UCI/FRS-Japan/Oslo Team
Trace-P Workshop
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Full chemistry simulations for the Trace-P period
with dual CTMs (Oslo & FRS/UCI) - includ. strat. O_3
Using Oslo/EC met fields based on EC-IFS pieced forecasts
(spinup + 24-hrs)
T63L40 (192 x 96 x 40) for Nov 1, 2000 through Apr 30, 2001
spinup year 1997 (T42L40) and soon 2000.

Proposed Papers/Contributions:

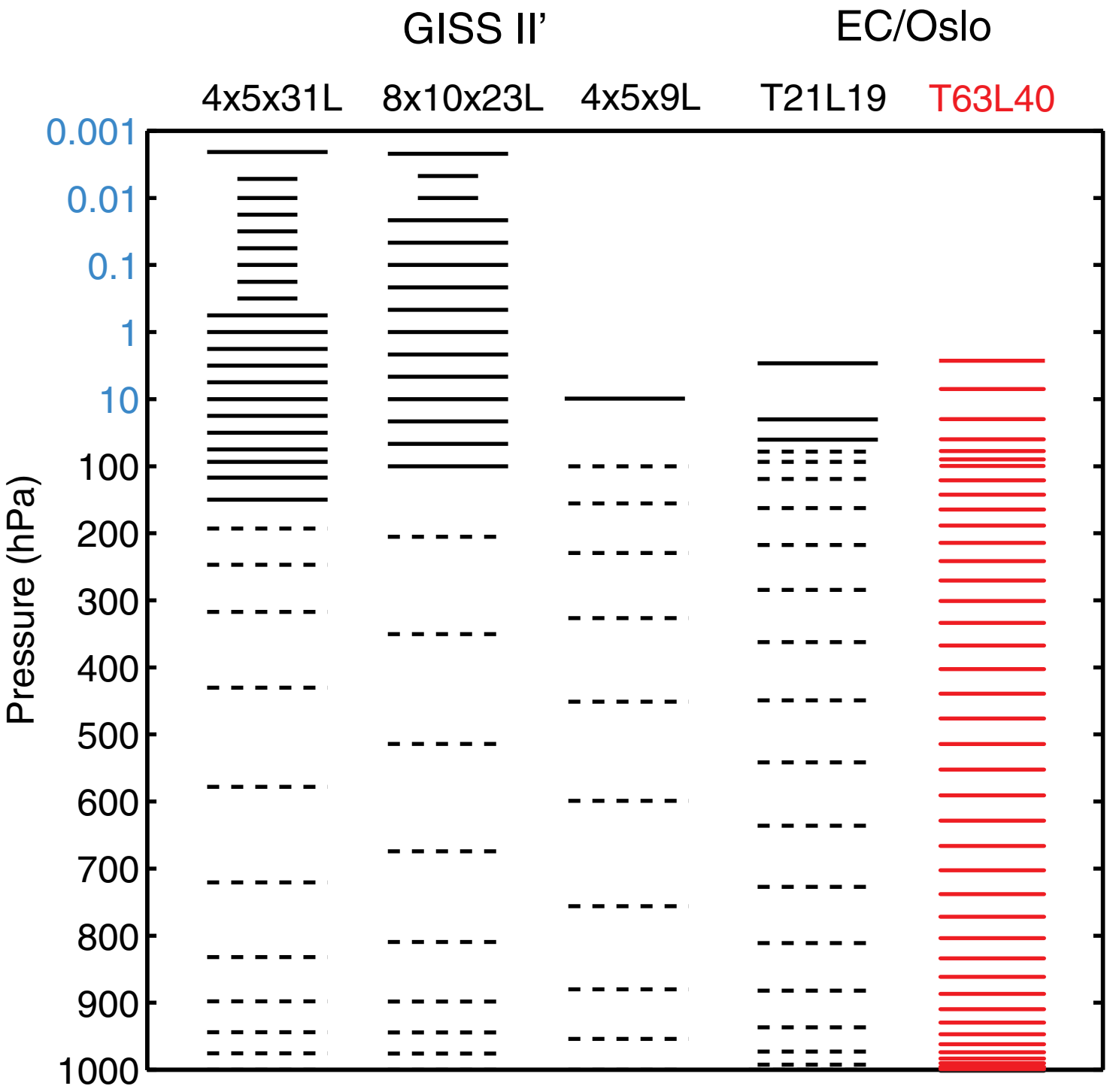
1. Paper on CTM simulated O_3 compared with lidar, in situ, sondes, total columns (stratospheric O_3 should be OK)

2. Paper on Global/Pacific-region O_3 budget associated with direct/precursor emissions from Asia.

3. Contribute UCI/FRS/Oslo CO-hindcasts to joint paper. Contribute Oslo/EC met fields.

Delays:

Testing L40 –> L30 CTM
New T63L40 met fields have noise in convection


GISS II'
EC/Oslo
4x5x31L
8x10x23L
4x5x9L
T21L19
T63L40
Pressure (hPa)
0.001
0.01
0.1
1
10
100
200
300
400
500
600
700
800
900
1000

Description of main features of Oslo CTM2.

