8, 52.0583_r8,&
56.1453_r8, 60.8797_r8, 61.6096_r8, 61.6096_r8, 61.6096_r8, 61.6096_r8,&
61.6096_r8, 61.6096_r8, 61.6096_r8, 61.6096_r8, 61.6096_r8, 61.6096_r8,&
61.6096_r8/
  save detab3060Noson

! -30+30 land DJF
  data detabtropicsldjff /&
14.1112_r8, 14.1112_r8, 14.1112_r8, 14.1112_r8, 14.1112_r8, 14.1112_r8,&
21.6484_r8, 26.4968_r8, 35.2015_r8, 44.1877_r8, 51.8588_r8, 59.4626_r8,&
64.3535_r8, 72.8794_r8, 69.0298_r8, 69.0298_r8, 73.0000_r8, 73.0000_r8,&
73.0000_r8, 73.0000_r8, 73.0000_r8, 73.0000_r8, 73.0000_r8, 73.0000_r8,&
73.0000_r8/
  save detabtropicsldjff

! -30+30 land MAM
  data detabtropicslmam /&
11.2549_r8, 11.2549_r8, 11.2549_r8, 11.2549_r8, 11.2549_r8, 16.4684_r8,&
20.9409_r8, 28.9171_r8, 37.0794_r8, 45.4198_r8, 51.5109_r8, 58.4374_r8,&
66.7202_r8, 73.7770_r8, 92.2404_r8, 105.474_r8, 105.474_r8, 105.474_r8,&
105.474_r8, 105.474_r8, 105.474_r8, 105.474_r8, 105.474_r8, 105.474_r8,&
105.474_r8/
  save detabtropicslmam

! -30+30 land JJA
  data detabtropicsljja /&
14.8852_r8, 14.8852_r8, 14.8852_r8, 14.8852_r8, 14.8852_r8, 14.8852_r8,&
18.4412_r8, 23.8292_r8, 34.5683_r8, 40.6783_r8, 50.2099_r8, 57.4005_r8,&
64.2896_r8, 76.3264_r8, 88.3262_r8, 105.707_r8, 105.707_r8, 105.707_r8,&
105.707_r8, 105.707_r8, 105.707_r8, 105.707_r8, 105.707_r8, 105.707_r8,&
105.707_r8/

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105.707_r8/
  save detabtropicsljjja

! -30+30 land SON
  data detabtropicslson /&
16.2703_r8, 16.2703_r8, 16.2703_r8, 16.2703_r8, 16.2703_r8, 16.2703_r8,&
21.0020_r8, 25.0023_r8, 33.4142_r8, 43.9722_r8, 52.1434_r8, 60.7564_r8,&
67.7064_r8, 76.4763_r8, 83.6643_r8, 83.6643_r8, 83.6643_r8, 83.6643_r8,&
83.6643_r8, 83.6643_r8, 83.6643_r8, 83.6643_r8, 83.6643_r8, 83.6643_r8,&
83.6643_r8/
  save detabtropicslson

! -30+30 ocean DJF
  data detabtropicsodjff /&
12.6536_r8, 12.6536_r8, 12.6536_r8, 12.6536_r8, 12.6536_r8, 15.1300_r8,&
21.7631_r8, 29.3892_r8, 35.6063_r8, 42.0858_r8, 47.5689_r8, 54.1107_r8,&
59.4198_r8, 66.6610_r8, 76.0893_r8, 76.0893_r8, 76.0893_r8, 76.0893_r8,&
76.0893_r8, 76.0893_r8, 76.0000_r8, 76.0000_r8, 76.0000_r8, 76.0000_r8,&
76.0000_r8/
  save detabtropicsodjff

! -30+30 ocean MAM
  data detabtropicsomam /&
11.9897_r8, 11.9897_r8, 11.9897_r8, 11.9897_r8, 11.9897_r8, 14.2733_r8,&
19.0663_r8, 27.8815_r8, 34.9759_r8, 42.0746_r8, 48.6983_r8, 55.6108_r8,&
61.2318_r8, 68.7592_r8, 76.4423_r8, 80.4790_r8, 80.4790_r8, 80.4790_r8,&
80.4790_r8, 80.4790_r8, 80.4790_r8, 80.4790_r8, 80.4790_r8, 80.4790_r8,&
80.4790_r8/
  save detabtropicsomam

