

Response to Request from Herman Wong on March 12, 2011

In an email to Kirk Winges of ENVIRON dated March 12, 2011, Herman Wong of EPA Region 10 made the following request:

When Rob Elleman returns from his travel, I would like to schedule a meeting with Ken and you (Nicole?) in our office to go over the CD containing the evaluations. As a prelude to the meeting, can Shell provide a table that list all the meteorological variables required by the AERMOD dispersion program (i.e., surface and profile file) and how each variable was obtained (e.g., measurement, OCD extracted, independently calculated...etc.) for the three field studies including any passed through variables? Of particular importance will be those variables derived specifically for a marine environment as oppose to a terrestrial application. These variables should be highlighted and explained in text and equations, formula, Fairall papers...etc. And, if there are other options not listed to obtain/derive these variables, please discuss them.

Response: The attached tables provide the detail on how each meteorological variable is calculated and/or obtained. Please note that in the CD that was sent to you last week with the model evaluation files had an error in the labeling of two of the directories. To avoid confusion, please reverse the pismo\case3-aermod and pismo\case4-aermod_5L. We can send a revised CD if you prefer.

Cameron Met. Data

Common Analysis for all Cases:

Input variables to COARE

Name	Description	Source or Value
	Latitude	29.9
	Longitude	-93.3
	Mix. Ht. For Gustiness Calc	-999 (dummy value, COARE uses 600m)
u(m/s)	Wind speed (m/s)	Tracer Experimental Data
tseaC	Temp. of Sea Surface (°C)	Tracer Experimental Data except when inconsistent with temperature gradient data, then calculated from temp. measurement height and temperature gradient
tairC	Air Temp. (°C)	Tracer Experimental Data
RH(%)	Relative Humidity (%)	Tracer Experimental Data
PresMb	Pressure (mb)	1000 for all hours (OCD default)
rsW/m2	Solar radiation (W/m ²)	0 for all hours
tsky	Sky cloud cover (tenths)	0 for all hours
Ceill(100ft)	Ceiling Height (100's ft)	888 for all hours
Rain(mm)	Rainfall (mm/h)	0 for all hours
hwaveM	Not used	not used -999 for all hours
twaveS	Not used	not used -999 for all hours
zws	Ht. of wind sensor (m)	10 or 18 from tracer experiment data
ztemp	Ht. of temp. sensor (m)	10 or 18 from tracer experiment data
zrh	Ht. of RH sensor (m)	10 or 18 from tracer experiment data
ts_depth	Depth of sea surface meas. (m)	0.5 for all cases

Output Variables from COARE

Symbol	Description	Units
hf	Sensible heat flux	W/m ²
ef	Latent heat flux	W/M ²
sst	Skin temperature (sst = tsea - dter + dsea)	Deg. C
tau	Wind stress	N/m ²
Wbar	Webb mean vertical velocity	m/s
rf	Relative humidity	%
dter	cool skin temperature difference	Deg C
dt_wrm	total warm layer temperature difference	Deg C

tk_pwp	thickness of warm layer	M
tkt*1000.	cool skin thickness	mm x 1000
Wg	gustiness factor	m/s
usr	M-O velocity scaling parameter u^* = friction velocity	m/s
tsr	M-O temperature scaling parameter t^*	Deg C
qsr*1000	M-O humidity scaling parameter q^*	kg/kg
xmol	Obukov Length	M
zo	Velocity roughness length	M
zot	Temperature roughness length	M
zoq	Humidity roughness length	M

Analysis Specific to Cases:

	Case1	Case 2	Case 3	Case 4	Case 5
Name	aermod_venk	aermod_nosigma	aermod	aermod_5L	aermod_drax
.sfc file	cameron_venk.sfc	cameron_venk.sfc	cameron_5L.sfc	cameron.sfc	cameron_venk.sfc
.pfl file	cameron.pfl	cameron_nosigma.pfl	cameron.pfl	cameron.pfl	cameron.pfl
Sigma Θ	measured	predicted	measured	measured	measured
Obukhov	>5	>5	>1	>5	>5
Lateral Dispersion	aermod	aermod	aermod	aermod	draxler
Mix Hts.	Venketram >25	Venketram >25	Observed	Observed	Venketram >25

