BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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FORAD: A COMPUTER PROGRAM FOR

SUMMING PROBABILISTIC ESTIMATES OF FUTURE DISCOVERY

AND PRODUCTION OF CRUDE OIL

by

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SUMMARY

Program FORAD has been written to sum probabilistic estimates of the rates of future crude oil discovery and production for a number of regions.

The probabilistic crude oil discovery and production data for each region, that are required as input, are produced as output files from programs LAMFO and FORC2. The names of these files and the number of iterations to be used in the random sampling are typed in at the terminal. The output from FORAD is the same as for program FORC2, but no output file is created.

INTRODUCTION

Programs LAMFO (Hinde, 1985a) and FORC2 (Hinde, 1985b) may be used to obtain probabilistic estimates of future discovery and production of crude oil for a region. These programs use a random sampling method to obtain histograms of annual crude oil production (usually for 20 years), a histogram of the amount of crude oil discovered during the period of the estimate (usually 10 years), and a histogram of the amount of crude oil in fields that are brought into production during the same period. The 22 histograms are stored in disk files.

Program FORAD was written so that the histograms for a number of regions may be summed. FORAD repeatedly carries out random sampling of the individual histograms for each region. The values obtained in each iteration are summed and the summed values are used to produce histograms. Final output from FORAD are 20 histograms of annual crude oil production, a histogram of the amount of crude oil discovered during the period of the estimate, and a histogram of the amount of crude oil contained in fields that are brought into production during the period of the estimate. Like FORC2 and LAMFO, the results are stored in disk files.

DESCRIPTION OF THE PROGRAM

The following steps are performed by the program.

1. The identification heading for the program is printed.

2. The user is prompted to type in the name of the file in which the discovery and production histograms for a region (calculated by LAMPO or FORC2) are stored. If the RETURN key is pressed, without a file name being entered, go to 8.

3. The following data are read from the file to core storage: the name of the region concerned, the period for which information is provided (usually 20 years), the number of classes in the histograms, the number of iterations used to create the histograms, the units of volume, the period for which the summation is required (usually 10 years), and the histograms and related statistics. A check is made that the periods for which data are provided match from file to file. A message is printed if there is a mis-match.

4. The statistics for the (22) histograms are normalised and the means and standard deviations calculated.

5. The 22 histograms are converted to 22 cumulative probability distributions and each is represented by up to 21 value and probability pairs.

6. The name of the input file, the name of the region concerned, and the number of iterations used to obtain the histograms are printed.

7. Go to 2.

8. The user is prompted to enter the number of iterations to be used in the summations. If no value is entered, it defaults to the maximum number of iterations used in the input histograms.

9. Each of the cumulative probability distributions is summed by Monte Carlo simulation, carrying out the following steps.

    9.1 Call subroutine MONTE to select a random value from the cumulative probability distribution for each region.

    9.2 Sum the random values.

    9.3 Add one to the frequency of the histogram class within which the sum falls.

10. The sums of the random values obtained in each iteration are added. The squares of the sums of the random values are added.

11. The first two statistical moments are calculated.

12. The mean, the standard deviation, and the 80'th and 20'th percentiles for each years estimated oil production are calculated and printed together with an accompanying graph by subroutine PLOUT and function PERC1.

13. The mean and 80'th and 20'th percentiles for the total amount of oil discovered and the total amount of oil discovered and brought into production, within the 10-years period, are calculated by function PERC1 and are printed.

    Subprograms and functions used by the main program are: MONTE, PLOUT, and PERC1. These were described in Hinde (1985b).

RUNNING THE PROGRAM

    If the program has been saved, it may be restored with the command,

    RP,FORAD

otherwise it must be compiled with the command

    FT,&FORAD,,%FORAD

and loaded with the commands

    RU,LOADR
    >EB
    >RE,%FORAD
    >END

The program is then run with the command

RU,FORAD,1

where 1 is the logical unit to which the output is to be sent (1 is set to 1 if output is to be sent to the terminal; 16 if it is to be sent to the printer).

The program asks for the name of an input file to be typed in. Up to 7 files may be entered. When no more files are to be used, press RETURN only. The program then asks for the number of iterations to be used in the Monte Carlo simulation. If RETURN is pressed without entering a value, the number of iterations is taken to be the maximum number that was used for all the input files.

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