! -30+30 ocean JJA
  data detabtropicsojjja /&
13.2940_r8, 13.2940_r8, 13.2940_r8, 13.2940_r8, 13.2940_r8, 13.2940_r8,&
16.8201_r8, 28.0410_r8, 35.2020_r8, 42.4541_r8, 50.1739_r8, 57.6039_r8,&
66.9249_r8, 77.8729_r8, 83.3073_r8, 82.1399_r8, 82.1399_r8, 82.1399_r8,&
82.1399_r8, 82.1399_r8, 82.1399_r8, 82.1399_r8, 82.1399_r8, 82.1399_r8,&
82.1399_r8/
  save detabtropicsojjja

! -30+30 ocean SON
  data detabtropicsoson /&
12.8327_r8, 12.8327_r8, 12.8327_r8, 12.8327_r8, 12.8327_r8, 12.8327_r8,&
19.5801_r8, 26.6990_r8, 35.3228_r8, 42.5790_r8, 49.4629_r8, 55.1989_r8,&
63.3183_r8, 70.2812_r8, 78.1690_r8, 91.8946_r8, 91.8946_r8, 91.8946_r8,&
91.8946_r8, 91.8946_r8, 91.8946_r8, 91.8946_r8, 91.8946_r8, 91.8946_r8,&
91.8946_r8/
  save detabtropicsoson

! -60 - 30 land DJF
  data detab6030Sldjff /&
48.2519_r8, 48.2519_r8, 48.2519_r8, 48.2519_r8, 48.2519_r8, 48.2519_r8,&
48.2519_r8, 48.2519_r8, 48.2519_r8, 48.2519_r8, 48.2519_r8, 50.1757_r8,&
53.4787_r8, 59.3502_r8, 57.8417_r8, 63.1094_r8, 63.1094_r8, 64.0000_r8,&
64.0000_r8, 64.0000_r8, 64.0000_r8, 64.0000_r8, 64.0000_r8, 64.0000_r8,&
64.0000_r8/

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64.0000_r8/
  save detab6030Sldjf

! -60 - 30 land MAM
  data detab6030Slmam /&
18.6302_r8, 18.6302_r8, 18.6302_r8, 18.6302_r8, 18.6302_r8, 18.6302_r8,&
18.6302_r8, 18.6302_r8, 18.6302_r8, 25.3258_r8, 31.4926_r8, 36.2135_r8,&
48.9016_r8, 56.2920_r8, 62.8172_r8, 62.8172_r8, 62.8172_r8, 62.8172_r8,&
62.8172_r8, 62.8172_r8, 62.8172_r8, 62.8172_r8, 62.8172_r8, 62.8172_r8,&
62.8172_r8/
  save detab6030Slmam

! -60 - 30 land JJA
  data detab6030Sljja /&
13.8341_r8, 13.8341_r8, 13.8341_r8, 13.8341_r8, 13.8341_r8, 13.8341_r8,&
13.8341_r8, 13.8341_r8, 13.8341_r8, 24.2075_r8, 28.1079_r8, 37.7415_r8,&
46.3799_r8, 54.4736_r8, 54.9086_r8, 54.9086_r8, 54.9086_r8, 54.9086_r8,&
54.9086_r8, 54.9086_r8, 54.9086_r8, 54.9086_r8, 54.9086_r8, 54.9086_r8,&
54.9086_r8/
  save detab6030Sljja

! -60 - 30 land SON
  data detab6030Slson /&
17.0147_r8, 17.0147_r8, 17.0147_r8, 17.0147_r8, 17.0147_r8, 17.0147_r8,&
17.0147_r8, 17.0147_r8, 17.0147_r8, 17.0147_r8, 30.2072_r8, 39.9466_r8,&
47.1773_r8, 55.6711_r8, 63.2095_r8, 71.1235_r8, 71.1235_r8, 71.1235_r8,&
71.1235_r8, 71.1235_r8, 71.1235_r8, 71.1235_r8, 71.1235_r8, 71.1235_r8,&
71.1235_r8/
  save detab6030Slson

