

### **Introduction to IDL**

Interactive Data Language was created in the mid to late 1970's for the space program.

First IDL license sold to NASA's Goddard Space Flight Center in 1979.

IDL is a nice tool for data visualization and is useful for processing large amounts of data.

Like MATLAB, has built in library of functions.

To open the IDL help utility: at the IDL command line type ? and hit enter

Copyright © 2014 University of Maryland.



First, need to modify .cshrc file.

Near the top of your list of "setenv" commands, please add

setenv IDL\_DIR /usr/local/rsi/idl\_8.0/idl/idl80
setenv IDL\_PATH +/usr/local/rsi/idl\_8.0/idl/idl/lib

after the line LM\_LICENSE\_FILE...

setenv IDL\_STARTUP /homes/metogra/userid/idl/idl\_startup\_aosc652.pro

Next, in your home directory, create a sub-directory called *idl* 

Copy the files: ~tcanty/idl/idl\_startup\_aosc652.pro ~tcanty/idl/read\_file.pro into your new idl directory

source your .cshrc file for these changes to take effect.

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.

2 3 Nov 2014

You should now be able to run IDL. To do so, type idl at the command prompt.

Type: x=4 and hit return Type: y=2 and hit return

To see the value of x, type: print, x

Let's try some basic math.

Type: print, x/y

Hopefully, the result will print out as 2

Now set x to equal 5 and repeat x/y

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.



# To find out information regarding variable type, use the IDL help command

help, x

X FLOAT = 5.00000

help,y

Y INT = 2

To set a variable as double precision, place a "d" after the number

**x=5.0d** 

help, x

X DOUBLE = 5.000000

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.

4

3 Nov 2014



Generally, you will be creating figures and doing calculations as part of an IDL program, not at the command line.

Please copy ~tcanty/AOSC652/2014/week\_10/test\*.pro

```
;Test1.pro
X=5.
Y=2.
Z1=X/Y
Z2=X^2/Y
print,format='("X=",F7.2," Y =", F7.2)',x,y
print,format='("X/Y =",F7.2," X^2/Y =",F7.2)',Z1,Z2
end
```

There are a couple of ways to run a program in IDL

.run will compile and run the code .rnew will erase all main variables in memory and compile and run the code

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.

5

3 Nov 2014



Generally, you will be creating figures and doing calculations as part of an IDL program, not at the command line.

Please copy ~tcanty/AOSC652/2014/week\_10/test\*.pro

;Test1.pro X=5. Y=2. Z1=X/Y Z2=X^2/Y print,format='("X=",F7.2," Y =", F7.2)',x,y print,format='("X/Y =",F7.2," X^2/Y =",F7.2)',Z1,Z2 end

There are a couple of ways to run a program in IDL

To run the program, type: .run test1

Copyright © 2014 University of Maryland.

## EXELIS

Now we'll look at how to do loops

```
Without exiting IDL,
```

.run test2.pro

This program demonstrates how to set up arrays:

X2=[5.,6.,7.,8.,9.,10.0]

and loops for i=1,x do begin ...... endfor

Copyright © 2014 University of Maryland.

#### Now we'll look at how to do loops

```
Without exiting IDL,
```

.run test2.pro

This program demonstrates how to set up arrays:

X2=[5.,6.,7.,8.,9.,10.0]	First problem:
and loops for i=1,x do begin 	In Fortran and Matlab, our indices go from <u>1</u> to <u>N</u>
endfor	In IDL, indices go from 0 to N-1

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.

#### Now we'll look at how to do loops

```
Without exiting IDL,
```

.run test2.pro

This program demonstrates how to set up arrays:

X2=[5.,6.,7.,8.,9.,10.0]	Second problem:
and loops for i=1,x do begin	IDL will retain information from variables used in previous programs or from the command
endfor	line if you do not use .rnew.

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.

# EXELIS

#### A closer look at how to do loops

x1=fltarr(5)

Y1=[1,2,3,4,5] Y2=[6,7,8,9,10]

for i=0,4 do begin x1(i)=y1(i)\*y2(i) endfor

Copyright © 2014 University of Maryland.



#### A closer look at how to do loops

x1=fltarr(5)

Y1=[1,2,3,4,5] Y2=[6,7,8,9,10]

for i=0,4 do x1(i)=y1(i)\*y2(i)

Copyright © 2014 University of Maryland.



