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# SPECIFICATION OF SEA-ICE CONCENTRATION IN THE OPERATIONAL GLOBAL MODEL

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Version 1

(To comply with UM version 3.2)

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## 1. INTRODUCTION

This document describes the method by which sea-ice concentration and sea-ice thickness fields are created for use by both the operational global atmospheric model and the operational global wave model. The system is based upon automatically decoding bulletins which originate at the Joint Ice Center, Washington and are sent on the Global Telecommunications System.

Section 2 describes the format of the data and how it is decoded, section 3 describes the programs involved and section 4 gives the operational details.

## 2. DATA PROCESSING

### 2.1 Data Source

Sea-ice analyses are performed routinely at the Navy/NOAA Joint Ice Center, Washington with much of the information being derived from satellite data, Kniskern 1991. Several bulletins are produced, including bulletins on icebergs, but only two of the bulletins are of interest here.

The bulletins used are entitled NPLICE and SPLICE which stand for North Polar Ice and South Polar Ice respectively. The bulletin headers are STAC01 for the NPLICE bulletin and STAA01 for the SPLICE bulletin. The issue of these bulletins is weekly, generally on a Tuesday. However, the receipt of these bulletins is slightly unreliable and the validity date of the data is normally the previous Friday. These bulletins are also received on the OMNET system along with other bulletins issued by the JIC.

An example of the bulletins is given in appendix 1. As can be seen, they consist of a list of coordinates where the sea-ice edge has been identified, although the sea-ice concentration criteria for this sea-ice edge is not known (10%?). In the model, the only permitted values of sea-ice concentration are 0 and 1, ie no sea-ice or sea-ice and so if grid point is covered by sea-ice then the sea-ice concentration is set to 1. The bulletins both start and end at Greenwich, a repeated coordinate denotes that the sea-ice terminates against a land mass. The resolution of the data is 30 nautical miles and the sea-ice is always to the left of the line.

### 2.2 Decoding of Data.

The decoding of the data is simply transforming the given coordinates to the modelgrid. This transformation has been designed to work for any regular lat-long grid resolution.

There are three approximations:-

1) The model grid boxes are perfectly square.
2) The sea-ice edge is straight between the reported coordinates.
3) The earth is locally flat in the area of the reported coordinates.

These approximations have been made to enable use of elementary geometry. Since we are only concerned whether a model grid point is covered with sea-ice or not, all of these approximations are reasonable and it is unlikely that large errors will be introduced, even when there is a large distance between coordinates. Also, land masses are ignored until the sea-ice edge has been determined and sea-ice filled in behind the edge. As there are slight differences in the working in the two hemispheres, they are described separately below.

In the equations, $\phi$ denotes latitude, $\lambda$ denotes longitude and subscripts r, i, o and c denote grid resolution, reported ice edge location grid origin and current location on grid respectively. Variables c and r are used to denote the index to the grid columns and grid rows respectively. When an index is calculated, only the integer part of the number is considered. All longitudes have been converted to degrees east, ie in the range 0 to 360, and latitudes are given in degrees north and south, ie in the range 90 to -90 with the northern hemisphere being positive. In the operational global model the sea-ice concentration is specified on pressure points, therefore $\lambda_o = 0$, $\phi_o = 90.0$ and the current grid resolution is $\lambda_r = 1.25$ and $\phi_r = 0.8333$ .

2.2.1 Northern Hemisphere

The data start and ends at the Greenwich Meridian and proceeds in a general easterly direction around the pole with the sea-ice always to the left of the line. The first task is to map the sea-ice edge and the second task is to fill in sea-ice between the pole and the sea-ice edge. The principle behind mapping the sea-ice edge is to set sea-ice at the most equatorward grid point that is behind the reported sea-ice edge.

For any coordinate $(\lambda,\phi)$, the grid reference of the top left grid point, P, is given by,

$$P = (\phi_o - \phi)/\phi_r + 1$$
$$P = (\lambda_o - \lambda)/\lambda_r + 1 \quad (2.1)$$

Assuming that the sea-ice edge is straight, the slope of the sea-ice edge between coordinates i and i+1 is given by,

$$S = (\phi_{i+1} - \phi_i)/(\lambda_{i+1} - \lambda_i) \quad (2.2)$$

Let $P_{col}$ of $\lambda_i$ be $c_1$ and $P_{col}$ of $\lambda_{i+1}$ be $c_2$, then there exists three possible situations:-

i) $c_1 = c_2$ ie. the sea-ice progression is either poleward or equatorward.

