Legacy to the Future Framework Design

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The purpose of the **Legacy to the Future** Framework is to provide an integrated modeling system which links legacy code components written in different languages and installed on different hardware platforms. Existing modeling systems have been narrow in focus, and efforts to link existing codes have been tedious and uncommon. However, new advances in computational tools enable a more general solution to this problem.

Legacy to the Future is implemented using JAVA and CORBA. This combination allows communication among objects written in different languages across address spaces and networks. It allows for the incorporation of existing legacy codes while adhering the following seven design criteria: (1) Extensible, (2) Distributed, (3) Multi-user, (4) Parallel, (5) Secure, (6) User friendly, and (7) Easily implemented. There are many advantages of this design. Any code module, existing or newly developed, may be added to the system. Any user with network access may use the system, but modules may restrict access for security. Many users can use the system at the same time. Legacy codes can run on the most appropriate platform avoiding conversion costs and providing for parallel computation where appropriate. A minimum amount of work is required to add a module to the system.

Legacy to the Future consists of a setup server and its associated run-history database, application servers, clients, and optional authentication and security services. Adding an application to the framework requires writing its input specification using the framework grammar and implementing its application server according to the defined framework IDL (interface description language). The setup server and client remain unchanged. A client requests a run specification through the setup server causing a GUI to be automatically generated. The user may edit the specification, register a new specification, request a simulation to be run, visualize results, or select among other supported actions.

We will demonstrate a **Legacy to the Future** implementation of a related set of codes native to UNIX and PC platforms. The software has been approved for open source distribution and is available from the web site.

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L2F - Legacy to the Future Framework
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L2F Design Goal

Provide a framework that builds upon existing state-of-the-art models to create integrated multidisciplinary simulation systems.

L2F Implementation

The recent wide acceptance of JAVA and CORBA makes L2F possible.

JAVA is a new platform neutral object oriented language with built in networking.
JDBC (JAVA database connectivity) allows sending database queries (SQL) to
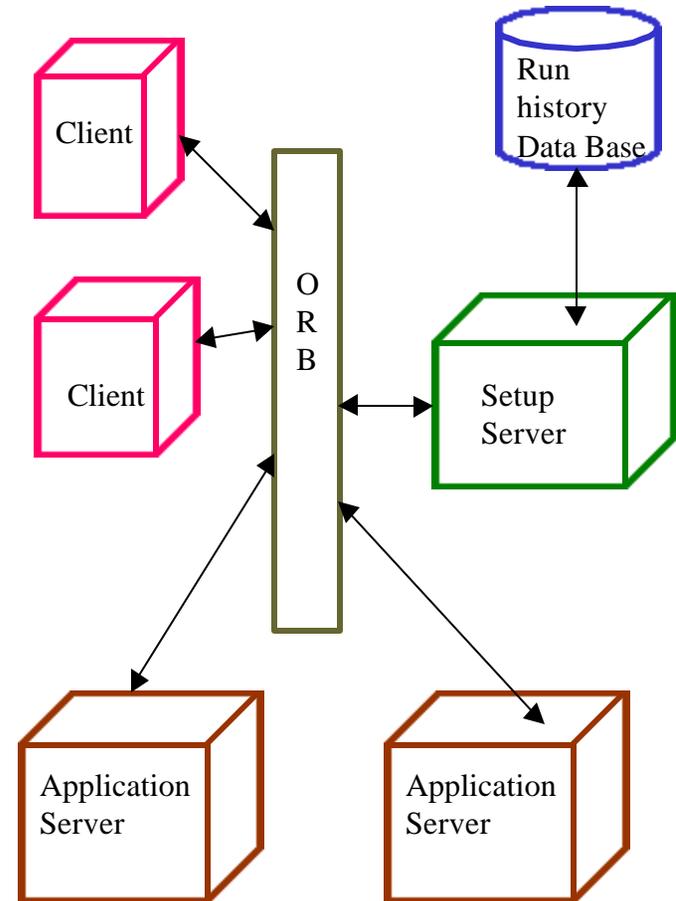any database; i.e., the same program can be used to connect to ORACLE and
SYBASE

CORBA (Common Object Request Broker Architecture) specifies the functionality
of the ORB (Object Request Broker). It provides platform transparency and
language transparency.
ORB is a software "object bus".   It lets objects transparently make requests to
and receive responses from other objects located anywhere on the network.
IDL is a language that is used to define the interface between objects. It defines
the data and services on the data that will be communicated and serves up
objects that can be understood on the platform from which the request has been
made.