.SFC file:

yr	year	81 or 82	81 or 82	81 or 82	81 or 82	81 or 82
mo	month	July or February	July or February	July or February	July or February	July or February
dy	day	Varies	Varies	Varies	Varies	Varies
jday	Julian Day	Varies	Varies	Varies	Varies	Varies
hr	Hour	Varies	Varies	Varies	Varies	Varies
SHF	Sensible Heat Flux (W/m ²)	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case
ustar	surface friction velocity (m/s)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)
wstar	Convective velocity scale (m/s)	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above
VPTG	Vertical potential temperature gradient above PBL (°C/m)	Set = 0.01 for all cases	Set = 0.01 for all cases	Set = 0.01 for all cases	Set = 0.01 for all cases	Set = 0.01 for all cases
Zi (Conv)	Convective Mixing Height (m)	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).

Zi (mech)	Mechanical Mixing Height (m)	$2300(u^*)^{1.5}$ limited to at least 25 m note u^* is modified as above	$2300(u^*)^{1.5}$ limited to at least 25 m note u^* is modified as above	Used Experiment Reported values for Z_{i-mech} (source unknown)	Used Experiment Reported values for Z_{i-mech} (source unknown)	$2300(u^*)^{1.5}$ limited to at least 25 m note u^* is modified as above
L	Monin-Obukhov Length (m)	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >1	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5
z0	Surface roughness Length(m)	Taken from COARE output	Taken from COARE output	Taken from COARE output	Taken from COARE output	Taken from COARE output
Bowen	Bowen Ratio	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0
Albedo	Albedo	Set to 0.055 for all cases	Set to 0.055 for all cases	Set to 0.055 for all cases	Set to 0.055 for all cases	Set to 0.055 for all cases
Speed	Wind Speed (m/s)	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data
Dir	Wind Direction	Set to 270° for all cases and receptor always set on plume centerline	Set to 270° for all cases and receptor always set on plume centerline	Set to 270° for all cases and receptor always set on plume centerline	Set to 270° for all cases and receptor always set on plume centerline	Set to 270° for all cases and receptor always set on plume centerline
Zwind	Ref. Ht. for wind Speed (m)	Either 10m or 18m from tracer experiment data	Either 10m or 18m from tracer experiment data	Either 10m or 18m from tracer experiment data	Either 10m or 18m from tracer experiment data	Either 10m or 18m from tracer experiment data
temp	Temperature (*K)	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data
Ztemp	Ref. Ht. for Temperature (m)	Either 10m or 18m from tracer experiment data	Either 10m or 18m from tracer experiment data	Either 10m or 18m from tracer experiment data	Either 10m or 18m from tracer experiment data	Either 10m or 18m from tracer experiment data
prec code	Precip. Code (not used)	Always 9999	Always 9999	Always 9999	Always 9999	Always 9999
precip	Precipitation (not used)	-9.00 for all cases	-9.00 for all cases	-9.00 for all cases	-9.00 for all cases	-9.00 for all cases
RH	Relative Humidity (%)	From the tracer experiment data	From the tracer experiment data	From the tracer experiment data	From the tracer experiment data	From the tracer experiment data
pres	Barometric Pressure (mb)	Always 1000	Always 1000	Always 1000	Always 1000	Always 1000
CC	Cloud Cover (tenths)	Always 0	Always 0	Always 0	Always 0	Always 0

.pfl file

For 2 heights - Data for First Height

yr	year	81 or 82	81 or 82	81 or 82	81 or 82	81 or 82
mo	month	July or February	July or February	July or February	July or February	July or February
dy	day	Varies	Varies	Varies	Varies	Varies
hour	hour	Varies	Varies	Varies	Varies	Varies
height1	meas. Ht. (m)	10 all cases	10 all cases	10 all cases	10 all cases	10 all cases
last?	Indicator if more than one level is used	0 for first level	0 for first level	0 for first level	0 for first level	0 for first level
dir1	wind direction	The first half of the experimental data used 270 for all cases. The second have of the experimenal data used 999 for all cases	The first half of the experimental data used 270 for all cases. The second have of the experimenal data used 999 for all cases	The first half of the experimental data used 270 for all cases. The second have of the experimenal data used 999 for all cases	The first half of the experimental data used 270 for all cases. The second have of the experimenal data used 999 for all cases	The first half of the experimental data used 270 for all cases. The second have of the experimenal data used 999 for all cases
speed1	Wind Speed (m/s)	The first half of the hours used experimental data measured at this height	The first half of the hours used experimental data measured at this height	The first half of the hours used experimental data measured at this height	The first half of the hours used experimental data measured at this height	The first half of the hours used experimental data measured at this height