If $\phi_{i+1} < \phi_i$ then the progression is equatorward and the sea-ice edge is set at the coordinate $P(c_2, r_2)$ where $r_2$ is given by

$$r_2 = (\phi_o - \phi_{i+1})/\phi_r + 1 \quad (2.3)$$

If however $\phi_{i+1} > \phi_i$ then the progression is poleward and the sea-ice edge is set at the coordinate $P(c_1, r_1)$ where $r_1$ is given by

$$r_1 = (\phi_o - \phi_i)/\phi_r + 1 \qquad (2.4)$$

ii) $c_1 < c_2$ ie. the sea-ice is progressing in the normal easterly direction. In this instance, the procedure is to work between $c_1$ and $c_2$ and calculate the latitude at which the sea-ice intersects with each interveaning column of the grid. For each of these columns, c, the sea-ice edge is set at the coordinate P(c,r) where r is given by,

$$r = (\phi_o - (S(\lambda_c - \lambda_i) + \phi_i)) / \phi_r + 1 \qquad (c_1+1) \preceq c \preceq c_2 \qquad (2.5)$$

If the columns $c_1$ and $c_2$ lie either side of the Greenwich Meridian then equation (2.5) is calculated for two ranges,

$$c_1 \preceq c \preceq N_{col} \text{ and } 1 \preceq c_2$$

where $N_{col}$ is the number of columns on the grid

iii) $c_1 > c_2$ ie. the sea-ice is progression in a westerly direction. The sea-ice edge is set at the coordinate P(c,r) where r is given by,

$$r = (\phi_o - (S(\lambda_c - \lambda_i) + \phi_i))/\phi_r + 2 \qquad (c_2+1) \leq c \leq c_1 \qquad (2.6)$$

Again, if $c_1$ and $c_2$ lie either side of the Greenwich Meridian equation (2.6) is calculated for two ranges,

$$1 \preceq c \preceq c_1 \text{ and } c_2 \preceq c \preceq N_{col}$$

When all coordinates have been processed, a sea-ice edge location should have been set in every grid column. However, a check is made to ensure that this is the case and if any column does not have a sea-ice edge set then it is set equal to column immediately adjacent to the west.

The second stage is to fill in with sea-ice all those points between the reported sea-ice edge and the pole. This stage is different depending on whether an odd or and even number number of sea-ice locations have been assigned to each column in the first stage.

i) Odd number of sea-ice locations identified.

A switch is used, which when on, indicates that a point is to be assigned to be sea-ice. This switch is initialized to be on and, working from the pole to equator, this switch alternates between on and off at every sea-ice edge location encountered. This ensures that all points from the pole to the most poleward sea-ice edge location are set to sea-ice and all points from the most equatorward sea-ice edge location remain free of sea-ice.

ii) Even number of sea-ice locations identified.

In this case, the row numbers of the most poleward and most equatorward sea-ice locations are identified. If two sea-ice edges are in adjacent rows then this is treated as a single sea-ice edge when the sea-ice is filled in. All points between the pole and the most poleward sea-ice edge location are set to be sea-ice and all points between the most equatorward sea-ice location and the equator remain free of sea-ice. Then the switch, as discussed above, is initialized to be off and working between the rows identified above, the switch alternates between on and off and points set to be sea-ice accordingly.

2.2.2 Southern Hemisphere

The data start and ends at the Greenwich Meridian and proceeds in a general westerly direction around the pole with the sea-ice always to the left of the line. The principle is the same as for the northern hemisphere but the orientation is different as we require the reference of the bottom right grid point releative to the sea-ice coordinate.

The slope of the sea-ice is calculated using equation 2.2. If again $P_{col}$ of $\lambda_i$ be $c_1$ and $P_{col}$ of $\lambda_{i+1}$ be $c_2$ , then the three possible situations are:-

i) $c_1 = c_2$ ie. the sea-ice progression is either poleward or equatorward.

