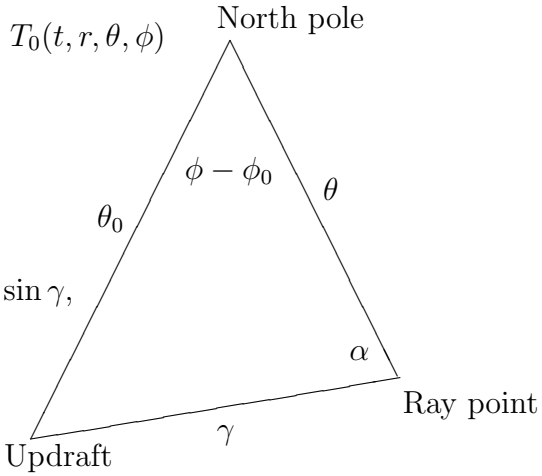
FORM TO SPECIFY INPUT DATA FOR TEMPERATURE PERTURBATION MODEL TDRAFT

$T = T_0(t, r, \theta, \phi) + A_1 f(\psi_1) + A_2 f(\psi_2)$, where $T_0(t, r, \theta, \phi)$ is given by a background temperature model,
$\psi = \sum_{i=1}^{2} \psi_i$ is the stream function,
$\psi_i = \frac{r_e^2 w_i h^2 \sin^2 \gamma_i}{h_i^2 + h^2}(1 - e^{-\beta_i})/2 - \frac{r_e^2 w_i \sin^2 \gamma_i}{2}$,
$\beta_i = \frac{\sin^2 \gamma}{\sin^2 \gamma_i}$, $h = r - r_e$,
$\cos \gamma = \sin \lambda_0 \cos \theta + \cos \lambda_0 \sin \theta \cos (\phi - \phi_0)$,
$\cos \alpha = [\sin \theta \cos \theta_0 - \sin \theta_0 \cos \theta \cos(\phi - \phi_0)]/ \sin \gamma$,
$\sin \alpha = \sin \theta_0 \sin(\phi - \phi_0)/ \sin \gamma$,
$\theta_0 = \pi/2 - \lambda_0$, and
$f(\psi) = A + B\psi$.



This model represents the temperature perturbation as a function of the stream function that gives an updraft plus a down draft.

Specify–
the model check for TDRAFT = 3.0 (w225)
the input data-format code = _____ (w226)
an input data-set identification number = _____ (w227)
an 80-character description of the model with parameters:

_____

and the model values:
A_1 _____ (w228)
A_2 _____ (w229)
A _____ Kelvin (w230)
B _____ Kelvin s km^{-3} (w231)
λ_0 latitude of the updraft/downdraft _____ rad, deg, km (w128)
ϕ_0 longitude of the updraft/downdraft _____ rad, deg, km (w129)
w_1 maximum speed of the updraft _____ km/s, m/s (w130)
γ_1 half width of the updraft _____ rad, deg, km (w131)
h_1 depth of the inflow _____ km, m (w132)
w_2 maximum speed of the downdraft _____ km/s, m/s (w133)
γ_2 half width of the downdraft _____ rad, deg, km (w134)
h_2 depth of the outflow _____ km, m (w135)

OTHER MODELS REQUIRED: Any background temperature model.

$$\frac{\partial T}{\partial r} = \frac{\partial T_0}{\partial r} + A_1 f\prime(\psi_1)\frac{\partial \psi_1}{\partial r} + A_2 f\prime(\psi_2)\frac{\partial \psi_2}{\partial r}$$
$$\frac{\partial T}{\partial \theta} = \frac{\partial T_0}{\partial \theta} + A_1 f\prime(\psi_1)\frac{\partial \psi_1}{\partial \theta} + A_2 f\prime(\psi_2)\frac{\partial \psi_2}{\partial \theta}$$
$$\frac{\partial T}{\partial \phi} = \frac{\partial T_0}{\partial \phi} + A_1 f\prime(\psi_1)\frac{\partial \psi_1}{\partial \phi} + A_2 f\prime(\psi_2)\frac{\partial \psi_2}{\partial \phi}$$
$$f\prime(\psi_i) = B$$
$$\frac{\partial \psi_i}{\partial r} = -rhv_{Hi}\sin\gamma$$
$$\frac{\partial \psi_i}{\partial \theta} = (\frac{1}{\sin\gamma}\frac{\partial \psi_i}{\partial \gamma})(\sin\gamma\frac{\partial \gamma}{\partial \theta})$$
$$\frac{\partial \psi_i}{\partial \phi} = (\frac{1}{\sin\gamma}\frac{\partial \psi_i}{\partial \gamma})(\sin\gamma\frac{\partial \gamma}{\partial \phi})$$
$$\frac{1}{\sin\gamma}\frac{\partial \psi_i}{\partial \gamma} = r^2 hv_{ri}$$

Definitions:

FORTRAN variable	Variable name	Definition
LAMBDA0	λ_0	Latitude of updraft/downdraft
PHI0	ϕ_0	Longitude of updraft/downdraft
W1	w_1	Maximum speed of updraft
W2	w_2	Maximum speed of downdraft
GAMMA1	γ_1	Half width of updraft
GAMMA2	γ_2	Half width of downdraft
H1	h_1	Depth of inflow
H2	h_2	Depth of outflow
EARTHR	r_e	Radius of the Earth
EARSQ	r_e^2	
SING1SQ	$\sin^2\gamma_1$	
SING2SQ	$\sin^2\gamma_2$	
SINLAM0	$\sin\lambda_0$	
	θ_0	Co-latitude of updraft/downdraft
COSTH0	$\cos\theta_0$	
COSLAM0	$\cos\lambda_0$	
SINTH0	$\sin\theta_0$	
H1SQ	h_1^2	
H2SQ	h_2^2	
VH	v_H	Horizontal component of wind velocity
	r	Distance from center of Earth to ray point
RSQ	r^2	
H	h	Height of ray point above sea level
HSQ	h^2	
HCUBE	h^3	