! -60 - 30 ocean DJF
  data detab6030Sodjff /&
42.2671_r8, 42.2671_r8, 42.2671_r8, 42.2671_r8, 42.2671_r8, 42.2671_r8,&
42.2671_r8, 42.2671_r8, 42.2671_r8, 45.3103_r8, 47.0435_r8, 53.0024_r8,&
57.9067_r8, 62.1769_r8, 63.8466_r8, 64.4544_r8, 64.4544_r8, 64.4544_r8,&
64.4544_r8, 64.4544_r8, 64.4544_r8, 64.4544_r8, 64.4544_r8, 64.4544_r8,&
64.4544_r8/
  save detab6030Sodjff

! -60 - 30 ocean MAM
  data detab6030Somam /&
21.6130_r8, 21.6130_r8, 21.6130_r8, 21.6130_r8, 21.6130_r8, 21.6130_r8,&
21.6130_r8, 21.6130_r8, 21.6130_r8, 31.9586_r8, 42.2193_r8, 51.0929_r8,&
56.5951_r8, 60.5488_r8, 62.6187_r8, 62.6187_r8, 63.0000_r8, 63.0000_r8,&
63.0000_r8, 63.0000_r8, 63.0000_r8, 63.0000_r8, 63.0000_r8, 63.0000_r8,&
63.0000_r8/
  save detab6030Somam

! -60 - 30 ocean JJA
  data detab6030Sojja /&
14.9972_r8, 14.9972_r8, 14.9972_r8, 14.9972_r8, 14.9972_r8, 14.9972_r8,&
14.9972_r8, 14.9972_r8, 35.3696_r8, 31.7288_r8, 37.5827_r8, 49.3519_r8,&
55.8342_r8, 60.3318_r8, 60.0801_r8, 61.7576_r8, 61.7576_r8, 61.7576_r8,&
61.7576_r8, 61.7576_r8, 61.7576_r8, 61.7576_r8, 61.7576_r8, 61.7576_r8,&
61.7576_r8/

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61.7576_r8/
  save detab6030Sojja

! -60 - 30 ocean SON
  data detab6030Soson /&
20.6161_r8, 20.6161_r8, 20.6161_r8, 20.6161_r8, 20.6161_r8, 20.6161_r8,&
20.6161_r8, 20.6161_r8, 29.7475_r8, 28.2397_r8, 40.9278_r8, 48.3739_r8,&
55.4569_r8, 60.1630_r8, 63.1713_r8, 63.1713_r8, 63.1713_r8, 63.1713_r8,&
63.1713_r8, 63.1713_r8, 63.1713_r8, 63.1713_r8, 63.1713_r8, 63.1713_r8,&
63.1713_r8/
  save detab6030Soson

! -90 -60 land DJF
  data detab9060Sldjff /&
16.7502_r8, 16.7502_r8, 16.7502_r8, 16.7502_r8, 16.7502_r8, 16.7502_r8,&
16.7502_r8, 16.7502_r8, 16.7502_r8, 16.7502_r8, 31.5383_r8, 33.8235_r8,&
35.7270_r8, 45.5092_r8, 52.3668_r8, 52.3668_r8, 53.0000_r8, 53.0000_r8,&
53.0000_r8, 53.0000_r8, 53.0000_r8, 53.0000_r8, 53.0000_r8, 53.0000_r8,&
53.0000_r8/
  save detab9060Sldjff

! -90 -60 land MAM
  data detab9060Slmam /&
26.7353_r8, 26.7353_r8, 26.7353_r8, 26.7353_r8, 26.7353_r8, 26.7353_r8,&
26.7353_r8, 26.7353_r8, 26.7353_r8, 26.3237_r8, 34.0260_r8, 37.7288_r8,&
37.5758_r8, 44.0389_r8, 51.2437_r8, 51.2437_r8, 52.0000_r8, 52.0000_r8,&
52.0000_r8, 52.0000_r8, 52.0000_r8, 52.0000_r8, 52.0000_r8, 52.0000_r8,&
52.0000_r8/
  save detab9060Slmam

