A Web-based Tool for Translating Unstructured Data from Dataloggers into Standard Formats

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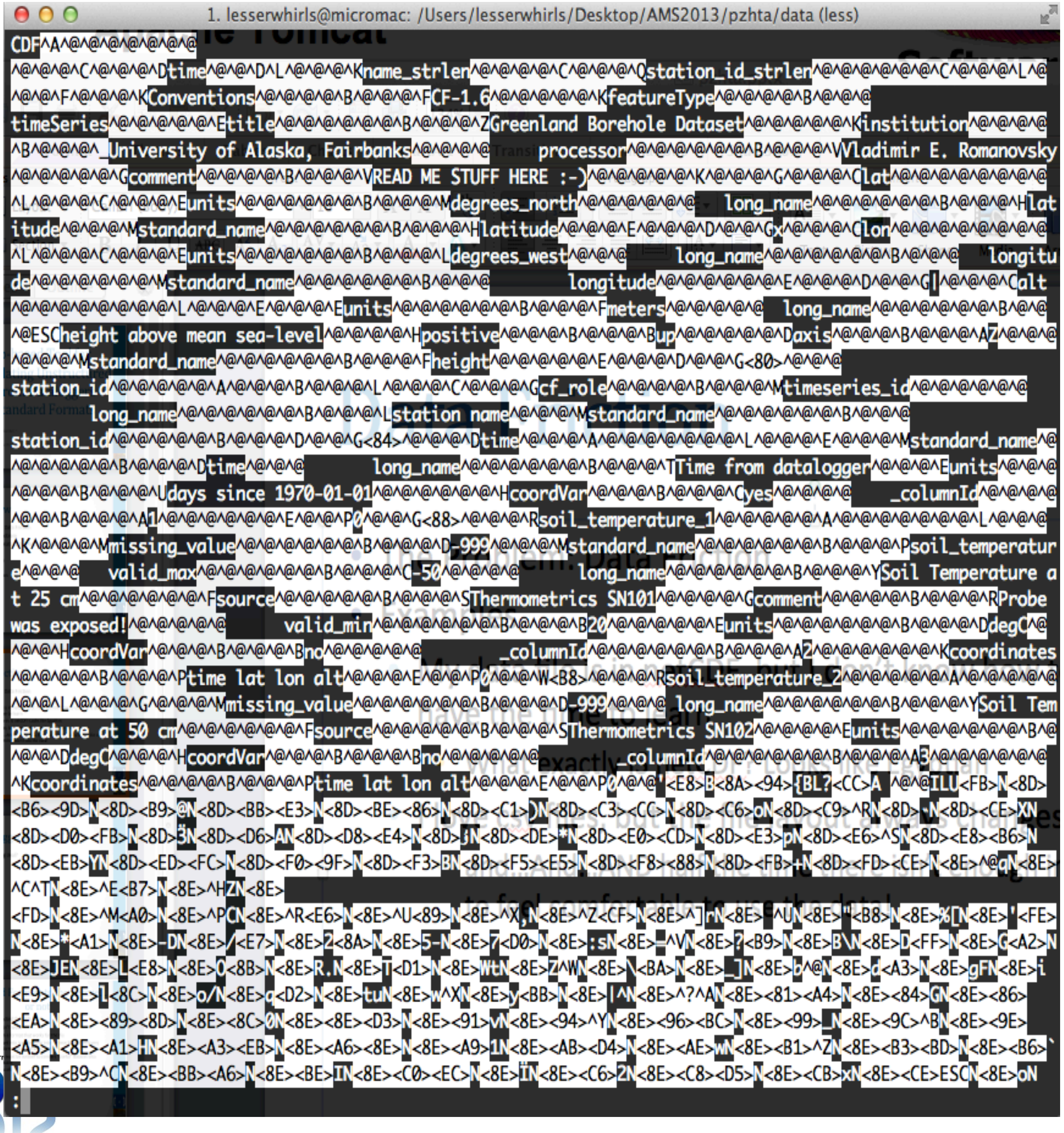
Overview

- The Problem: Data Friction
- The Logger Problem
- Standard Formats to the Rescue (…or not)
- ρζητα
  - Architecture
  - Workflow
  - Current Status

Data Friction

- The Problem: Data Friction
- Examples:
  - The data I need is stuffed into a netCDF file, but I don't know how to use it and don't have the time to learn.
    - I might like to learn, but I don't have the time.
    - Just what exactly IS netCDF? Looks like Egyptian Hieroglyphics.