If $\phi_i < \phi_{i+1}$ then the progression is equatorward and the sea-ice edge is set at the coordinate $P(c_2,r_2)$ where $r_2$ is given by

$$r_2 = (\phi_o - \phi_{i+1})/\phi_r + 2 \qquad (2.7)$$

If however $\phi_i > \phi_{i+1}$ then the progression is poleward and the sea-ice edge is set at the coordinate $P(c_1, r_1)$ where $r_1$ is given by

$$r_1 = (\phi_o - \phi_i)/\phi_r + 2 \qquad (2.8)$$

ii) $c_2 < c_1$ ie. the sea-ice is progressing in the normal westerly direction. In this instance, the procedure is to work between $c_1$ and $c_2$ and calculate the latitude at which the sea-ice intersects with each column of the grid. For each of these columns, c, the sea-ice edge is set at the coordinate P(c,r) where r is given by,

$$r = (\phi_o - (\phi_i - (S(\lambda_i - \lambda_c))))/\phi_r + 2 \qquad (c_2 +1) \le c \le c_1 \qquad (2.9)$$

If the columns $c_1$ and $c_2$ lie either side of the Greenwich Meridian then equation (2.9) is calculated for two ranges,

$$1 \preceq c \preceq c_1 \text{ and } c_2 \preceq c \preceq N_{col}$$

iii) $c_2 > c_1$ ie. the sea-ice is progression in a easterly direction. The sea-ice edge is set at the coordinate P(c,r) where r is given by,

$$r = (\phi_o - (\phi_i - (S((\lambda_i - \lambda_c))))/\phi_r +1 \qquad (c_2 +1) \le c \le c_1 \qquad (2.10)$$

If the columns $c_1$ and $c_2$ lie either side of the Greenwich Meridian then equation (2.10) is calculated for two ranges,

$c_1 \leq c \leq N_{col}$ and $1 \leq c \leq c_2$

When all coordinates have been processed, a sea-ice edge location should have been set in every grid column. However, a check is made to ensure that this is the case and if any column does not have a sea-ice edge set then it is set equal to column immediately adjacent to the east. Due to the nature of the southern hemisphere bulletin, a sea-ice edge is not set in column 1 and sometimes a sea-ice edge is not set in column 2 so both these columns have the same data as column 3.

Sea-ice is set at points between the pole and the reported sea-ice edge in the same way as the northern hemisphere.

## 2.3 Inland Seas/Lakes

These bulletins do not include inland seas or lakes such as the Great Lakes, where specification of sea-ice is nevertheless very important. Data for these areas is provided from the climatological dataset. The areas set from climatology are defined by the boundaries: 67.5 N to 47.0N , 230.0 E to 265.0 E (Slave/Bear Lakes); 50.0 N to 40.0 N, 265.0E to 285.0E (Great Lakes); 50.0 N to 30.0 N, 25.0E to 75.0E (Eurasian lakes).

## 2.4 Quality Control

If the sea-ice field has been updated, whether from a bulletin or by climatology, then a basic quality control procedure is performed to attempt to elliminate spurious sea-ice fingers or holes in the sea-ice cover. A point will only remain as sea-ice if at least one of its neighbours is also sea-ice, provided that at least 6 of its neighbours are sea points. A point will become sea-ice if only 1 of its neighbours is also free of sea-ice, providing that at least 6 of its neighbours are sea points. Also, a point is not permitted to freeze if the SST field is above a certain value, prescribed by a variable in the control namelist. These checks ellinmate most, but not all, spurious points. It must be remembered that in coastal waters, where the ocean is relatively shallow, then the sea-ice can have a perculiar pattern.

## 2.5 Sea-ice Thickness.

A value of sea-ice thickness is set at all points which have a non-zero value of sea-ice. The values set are 2m for the northern hemisphere and 1m for the southern hemisphere.

## 3. PROGRAM DESCRIPTION

3.1 ICEDAY

This program is run on the CRAY. Its purpose is to decode the sea-ice bulletins and create the sea-ice field for the current day. The program consists of the following members of MS12.CJSSTLIB.SEAICE: CANCINT, C@EDGE, C@FILL, C@MESS, DAYCHK, DAY@NUMB, ICEDAY, ICE@CONV, ICE@INT, ICE@QC, IN@FLDS, OUT@FLDS, MAP@PRT, and OUT@FLDS. The program also uses the following members from the Unified Model librray, UM1.CODExxx.SRCE where xxx is the version number: BUFFIN1A, BUFOUT1A, CHKLOO1A, CHSUNITS, CLOSE1A, C@MDI, IOERR1A, NEWPAC1A, OPEN1A, P21BIT1A, POSERR1A, PRFIXH1A, PRIFLD1A, PRRFLD1A, READFL1A, READHE1A, TINTC1A, TINT1A, WRITFL1A and WRITHE1A. Also members PP@TITL and PR@LOOK are used from MS12.CJSSTLIB.SRCE, these are UM routines but the ones used on the UM library are not used as this would mean the program would need to change at every UM release. However, other changes in the UM may enforce a change and it is advisable that all UM routines are updated to the latest versions periodically.