! -90 -60 land JJA
  data detab9060Sljja /&
22.0050_r8, 22.0050_r8, 22.0050_r8, 22.0050_r8, 17.7090_r8, 18.6464_r8,&
20.2079_r8, 20.3748_r8, 22.6837_r8, 29.9852_r8, 36.1861_r8, 41.4553_r8,&
49.9911_r8, 54.1427_r8, 53.8655_r8, 57.0614_r8, 57.0000_r8, 57.0000_r8,&
57.0000_r8, 57.0000_r8, 57.0000_r8, 57.0000_r8, 57.0000_r8, 57.0000_r8,&
57.0000_r8/
  save detab9060Sljja

! -90 -60 land SON
  data detab9060Slson /&
14.8854_r8, 14.8854_r8, 14.8854_r8, 14.8854_r8, 17.9281_r8, 19.7008_r8,&
18.8625_r8, 20.3725_r8, 25.7813_r8, 28.7565_r8, 34.6998_r8, 40.4984_r8,&
47.5980_r8, 52.8205_r8, 57.3446_r8, 57.3446_r8, 58.0000_r8, 58.0000_r8,&
58.0000_r8, 58.0000_r8, 58.0000_r8, 58.0000_r8, 58.0000_r8, 58.0000_r8,&
58.0000_r8/
  save detab9060Slson

! -90 -60 ocean DJF
  data detab9060Sodjff /&
35.1645_r8, 35.1645_r8, 35.1645_r8, 35.1645_r8, 35.1645_r8, 35.1645_r8,&
35.1645_r8, 35.1645_r8, 35.1645_r8, 35.1645_r8, 35.1645_r8, 35.1645_r8,&
54.4382_r8, 54.4335_r8, 52.9006_r8, 64.6571_r8, 64.6571_r8, 64.6571_r8,&
64.6571_r8, 64.6571_r8, 64.6571_r8, 64.6571_r8, 64.6571_r8, 64.6571_r8,&
64.6571_r8/

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64.6571_r8/
  save detab9060Sodjff

! -90 -60 ocean MAM
  data detab9060Somam /&
17.4123_r8, 17.4123_r8, 17.4123_r8, 17.4123_r8, 17.4123_r8, 17.4123_r8,&
17.4123_r8, 17.4123_r8, 17.4123_r8, 27.3100_r8, 37.2145_r8, 47.7802_r8,&
51.1185_r8, 57.0256_r8, 58.5765_r8, 63.5736_r8, 63.5736_r8, 63.5736_r8,&
63.5736_r8, 63.5736_r8, 63.5736_r8, 63.5736_r8, 63.5736_r8, 63.5736_r8,&
63.5736_r8/
  save detab9060Somam

! -90 -60 ocean JJA
  data detab9060Sojja /&
18.1983_r8, 18.1983_r8, 18.1983_r8, 18.1983_r8, 18.1983_r8, 18.1983_r8,&
18.1983_r8, 27.5525_r8, 30.3225_r8, 47.5780_r8, 45.0101_r8, 48.4131_r8,&
57.5580_r8, 53.6524_r8, 58.7674_r8, 58.7674_r8, 59.0000_r8, 59.0000_r8,&
59.0000_r8, 59.0000_r8, 59.0000_r8, 59.0000_r8, 59.0000_r8, 59.0000_r8,&
59.0000_r8/
  save detab9060Sojja