temp1	Temperature (°C)	6 of the 26 hours used experimental data measured at this height	6 of the 26 hours used experimental data measured at this height	6 of the 26 hours used experimental data measured at this height	6 of the 26 hours used experimental data measured at this height	6 of the 26 hours used experimental data measured at this height
SigTheta1	sigma theta (deg)	8 of the 26 hours used experimental data measured at this height	Assumed 999 for all horus	8 of the 26 hours used experimental data measured at this height	8 of the 26 hours used experimental data measured at this height	8 of the 26 hours used experimental data measured at this height
SigW1	Sigma W (m/s)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)
For 2 heights - Data for Second Height						
yr	year	81 or 82	81 or 82	81 or 82	81 or 82	81 or 82
mo	month	July or February	July or February	July or February	July or February	July or February
dy	day	Varies	Varies	Varies	Varies	Varies
hour	hour	Varies	Varies	Varies	Varies	Varies
height2	meas. Ht. (m)	18 all cases	18 all cases	18 all cases	18 all cases	18 all cases
last?	Indicator if more than one level is used	1 for second level	1 for second level	1 for second level	1 for second level	1 for second level
dir2	wind direction	The first half of the experimental data used 999 for all cases. The second have of the experimenal data used 270 for all cases	The first half of the experimental data used 999 for all cases. The second have of the experimenal data used 270 for all cases	The first half of the experimental data used 999 for all cases. The second have of the experimenal data used 270 for all cases	The first half of the experimental data used 999 for all cases. The second have of the experimenal data used 270 for all cases	The first half of the experimental data used 999 for all cases. The second have of the experimenal data used 270 for all cases
speed2	Wind Speed (m/s)	The second half of the hours used experimental data measured at this height	The second half of the hours used experimental data measured at this height	The second half of the hours used experimental data measured at this height	The second half of the hours used experimental data measured at this height	The second half of the hours used experimental data measured at this height
temp2	Temperature (°C)	20 of the 26 hours used experimental data measured at this height	20 of the 26 hours used experimental data measured at this height	20 of the 26 hours used experimental data measured at this height	20 of the 26 hours used experimental data measured at this height	20 of the 26 hours used experimental data measured at this height
SigTheta2	sigma theta (deg)	13 of the 26 hours used experimental data measured at this height	Assumed 999 for all horus	13 of the 26 hours used experimental data measured at this height	13 of the 26 hours used experimental data measured at this height	13 of the 26 hours used experimental data measured at this height
SigW2	Sigma W (m/s)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)

Pimso Beach Met. Data

Common Analysis for all Cases:

Input variables to COARE

Name	Description	Source or Value
	Latitude	35.1
	Longitude	-120.6
	Mix. Ht. For Gustiness Calc	-999 (dummy value, COARE uses 600m)
u(m/s)	Wind speed (m/s)	Tracer Experimental Data
tseaC	Temp. of Sea Surface (°C)	Tracer Experimental Data except when inconsistent with temperature gradient data, then calculated from temp. measurement height and temperature gradient
tairC	Air Temp. (°C)	Tracer Experimental Data
RH(%)	Relative Humidity (%)	Tracer Experimental Data
PresMb	Pressure (mb)	1000 for all hours (OCD default)
rsW/m2	Solar radiation (W/m ²)	0 for all hours
tsky	Sky cloud cover (tenths)	0 for all hours
Ceill(100ft)	Ceiling Height (100's ft)	888 for all hours
Rain(mm)	Rainfall (mm/h)	0 for all hours
hwaveM	Not used	not used -999 for all hours
twaveS	Not used	not used -999 for all hours
zws	Ht. of wind sensor (m)	20.5
ztemp	Ht. of temp. sensor (m)	7
zrh	Ht. of RH sensor (m)	7
ts_depth	Depth of sea surface meas. (m)	0.5