Oslo CTM2 is an off-line chemical transport/tracer model (CTM) that use pre calculated transport and physical fields to simulate chemical turnover and distribution in the atmosphere. The model is valid for the global troposphere and is three-dimensional with the model domain reaching from the ground up to 10 hPa for the current data set. In the horizontal the model has a resolution that is determined by the input data provided. Currently we have two data sets; one based on ECMWF forecast data with a T63 (1.875°x1875°) and a data set from CCM3 that is T42 (2.8125°x2.8125°) resolution. For this project ECMWF data will be used. Also in the vertical, the model resolution is determined by the input data and at the moment we use 19 levels from the surface up to 10 hPa.

Advection is done using the Second order moment (Prather, 1986), Convection is based on the Tiedkte mass flux scheme (Tiedtke, 1987), where vertical transport of species is determined by the surplus/deficit of mass flux in a column. The chemical scheme is based upon the QSSA approach (Hesstvedt 1974, Berntsen and Isaksen, 1999). Photodissociation is done on-line following Wild et al., (1999). Emissions is base upon GEIA and EDGAR for natural emissions, and Mueller (1992) for anthropogenic emissions. Deposition is based upon Wesely (1989) and the boundary layer is treated according to the Holtslag K-profile scheme (Holtslag et al., 1990). Influence of stratospheric ozone is estimated using a synthetic ozone approach (McLinden et al., 1999) where ozone flux in the stratosphere is prescribed but the model transport generates an ozone distribution that varies with time and space.

The model is shown to simulate the seasonal variations of ozone and CO at a number of stations both in the Northern and Southern Hemisphere well (Sundet, 1997; Jonson et al. 1999). Transport of simplified ozone in the TOPOZ-2 project also show that the model does a good job in describing the transport in the upper troposphere and lower stratosphere compared to MOZAIC data.

References:

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Holtslag, A. A. M., E. I .F DrBruijn and H.-L. Pan: A High resolution air mass transformation model for short-range weather forecasting, *Mon. Wea. Rev., 118*, 1561-1575, 1990

Jonson J. E., J. K. Sundet and L. Tarrason: Model calculations of present and future levels of ozone and ozone precursors with a global and regional model. *Atmospheric Environment, Accepted*, 1999

Mclinden C. A, S. Olsen, B. Hannegan, O. Wild, M. J. Prather and J. Sundet: Stratospheric Ozone in 3-d Models: A simple chemistry and the cross-tropopause flux*, J. Geophys. Res., submitted* December, 1999

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Prather, M. J.: Numerical advection by conservation of second-order moments, *J. Geophys. Res.*, *91*, 6671-6681, 1986

Sundet, J. K.: Model Studies with a 3-d Global CTM using ECMWF data. *Ph.D. thesis, Dept. of Geophysics, University of Oslo*, Norway, 1997

Tiedtke, M.: A Comprehensive Mass Flux Scheme for Cumulus Parameterisation on Large Scale Models, *Mon. Wea.*, *Rev.*, *117*, 1779-1800, 1989

Wesley, M. L.: Parameterization of surface resistances to gaseous dry deposition in regional-scale numerical models. *Atmos. Environ., 23*, 1293-1304, 1989