! -90 -60 ocean SON
  data detab9060Soson /&
20.6891_r8, 20.6891_r8, 20.6891_r8, 20.6891_r8, 20.6891_r8, 20.6891_r8,&
20.6891_r8, 20.6891_r8, 20.6891_r8, 44.7265_r8, 48.5900_r8, 50.9310_r8,&
51.1981_r8, 55.8314_r8, 58.9779_r8, 58.9779_r8, 58.9779_r8, 58.9779_r8,&
58.9779_r8, 58.9779_r8, 58.9779_r8, 58.9779_r8, 58.9779_r8, 58.9779_r8,&
58.9779_r8/
  save detab9060Soson

deo = 50._r8
del = 50._r8
index = 0

latdeg = lat*180._r8/pi
latdeg_plus5 = latdeg + 5._r8
latdeg_minus5 = latdeg - 5._r8

index = int((tamb - min_retab)/deltatemp)
index = min(max(index,min_index),len_retab-1)

corr = (tamb - min_retab)/deltatemp-index

! Obtain de for upper-value latitude:
if (mon.eq.12.or.mon.eq.1.or.mon.eq.2) then
  if (latdeg_plus5.gt.60.0_r8) then
    deo = detab6090Nodjff(index)*(1._r8-
corr)+detab6090Nodjff(index+1)*corr
    del = detab6090Nldjff(index)*(1._r8-
corr)+detab6090Nldjff(index+1)*corr
  end if
  if (latdeg_plus5.gt.30.0_r8.and.latdeg_plus5.le.60.0_r8) then
    deo = detab3060Nodjff(index)*(1._r8-
corr)+detab3060Nodjff(index+1)*corr

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        del = detab3060Nldjf(index)*(1._r8-
corr)+detab3060Nldjf(index+1)*corr
        endif
        if (latdeg_plus5.ge.-30.0_r8.and.latdeg_plus5.le.30.0_r8) then
            deo = detabtropicsodjf(index)*(1._r8-
corr)+detabtropicsodjf(index+1)*corr
            del = detabtropicsldjf(index)*(1._r8-
corr)+detabtropicsldjf(index+1)*corr
            endif
            if (latdeg_plus5.ge.-60.0_r8.and.latdeg_plus5.lt.-30.0_r8) then
                deo = detab6030Sodjf(index)*(1._r8-
corr)+detab6030Sodjf(index+1)*corr
                del = detab6030Sldjf(index)*(1._r8-
corr)+detab6030Sldjf(index+1)*corr
                endif
                if (latdeg_plus5.lt.-60.0_r8) then
                    deo = detab9060Sodjf(index)*(1._r8-
corr)+detab9060Sodjf(index+1)*corr
                    del = detab9060Sldjf(index)*(1._r8-
corr)+detab9060Sldjf(index+1)*corr
                end if
            end if
            if (mon.eq.3.or.mon.eq.4.or.mon.eq.5) then
                if (latdeg_plus5.gt.60.0_r8) then
                    deo = detab6090Nomam(index)*(1._r8-
corr)+detab6090Nomam(index+1)*corr
                    del = detab6090Nlmam(index)*(1._r8-
corr)+detab6090Nlmam(index+1)*corr
                end if
                if (latdeg_plus5.gt.30.0_r8.and.latdeg_plus5.le.60.0_r8) then
                    deo = detab3060Nomam(index)*(1._r8-
corr)+detab3060Nomam(index+1)*corr
                    del = detab3060Nlmam(index)*(1._r8-
corr)+detab3060Nlmam(index+1)*corr
                endif
                if (latdeg_plus5.ge.-30.0_r8.and.latdeg_plus5.le.30.0_r8) then
                    deo = detabtropicsomam(index)*(1._r8-
corr)+detabtropicsomam(index+1)*corr
                    del = detabtropicslmam(index)*(1._r8-
corr)+detabtropicslmam(index+1)*corr
                endif
                if (latdeg_plus5.ge.-60.0_r8.and.latdeg_plus5.lt.-30.0_r8) then
                    deo = detab6030Somam(index)*(1._r8-
corr)+detab6030Somam(index+1)*corr
                    del = detab6030Slmam(index)*(1._r8-
corr)+detab6030Slmam(index+1)*corr
                endif
                if (latdeg_plus5.lt.-60.0_r8) then
                    deo = detab9060Somam(index)*(1._r8-
corr)+detab9060Somam(index+1)*corr
                    del = detab9060Slmam(index)*(1._r8-
corr)+detab9060Slmam(index+1)*corr
                end if
            end if
        end if
    end if