Output Variables from COARE

Symbol	Description	Units
hf	Sensible heat flux	W/m ²
ef	Latent heat flux	W/M ²
sst	Skin temperature (sst = tsea - dter + dsea)	Deg. C
tau	Wind stress	N/m ²
Wbar	Webb mean vertical velocity	m/s
rf	Relative humidity	%
dter	cool skin temperature difference	Deg C
dt_wrm	total warm layer temperature difference	Deg C

tk_pwp	thickness of warm layer	M
tkt*1000.	cool skin thickness	mm x 1000
Wg	gustiness factor	m/s
usr	M-O velocity scaling parameter u^* = friction velocity	m/s
tsr	M-O temperature scaling parameter t^*	Deg C
qsr*1000	M-O humidity scaling parameter q^*	kg/kg
xmol	Obukov Length	M
zo	Velocity roughness length	M
zot	Temperature roughness length	M
zoq	Humidity roughness length	M

Analysis Specific to Cases:

	Case1	Case 2	Case 3	Case 4	Case 5
Name	aermod_venk	aermod_nosigma	aermod_5L	aermod	aermod_drax
.sfc file	pismo_venk.sfc	pismo_venk.sfc	pismo_5L.sfc	pismo.sfc	pismo_venk.sfc
.pfl file	pismo.pfl	pismo_nosigma.pfl	pismo.pfl	pismo.pfl	pismo.pfl
Sigma Θ	measured	predicted	measured	measured	measured
Obukhov	>5	>5	>1	>5	>5
Lateral Dispersion	aermod	aermod	aermod	aermod	draxler
Mix Hts.	Venketram >25	Venketram >25	Observed	Observed	Venketram >25

.SFC file:

yr	year	81 or 82	81 or 82	81 or 82	81 or 82	81 or 82
mo	month	December or June	December or June	December or June	December or June	December or June
dy	day	Varies	Varies	Varies	Varies	Varies
jday	Julian Day	Varies	Varies	Varies	Varies	Varies
hr	Hour	Varies	Varies	Varies	Varies	Varies
SHF	Sensible Heat Flux (W/m ²)	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case
ustar	surface friction velocity (m/s)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)
wstar	Convective velocity scale (m/s)	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})/(0.4L)]^{1/3}$ note u^* is modified as above
VPTG	Vertical potential temperature gradient above PBL (°C/m)	Set = 0.01 for all cases	Set = 0.01 for all cases	Set = 0.01 for all cases	Set = 0.01 for all cases	Set = 0.01 for all cases
Zi (Conv)	Convective Mixing Height (m)	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).

Zi (mech)	Mechanical Mixing Height (m)	$2300(u^*)^{1.5}$ limited to at least 25 m note u^* is modified as above	$2300(u^*)^{1.5}$ limited to at least 25 m note u^* is modified as above	Used Experiment Reported values for Z_{i-mech} (source unknown)	Used Experiment Reported values for Z_{i-mech} (source unknown)	$2300(u^*)^{1.5}$ limited to at least 25 m note u^* is modified as above
L	Monin-Obukhov Length (m)	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5 and <8888	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5 and <8888	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >1 and <8888	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5 and <8888	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5 and <8888
z0	Surface roughness Length(m)	Taken from COARE output	Taken from COARE output	Taken from COARE output	Taken from COARE output	Taken from COARE output
Bowen	Bowen Ratio	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0
Albedo	Albedo	Set to 0.055 for all cases	Set to 0.055 for all cases	Set to 0.055 for all cases	Set to 0.055 for all cases	Set to 0.055 for all cases
Speed	Wind Speed (m/s)	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data
Dir	Wind Direction	Set to 270° for all cases and receptor always set on plume centerline	Set to 270° for all cases and receptor always set on plume centerline	Set to 270° for all cases and receptor always set on plume centerline	Set to 270° for all cases and receptor always set on plume centerline	Set to 270° for all cases and receptor always set on plume centerline
Zwind	Ref. Ht. for wind Speed (m)	20.5 m for all cases	20.5 m for all cases	20.5 m for all cases	20.5 m for all cases	20.5 m for all cases
temp	Temperature (°K)	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data
Ztemp	Ref. Ht. for Temperature (m)	7 m for all cases	7 m for all cases	7 m for all cases	7 m for all cases	7 m for all cases
prec code	Precip. Code (not used)	Always 9999	Always 9999	Always 9999	Always 9999	Always 9999
precip	Precipitation (not used)	-9.00 for all cases	-9.00 for all cases	-9.00 for all cases	-9.00 for all cases	-9.00 for all cases
RH	Relative Humidity (%)	From the tracer experiment data	From the tracer experiment data	From the tracer experiment data	From the tracer experiment data	From the tracer experiment data
pres	Barometric Pressure (mb)	Always 1000	Always 1000	Always 1000	Always 1000	Always 1000
CC	Cloud Cover (tenths)	Always 0	Always 0	Always 0	Always 0	Always 0