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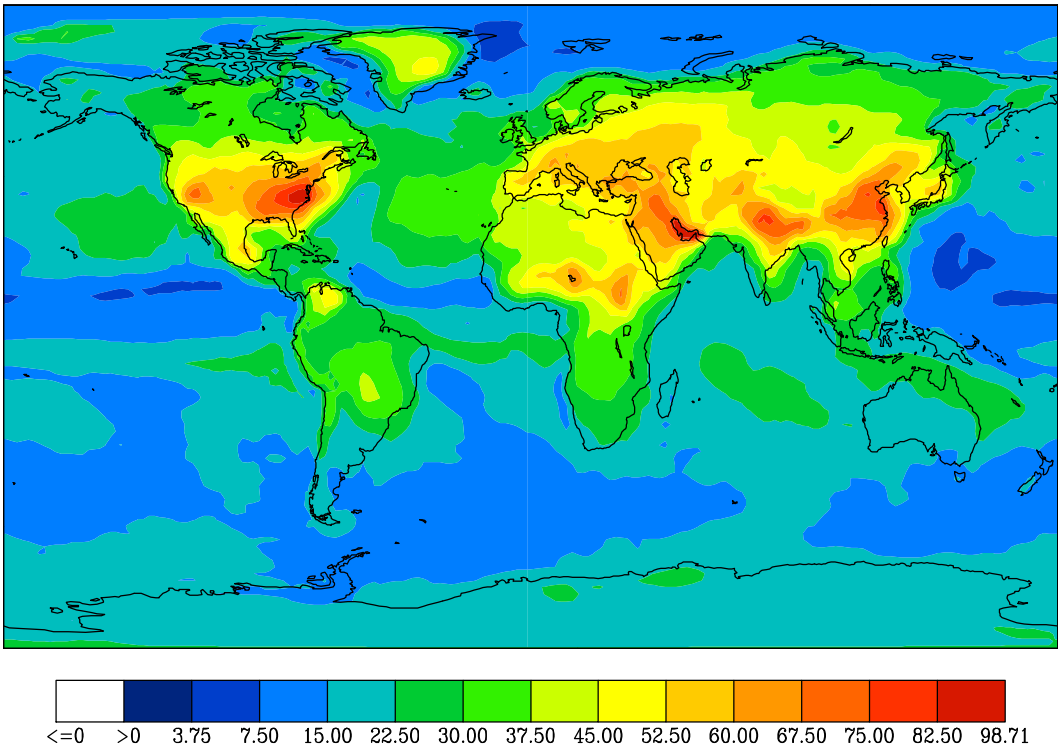
