Winds, Surface-Atmosphere Exchange and Hydrology in Complex Terrain

Val Ferret, CH

Tambarga, BF
Large Scale Turbulence Structures in Alpine Valley

1. Combine turbulence and lidar data to understand the flow dynamics of katabatic winds in an alpine valley.

2. The role of heat advection along the valley on the surface energy exchange.

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Master Project ENAC 2012/13

Computational study of Turbulent Katabatic Flows

General Description:
Slope winds (Katabatic flows) are typical for vast areas of the Earth, and often play an important role in the weather and climate of these areas. From the standpoint of basic fluid dynamics, slope winds are buoyantly driven Boundary layer-type flows along cooled sloping surfaces in a stratified fluid.

Objective 1 (physical phenomena):
- Gain a deeper understanding of the phenomena
  - Statistics of velocity/temperature fields
  - Comparison between numerical and analytical models
  - Atmospheric Stratification & Slope Angle’s effects

Objective 2 (turbulence modeling):
- Assess performances of LES-type closure models
  - Behaviour of LES subgrid models
  - Possible improvement in the parametrization

Contacts - Supervision:
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Master Project ENAC 2012/13
Optimization of EPFL-LES code for Multi-core CPU/GPU

General Description:
Turbulence is characterized by a broad spectra of scales and this makes turbulent flow simulations extremely challenging due to their computational costs. With this master project we would like to maximize the efficiency and power of the EPFL-LES code adopting the latest available technologies and modifying the core algorithms.

Objectives:
- Perform Benchmarking between GPU and threaded CPU
  - OPENblas2? MKL? Cuda?
- Optimize EPFL-LES algorithm for shared memory machines;
  - Computation of peak Flops/s and memory Bandwidth
- Optimization of memory usage.

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MSc (PdM) project, CRYOS / EFLUM

- Heat and mass transfer within and above the snow pack
- Simulation of the snow pack and surface atmosphere interaction

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Val Ferret 2012 and Plaine Morte 2013

Snow-atmosphere interactions: snow transport and impact of snow on turbulence

Snowpack evolution along the winter

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Ecohydrology & Watershed Modeling of Agricultural Catchment, Burkina Faso

- Research - development project: improve local management of water and other natural resources
- Possible field trip/internship to site: Village of Tambarga, Burkina Faso
- Rich and diverse hydro-meteorologic data:
- Come discuss your ideas:
Some ideas for projects:

1) **Erosion Analysis**: What is the erosion process in our catchment? Secondary data available, needs comparison with erosion models.

2) **Stable Isotope Analysis**: How and when is the ground water recharged? Where does the surface water come from? Answer these questions with stable isotopes of water. Three years sample data is available. Potential for laboratory work.

3) **Geo-Eye Image Analysis**: Use a geo-eye image (high resolution) to refine coarser satellite data for land cover inputs into models.

4) **Precipitation Generator using Atlantic Sea Surface Temperature**: Build a precipitation prediction model using SST & rainfall measures.

5) **Soil Water Assessment Tool (SWAT)**: Implement, calibrate, and validate model for small watershed; test management scenarios; Integration with ongoing research

6) **Social Aspects of Water Resource Management**: What are the social aspects of resource use/conservation, and eventual opportunities for increased food production in this village. Use existing and new interview data, crop models etc. and propose applications from research. Travel to Burkina essential.
Val Ferret catchment (Valais, CH)

3 Ideas
1. Watershed modeling: Lumped model
2. Understanding Chemical signals (EC) for discharge
3. Snow Camera processing

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Votre future contribution est vivement recommandée, souhaitée et encouragée.

(stage, projet de semestre; projet de master; etc.)

Venez nous rendre visite: Rez de chaussé bâtiment GR

http://eflum.epfl.ch/