UM routines are not decribed here, see appropriate UM documentation.

Index to comdecks:
CANCINT, CICECRTL - both contain necessary variables for reading in datasets.
ICEFLD - holds data field arrays and grid details

Index to program:
PROGRAM ICEDAY
  CALL OPEN (4 times)
  CALL READHK
  CALL DAYCHK
  CALL IN_FLDS
  CALL DAY_NUMB
  CALL ICE_CONV
  CALL DAY_NUMB (twice)
  CALL C_EDGE
  CALL C_FILL
  CALL ICE_INT
  CALL ICE_QC
  CALL PR_LOOK
  CALL PR_RFLD
  CALL OUT_FLDS
  CALL C_MESS
  CALL CLOSE (4 times)

  SUBROUTINE READHK - to read housekeeping file
  SUBROUTINE IN_FLDS - to read in the daily sea-ice field
  SUBROUTINE ICE_CONV - to read in and convert to CRAY numbers JIC data
  SUBROUTINE DAY_NUMB - to calculate the year day number

SUBROUTINE C_EDGE - to map the sea-ice edge onto the model grid
SUBROUTINE C_FILL - to fill in sea-ice behind edge
SUBROUTINE ICE_INT - to obtain a time interpolated climatological sea-ice field for the current date
SUBROUTINE ICE_QC - to perform quality control
SUBROUTINE OUT_FLDS - to write out the daily sea-ice field
SUBROUTINE C_MESS - to create a message file

The program is controlled by ICEDAY. First all the ancillary files that are to be used are opened and then all the return codes and namelist variables are initialised. ICE_CONV is called to read in the JIC bulletin that has been transferred from the HDS. The dates of the bulletin are compared with the dates of the previous bulletin, which have been stored in the fixed length header of the daily sea-ice file. If a new bulletin has not been received than a check of the age of the current data is made and if it is greater than 25 days the data is set equal to climatology. If a new bulletin has been received then it is mapped onto the model grid using routines C_EDGE and C_FILL using the equations decsribed above. If there has been a new NPLICE bulletin then the climatological field is read so and the inland seas and lakes decsribed above are set. If the sea-ice field has changed in anyway, either being set from a bulletin or from climatology then a quality check is made to remove spurios fingers and holes in the sea-ice cover. If a new bulletin has not been received and the age of the current data is less than 25 days then no changes will be made to the sea-ice field. Finally, a message file is created and the daily sea-ice file written out and all the ancillary files are closed. The age check is also performed if an error has occured in ICE_CONV, errors in ICE_CONV are not normally fatal and are described below.

There is a check to ensure that no changes whatsoever can be made to the sea-ice field on a Friday, Saturday or Sunday, this includes any namelist overrides although this feature can be disabled using another namelist variable.

NAMELIST /INPUT/ variables (default values in brackets).
LN_CLIM Logical (F) - on to set northern hemisphere to climatology.
LS_CLIM Logical (F) - on to set southern hemsiphere to climatology.
LDATE_U Logical (T) - on to set dates in fixed length header to bulletin dates. If switched off then the JIC bulletin is not read. (Useful if the JIC bulletin has become corrupted)
AGE_FIELD_MAX Real (25) Maximum age of field until it is reset to climatology.
LDATE_O Logical (T) - on to invoke day of week check facility
LDIAGR Logical (F) - on for writes from ICEDAY and ICE_CONV.
LDIAG1 Logical (F) - on for writes from C_EDGE
LDIAG2 Logical (F) - on for writes from C_FILL
LDIAG3 Logical (F) - on for writes from ICE_QC
LDIAG4 Logical (F) - on for writes from C_MESS
LDIAGM Logical (F) - on to write out maps of the ice edge and final cover.

Several of the routines have return codes which are non-zero if an error has occurred. Normally a message is written out explaining the cause of the error. The routines capable of giving a non-zero return code and the subsequent action by ICEDAY are given in the table below.

| SUBROUTINE | ACTION BY ICEDAY |
|---|---|
| READHK | ABORT program |
| OPEN | ABORT program |
| IN_FLDS | ABORT program |
| ICE_CONV | program continues and age of current data is checked. A message is written out defining what the error is. |
| OUT_FLDS | ABORT program |

Program I/O

Unit 10 - housekeeping file (IN)
Unit 11 - current daily sea-ice dataset (IN) * (ICEINSURF)
Unit 12 - climatological sea-ice dataset (IN) * (ICECLIMSURF)
Unit 13 - sea-ice data transferred from HDS (IN )
Unit 14 - current SST analysis (IN) * (SSTINSURF)
Unit 15 - control namelist (IN)
Unit 21 - new daily sea-ice dataset (OUT) * (ICEOUTSURF)
Unit 24 - message file (IN)
Unit 25 - message file (OUT)
Unit 30 - character map of sea-ice distribution (OUT)

*These files are defined by the use of the environmetal varibles given in brackets.