L2F Framework Design Features

- Platform neutral
- Language neutral
- "Plug and play" with legacy or new models
- Provides security and confidentiality
- Universal access via the internet
- Distributed components

Client

Client

O R B

Run history Data Base

Setup Server

Application Server

Application Server

L2F Framework Capabilities

- Provides chaining of low-level models to produce integrated models.
- Allows secure inter and intra-national collaborations.
- Requires a minimal amount of work to add a new model or component to the Framework.
- Provides catalogue of run histories.
- Ensures performance by running models on their native platforms.
- Allows model owner to control access to owner's model's data.
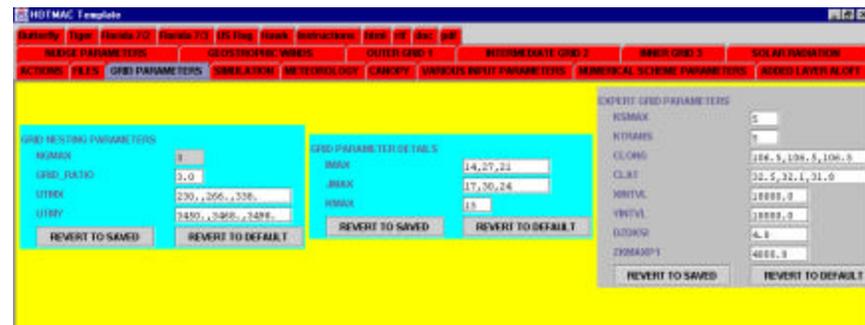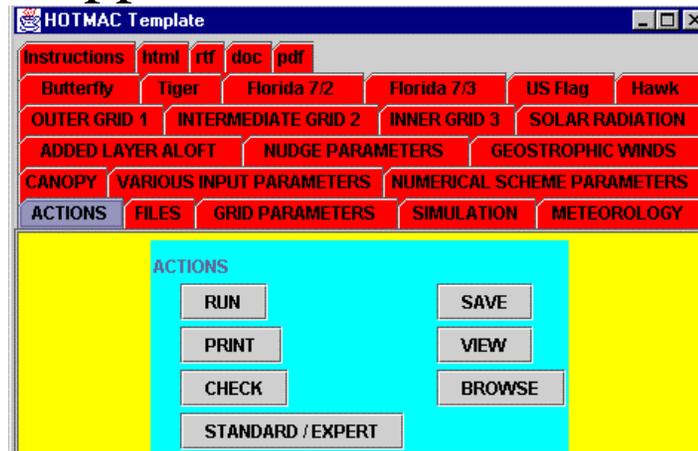- Moves data only as necessary.