.pfl file

For 2 heights - Data for First Height

yr	year	81 or 82	81 or 82	81 or 82	81 or 82	81 or 82
mo	month	December or June	December or June	December or June	December or June	December or June
dy	day	Varies	Varies	Varies	Varies	Varies
hour	hour	Varies	Varies	Varies	Varies	Varies
height1	meas. Ht. (m)	7 all cases	7 all cases	7 all cases	7 all cases	7 all cases
last?	Indicator if more than one level is used	0 for first level	0 for first level	0 for first level	0 for first level	0 for first level
dir1	wind direction	In all cases 999 (wind direction measured only at second height)	In all cases 999 (wind direction measured only at second height)	In all cases 999 (wind direction measured only at second height)	In all cases 999 (wind direction measured only at second height)	In all cases 999 (wind direction measured only at second height)
speed1	Wind Speed (m/s)	In all cases 99 (wind speed measured only at second height)	In all cases 99 (wind speed measured only at second height)	In all cases 99 (wind speed measured only at second height)	In all cases 99 (wind speed measured only at second height)	In all cases 99 (wind speed measured only at second height)
temp1	Temperature (°C)	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data

SigTheta1	sigma theta (deg)	In all cases 999 (wind direction measured only at second hieght)	In all cases 999 (wind direction measured only at second hieght)	In all cases 999 (wind direction measured only at second hieght)	In all cases 999 (wind direction measured only at second hieght)	In all cases 999 (wind direction measured only at second hieght)
SigW1	Sigma W (m/s)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)

For 2 heights - Data for Second Height

yr	year	81 or 82	81 or 82	81 or 82	81 or 82	81 or 82
mo	month	December or June	December or June	December or June	December or June	December or June
dy	day	Varies	Varies	Varies	Varies	Varies
hour	hour	Varies	Varies	Varies	Varies	Varies
height2	meas. Ht. (m)	20.5 all cases	20.5 all cases	20.5 all cases	20.5 all cases	20.5 all cases
last?	Indicator if more than one level is used	1 for second level	1 for second level	1 for second level	1 for second level	1 for second level
dir2	wind direction	270 for all cases	270 for all cases	270 for all cases	270 for all cases	270 for all cases
speed2	Wind Speed (m/s)	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data
temp2	Temperature (°C)	99 for all cases (temp. not measured at this height)	99 for all cases (temp. not measured at this height)	99 for all cases (temp. not measured at this height)	99 for all cases (temp. not measured at this height)	99 for all cases (temp. not measured at this height)
SigTheta2	sigma theta (deg)	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data
SigW2	Sigma W (m/s)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)

Carpinteria Met. Data

Common Analysis for all Cases:

Input variables to COARE

Name	Description	Source or Value
	Latitude	34.4
	Longitude	-119.5
	Mix. Ht. For Gustiness Calc	-999 (dummy value, COARE uses 600m)
u(m/s)	Wind speed (m/s)	Tracer Experimental Data
tseaC	Temp. of Sea Surface (°C)	Tracer Experimental Data except when inconsistent with temperature gradient data, then calculated from temp. measurement height and temperature gradient
tairC	Air Temp. (°C)	Tracer Experimental Data
RH(%)	Relative Humidity (%)	Tracer Experimental Data
PresMb	Pressure (mb)	1000 for all hours (OCD default)
rsW/m2	Solar radiation (W/m ²)	0 for all hours
tsky	Sky cloud cover (tenths)	0 for all hours
Ceill(100ft)	Ceiling Height (100's ft)	888 for all hours
Rain(mm)	Rainfall (mm/h)	0 for all hours
hwaveM	Not used	not used -999 for all hours
twaveS	Not used	not used -999 for all hours
zws	Ht. of wind sensor (m)	Variable heights from 24 to 91 m depending on the experiment
ztemp	Ht. of temp. sensor (m)	9 m from tracer experiment data
zrh	Ht. of RH sensor (m)	9 m from tracer experiment data
ts_depth	Depth of sea surface meas. (m)	0.5 for all cases