Data Friction


1. lesserwhirls@micromac: /Users/lesserwhirls/Desktop/AMS2013/pzhta/data (less)

```
CDF^A^@^@^@^@^@^@^@
^@^@^@^C^@^@^@^Dtime^@^@^D^L^@^@^@^Kname_strlen^@^@^@^@^C^@^@^@^Qstation_id_strlen^@^@^@^@^@^@^C^@^@^@^L^@
^@^@^F^@^@^@^KConventions^@^@^@^@^B^@^@^@^FCF-1.6^@^@^@^@^@^KfeatureType^@^@^@^@^B^@^@^@
timeSeries^@^@^@^@^@^Etitle^@^@^@^@^@^@^B^@^@^@^ZGreenland Borehole Dataset^@^@^@^@^@^Kinstitution^@^@^@^@
^B^@^@^@^_University of Alaska, Fairbanks^@^@^@^@        processor^@^@^@^@^@^@^B^@^@^@^VVladimir E. Romanovsky
^@^@^@^@^@^Gcomment^@^@^@^@^B^@^@^@^VREAD ME STUFF HERE :-)^@^@^@^@^@^K^@^@^@^G^@^@^@^Clat^@^@^@^@^@^@^@^@
^L^@^@^@^C^@^@^@^Eunits^@^@^@^@^@^@^B^@^@^@^Mdegrees_north^@^@^@^@^@^@  long_name^@^@^@^@^@^@^B^@^@^@^Hlat
itude^@^@^@^Mstandard_name^@^@^@^@^@^@^B^@^@^@^Hlatitude^@^@^@^E^@^@^@^D^@^@^Gx^@^@^@^Clon^@^@^@^@^@^@^@^@
^L^@^@^@^C^@^@^@^Eunits^@^@^@^@^@^@^B^@^@^@^Ldegrees_west^@^@^@      long_name^@^@^@^@^@^@^B^@^@^@    longitu
de^@^@^@^@^@^@^Mstandard_name^@^@^@^@^@^@^B^@^@^@          longitude^@^@^@^@^@^@^E^@^@^@^D^@^@^G|^@^@^@^Calt
^@^@^@^@^@^@^@^@^L^@^@^@^E^@^@^@^Eunits^@^@^@^@^@^@^B^@^@^@^Fmeters^@^@^@^@^@  long_name^@^@^@^@^@^@^B^@^@
^@ESCheight above mean sea-level^@^@^@^@^Hpositive^@^@^@^B^@^@^@^Bup^@^@^@^@^@^Daxis^@^@^@^B^@^@^@^AZ^@^@^@
^@^@^@^Mstandard_name^@^@^@^@^@^@^B^@^@^@^Fheight^@^@^@^@^E^@^@^@^D^@^@^G<80>^@^@^@
station_id^@^@^@^@^@^A^@^@^@^B^@^@^@^L^@^@^@^C^@^@^@^Gcf_role^@^@^@^@^B^@^@^@^Mtimeseries_id^@^@^@^@^@^@
          long_name^@^@^@^@^@^@^B^@^@^@^Lstation name^@^@^@^Mstandard_name^@^@^@^@^@^@^B^@^@^@
station_id^@^@^@^@^@^B^@^@^@^D^@^@^G<84>^@^@^@^Dtime^@^@^@^A^@^@^@^@^@^@^@^L^@^@^@^E^@^@^@^Mstandard_name^@
^@^@^@^@^@^B^@^@^@^Dtime^@^@^@         long_name^@^@^@^@^@^@^B^@^@^@^TTime from datalogger^@^@^@^Eunits^@^@^@
^@^@^@^B^@^@^@^Udays since 1970-01-01^@^@^@^@^@^@^HcoordVar^@^@^@^B^@^@^@^Cyes^@^@^@^@      _columnId^@^@^@
^@^@^B^@^@^@^A1^@^@^@^@^@^@^E^@^@^P0^@^@^G<88>^@^@^@^Rsoil_temperature_1^@^@^@^@^@^A^@^@^@^@^@^@^@^L^@^@^@
^K^@^@^@^Mmissing_value^@^@^@^@^@^@^B^@^@^@^D-999^@^@^@^Mstandard_name^@^@^@^@^@^@^B^@^@^@^Psoil_temperatur
e^@^@^@    valid_max^@^@^@^@^@^@^B^@^@^@^C-50^@^@^@^@         long_name^@^@^@^@^@^@^B^@^@^@^YSoil Temperature a
t 25 cm^@^@^@^@^@^@^Fsource^@^@^@^@^@^B^@^@^@^SThermometrics SN101^@^@^@^@^Gcomment^@^@^@^@^B^@^@^@^RProbe
was exposed!^@^@^@^@^@        valid_min^@^@^@^@^@^@^B^@^@^@^B20^@^@^@^@^@^Eunits^@^@^@^@^@^@^B^@^@^@^DdegC^@
^@^@^HcoordVar^@^@^@^B^@^@^@^Bno^@^@^@^@^@          _columnId^@^@^@^@^@^@^B^@^@^@^A2^@^@^@^@^@^@^Kcoordinates
^@^@^@^@^B^@^@^@^Ptime lat lon alt^@^@^@^E^@^@^P0^@^@^W<B8>^@^@^@^Rsoil_temperature_2^@^@^@^@^@^A^@^@^@^@^@
^@^@^L^@^@^@^G^@^@^@^Mmissing_value^@^@^@^@^@^@^B^@^@^@^D-999^@^@^@ long_name^@^@^@^@^@^@^B^@^@^@^YSoil Tem
perature at 50 cm^@^@^@^@^@^@^Fsource^@^@^@^@^@^B^@^@^@^SThermometrics SN102^@^@^@^@^Eunits^@^@^@^@^@^@^B^@
^@^@^DdegC^@^@^@^HcoordVar^@^@^@^B^@^@^@^Bno^@^@^@^@^@        _columnId^@^@^@^@^@^@^B^@^@^@^A3^@^@^@^@^@^@
^Kcoordinates^@^@^@^@^B^@^@^@^Ptime lat lon alt^@^@^@^E^@^@^P0^@^@'<E8>B<8A><94>{BL?<CC>A ^@^@ILU<FB>N<8D>
<B6><9D>N<8D><B9>@N<8D><BB><E3>N<8D><BE><86>N<8D><C1>)N<8D><C3><CC>N<8D><C6>oN<8D><C9>^RN<8D>^N<8D><CE>XN
<8D><D0><FB>N<8D>ËN<8D><D6>AN<8D><D8><E4>N<8D>ĵN<8D><DE>*N<8D><E0><CD>N<8D><E3>pN<8D><E6>^SN<8D><E8><B6>N
<8D><EB>YN<8D><ED><FC>N<8D><F0><9F>N<8D><F3>BN<8D><F5><E5>N<8D><F8><88>N<8D><FB>+N<8D><FD><CE>N<8E>^@qN<8E>
^C^TN<8E>^E<B7>N<8E>^HZN<8E>
<FD>N<8E>^M<A0>N<8E>^PCN<8E>^R<E6>N<8E>^U<89>N<8E>^X,N<8E>^Z<CF>N<8E>^]rN<8E>^UN<8E>"<B8>N<8E>%[N<8E>'<FE>
N<8E>*<A1>N<8E>-DN<8E>/<E7>N<8E>2<8A>N<8E>5-N<8E>7<D0>N<8E>:sN<8E>=^VN<8E>?<B9>N<8E>B\N<8E>D<FF>N<8E>G<A2>N
<8E>JEN<8E>L<E8>N<8E>O<8B>N<8E>R.N<8E>T<D1>N<8E>WtN<8E>Z^WN<8E>\<BA>N<8E>_]N<8E>b^@N<8E>d<A3>N<8E>gFN<8E>i
<E9>N<8E>l<8C>N<8E>o/N<8E>q<D2>N<8E>tuN<8E>w^XN<8E>y<BB>N<8E>|^N<8E>^?^AN<8E><81><A4>N<8E><84>GN<8E><86>
<EA>N<8E><89><8D>N<8E><8C>0N<8E><8E><D3>N<8E><91>vN<8E><94>^YN<8E><96><BC>N<8E><99>_N<8E><9C>^BN<8E><9E>
<A5>N<8E><A1>HN<8E><A3><EB>N<8E><A6><8E>N<8E><A9>1N<8E><AB><D4>N<8E><AE>wN<8E><B1>^ZN<8E><B3><BD>N<8E><B6>`
N<8E><B9>^CN<8E><BB><A6>N<8E><BE>IN<8E><C0><EC>N<8E>ÏN<8E><C6>2N<8E><C8><D5>N<8E><CB>xN<8E><CE>ESCN<8E>oN
:
```

Data Friction

- The Problem: Data Friction
- Examples:
  - My data file is in netCDF, but I don’t know how to use it and don’t have the time to learn.
    - I might like to learn, but I don’t have the time.
    - Just what exactly IS netCDF? Looks like Egyptian Hieroglyphics.
  - I love csv files, but the file layout always changes!
    - and…And…AND half the time there isn’t enough information available for me to feel comfortable using the data!

The “Logger Problem”

- What’s the big deal?
  - Vast amount of datalogger output available
    - Typically in ASCII CSV format
    - *N* number of files, ~*N* number of layouts
    - Not in a format to easily enable search, subset capabilities, other services
  - Value* added by placing into spreadsheet
- The “Logger Problem” is Huge for the Advanced Cooperative Arctic Data and Information Service (ACADIS) Project

Standard Formats to the Rescue!

- Solution: Standard Formats!

Standard Formats to the Rescue… or not…

- Solution: Standard Formats ☹

Standard Formats to the Rescue… or not…

- Solution: Standard Formats ☹

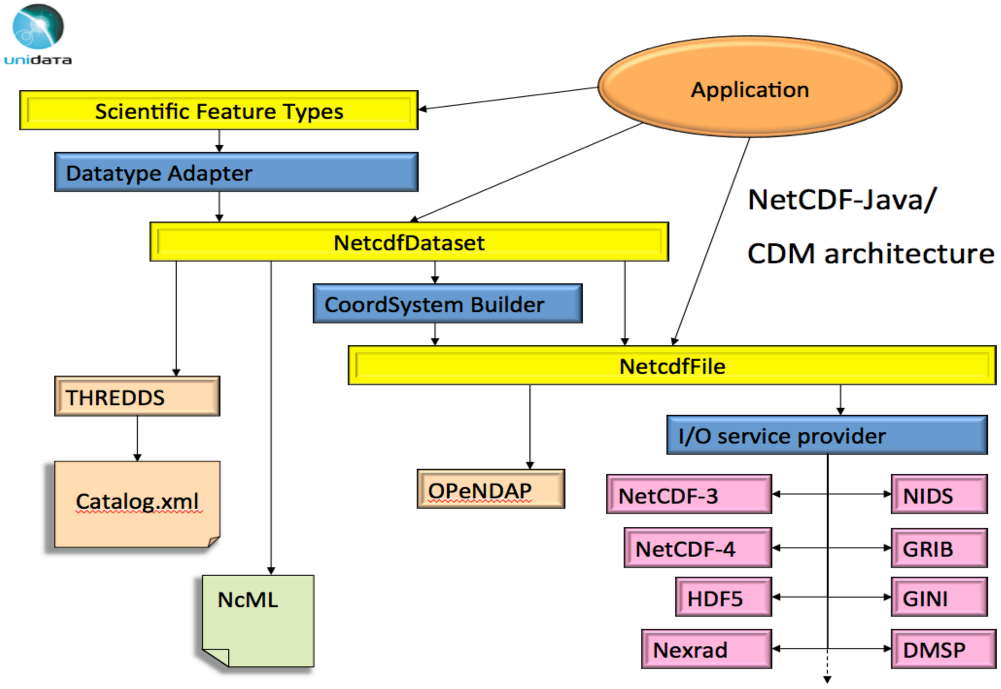
- Why this Does Not Work:
  - Data come in a format that works for the PIs
  - Why put effort into transforming into a a new format with very specific conformance constraints (e.g. CF)
  - Usually code must be written to convert "useful" dataset into "standard" dataset
    - Even more work to do *before getting to the science stuff*!