L2F Framework Components

Built-in

- Setup Server (CORBA, Java, JDBC)
- Run History Data Base (any JDBC supported data base; Oracle….)
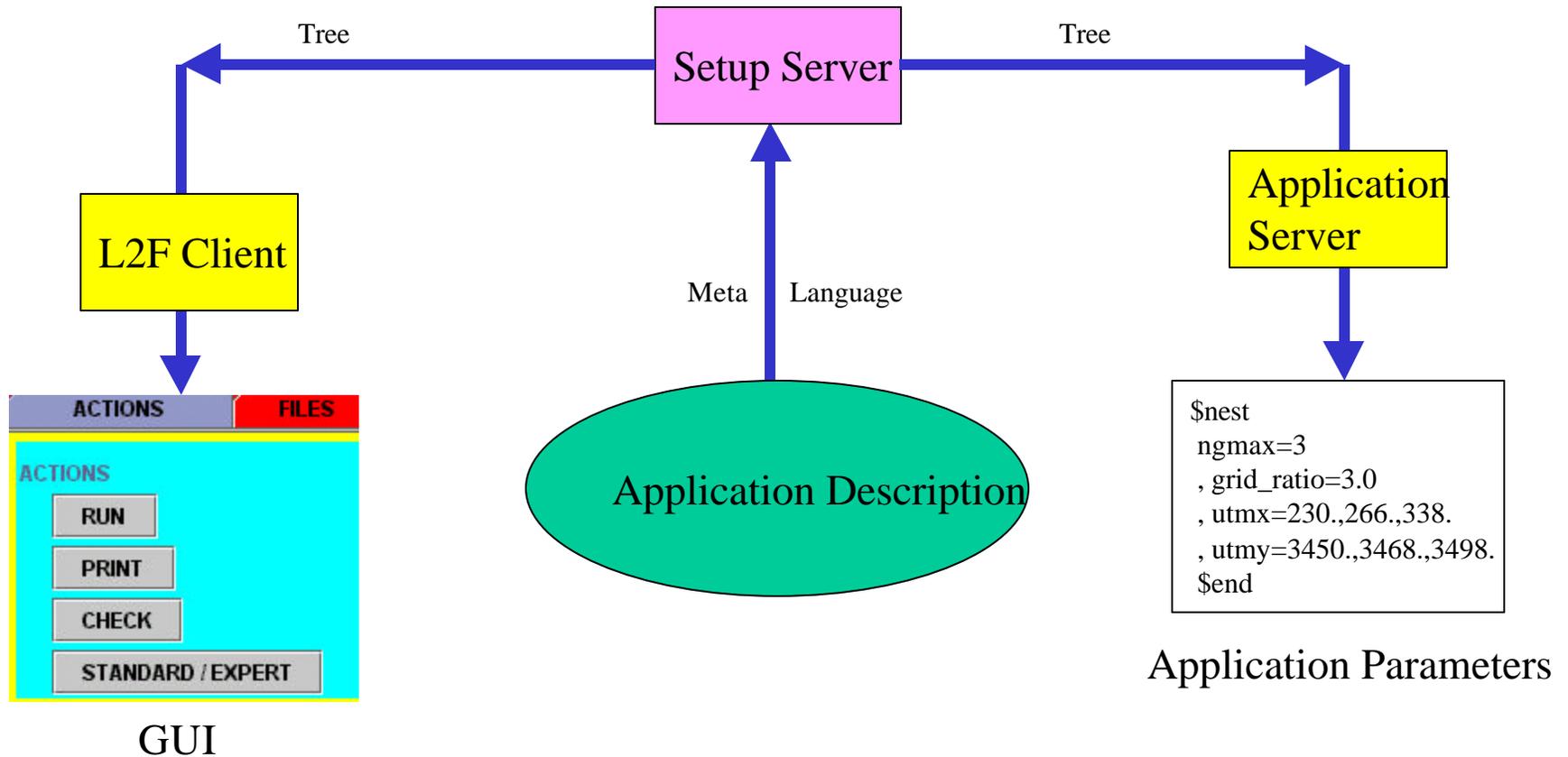- Client (CORBA, Java)

Plug-In Application Servers

- Must be supplied for each application that is attached.
- No restriction on application language.
- Server is CORBA compliant, implements Framework Interface.
- Server implemented in any language with a CORBA Binding: Java, C, C++ …

L2F Framework Client

- Provides graphical user interface.
- Allows the user to locate, select, and edit an entry in the Run History Data Base.
- Allows the user to edit an input file.
- Allows the user to prepare a new Run History entry.
- Allows the user to request the Setup Server to start an application server.

L2F: Meta Language

Tree   **Setup Server**   Tree

L2F Client

Meta   Language

Application Server

ACTIONS   FILES

ACTIONS

RUN

PRINT

CHECK

STANDARD / EXPERT

Application Description

```
$nest
 ngmax=3
, grid_ratio=3.0
, utmx=230.,266.,338.
, utmy=3450.,3468.,3498.
 $end
```