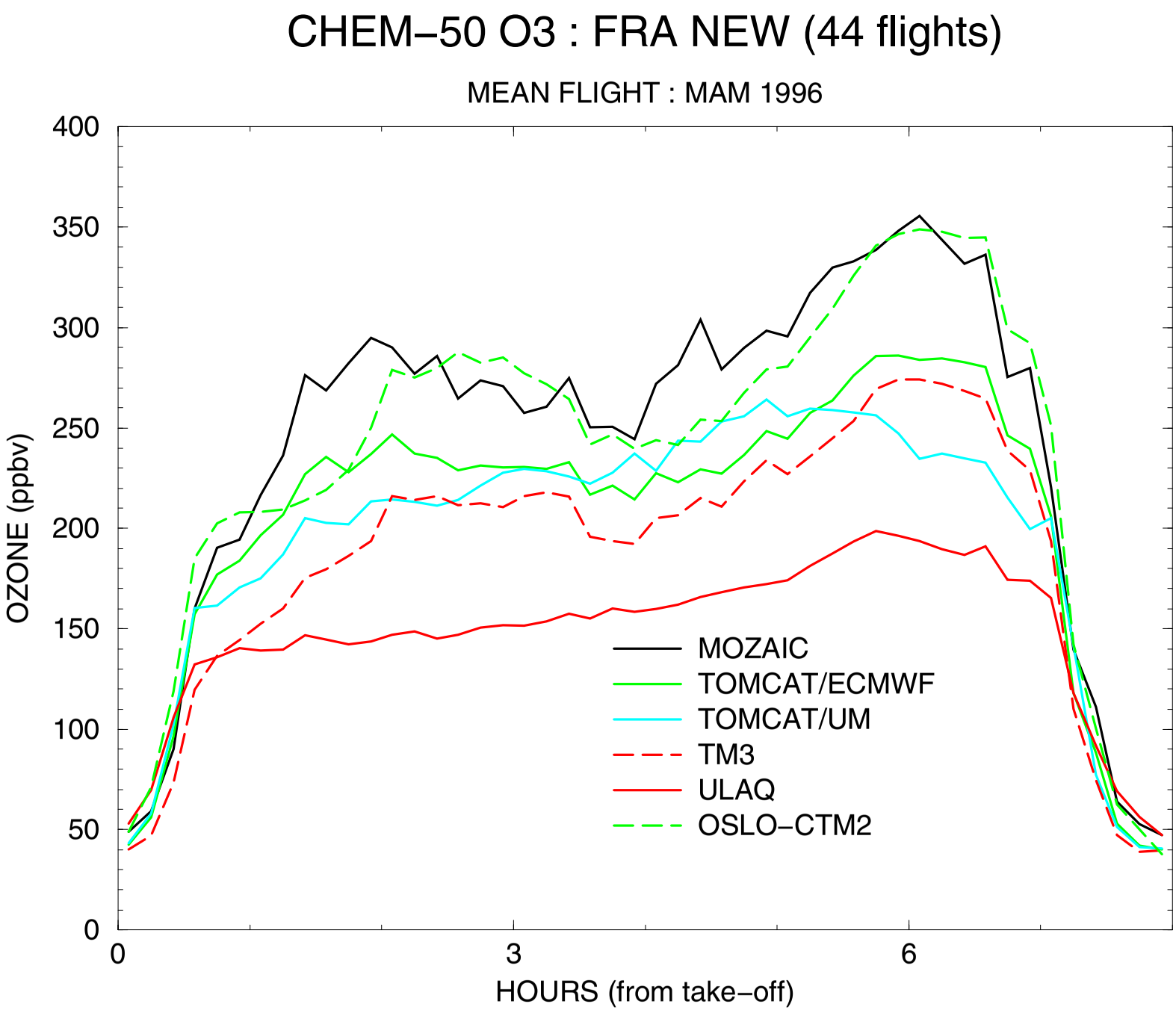
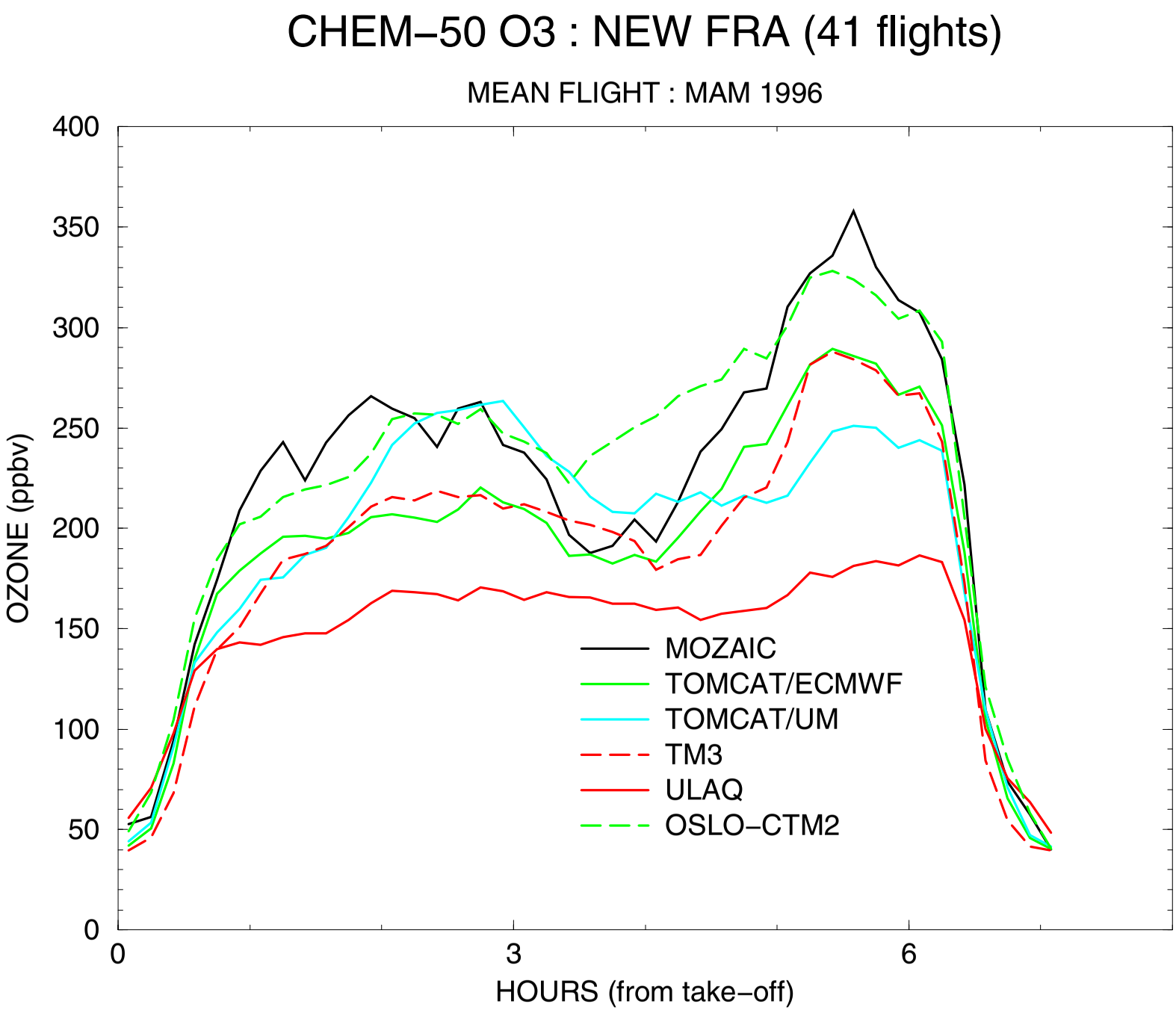