ρζητα

- What is ρζητα?
  - Vision: General Purpose Data Format converter
  - Goal: Get data into standard format ***while providing data users with the format they want***
  - Why?
    - Enable services such as search, subsetting, aggregation, etc. for observational datasets, without writing readers for each “flavor” of ASCII data

ρζητα - Architecture

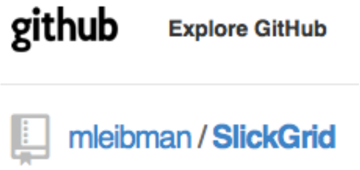
- Basic Idea
  - Common Data Model (CDM)
    - netCDF-Java
  - I/O service provider (IOSP)
  - Web interface for collection of metadata
    - as needed
- The Idea is to get into CDM, then use IOSPs



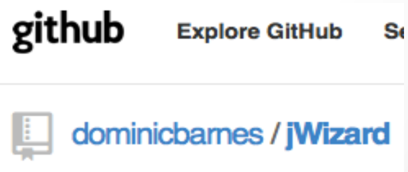
ρζητα - Architecture

- Java WebApp
  - Java
  - Apache Tomcat
  - Spring MVC
  - netCDF-Java(CDM)
  - JavaScript
    - jQuery, SlickGrid, jWizard

{js}



mleibman / SlickGrid

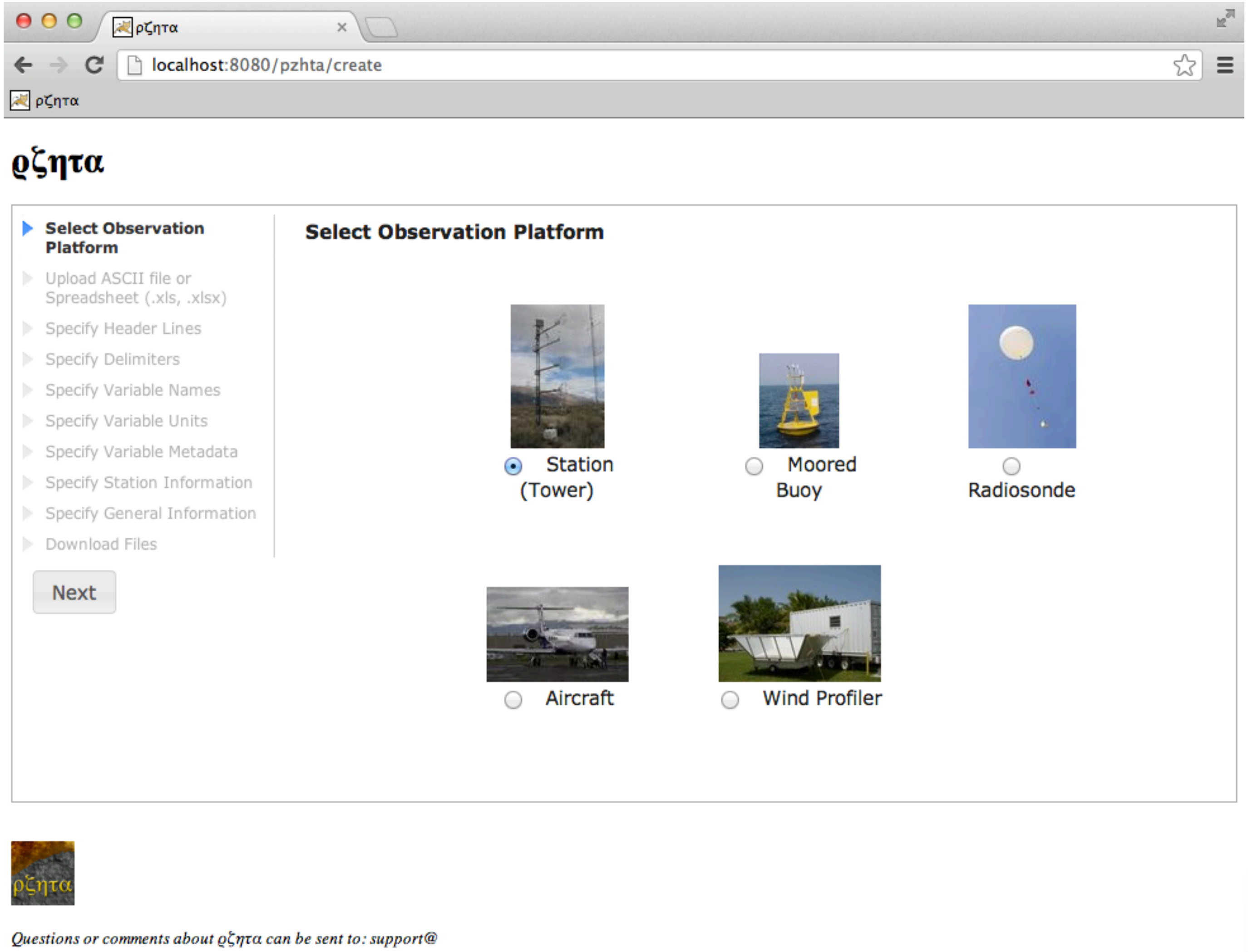


dominicbarnes / jWizard

ρζητα - Workflow

- Workflow
  - Define Discrete Sampling Geometry

Define Discrete Sampling Geometry



ρζητα

localhost:8080/pzhta/create

ρζητα

ρζητα

- **Select Observation Platform**
- Upload ASCII file or Spreadsheet (.xls, .xlsx)
- Specify Header Lines
- Specify Delimiters
- Specify Variable Names
- Specify Variable Units
- Specify Variable Metadata
- Specify Station Information
- Specify General Information
- Download Files

Next

Select Observation Platform

● Station (Tower)