GUI

Application Parameters

Login

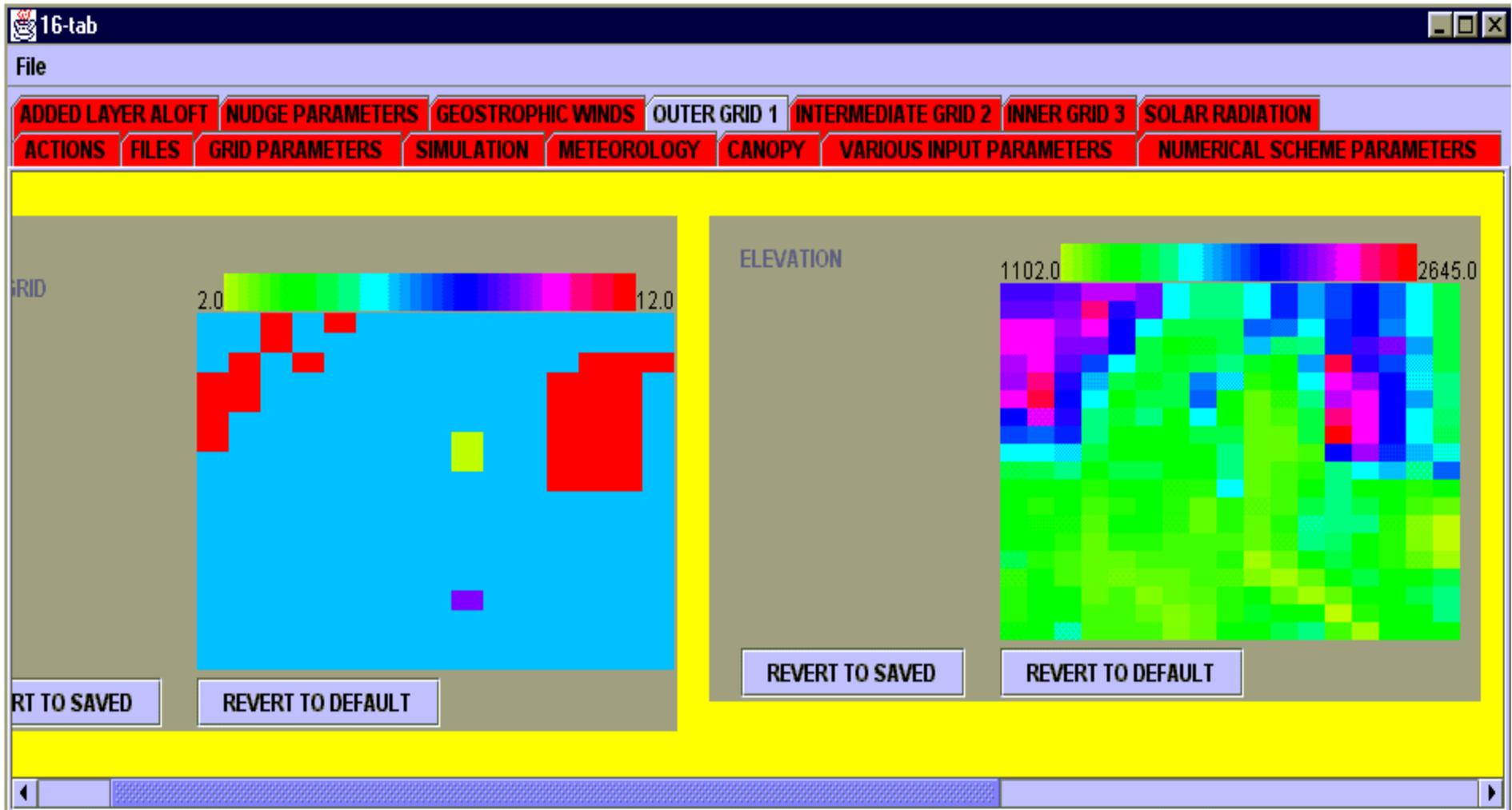# Visualization of Input Data

File

ADDED LAYER ALOFT | NUDGE PARAMETERS | GEOSTROPHIC WINDS | OUTER GRID 1 | INTERMEDIATE GRID 2 | INNER GRID 3 | SOLAR RADIATION