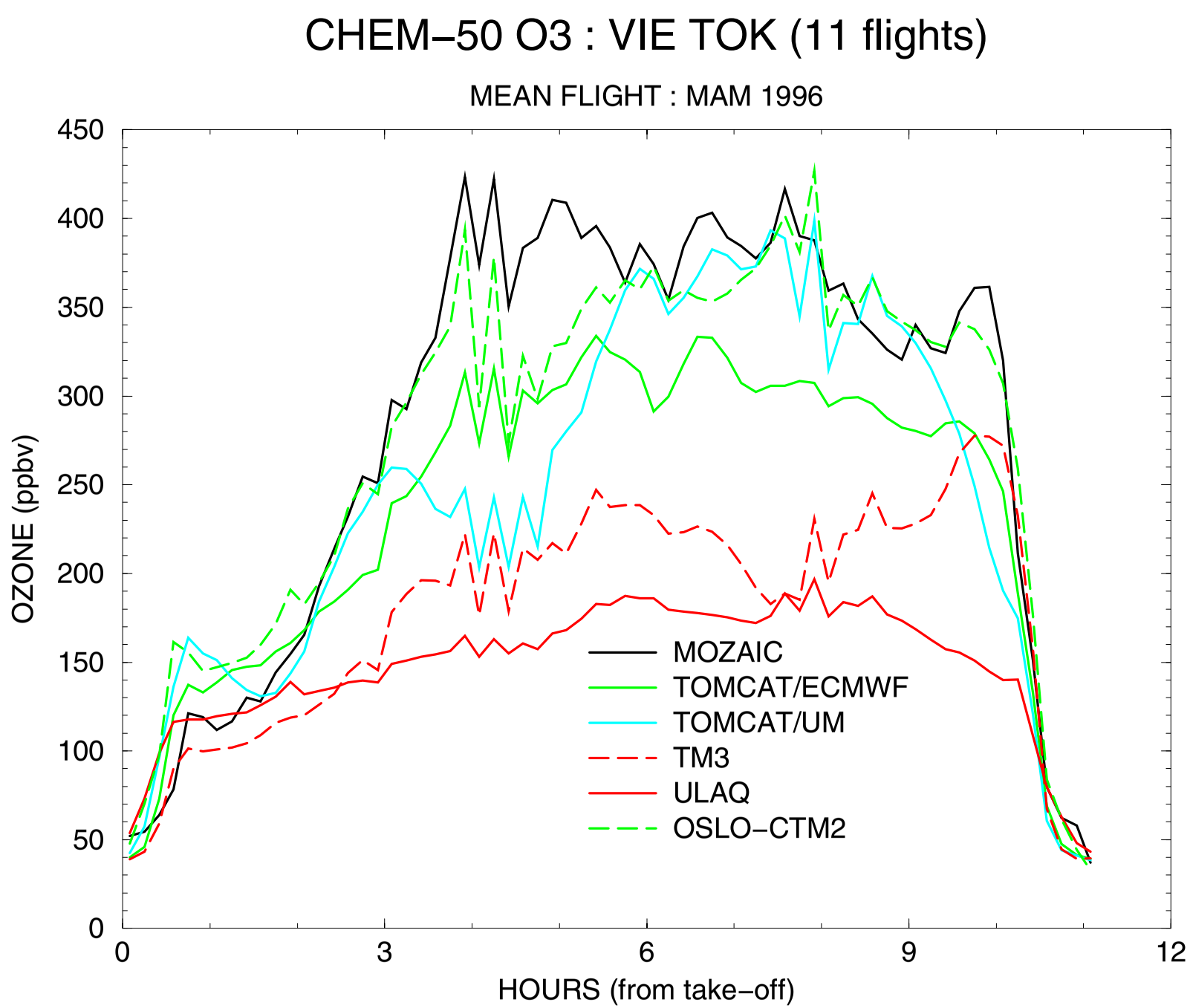
U. Oslo CTM using Oslo/EC T63L19

