## INTRODUCTION

## METHODOLOGY

## OBTAINING

The distribution version of the SPI program is available as a compressed unix tar file. It is available via anonymous ftp on ulysses.atmos.colostate.edu (129.82.107.18). It is located in pub/spi.tar.Z.

Here's an example (type the text in ***'s, without the ***'s):

```
-------------------------------------------------------------------------
-
> ***ftp 129.82.107.18***
Connected to 129.82.107.18.
220 ulysses FTP server (SunOS 4.1) ready.
/users/johnk/.netrc: Permission denied
Name (129.82.107.18:johnk): ***ftp***
331 Guest login ok, send ident as password.
Password:***johnk@***
230 Guest login ok, access restrictions apply.
ftp> ***cd pub***
250 CWD command successful.
ftp> ***bin***
200 Type set to I.
ftp> ***get spi.tar.Z***
200 PORT command successful.
150 Binary data connection for spi.tar.Z (129.82.107.18,2364) (36161
bytes).
226 Binary Transfer complete.
local: spi.tar.Z remote: spi.tar.Z
36161 bytes received in 0.015 seconds (2.4e+03 Kbytes/s)
ftp>***quit***
221 Goodbye.
>***uncompress spi.tar.Z***
> ***tar xvf spi.tar***
x spi/Makefile, 402 bytes, 1 tape blocks
x spi/data/53005.mon, 10904 bytes, 22 tape blocks
x spi/data/53038.mon, 10875 bytes, 22 tape blocks
x spi/data/53359.mon, 10434 bytes, 21 tape blocks
x spi/data/53488.mon, 10917 bytes, 22 tape blocks
x spi/data/denver.dat, 7821 bytes, 16 tape blocks
x spi/data/crested.hcn, 6150 bytes, 13 tape blocks
x spi/data/denver.spi, 8161 bytes, 16 tape blocks
x spi/ghcn_filter.c, 1446 bytes, 3 tape blocks
x spi/mon_filter.c, 1981 bytes, 4 tape blocks
x spi/rd_prec.c, 1288 bytes, 3 tape blocks
x spi/spi.c, 2089 bytes, 5 tape blocks
x spi/spi.doc, 4190 bytes, 9 tape blocks
x spi/spi.h, 945 bytes, 2 tape blocks
x spi/spi_empiric.c, 4763 bytes, 10 tape blocks
```

```
x spi/spi_gamma.c, 10071 bytes, 20 tape blocks
```

-----end of example-------------------------------------------------------

Inventory of Files

Makefile - Unix style makefile
ghcn_filter.c - Example input filter for GHCN data format
mon_filter.c - Example input filter for Mon Drought format
rd_prec.c - Function reads input.
spi.c - Main.
spi.doc - This file.
spi.h - Spi header file.
spi_empiric.c - Function to compute SPI using empiric distrib.
spi_gamma.c - Function to compute SPI using gamma distrib.

data: - example data files
53005.mon
53038.mon
53359.mon
53488.mon
crested.hcn
denver.dat
denver.spi - example output.

BUILDING

The requirements to compile and run spi are:

o An ANSI standard C compiler. GNU gcc version 2.3.3 running under Linux was used for developement, but the code is generic enough that it should compile easily with any ANSI compiler. If you are forced to use a K&R compiler, you will have modify the function headers and remove the function prototypes.

o An operating system that supports unix-like I/O redirection. Other operating system may be used, but will require some code modifications.

o Sufficient memory to support the program and data arrays.

o A math library that provides lgamma(), the log gamma function. (On some systems lgamma may be named gamma.)

Unix systems:

1) Edit Makefile to suit your system.

2) Type 'make'.

Other systems:

1) Compile spi.c, rd_prec.c and spi_gamma.c (or spi_empiric.c).

2) Link the resulting object modules with the appropriate math library.

If you have trouble running spi because your system does not have enough memory, you may want to edit spi.h and change the lines:

```
#define BEGYR  1850
#define ENDYR  2000
```

to specify a shorter period of record.

## RUNNING

The spi program is implemented as a unix-style filter; i.e. it reads from standard input (stdin) and write to standard output (stdout). Thus it is easy to use with a variety of input data and output processing without rewriting the SPI generating program.  All that needs to be done is to write apropriate 'frontend' and 'backend' filter.  For example, if several data streams are to be analyzed and each has a different format, we need only to write a filter that reads each format and outputs the format spi expects.  Similarly, we may have several filters that plot time series or perform statistical analysis on the resulting index values.

Spi also requires specifying one or more time scale parameters.  Simply add these to the command line.  For example:

```
      spi 3 6 12 <infile.dat >outfile.dat
```

### Input and Filters

Input to the spi program consists of a file for each station.  The file contains a single head line; this line may contain any character data; e.g. station number, latitude, longitude, etc.  The header is passed as-is to stdout.  Following the header are a the data records; each data record has 3 blank separarted fields:

```
      yyyy mm prec

        Where:
            yyyy - year; values > ENDYR and < BEGYR will be skipped.
            mm   - month [1-12]
            prec - precipitation (in 0.01's of inches)

        Special codes:
            -9900 = Missing
```

Two input filters have been included with the spi package as examples. One, mon_filter, translates files in the Colorado Climate monthly data format (.mon).  The other, ghcn_filter, reads data files extracted from the Global Historic Climate Network.  Examples of these formats appear in the data subdirectory.

Usage Examples

1) List 12 month time scale values for data in denver.dat:

```
      spi 12 <denver.dat
```

Note: Output from this example is in data/denver.spi.

2) Display spi index for time scale 3, 6 and 12 months using data in the file 53005.mon.  The file is is '.mon' format. Send the results to the file 53005.spi:

```
      mon_filter <53005.mon | spi 3 6 12 >53005.spi
```

3) Display current index values for all '.mon' format files in ./data.  This is a unix shell script:

```
#--begin script--
#!/bin/sh

for i in ./data/*.mon; do
  echo $i
  mon_filter <$i | spi 12 24 36 | tail -1
done

#--end script--
```