Output Variables from COARE

Symbol	Description	Units
hf	Sensible heat flux	W/m ²
ef	Latent heat flux	W/M ²
sst	Skin temperature (sst = tsea - dter + dsea)	Deg. C
tau	Wind stress	N/m ²
Wbar	Webb mean vertical velocity	m/s
rf	Relative humidity	%
dter	cool skin temperature difference	Deg C

dt_wrm	total warm layer temperature difference	Deg C
tk_pwp	thickness of warm layer	M
tkt*1000.	cool skin thickness	mm x 1000
Wg	gustiness factor	m/s
usr	M-O velocity scaling parameter u^* = friction velocity	m/s
tsr	M-O temperature scaling parameter t^*	Deg C
qsr*1000	M-O humidity scaling parameter q^*	kg/kg
xmol	Obukov Length	M
zo	Velocity roughness length	M
zot	Temperature roughness length	M
zoq	Humidity roughness length	M

Analysis Specific to Cases:

		Case1	Case 2	Case 3	Case 4	Case 5
Name		aermod_venk	aermod_nosigma	aermod	aermod_5L	aermod_drax
.sfc file		carp_venk.sfc	carp_venk.sfc	carp.sfc	carp_5L.sfc	carp_venk.sfc
.pfl file		carp.pfl	carp_nosigma.pfl	carp.pfl	carp.pfl	carp.pfl
Sigma Θ		measured	predicted	measured	measured	measured
Obukhov		>5	>5	>1	>5	>5
Lateral Dispersion		aermod	aermod	aermod	aermod	draxler
Mix Hts.		Venketram >25	Venketram >25	Observed	Observed	Venketram >25

.SFC file:

yr	year	85 in all cases	85 in all cases	85 in all cases	85 in all cases	85 in all cases
mo	month	September or October	September or October	September or October	September or October	September or October
dy	day	Varies	Varies	Varies	Varies	Varies
jday	Julian Day	Varies	Varies	Varies	Varies	Varies
hr	Hour	Varies	Varies	Varies	Varies	Varies
SHF	Sensible Heat Flux (W/m ²)	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case	COARE Output Does not vary from Case to Case
ustar	surface friction velocity (m/s)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)	Ustar from COARE is multiplied by $(L_{mod}/L_{COARE})^{1/3}$ (see L disc. Below)
wstar	Convective velocity scale (m/s)	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})]/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})]/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})]/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})]/(0.4L)]^{1/3}$ note u^* is modified as above	Not used for stable cases. If Unstable = $[(u^*)(Z_{i-conv})]/(0.4L)]^{1/3}$ note u^* is modified as above
VPTG	Vertical potential temperature gradient above PBL (°C/m)	Set = 0.01 for all cases	Set = 0.01 for all cases	Set = 0.01 for all cases	Set = 0.01 for all cases	Set = 0.01 for all cases
Zi (Conv)	Convective Mixing Height (m)	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).	Not used for stable cases. If unstable use value from tracer study (source unknown).