○ Moored Buoy

○ Radiosonde

○ Aircraft

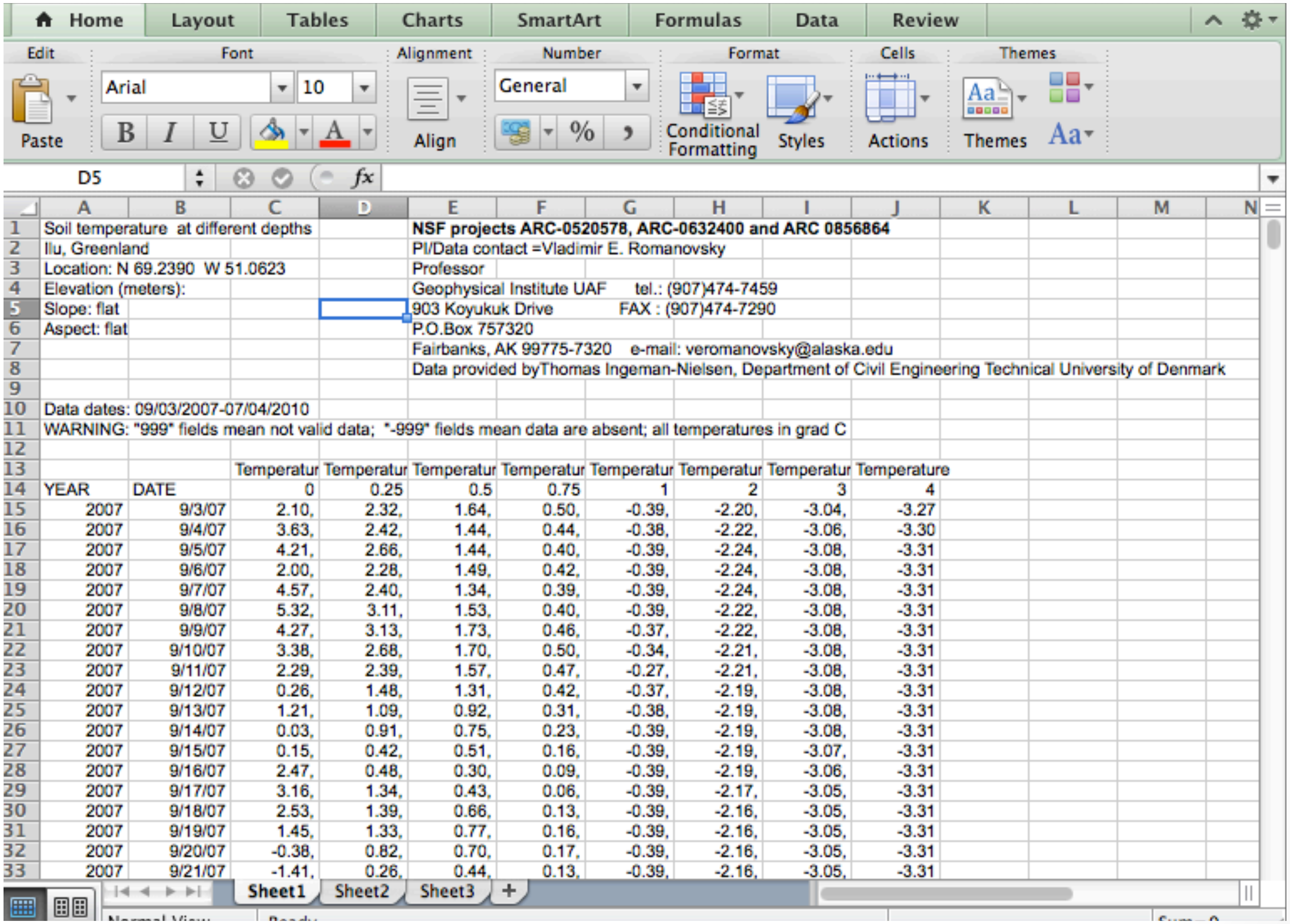
○ Wind Profiler

Questions or comments about ρζητα can be sent to: support@

ρζητα - Workflow

- Workflow
  - Define Discrete Sampling Geometry
  - Upload CSV, XLS(X)

Example Input



Soil temperature at different depths
Ilu, Greenland
Location: N 69.2390 W 51.0623
Elevation (meters):
Slope: flat
Aspect: flat

NSF projects ARC-0520578, ARC-0632400 and ARC 0856864
PI/Data contact =Vladimir E. Romanovsky
Professor
Geophysical Institute UAF   tel.: (907)474-7459
903 Koyukuk Drive   FAX : (907)474-7290
P.O.Box 757320
Fairbanks, AK 99775-7320   e-mail: veromanovsky@alaska.edu
Data provided byThomas Ingeman-Nielsen, Department of Civil Engineering Technical University of Denmark

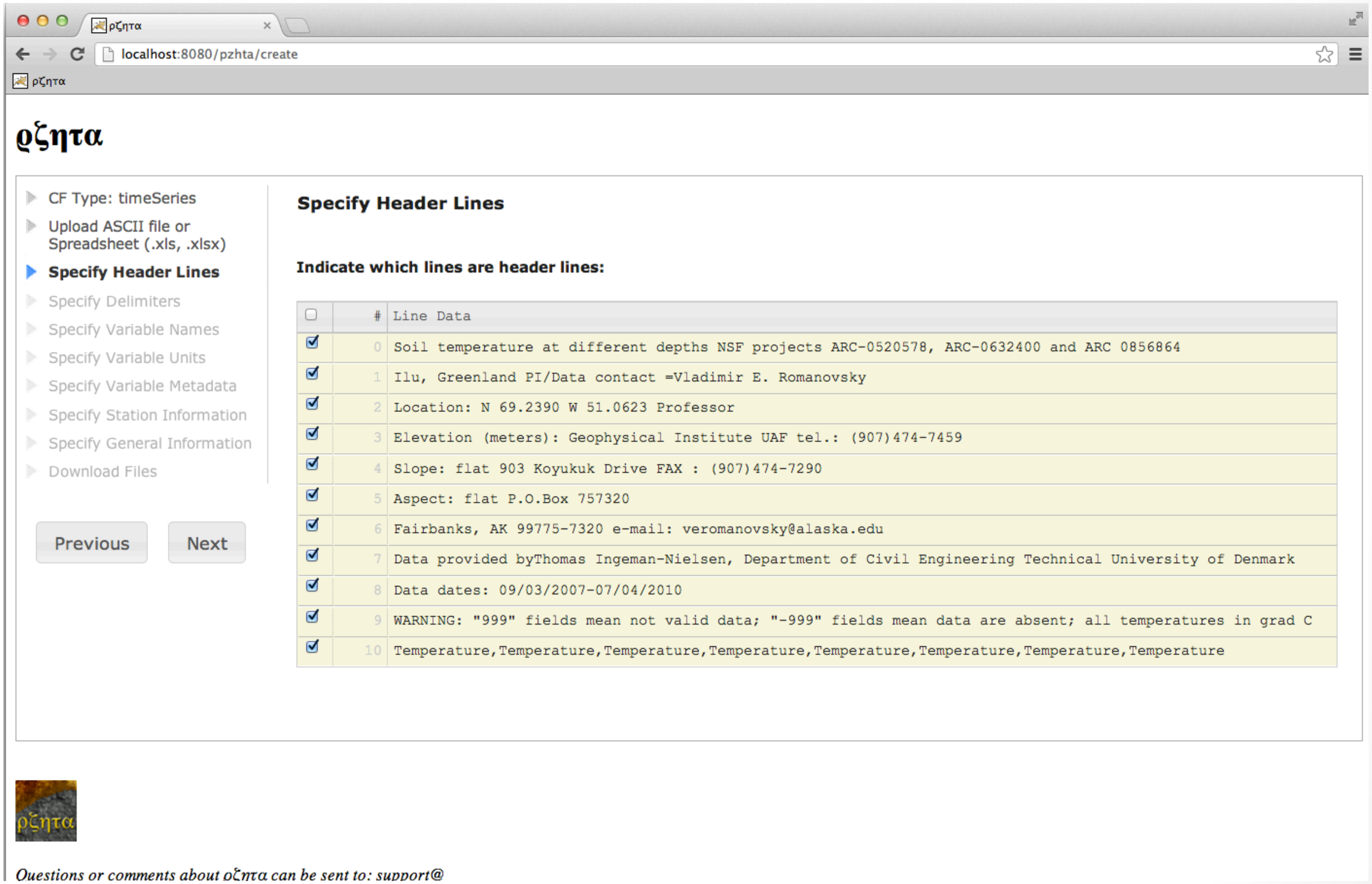
Data dates: 09/03/2007-07/04/2010
WARNING: "999" fields mean not valid data; "-999" fields mean data are absent; all temperatures in grad C