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    if (mon.eq.6.or.mon.eq.7.or.mon.eq.8) then
        if (latdeg_plus5.gt.60.0_r8) then
            deo = detab6090Nojja(index)*(1._r8-
corr)+detab6090Nojja(index+1)*corr
            del = detab6090Nljja(index)*(1._r8-
corr)+detab6090Nljja(index+1)*corr
        end if
        if (latdeg_plus5.gt.30.0_r8.and.latdeg_plus5.le.60.0_r8) then
            deo = detab3060Nojja(index)*(1._r8-
corr)+detab3060Nojja(index+1)*corr
            del = detab3060Nljja(index)*(1._r8-
corr)+detab3060Nljja(index+1)*corr
        endif
        if (latdeg_plus5.ge.-30.0_r8.and.latdeg_plus5.le.30.0_r8) then
            deo = detabtropicsojja(index)*(1._r8-
corr)+detabtropicsojja(index+1)*corr
            del = detabtropicsljja(index)*(1._r8-
corr)+detabtropicsljja(index+1)*corr
        endif
        if (latdeg_plus5.ge.-60.0_r8.and.latdeg_plus5.lt.-30.0_r8) then
            deo = detab6030Sojja(index)*(1._r8-
corr)+detab6030Sojja(index+1)*corr
            del = detab6030Sljja(index)*(1._r8-
corr)+detab6030Sljja(index+1)*corr
        endif
        if (latdeg_plus5.lt.-60.0_r8) then
            deo = detab9060Sojja(index)*(1._r8-
corr)+detab9060Sojja(index+1)*corr
            del = detab9060Sljja(index)*(1._r8-
corr)+detab9060Sljja(index+1)*corr
        end if
    end if
    if (mon.eq.9.or.mon.eq.10.or.mon.eq.11) then
        if (latdeg_plus5.gt.60.0_r8) then
            deo = detab6090Noson(index)*(1._r8-
corr)+detab6090Noson(index+1)*corr
            del = detab6090Nlson(index)*(1._r8-
corr)+detab6090Nlson(index+1)*corr
        end if
        if (latdeg_plus5.gt.30.0_r8.and.latdeg_plus5.le.60.0_r8) then
            deo = detab3060Noson(index)*(1._r8-
corr)+detab3060Noson(index+1)*corr
            del = detab3060Nlson(index)*(1._r8-
corr)+detab3060Nlson(index+1)*corr
        endif
        if (latdeg_plus5.ge.-30.0_r8.and.latdeg_plus5.le.30.0_r8) then
            deo = detabtropicsoson(index)*(1._r8-
corr)+detabtropicsoson(index+1)*corr
            del = detabtropicslson(index)*(1._r8-
corr)+detabtropicslson(index+1)*corr
        endif
        if (latdeg_plus5.ge.-60.0_r8.and.latdeg_plus5.lt.-30.0_r8) then
            deo = detab6030Soson(index)*(1._r8-
corr)+detab6030Soson(index+1)*corr

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        del = detab6030Slson(index)*(1._r8-
corr)+detab6030Slson(index+1)*corr
        endif
        if (latdeg_plus5.lt.-60.0_r8) then
            deo = detab9060Soson(index)*(1._r8-
corr)+detab9060Soson(index+1)*corr
            del = detab9060Slson(index)*(1._r8-
corr)+detab9060Slson(index+1)*corr
            end if
        end if
        de_plus5 = max(((1.0_r8-luindex) * deo + luindex*del),0._r8)