Zi (mech)	Mechanical Mixing Height (m)	$2300(u^*)^{1.5}$ limited to at least 25 m note u^* is modified as above	$2300(u^*)^{1.5}$ limited to at least 25 m note u^* is modified as above	Used Experiment Reported values for Z_{i-mech} (source unknown)	Used Experiment Reported values for Z_{i-mech} (source unknown)	$2300(u^*)^{1.5}$ limited to at least 25 m note u^* is modified as above
L	Monin-Obukhov Length (m)	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >1	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5	L_{mod} is used here and it is just L from COARE (L_{COARE}) limited to >5
z0	Surface roughness Length(m)	Taken from COARE output	Taken from COARE output	Taken from COARE output	Taken from COARE output	Taken from COARE output
Bowen	Bowen Ratio	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0	Ratio of the sensible heat flux from COARE to the latent heat flux from COARE, but limited to >0 and set to 0 if the sensible heat flux is <0
Albedo	Albedo	Set to 0.055 for all cases	Set to 0.055 for all cases	Set to 0.055 for all cases	Set to 0.055 for all cases	Set to 0.055 for all cases
Speed	Wind Speed (m/s)	From tracer experiment data (limited to >1)	From tracer experiment data (limited to >1)	From tracer experiment data (limited to >1)	From tracer experiment data (limited to >1)	From tracer experiment data (limited to >1)
Dir	Wind Direction	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value
Zwind	Ref. Ht. for wind Speed (m)	Variable heights from 24 to 91 m depending on the experiment	Variable heights from 24 to 91 m depending on the experiment	Variable heights from 24 to 91 m depending on the experiment	Variable heights from 24 to 91 m depending on the experiment	Variable heights from 24 to 91 m depending on the experiment
temp	Temperature (°K)	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data	From tracer experiment data
Ztemp	Ref. Ht. for Temperature (m)	9 m for all cases	9 m for all cases	9 m for all cases	9 m for all cases	9 m for all cases
prec code	Precip. Code (not used)	Always 9999	Always 9999	Always 9999	Always 9999	Always 9999
precip	Precipitation (not used)	-9.00 for all cases	-9.00 for all cases	-9.00 for all cases	-9.00 for all cases	-9.00 for all cases
RH	Relative Humidity (%)	From the tracer experiment data	From the tracer experiment data	From the tracer experiment data	From the tracer experiment data	From the tracer experiment data
pres	Barometric Pressure (mb)	Always 1000	Always 1000	Always 1000	Always 1000	Always 1000
CC	Cloud Cover (tenths)	Always 0	Always 0	Always 0	Always 0	Always 0

.pfl file

For 2 heights - Data for First Height

yr	year	85 in all cases	85 in all cases	85 in all cases	85 in all cases	85 in all cases
mo	month	September or October	September or October	September or October	September or October	September or October
dy	day	Varies	Varies	Varies	Varies	Varies
hour	hour	Varies	Varies	Varies	Varies	Varies
height1	meas. Ht. (m)	9 in all cases	9 in all cases	9 in all cases	9 in all cases	9 in all cases
last?	Indicator if more than one level is used	0 for first level	0 for first level	0 for first level	0 for first level	0 for first level
dir1	wind direction	In all cases 999 (wind direction measured only at second height)	In all cases 999 (wind direction measured only at second height)	In all cases 999 (wind direction measured only at second height)	In all cases 999 (wind direction measured only at second height)	In all cases 999 (wind direction measured only at second height)
speed1	Wind Speed (m/s)	In all cases 99 (wind speed measured only at second height)	In all cases 99 (wind speed measured only at second height)	In all cases 99 (wind speed measured only at second height)	In all cases 99 (wind speed measured only at second height)	In all cases 99 (wind speed measured only at second height)
temp1	Temperature (°C)	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data

SigTheta1	sigma theta (deg)	In all cases 999 (wind direction measured only at second hieght)	In all cases 999 (wind direction measured only at second hieght)	In all cases 999 (wind direction measured only at second hieght)	In all cases 999 (wind direction measured only at second hieght)	In all cases 999 (wind direction measured only at second hieght)
SigW1	Sigma W (m/s)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)

For 2 heights - Data for Second Height

yr	year	85 in all cases	85 in all cases	85 in all cases	85 in all cases	85 in all cases
mo	month	September or October	September or October	September or October	September or October	September or October
dy	day	Varies	Varies	Varies	Varies	Varies
hour	hour	Varies	Varies	Varies	Varies	Varies
height2	meas. Ht. (m)	From Tracer Experimental Data. Varies by hour from 24m - 91 m	From Tracer Experimental Data. Varies by hour from 24m - 91 m	From Tracer Experimental Data. Varies by hour from 24m - 91 m	From Tracer Experimental Data. Varies by hour from 24m - 91 m	From Tracer Experimental Data. Varies by hour from 24m - 91 m
last?	Indicator if more than one level is used	1 for second level	1 for second level	1 for second level	1 for second level	1 for second level
dir2	wind direction	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value	Taken from tracer experimental data. Peak Model prediction from all receptors compared to observed value
speed2	Wind Speed (m/s)	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data
temp2	Temperature (°C)	99 for all cases (temp. not measured at this height)	99 for all cases (temp. not measured at this height)	99 for all cases (temp. not measured at this height)	99 for all cases (temp. not measured at this height)	99 for all cases (temp. not measured at this height)
SigTheta2	sigma theta (deg)	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data	Taken from tracer experimental data
SigW2	Sigma W (m/s)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)	999 for all cases (not used)