<O_3> JUN 1996




CHEM–50 O3 : FRA NEW (44 flights)
MEAN FLIGHT : MAM 1996
OZONE (ppbv)
HOURS (from take–off)
0
50
100
150
200
250
300
350
400
0
3
6
MOZAIC
TOMCAT/ECMWF
TOMCAT/UM
TM3
ULAQ
OSLO–CTM2


CHEM–50 O3 : NEW FRA (41 flights)
MEAN FLIGHT : MAM 1996
OZONE (ppbv)
HOURS (from take–off)
0
50
100
150
200
250
300
350
400
0
3
6
MOZAIC
TOMCAT/ECMWF
TOMCAT/UM
TM3
ULAQ
OSLO–CTM2


CHEM–50 O3 : VIE TOK (11 flights)
MEAN FLIGHT : MAM 1996
OZONE (ppbv)
HOURS (from take–off)
0
50
100
150
200
250
300
350
400
450
0
3
6
9
12
MOZAIC
TOMCAT/ECMWF
TOMCAT/UM
TM3
ULAQ
OSLO–CTM2

3-D Global Modelling for TRACE-P

FRSGC/UCI/Oslo

Oliver Wild

Frontier Research System for Global Change
Yokohama, Japan

Collaborators:

Michael Prather *(U.C. Irvine)*
Ivar Isaksen, Jostein Sundet *(University of Oslo)*
Hajime Akimoto *(FRSGC)*

FRSGC/UCI/Oslo: 3-D Global Modelling for TRACE-P

Objectives

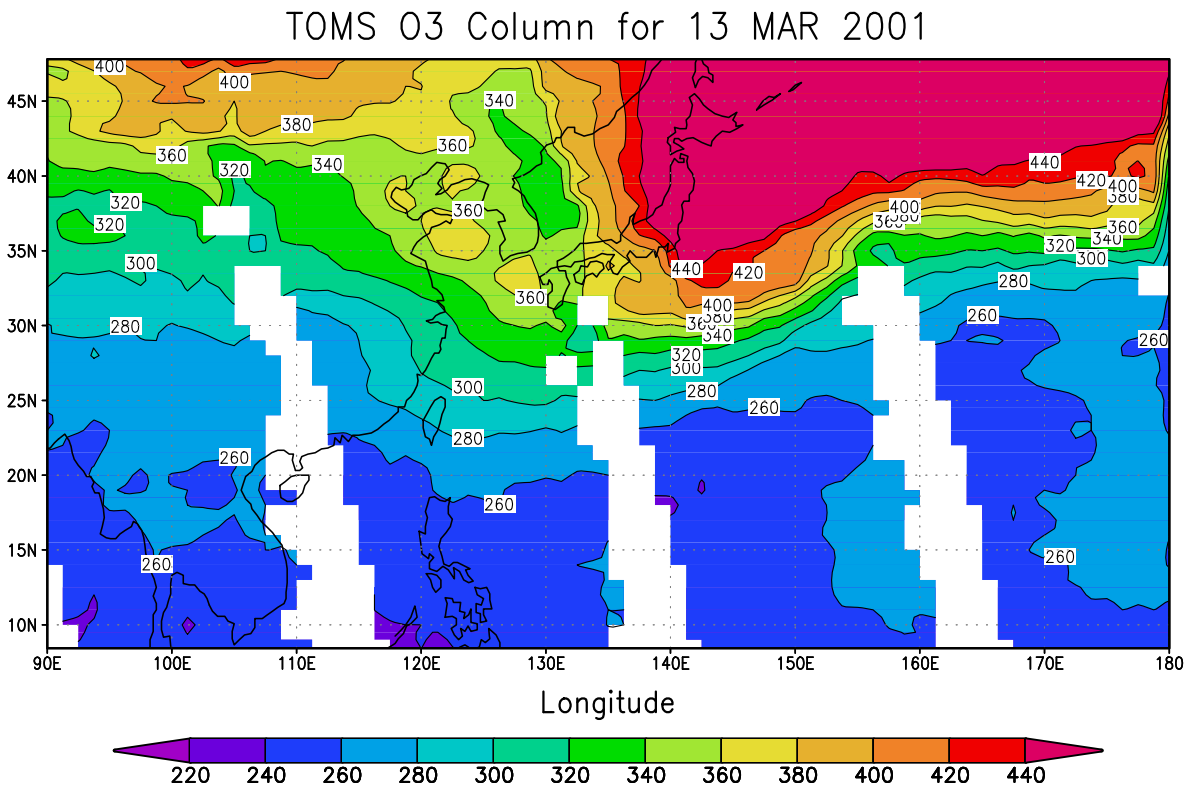
- Develop high-resolution global EC pieced-forecast fields
- Determine contributions to global tropospheric oxidant capacity from different source regions/emission types over Asia (budgets)
- Determine how different source regions/emission types in Asia affect primary/secondary pollutants over the Pacific and beyond (mechanisms)