Operational Changes.

V1.0 Create daily seaice and SST files from climatological fields.

V2.0 26/2/91 Remove SST from program as SST analysis introduced.

V3.0 1/10/91 Create seaice file by decoding bulletins received from JIC.

V3.1 7/1/92 Add routine ICE_QC.

V3.2 3/3/92 Add code to cope with data crossing Greenwich Meridian. Add control namelist to set data to climatology manually if desired.

V4.0 5/5/92. Change maximim age of field permitted before reverting to climatology to 25 and add it to namelist. Check ice field against SST analysis and perform check of which day of week it is to prevent changes over weekend period. Correct error in setting ice depth which meant that ice depth was only being set at polar regions (missing data everywhere else instead of 0). Add message file and further QC checks
(New program library made - number 1)
.

V4.1 15/6/93 Correct bug in C_EDGE.
(modset CJ150692 program library 2)

V4.2 23/02/93 Upgrade all UM routines to UM version 3.0. This includes using portable I/O routines and changing packing indicator.
(modset CJ130393 program library 3)

V4.3 08/07/03 Correct code for Unicos 7.
(modset CJ290693 program library 4)

V4.4 19/10/93. Upgrade all UM routines to UM version 3.2, especially to handle new real missing data indictaor introduced at this time. Also, bulletins that start and end at any longitude can now be handled.
(new program library made - 1)

### 3.2 ICEFMT

The character map created by ICEDAY is written out using a format statement of 255A1 because the CRAY cannot handle formatted files with a record length longer than 255 characters. ICEFMT is a simple program on the HDS which reads in the transferred character map as 255A1, rewinds the dataset and rewrites the character map as 288A1 so that it can be browsed more easily.

Program I/O:
Unit 6 - output messages
Unit 10 - character map of sea-ice distribution.

## 4. OPERATIONAL JOBS AND DATASETS

HDS Datasets:

SDB.ICEDATA - direct access dataset of record length 4096. The SPLICE bulletin is on record 3 and the NPLICE bulletin is on record 4. The DCB information is RECFM=F, LRECL=4096, BLKSIZE=4096.

COP.SEAICE - character map of the current sea-ice concentration field.
There is a header of CHEADER,HDSRUN which is read using the format of (A27,L1) where CHEADER is a variable of CHARACTER*27 containing the validity date of the data and HDSRUN is a LOGICAL variable which is set to .TRUE. if the data needs to be reformatted on the HDS.

The remainder of the dataset is an array of 288 columns by 217 rows with the legend of ’I’ = sea-ice, ’*’ = land point, ’ ’=open sea.

The DCB information is RECFM=FB, LRECL=288, BLKSIZE=288.

CRAY Datasets:
/u/opfc/op2/op/dataw/qwgl.hkfile - housekeeping file
/u/opfc/op2/op/dataw/qwgl.daily.ice - current daily sea-ice dataset
/u/opfc/op1/op/datar/qrgl.clim.ice - climatological sea-ice dataset

/u/opfc/op3/op/datat/qtice.jic.data - sea-ice bulletin transferred from HDS
/u/opfc/op3/op/datat/qtgl.daily.ice - new daily sea-ice dataset
/u/opfc/op3/op/datat/qticemap - character map to transfer to HDS

These datasets are in the format described by Unified Model Documentation Paper No. F3.

Running of ICEDAY
Operational source: /u/opfc/op1/op/source/qcice.daily
Operational executable: /u/opfc/op1/op/libs/qxice.daily
The executable forms part of script SURF which is run in the QG06 run of the model only. The dataset SDB.ICEDATA is copied across to £DATAT/qtice.jic.data and in doing so becomes a sequential dataset, each line being 40 characters long. The program is executed and if the run is successful the new daily sea-ice and message files are copied to the permanent CRAY directories. Finally, the character map is copied to the HDS dataset COP.SEAICE.

If qxice.daily fails within the operational run then SURF can be rerun and qxice.daily skipped if ice=false is set in COP.CRAY.SFSELECT.