#### A closer look at how to do loops

Y1=[1,2,3,4,5] Y2=[6,7,8,9,10]

x1=y1\*y2

Copyright © 2014 University of Maryland.

You can save your current session in IDL

To create an IDL save file,

save,file='idl1.sav'

Now, exit and restart IDL

Type: restore,file='idl1.sav'

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.



Input/Output

Copy the file ~tcanty/AOSC652/2014/week\_10/random\_integers\_1\_10000.dat

Let's take a look at test3a.pro

```
filename=' '
read,' Enter filename ', filename
```

```
openr,1,filename
readf,1,ncol,nhead
cdum=' '
for i=0,nhead-2 do begin
readf,1,cdum
endfor
```

Copyright © 2014 University of Maryland.



Input/Output

```
Copy the file 
~tcanty/AOSC652/2014/week_10/random_integers_1_10000.dat
```

Let's take a look at test3a.pro

```
count=0
variables=fltarr(ncol,1.e6)
variables(*,*)=-999.00
```

```
tmp=fltarr(ncol)
while (not eof(1)) do begin
    readf,1,tmp
    variables(0:ncol-1,count)=tmp
    count=long(count)+1
endwhile
    variables=variables(*,0:count-1)
close,1
```

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.

15 3 Nov 2014



Copy the file ~tcanty/AOSC652/2014/week\_10/random\_integers\_1\_10000.dat

Let's take a look at test3a.pro

openw,2,'sorted\_integers\_10000.dat'

```
printf,2,'3,3'
printf,2,'Sequence, Integer Value, Sorted Integer'
printf,2,'Integers 1 to 10000, Randomly Sorted Using Random Number
Generator Seed -99'
```

for i=0L,sz-1 do begin
 printf,2,variables(0,i),variables(1,i),sorted\_data(i),format='(3(1x,I7))'
endfor

#### close,2

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.

3 Nov 2014



Input/Output

To sort data in IDL, use the "sort" command

```
xsort=sort(variables(1,*))
```

"sort" outputs an array of indices that allows you to re-order the original array.

sorted\_data=variables(1,xsort)

Copyright © 2014 University of Maryland.



Input/Output

Now take a look at test3b.pro

What is the major difference between test3a.pro and test3b.pro?

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.

Input/Output

Now take a look at test3b.pro

What is the major difference between test3a.pro and test3b.pro?

Earlier, we added a program to your an idl directory called read\_file.pro.

Just as **load\_header\_data.m** read files into MATLAB, read\_file.pro reads "Ross & Tim" formatted files into an IDL program.

read\_file,filename,variables,headers

"variables" contains the data contained in the file "headers" contains the names of the data in each column

Copyright © 2014 University of Maryland.

This material may not be reproduced or redistributed, in whole or in part, without written permission from Ross Salawitch or Tim Canty.



Manipulating data:

Please copy ~tcanty/AOSC652/2014/week\_10/plot\_temp.pro ~tcanty/AOSC652/2014/week\_10/beltsville.dat ~tcanty/AOSC652/2014/week\_10/beltsville\_10yr\_mean\_sd.dat

What does the program test4.pro do?

Copyright © 2014 University of Maryland.



Manipulating data:

The "where" command, like the "find" command in MATLAB, allows you to find the indices of an array that satisfies a given argument.

p1=where(month eq 12 and tave ne -999.00)

```
dec_mean=mean(tave(p1))
dec_sdev=stddev(tave(p1))
```

Copyright © 2014 University of Maryland.



Manipulating data:

The "where" command, like the "find" command in MATLAB, allows you to find the indices of an array that satisfies a given argument.

p1=where(month eq 12 and tave ne -999.00)

```
dec_mean=mean(tave(p1))
dec_sdev=stddev(tave(p1))
```

What does the rest of this code do?

Copyright © 2014 University of Maryland.

Data visualization:



First,

Copy ~tcanty/IDL/symbols.pro ~tcanty/IDL/oploterror.pro ~tcanty/IDL/colorbar1.pro

into your idl directory.

These programs will make it easier to plot different types of symbols, error bars, and a color bar.

Copy ~tcanty/IDL/generic.pro into your working directory

This program can be thought of as a customizable "stncl" file that you can use to plot data.

Copyright © 2014 University of Maryland.