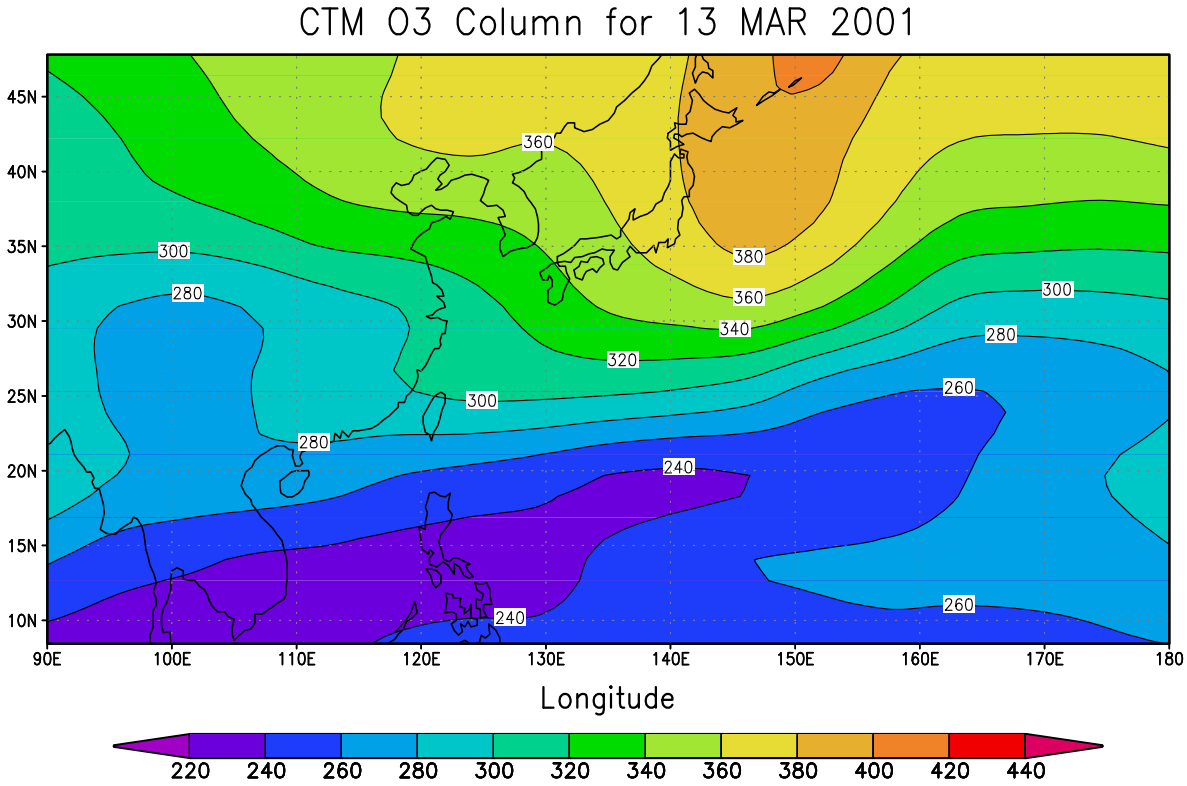
Contributions

- CTM chemical fields for the TRACE-P period
- Collaborative studies: Lidar, satellite, in-situ...
- Model intercomparison studies

Status

- EC-IFS T63 (1.8°) 40-level fields produced October (Oslo)
- Modelling studies just beginning.....


TOMS O3 Column for 13 MAR 2001
45N
40N
35N
30N
25N
20N
15N
10N
90E
100E
110E
120E
130E
140E
150E
160E
170E
180
Longitude
220
240
260
280
300
320
340
360
380
400
420
440