		Temperatur	Temperatur	Temperatur	Temperatur	Temperatur	Temperatur	Temperatur	Temperature
YEAR	DATE	0	0.25	0.5	0.75	1	2	3	4
2007	9/3/07	2.10,	2.32,	1.64,	0.50,	-0.39,	-2.20,	-3.04,	-3.27
2007	9/4/07	3.63,	2.42,	1.44,	0.44,	-0.38,	-2.22,	-3.06,	-3.30
2007	9/5/07	4.21,	2.66,	1.44,	0.40,	-0.39,	-2.24,	-3.08,	-3.31
2007	9/6/07	2.00,	2.28,	1.49,	0.42,	-0.39,	-2.24,	-3.08,	-3.31
2007	9/7/07	4.57,	2.40,	1.34,	0.39,	-0.39,	-2.24,	-3.08,	-3.31
2007	9/8/07	5.32,	3.11,	1.53,	0.40,	-0.39,	-2.22,	-3.08,	-3.31
2007	9/9/07	4.27,	3.13,	1.73,	0.46,	-0.37,	-2.22,	-3.08,	-3.31
2007	9/10/07	3.38,	2.68,	1.70,	0.50,	-0.34,	-2.21,	-3.08,	-3.31
2007	9/11/07	2.29,	2.39,	1.57,	0.47,	-0.27,	-2.21,	-3.08,	-3.31
2007	9/12/07	0.26,	1.48,	1.31,	0.42,	-0.37,	-2.19,	-3.08,	-3.31
2007	9/13/07	1.21,	1.09,	0.92,	0.31,	-0.38,	-2.19,	-3.08,	-3.31
2007	9/14/07	0.03,	0.91,	0.75,	0.23,	-0.39,	-2.19,	-3.08,	-3.31
2007	9/15/07	0.15,	0.42,	0.51,	0.16,	-0.39,	-2.19,	-3.07,	-3.31
2007	9/16/07	2.47,	0.48,	0.30,	0.09,	-0.39,	-2.19,	-3.06,	-3.31
2007	9/17/07	3.16,	1.34,	0.43,	0.06,	-0.39,	-2.17,	-3.05,	-3.31
2007	9/18/07	2.53,	1.39,	0.66,	0.13,	-0.39,	-2.16,	-3.05,	-3.31
2007	9/19/07	1.45,	1.33,	0.77,	0.16,	-0.39,	-2.16,	-3.05,	-3.31
2007	9/20/07	-0.38,	0.82,	0.70,	0.17,	-0.39,	-2.16,	-3.05,	-3.31
2007	9/21/07	-1.41,	0.26,	0.44,	0.13,	-0.39,	-2.16,	-3.05,	-3.31

ρζητα - Workflow

- Workflow
  - Define Discrete Sampling Geometry
  - Upload CSV, XLS(X)
  - Define Parsing Information

Define Parsing Information


ρζητα
localhost:8080/pzhta/create
ρζητα
ρζητα
CF Type: timeSeries
Upload ASCII file or Spreadsheet (.xls, .xlsx)
Specify Header Lines
Specify Delimiters
Specify Variable Names
Specify Variable Units
Specify Variable Metadata
Specify Station Information
Specify General Information
Download Files
Previous
Next
ρζητα

Specify Header Lines

Indicate which lines are header lines:

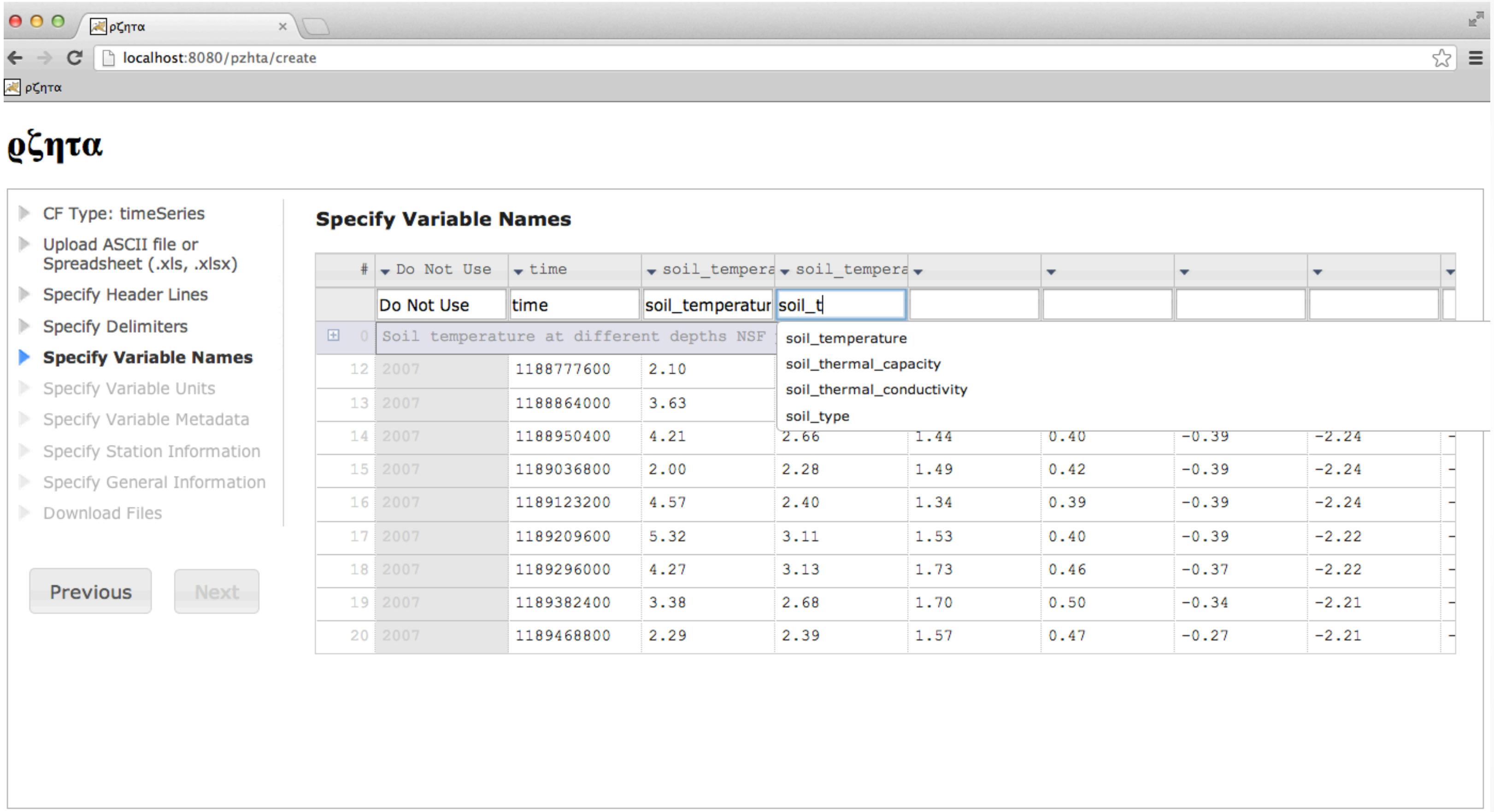
□	#	Line Data
☑	0	Soil temperature at different depths NSF projects ARC-0520578, ARC-0632400 and ARC 0856864
☑	1	Ilu, Greenland PI/Data contact =Vladimir E. Romanovsky
☑	2	Location: N 69.2390 W 51.0623 Professor
☑	3	Elevation (meters): Geophysical Institute UAF tel.: (907)474-7459
☑	4	Slope: flat 903 Koyukuk Drive FAX : (907)474-7290
☑	5	Aspect: flat P.O.Box 757320
☑	6	Fairbanks, AK 99775-7320 e-mail: veromanovsky@alaska.edu
☑	7	Data provided byThomas Ingeman-Nielsen, Department of Civil Engineering Technical University of Denmark
☑	8	Data dates: 09/03/2007-07/04/2010
☑	9	WARNING: "999" fields mean not valid data; "-999" fields mean data are absent; all temperatures in grad C
☑	10	Temperature,Temperature,Temperature,Temperature,Temperature,Temperature,Temperature,Temperature