! Obtain de for lower-value latitude:
    if (mon.eq.12.or.mon.eq.1.or.mon.eq.2) then
        if (latdeg_minus5.gt.60.0_r8) then
            deo = detab6090Nodjf(index)*(1._r8-
corr)+detab6090Nodjf(index+1)*corr
            del = detab6090Nldjf(index)*(1._r8-
corr)+detab6090Nldjf(index+1)*corr
            end if
            if (latdeg_minus5.gt.30.0_r8.and.latdeg_minus5.le.60.0_r8) then
                deo = detab3060Nodjf(index)*(1._r8-
corr)+detab3060Nodjf(index+1)*corr
                del = detab3060Nldjf(index)*(1._r8-
corr)+detab3060Nldjf(index+1)*corr
            endif
            if (latdeg_minus5.ge.-30.0_r8.and.latdeg_minus5.le.30.0_r8) then
                deo = detabtropicsodjf(index)*(1._r8-
corr)+detabtropicsodjf(index+1)*corr
                del = detabtropicsldjf(index)*(1._r8-
corr)+detabtropicsldjf(index+1)*corr
            endif
            if (latdeg_minus5.ge.-60.0_r8.and.latdeg_minus5.lt.-30.0_r8) then
                deo = detab6030Sodjf(index)*(1._r8-
corr)+detab6030Sodjf(index+1)*corr
                del = detab6030Sldjf(index)*(1._r8-
corr)+detab6030Sldjf(index+1)*corr
            endif
            if (latdeg_minus5.lt.-60.0_r8) then
                deo = detab9060Sodjf(index)*(1._r8-
corr)+detab9060Sodjf(index+1)*corr
                del = detab9060Sldjf(index)*(1._r8-
corr)+detab9060Sldjf(index+1)*corr
            end if
        end if
        if (mon.eq.3.or.mon.eq.4.or.mon.eq.5) then
            if (latdeg_minus5.gt.60.0_r8) then
                deo = detab6090Nomam(index)*(1._r8-
corr)+detab6090Nomam(index+1)*corr
                del = detab6090Nlmam(index)*(1._r8-
corr)+detab6090Nlmam(index+1)*corr
            end if
            if (latdeg_minus5.gt.30.0_r8.and.latdeg_minus5.le.60.0_r8) then

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        deo = detab3060Nomam(index)*(1._r8-
corr)+detab3060Nomam(index+1)*corr
        del = detab3060Nlmam(index)*(1._r8-
corr)+detab3060Nlmam(index+1)*corr
    endif
    if (latdeg_minus5.ge.-30.0_r8.and.latdeg_minus5.le.30.0_r8) then
        deo = detabtropicsomam(index)*(1._r8-
corr)+detabtropicsomam(index+1)*corr
        del = detabtropicslmam(index)*(1._r8-
corr)+detabtropicslmam(index+1)*corr
    endif
    if (latdeg_minus5.ge.-60.0_r8.and.latdeg_minus5.lt.-30.0_r8) then
        deo = detab6030Somam(index)*(1._r8-
corr)+detab6030Somam(index+1)*corr
        del = detab6030Slmam(index)*(1._r8-
corr)+detab6030Slmam(index+1)*corr
    endif
    if (latdeg_minus5.lt.-60.0_r8) then
        deo = detab9060Somam(index)*(1._r8-
corr)+detab9060Somam(index+1)*corr
        del = detab9060Slmam(index)*(1._r8-
corr)+detab9060Slmam(index+1)*corr
    end if
end if
if (mon.eq.6.or.mon.eq.7.or.mon.eq.8) then
    if (latdeg_minus5.gt.60.0_r8) then
        deo = detab6090Nojja(index)*(1._r8-
corr)+detab6090Nojja(index+1)*corr
        del = detab6090Nljja(index)*(1._r8-
corr)+detab6090Nljja(index+1)*corr
    end if
    if (latdeg_minus5.gt.30.0_r8.and.latdeg_minus5.le.60.0_r8) then
        deo = detab3060Nojja(index)*(1._r8-
corr)+detab3060Nojja(index+1)*corr
        del = detab3060Nljja(index)*(1._r8-
corr)+detab3060Nljja(index+1)*corr
    endif
    if (latdeg_minus5.ge.-30.0_r8.and.latdeg_minus5.le.30.0_r8) then
        deo = detabtropicsojja(index)*(1._r8-
corr)+detabtropicsojja(index+1)*corr
        del = detabtropicsljja(index)*(1._r8-
corr)+detabtropicsljja(index+1)*corr
    endif
    if (latdeg_minus5.ge.-60.0_r8.and.latdeg_minus5.lt.-30.0_r8) then
        deo = detab6030Sojja(index)*(1._r8-
corr)+detab6030Sojja(index+1)*corr
        del = detab6030Sljja(index)*(1._r8-
corr)+detab6030Sljja(index+1)*corr
    endif
    if (latdeg_minus5.lt.-60.0_r8) then
        deo = detab9060Sojja(index)*(1._r8-
corr)+detab9060Sojja(index+1)*corr
        del = detab9060Sljja(index)*(1._r8-
corr)+detab9060Sljja(index+1)*corr
    end if
end if