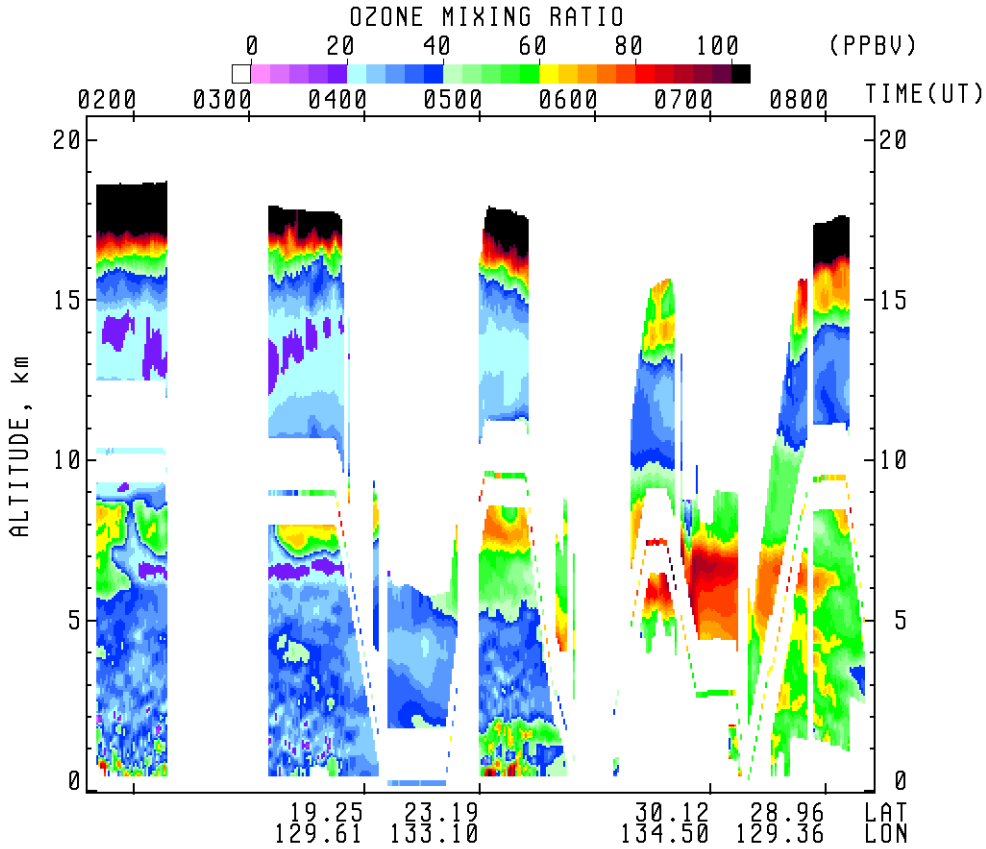
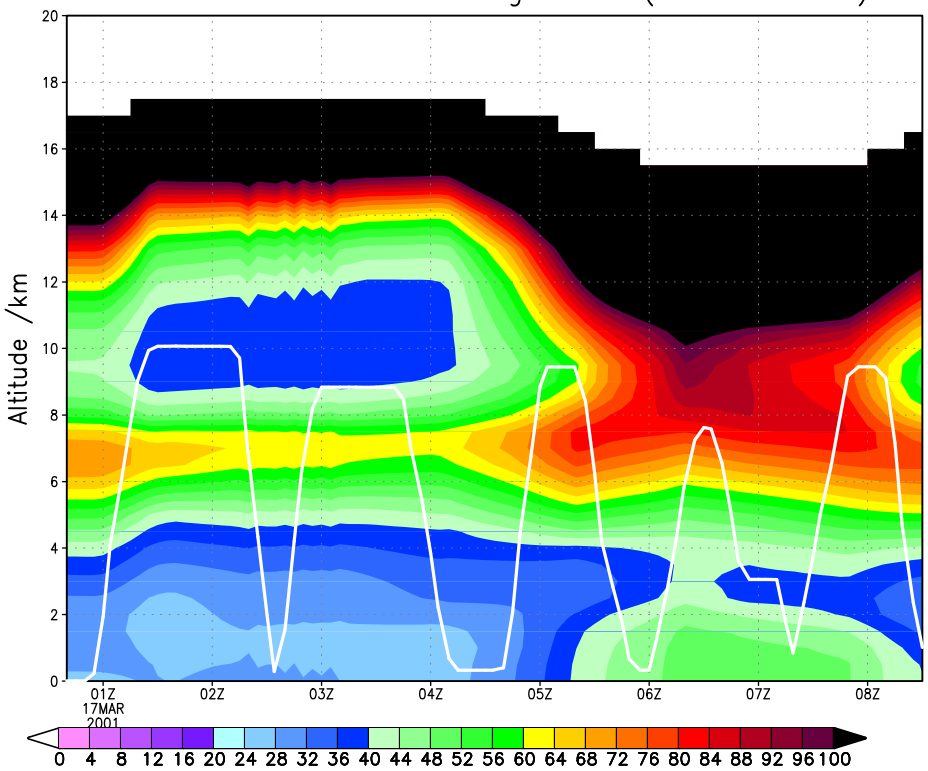

CTM O3 Column for 13 MAR 2001
45N
40N
35N
30N
25N
20N
15N
10N
90E
100E
110E
120E
130E
140E
150E
160E
170E
180
Longitude
220
240
260
280
300
320
340
360
380
400
420
440

DIAL Ozone and Aerosols
Browell/ Butler, Hair

DC-8 Flight Date: 20010317
Analysis Date: 20010317

TRACE-P FLT # 11 3-17-2001
Hong Kong to Okinawa 2

beoz1d11



Ozone Profile for DC8 Flight 11 (17 Mar 2001)