	θ	Co-latitude of ray point
COSTH	$\cos\theta$	
SINTH	$\sin\theta$	
PH	ϕ	Longitude of ray point
COSPH	$\cos(\phi - \phi_0)$	
SINPH	$\sin(\phi - \phi_0)$	
	γ	Great circle angle between updraft/downdraft and ray point
COSGAM	$\cos\gamma$	
SINGAM	$\sin\gamma$	
SINGSQ	$\sin^2\gamma$	
BETA1	$\beta_1 = \sin^2\gamma/\sin^2\gamma_1$	
BETA2	$\beta_2 = \sin^2\gamma/\sin^2\gamma_2$	
EXBET1	$e^{-\beta_1}$	
EXBET2	$e^{-\beta_2}$	
SUM1	$h_1^2 + h^2$	
SUM2	$h_2^2 + h^2$	
SUM1SQ	$(h_1^2 + h^2)^2$	
SUM2SQ	$(h_2^2 + h^2)^2$	
TEMP	$r_e^2 h\cos\gamma/r^2$	
VR1	$v_{r1} = r_e^2 h\cos\gamma/r^2 w_1 e^{-\beta_1}/(h_1^2 + h^2)$	
VR2	$v_{r2} = r_e^2 h\cos\gamma/r^2 w_2 e^{-\beta_2}/(h_2^2 + h^2)$	
VR	$v_r = (v_{r1} + v_{r2})h$	Vertical component of wind velocity
PVRR	$\partial v_r/\partial r$	
PVRR1	$\partial v_r/\partial r$	for updraft only
PVRR2	$\partial v_r/\partial r$	for downdraft only
SECGAM	$\sec\gamma$	
SGPGTH	$\sin\gamma\partial\gamma/\partial\theta$	
SGPGPH	$\sin\gamma\partial\gamma/\partial\phi$	
PVRG1	$1/\sin\gamma\partial v_r/\partial\gamma$	for updraft only
PVRG2	$1/\sin\gamma\partial v_r/\partial\gamma$	for downdraft only
PVRTH	$\partial v_r/\partial\theta$	
PVRPH	$\partial v_r/\partial\phi$	
TEMPB	$-r_e^2/(r\sin\gamma)$	
TEMP1	$1 - e^{-\beta_1}$	
TEMP2	$1 - e^{-\beta_2}$	
VH1	v_{H1}	
VH2	v_{H2}	

VH	$v_H = (v_{H1} + v_{H2})h$	horizontal component of wind velocity
	α	azimuth angle of updraft counter-clockwise from North as viewed from ray point
SINALP	$\sin\alpha$	
SINALPSQ	$\sin^2\alpha$	
COSALP	$\cos\alpha$	
COSALPSQ	$\cos^2\alpha$	
VTH	v_θ	Southward component of wind velocity
VPH	v_ϕ	Eastward component of wind velocity
PVHR	$\partial v_H/\partial r$	
PVHR1	$\partial v_H/\partial r$	for updraft only
PVHR2	$\partial v_H/\partial r$	for downdraft only
PVTHR	$\partial v_\theta/\partial r$	
PSINALPTH	$\partial \sin\alpha/\partial\theta$	
PSINALPPH	$\partial \sin\alpha/\partial\phi$	
PCOSALPTH	$\partial \cos\alpha/\partial\theta$	
PCOSALPPH	$\partial \cos\alpha/\partial\phi$	
PVHPG	$1/\sin\gamma\partial v_H/\partial\gamma$	
PVHPG1	$1/\sin\gamma\partial v_H/\partial\gamma$	for updraft only
PVHPG2	$1/\sin\gamma\partial v_H/\partial\gamma$	for downdraft only
PVHTH	$\partial v_H/\partial\theta$	
PVHPH	$\partial v_H/\partial\phi$	
PVTHTH	$\partial v_\theta/\partial\theta$	
PVTHPH	$\partial v_\theta/\partial\phi$	
PVPHR	$\partial v_\phi/\partial r$	
PVPHTH	$\partial v_\phi/\partial\theta$	
PVPHPH	$\partial v_\phi/\partial\phi$	
VSQ	$\lvert v\rvert^2$	
V	$\lvert v\rvert$	
PVTH	$\partial\lvert v\rvert/\partial\theta$	
PVPH	$\partial\lvert v\rvert/\partial\phi$	
PVR	$\partial\lvert v\rvert/\partial r$	
C1	$C_1 = \frac{r_e^2 w_1 \sin^2\gamma_1}{2}$	
C2	$C_2 = \frac{r_e^2 w_2 \sin^2\gamma_2}{2}$	
PPSI1R	$\partial\psi_1/\partial r$	
PPSI2R	$\partial\psi_2/\partial r$	
PPSI1TH	$\partial\psi_1/\partial\theta$	

PPSI2TH	$\partial\psi_2/\partial\theta$
PPSI1PH	$\partial\psi_1/\partial\phi$
PPSI2PH	$\partial\psi_2/\partial\phi$
PTR	$\frac{\partial T}{\partial r}$
PTTH	$\frac{\partial T}{\partial \theta}$
PTPH	$\frac{\partial T}{\partial \phi}$
PSI1	ψ_1
PSI2	ψ_2
CSCGPPSI1G	$\frac{1}{\sin\gamma}\frac{\partial\psi_1}{\partial\gamma}$
CSCGPPSI2G	$\frac{1}{\sin\gamma}\frac{\partial\psi_2}{\partial\gamma}$