Questions or comments about ρζητα can be sent to: support@

ρζητα - Workflow

- Workflow
  - Define Discrete Sampling Geometry
  - Upload CSV, XLS(X)
  - Define Parsing Information
  - Define Variable Metadata

Define Variable Metadata



Specify Variable Names

#	Do Not Use	time	soil_tempera	soil_tempera					
	Do Not Use	time	soil_temperatur	soil_t					
0	Soil temperature at different depths NSF								
12	2007	1188777600	2.10						
13	2007	1188864000	3.63						
14	2007	1188950400	4.21	2.66	1.44	0.40	-0.39	-2.24	-
15	2007	1189036800	2.00	2.28	1.49	0.42	-0.39	-2.24	-
16	2007	1189123200	4.57	2.40	1.34	0.39	-0.39	-2.24	-
17	2007	1189209600	5.32	3.11	1.53	0.40	-0.39	-2.22	-
18	2007	1189296000	4.27	3.13	1.73	0.46	-0.37	-2.22	-
19	2007	1189382400	3.38	2.68	1.70	0.50	-0.34	-2.21	-
20	2007	1189468800	2.29	2.39	1.57	0.47	-0.27	-2.21	-

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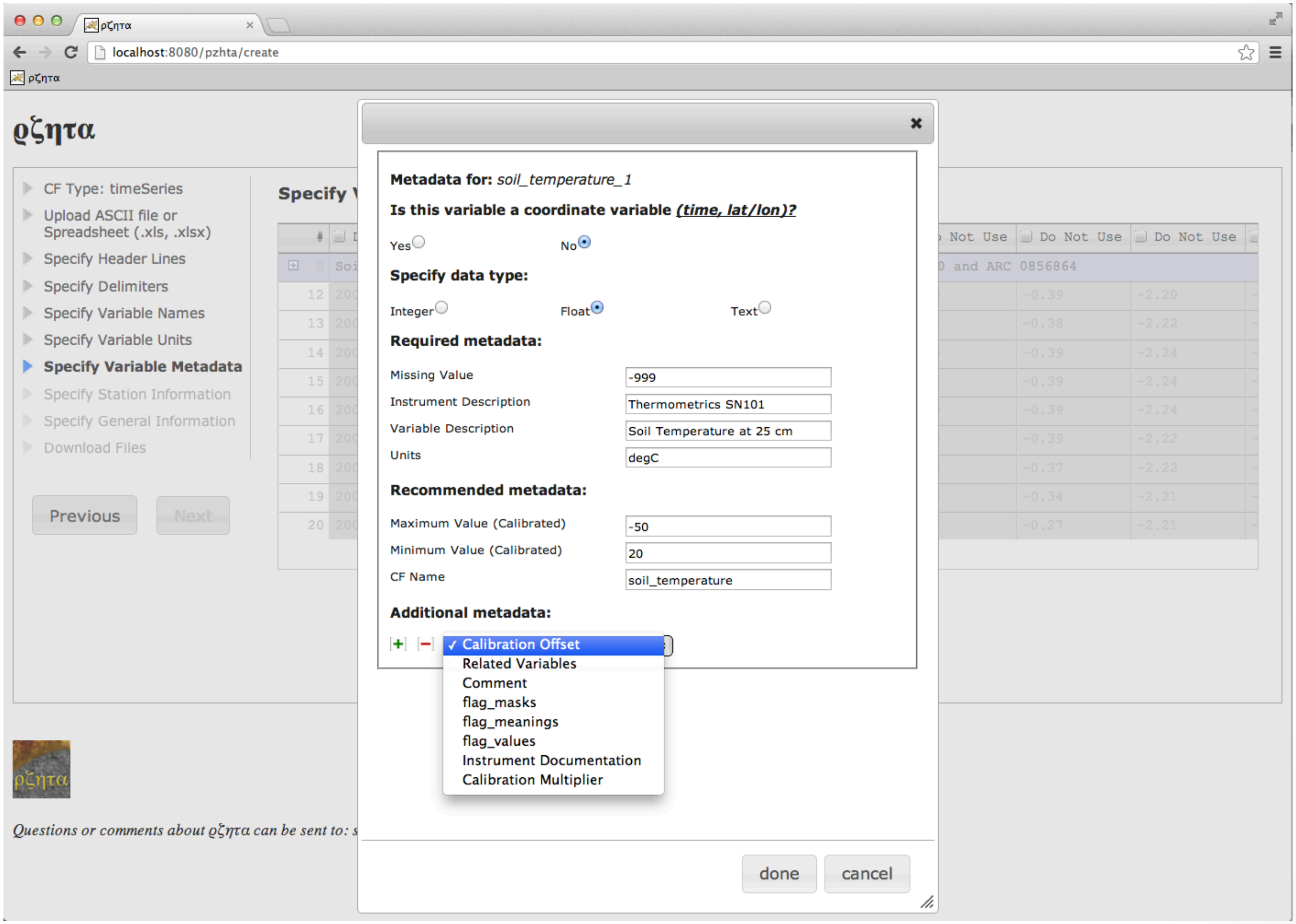
Define Variable Metadata



Metadata for: *soil_temperature_1*

Is this variable a coordinate variable *(time, lat/lon)?*

Yes ○ No ●

Specify data type:

Integer ○ Float ● Text ○

Required metadata:

Missing Value	-999
Instrument Description	Thermometrics SN101
Variable Description	Soil Temperature at 25 cm
Units	degC

Recommended metadata:

Maximum Value (Calibrated)	-50
Minimum Value (Calibrated)	20
CF Name	soil_temperature

Additional metadata:

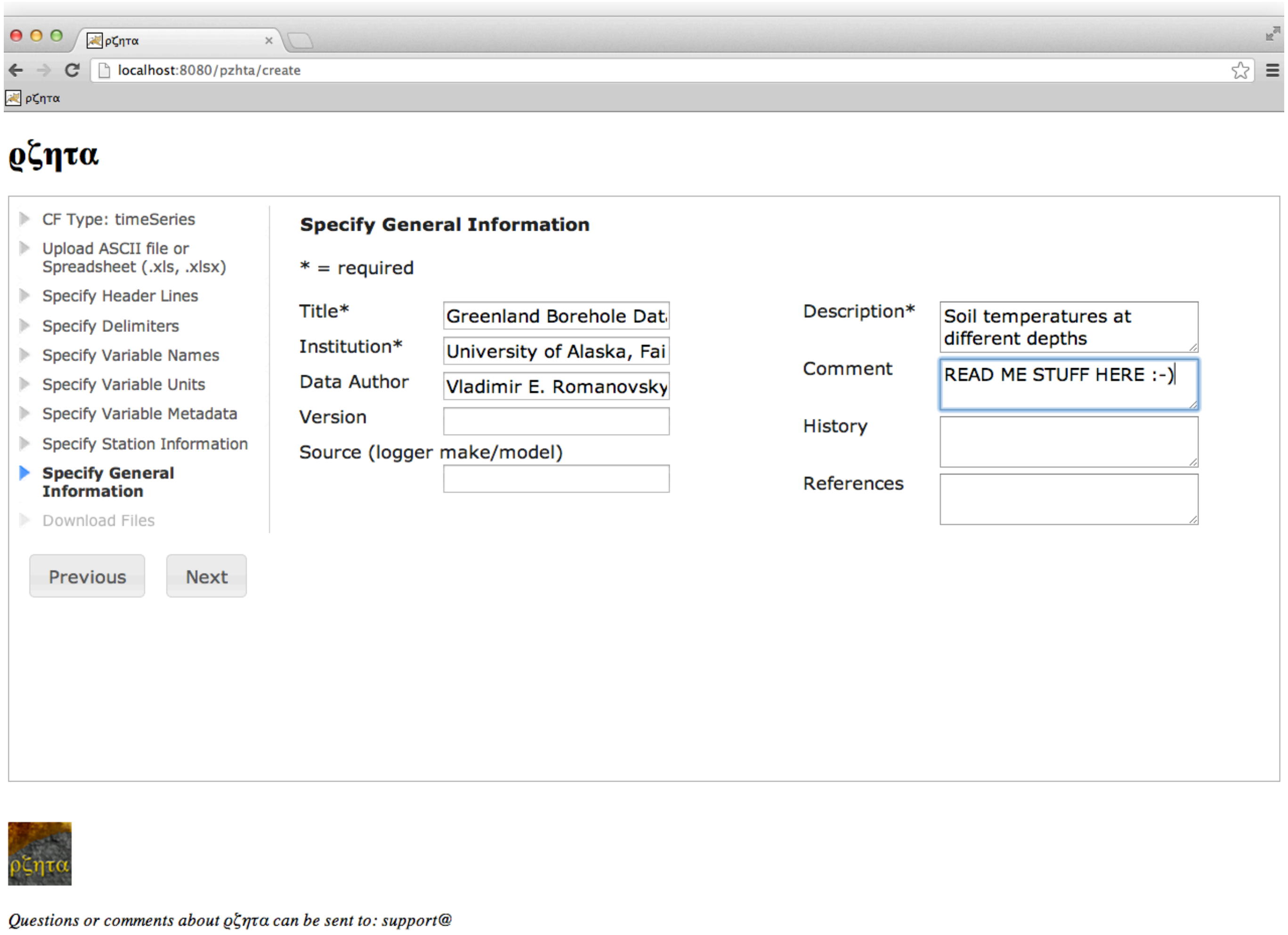
✓ Calibration Offset

Questions or comments about ρζητα can be sent to: s

ρζητα - Workflow

- Workflow
  - Define Discrete Sampling Geometry
  - Upload CSV, XLS(X)
  - Define Parsing Information
  - Define Variable Metadata
  - Define Global Metadata

Define Global Metadata


ρζητα
localhost:8080/pzhta/create
ρζητα
CF Type: timeSeries
Upload ASCII file or Spreadsheet (.xls, .xlsx)
Specify Header Lines
Specify Delimiters
Specify Variable Names
Specify Variable Units
Specify Variable Metadata
Specify Station Information
Specify General Information
Download Files
Previous
Next
ρζητα

Specify General Information

* = required

Title*	Greenland Borehole Dat
Institution*	University of Alaska, Fai
Data Author	Vladimir E. Romanovsky
Version	
Source (logger make/model)	
Description*	Soil temperatures at different depths
Comment	READ ME STUFF HERE :-)
History	
References	

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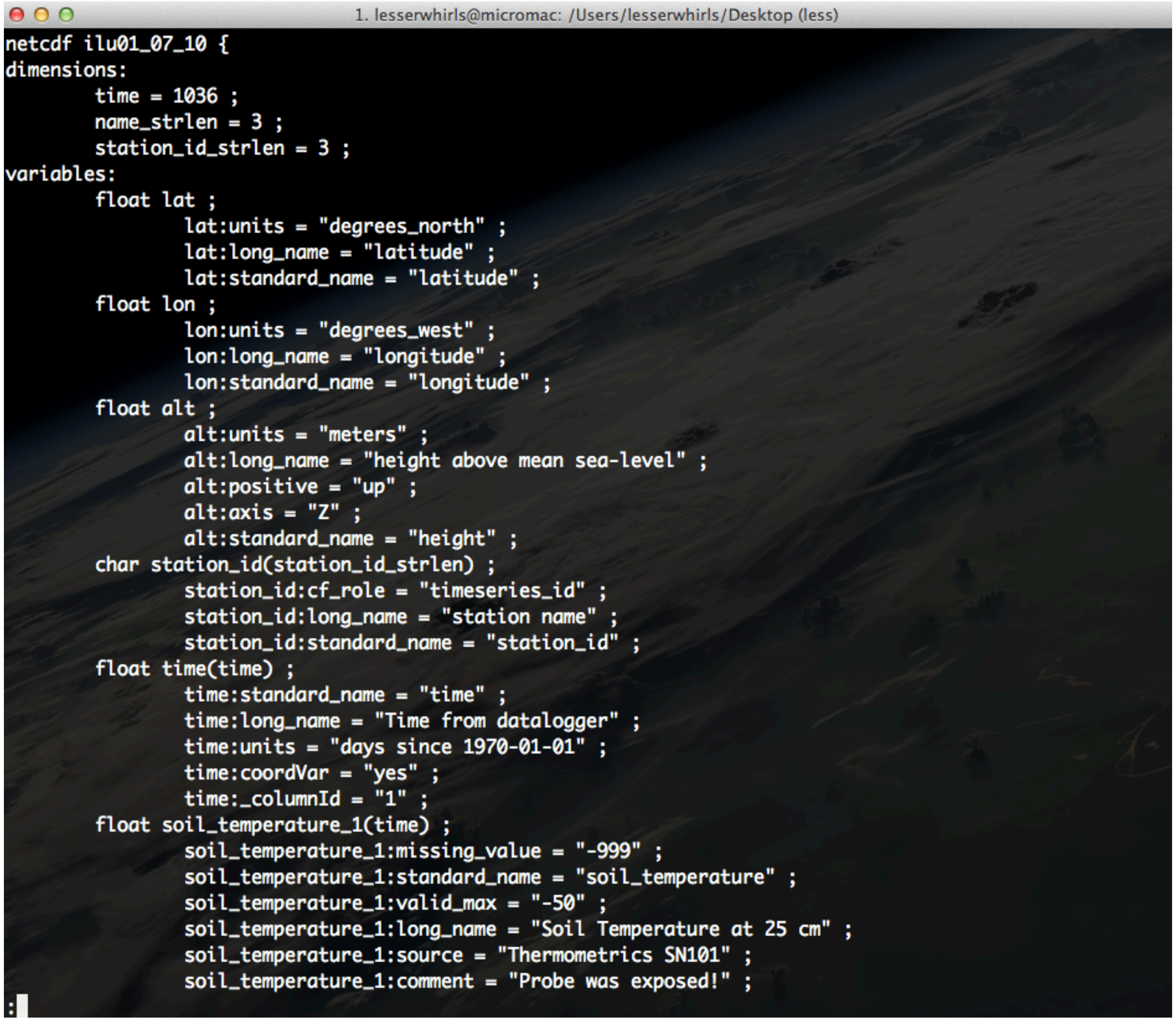
ρζητα - Workflow

- Workflow
  - Define Discrete Sampling Geometry
  - Upload CSV, XLS(X)
  - Define Parsing Information
  - Define Variable Metadata
  - Define Global Metadata
  - Transform

ρζητα - Workflow

- Workflow
  - Define Discrete Sampling Geometry
  - Upload CSV, XLS(X)
  - Define Parsing Information
  - Define Variable Metadata
  - Define Global Metadata
  - Transform
  - Return netCDF and Transaction Receipt (NcML file)