ACTIONS | FILES | GRID PARAMETERS | SIMULATION | METEOROLOGY | CANOPY | VARIOUS INPUT PARAMETERS | NUMERICAL SCHEME PARAMETERS
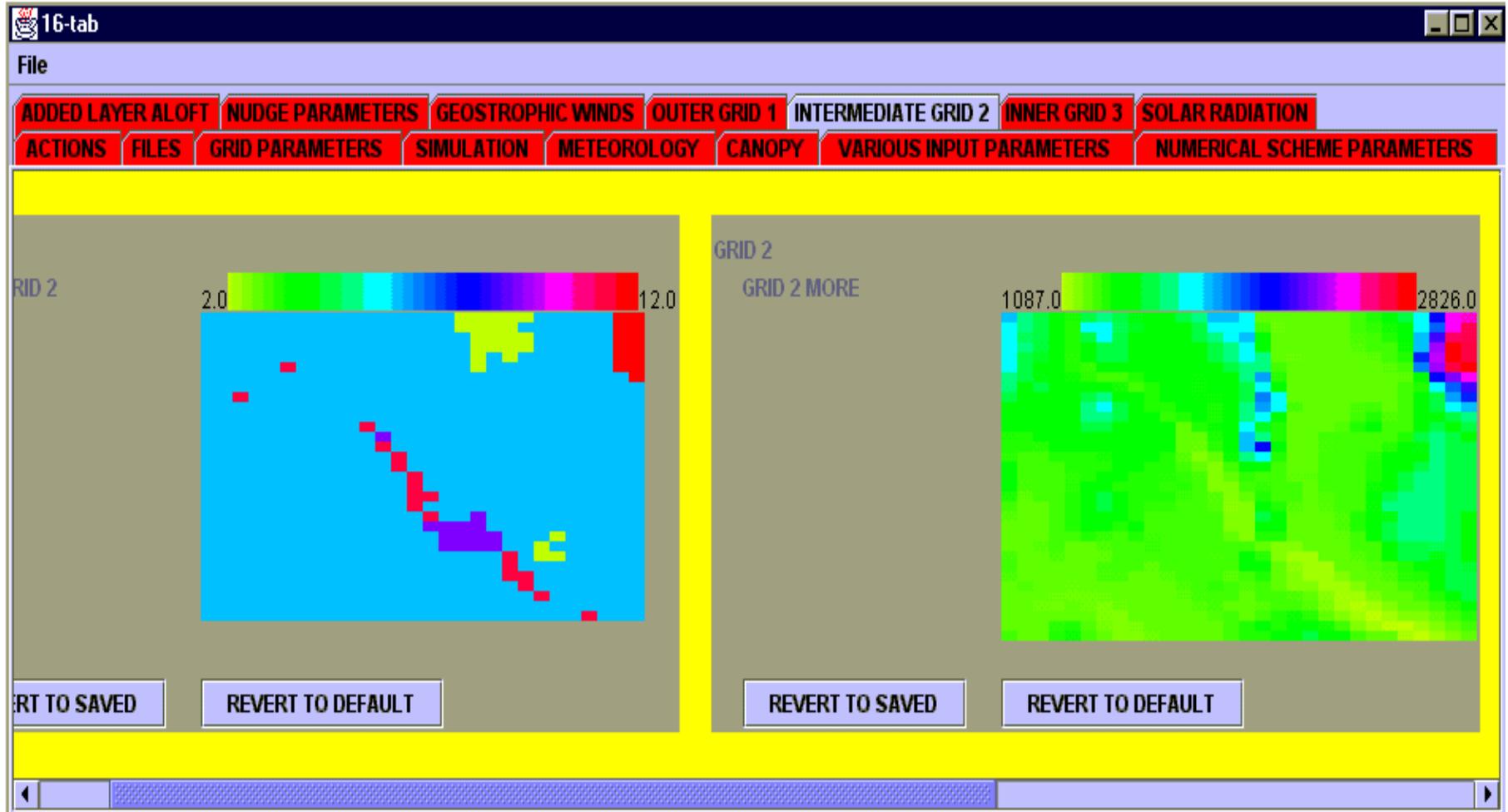
ELEVATION

	1	2	3	4	5	6	7	8	
1	2109	2109	2139	2260	2260	2197	1617	1536	1563
2	2151	2151	2194	2426	2060	2197	1617	1536	1563
3	2382	2382	2230	2370	1962	1645	1473	1485	1486
4	2319	2319	2175	2198	2035	1470	1422	1444	1455
5	2250	2354	2157	1906	1713	1474	1445	1486	1588
6	2220	2463	2063	1756	1493	1444	1502	1830	1716
7	2327	2507	2017	1669	1401	1461	1516	1857	1365
8	1980	2292	2084	1602	1447	1561	1423	1659	1417
9	1890	1870	1944	1556	1345	1438	1358	1471	1488
10	1633	1655	1716	1493	1377	1363	1326	1360	1594
11	1449	1479	1546	1403	1472	1504	1330	1357	1602
12	1387	1367	1319	1291	1365	1380	1309	1286	1634
13	1323	1307	1396	1257	1286	1339	1286	1210	1296
14	1391	1316	1314	1233	1339	1382	1277	1220	1300
15	1410	1319	1288	1220	1280	1291	1261	1239	1264
16	1522	1302	1266	1218	1208	1240	1241	1247	1283
17	1274	1354	1241	1210	1193	1204	1222	1247	1236
18	1289	1376	1347	1203	1262	1186	1206	1233	1286
19	1296	1389	1425	1256	1263	1216	1185	1221	1307
20	1317	1341	1605	1240	1252	1256	1179	1227	1355

Visualization of Input Data

Visualization of Input Data

Visualization of Input Data

L2F Summary

- Implements an integrated simulation system of existing and new modeling codes.
- Uses industry standard JAVA and CORBA to provide platform and language independence, security, and universal internet access.
- Provides automatic GUI generation and viewing of results.
- Requires a minimal amount of work to "plug" in a new module using the L2F Meta Language.
- Provides the capability of storing, retrieving and modifying past calculations.