Location of non-operational jobs etc:
Source library (HDS): MS12.CJSSTLIB.SEAICE
Program Library (CRAY): /u/m11/user1/t11cj/sst_pl_v32/ice.daily1
The following jobs are also MS12.CJSSTLIB.SSTCNTL
ICCRPL - to make initial program library
ICCRMD - to create a modeck for a program library
ICCREX - to create an executable
ICCRGO - to run executable
ICCREXP - to run executable with a modeck to a program library
ICCRPLU - to create a new program library using a modeck

To make a change to the program, first create a MODSET, create a new program library and from the program library create an executable.

Running of ICEFMT
ICEFMT is run by job QG06AADS
Load module: COP.CORE.LOADLIB(ICEFMT)
Source code: COP.CORE.SOURCE(ICEFMT)
Job to make load module: COP.CORE.BUILD(ICEFMT)

There is also an archive of all JIC bulletins that have been received since the scheme ws implemented operationally. This archive is on MS12.CJICE.BULLETIN and is updated after a new bulletin has been read in by running job MS12.CJSSTLIB.SEAICE(@CNTLICE).

Reference

Kniskern,F.E. (1991). 'The Navy/NOAA Joint Ice Center's role in climate and global change program'. Palaeogeography, Palaeoclimatology, Palaeoecology (Global and Planetary Change Section) 90 pp207-213.

Appendix 1

Example of the bulletins NPLICE and SPLICE. There is a header which contains the validity date followed by the data.

```
086
STAA01 KWBC 131240
SPLICEC2930708162000WASHINGTON00
586S0000W 587S0018W 580S0030W 576S0044W
570S0054W 572S0070W 570S0103W 572S0110W
568S0125W 573S0134W 573S0160W 573S0180W
574S0194W 580S0202W 580S0211W 582S0217W
587S0220W 591S0238W 577S0243W 570S0237W
564S0252W 560S0252W 555S0264W 560S0275W
566S0288W 573S0305W 580S0328W 575S0342W
588S0364W 592S0363W 590S0382W 585S0396W
588S0403W 591S0423W 592S0435W 593S0451W
590S0481W 597S0486W 600S0498W 600S0506W
606S0525W 610S0542W 613S0561W 620S0583W
625S0600W 630S0607W 636S0613W 640S0635W
634S0650W 625S0660W 626S0673W 632S0692W
640S0684W 643S0706W 640S0716W 642S0730W
644S0753W 646S0760W 647S0770W 644S0775W
651S0810W 660S0823W 670S0830W 676S0833W
674S0855W 673S0886W 680S0900W 680S0930W
674S0947W 675S0994W 684S1026W 680S1044W
686S1062W 684S1084W 687S1114W 683S1127W
680S1136W 686S1145W 683S1170W 680S1206W
685S1225W 680S1257W 678S1295W 675S1312W
676S1334W 677S1352W 670S1366W 664S1386W
666S1420W 658S1440W 650S1460W 644S1460W
643S1482W 642S1503W 641S1523W 636S1552W
633S1567W 630S1572W 625S1587W 625S1601W
630S1623W 633S1648W 640S1670W 644S1680W
650S1715W 647S1740W 655S1756W 650S1766W
654S1790W 646S1797E 640S1776E 634S1760E
627S1730E 630S1704E 626S1687E 620S1658E
620S1640E 625S1640E 626S1630E 621S1618E
620S1605E 623S1590E 620S1567E 620S1550E
621S1537E 614S1530E 615S1520E 622S1496E
627S1492E 626S1474E 632S1456E 630S1435E
630S1413E 630S1400E 635S1390E 634S1381E
637S1367E 634S1343E 635S1323E 640S1293E
640S1273E 640S1254E 642S1230E 633S1214E
635S1200E 635S1174E 634S1150E 630S1143E
632S1115E 626S1100E 623S1080E 622S1065E
620S1055E 620S1037E 613S1015E 610S0997E
610S0986E 615S0980E 613S0950E 613S0931E
618S0917E 614S0903E 617S0890E 610S0873E
610S0865E 612S0850E 612S0830E 604S0811E
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605S0795E 605S0776E 605S0748E 613S0732E
620S0708E 615S0680E 620S0660E 615S0637E
613S0630E 616S0610E 613S0593E 610S0573E
611S0550E 610S0530E 608S0508E 612S0492E
610S0471E 610S0450E 613S0433E 610S0413E
607S0403E 610S0391E 620S0376E 612S0362E
602S0344E 604S0333E 603S0325E 614S0313E
612S0293E 604S0280E 608S0270E 610S0242E
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