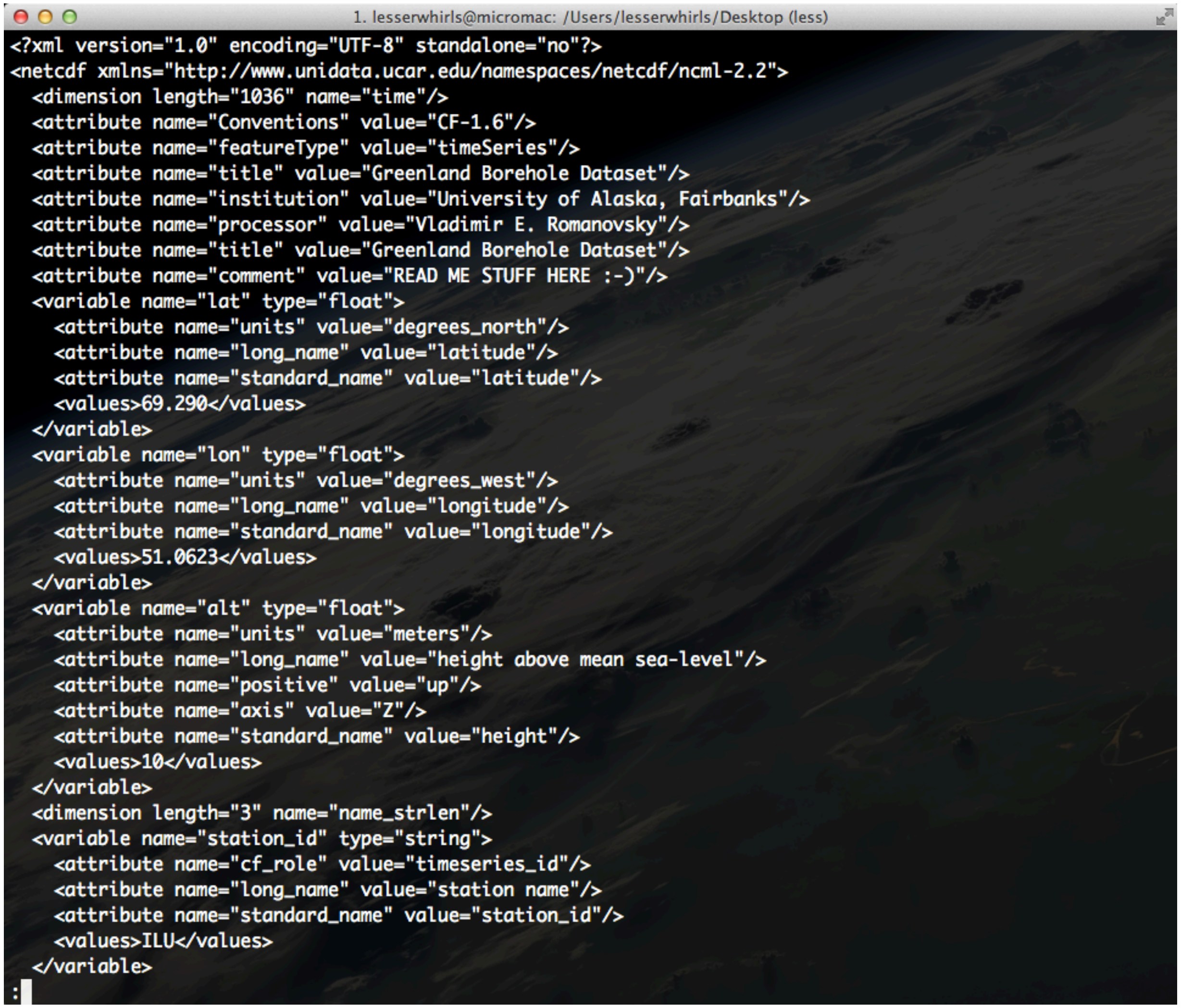
netCDF file (CF-1.6 Compliant)



1. lesserwhirls@micromac: /Users/lesserwhirls/Desktop (less)

```
netcdf ilu01_07_10 {
dimensions:
        time = 1036 ;
        name_strlen = 3 ;
        station_id_strlen = 3 ;
variables:
        float lat ;
                lat:units = "degrees_north" ;
                lat:long_name = "latitude" ;
                lat:standard_name = "latitude" ;
        float lon ;
                lon:units = "degrees_west" ;
                lon:long_name = "longitude" ;
                lon:standard_name = "longitude" ;
        float alt ;
                alt:units = "meters" ;
                alt:long_name = "height above mean sea-level" ;
                alt:positive = "up" ;
                alt:axis = "Z" ;
                alt:standard_name = "height" ;
        char station_id(station_id_strlen) ;
                station_id:cf_role = "timeseries_id" ;
                station_id:long_name = "station name" ;
                station_id:standard_name = "station_id" ;
        float time(time) ;
                time:standard_name = "time" ;
                time:long_name = "Time from datalogger" ;
                time:units = "days since 1970-01-01" ;
                time:coordVar = "yes" ;
                time:_columnId = "1" ;
        float soil_temperature_1(time) ;
                soil_temperature_1:missing_value = "-999" ;
                soil_temperature_1:standard_name = "soil_temperature" ;
                soil_temperature_1:valid_max = "-50" ;
                soil_temperature_1:long_name = "Soil Temperature at 25 cm" ;
                soil_temperature_1:source = "Thermometrics SN101" ;
                soil_temperature_1:comment = "Probe was exposed!" ;
:
```

Transaction Receipt (NcML file)



1. lesserwhirls@micromac: /Users/lesserwhirls/Desktop (less)

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<netcdf xmlns="http://www.unidata.ucar.edu/namespaces/netcdf/ncml-2.2">
  <dimension length="1036" name="time"/>
  <attribute name="Conventions" value="CF-1.6"/>
  <attribute name="featureType" value="timeSeries"/>
  <attribute name="title" value="Greenland Borehole Dataset"/>
  <attribute name="institution" value="University of Alaska, Fairbanks"/>
  <attribute name="processor" value="Vladimir E. Romanovsky"/>
  <attribute name="title" value="Greenland Borehole Dataset"/>
  <attribute name="comment" value="READ ME STUFF HERE :-)"/>
  <variable name="lat" type="float">
    <attribute name="units" value="degrees_north"/>
    <attribute name="long_name" value="latitude"/>
    <attribute name="standard_name" value="latitude"/>
    <values>69.290</values>
  </variable>
  <variable name="lon" type="float">
    <attribute name="units" value="degrees_west"/>
    <attribute name="long_name" value="longitude"/>
    <attribute name="standard_name" value="longitude"/>
    <values>51.0623</values>
  </variable>
  <variable name="alt" type="float">
    <attribute name="units" value="meters"/>
    <attribute name="long_name" value="height above mean sea-level"/>
    <attribute name="positive" value="up"/>
    <attribute name="axis" value="Z"/>
    <attribute name="standard_name" value="height"/>
    <values>10</values>
  </variable>
  <dimension length="3" name="name_strlen"/>
  <variable name="station_id" type="string">
    <attribute name="cf_role" value="timeseries_id"/>
    <attribute name="long_name" value="station name"/>
    <attribute name="standard_name" value="station_id"/>
    <values>ILU</values>
  </variable>
:
```

ρζητα - Status

- Current Status
  - Import Single-block CSV, XLS(X)
  - Produce netCDF with NcML Transaction Receipt
    - Prepared for data portal submission
  - Will soon be on GitHub
- Next Steps
  - Enable Mining of Header block
  - Import Multi-block CSV, XLS(X) files
  - Allow Upload of CF1.6 netCDF Discrete Geometry (A.K.A. point) Files
  - Return "Standard" CSV or XLS(X) format
- Somewhat Larger Goals
  - Enable desktop use for easy subsetting on CDM files
    - E.g. Easy grid point times series extraction from netCDF or GRIB files (returned as what the user would like, of course)

ρζητα - Questions

- Unidata Funded by NSF 0833450 (AGS)
  - http://www.unidata.ucar.edu
- The Advanced Cooperative Arctic Data and Information Service (ACADIS) Funded by NSF 1016034 (ARC)
  - http://www.aoncadis.org/