SOCRATES clear-sky radiation calculations. Driving and output data.

This document describes input and output data files produced by SOCRATES during an offline calculation of clear-sky LW and SW radiative fluxes. The calculations have been carried out at two levels of spectral discretisation: The first using broad-band operational spectral files for GA7 (9 band in LW and 6 band in SW), and the second using narrow-band (300 band in LW and 260 band in SW) spectral files to produce a 'truth' calculation that can be used as a training target, and against which results can be compared.

Raw data source

All driving data required by SOCRATES were taken from short runs of the Global NWP Case Study Suite (u-av302, copy of u-ak926) on an N320 grid (Δx ~ 40km at equator). Four independent dates were run which covered winter, summer, and spring (northern hemisphere) from two years. Samples were taken after 24 and 36 hrs to allow spin-up from the initial state.

To reduce the amount of raw data, and since clear-sky calculations are the aim of this pilot study, the model columns have been filtered for total cloud fraction <= 0.5. This can be increased if more data are needed.

To facilitate parallel processing the raw data have been chunked into parts with a maximum of 1500 columns in each file. The total number of columns available for training, testing and validation is therefore ~316000 for LW and approximately half this number for SW (night columns where szen >= 90 are set to zero).

The input and output files are described below. Note that there is some redundancy in the output data since the net fluxes and heating rates are derived quantities. However, these quantities (particularly the net flux divergence across layers) are critical to the model dynamics, and so emulating these directly, rather than deriving them from other emulated fluxes, may be beneficial.

Input Files

File names:

[datetime]_cs_part_[partnumber].[suffix]

[datetime] = 20110610T00, 20110824T12, 20140103T12, or 20140314T00

[partnumber] = [0,1,…M-1], where M = 50, 59, 53, and 49 respectively

[suffix] = See Table 1.

The GA7 configuration uses 70 vertical levels. From Section 2.4 of the SOCRATES user guide:

In the radiation code the atmosphere is divided into a number of homogeneous layers numbered downwards from 1 to N, these are bounded by levels numbered downwards from 0 to N. Input data is supplied as representative values in layers (equivalent to theta-levels in the UM).

Suffix	Dimensions	Notes
p	MxN	Pressure in layers
pl	Mx(N+1)	Pressure on levels
tstar	M	Surface temperature
t	MxN	Temperture in layers
tl	Mx(N+1)	Temperature on levels
stoa	M	Top of atmosphere solar flux
szen	M	Solar zenith angle
surflw	M	LW surface albedo
surfsw	M	SW surface albedo
q	MxN	Water vapour
co2	MxN	Carbon Dioxide
o3	MxN	Ozone
n2o	MxN	Nitrous Oxide
ch4	MxN	Methane
o2	MxN	Oxygen
cfc12	MxN	CFC12 equivalent
hfc134a	MxN	HFC134a equivalent

Table 1. Description of input files. See SOCRATES user guide Section 2.4 for details

Output Files

Fluxes are calculated on model levels (N+1). Heating rates are defined on model layers and are derived from the net flux divergence across each layer.

File names:

[datetime]_cs_part_[partnumber]_[wavelength]_[config].[suffix]

Where [datetime] and [partnumber] are as above.

[wavelength] = sw or lw

[config] = ga7, 300, or 260

[suffix] = See Table 2.

	Suffix	Dimensions	Notes
LW	dflx	Mx(N+1)	Downward flux on levels
	uflx	Mx(N+1)	Upwards flux on levels
	nflx	Mx(N+1)	Net downwards flux (dflx - uflx)
	hrts	MxN	Heating rates in layers
SW	sflx	Mx(N+1)	Direct (unscattered) downwards flux on levels
	dflx	Mx(N+1)	Diffuse (scattered) downwards flux on levels
	vflx	Mx(N+1)	Total (direct + diffuse) downwards flux on levels
	uflx	Mx(N+1)	Upwards flux on levels (diffuse only)
	nflx	Mx(N+1)	Net downwards flux (vflx - uflx)
	hrts	MxN	Heating rates in layers

Table 2. Description of output files