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        end if
    end if
    if (mon.eq.9.or.mon.eq.10.or.mon.eq.11) then
        if (latdeg_minus5.gt.60.0_r8) then
            deo = detab6090Noson(index)*(1._r8-
corr)+detab6090Noson(index+1)*corr
            del = detab6090Nlson(index)*(1._r8-
corr)+detab6090Nlson(index+1)*corr
        end if
        if (latdeg_minus5.gt.30.0_r8.and.latdeg_minus5.le.60.0_r8) then
            deo = detab3060Noson(index)*(1._r8-
corr)+detab3060Noson(index+1)*corr
            del = detab3060Nlson(index)*(1._r8-
corr)+detab3060Nlson(index+1)*corr
        endif
        if (latdeg_minus5.ge.-30.0_r8.and.latdeg_minus5.le.30.0_r8) then
            deo = detabtropicsoson(index)*(1._r8-
corr)+detabtropicsoson(index+1)*corr
            del = detabtropicslson(index)*(1._r8-
corr)+detabtropicslson(index+1)*corr
        endif
        if (latdeg_minus5.ge.-60.0_r8.and.latdeg_minus5.lt.-30.0_r8) then
            deo = detab6030Soson(index)*(1._r8-
corr)+detab6030Soson(index+1)*corr
            del = detab6030Slson(index)*(1._r8-
corr)+detab6030Slson(index+1)*corr
        endif
        if (latdeg_minus5.lt.-60.0_r8) then
            deo = detab9060Soson(index)*(1._r8-
corr)+detab9060Soson(index+1)*corr
            del = detab9060Slson(index)*(1._r8-
corr)+detab9060Slson(index+1)*corr
        end if
    end if
    de_minus5 = max(((1.0_r8-luindex) * deo + luindex*del), 0._r8)

```

! Final calculation of de:

```

! latdeg_minus5 <= -60 and -60 <= latdeg_plus5
if (latdeg_minus5.le.-60.0_r8.and.latdeg_plus5.ge.-60.0_r8) then
    de=(ABS(-60._r8 - (latdeg_minus5))/10._r8)*de_minus5 &
    + (ABS(-60._r8 - (latdeg_plus5))/10._r8)*de_plus5

! latdeg_minus5 <= -30 and -30 <= latdeg_plus5
else if (latdeg_minus5.le.-30.0_r8.and.latdeg_plus5.ge.-30.0_r8) then
    de=(ABS(-30._r8 - (latdeg_minus5))/10._r8)*de_minus5 &
    + (ABS(-30._r8 - (latdeg_plus5))/10._r8)*de_plus5

! latdeg_minus5 <= 30 and 30 <= latdeg_plus5
else if (latdeg_minus5.le.30.0_r8.and.latdeg_plus5.ge.30.0_r8) then
    de=(ABS(30._r8 - (latdeg_minus5))/10._r8)*de_minus5 &
    + (ABS(30._r8 - (latdeg_plus5))/10._r8)*de_plus5

```

```

! latdeg_minus5 <= 60 and 60 <= latdeg_plus5
else if (latdeg_minus5.le.60.0_r8.and.latdeg_plus5.ge.60.0_r8) then
  de=(ABS(60._r8 - (latdeg_minus5))/10._r8)*de_minus5 &
    + (ABS(60._r8 - (latdeg_plus5))/10._r8)*de_plus5
! other case; Now, the slope should be zero.
else
  de = (de_minus5 + de_plus5)/2._r8
endif

!Final calculation of de:
!Limits to constrain de to only the observed range and avoid
extrapolation.

if (de .lt. 11._r8) then
  de = 11._r8
endif
if (de .gt. 106._r8) then
  de = 106._r8
endif
return
end subroutine deitabhet

```